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CONSULTING ACTUARY - RETIREMENT BENEFITS

**A MODEL (DETERMINISTIC) FOR LEAVE BENEFITS
VALUATION**

16th Global Conference of Actuaries & 2014 AGFA

17th – 18th Feb, 2014 Mumbai - India

1 Brief Reference to AS15(R)

Paras 11-16

Accumulating compensated absences

Whether vesting (ie encashment at separation) or not

– obligation must be recognized

–even if employee turn-over may affect measurement.

Para 15 :Illustration of liability to be recognized

Number of employees: 100

Leave entitlement: 5 days p.a.

Leave carry forward allowed : for 1 year

Past experience : 92 employees will avail ≤ 5 days

8 employees will avail **6.5** days

Excess leave recognized $8 \times (6.5 - 5)$ days

Liability to be recognized 12 days Pay

[Method adopted is Last in First out [LIFO]]

Brief Reference to AS15(R) (contd)

Long Term Compensated Absence (LTCA)

Leave can be carried forward for longer periods

Generally carry forward is subject to a maximum

Unutilized leave exceeding maximum will lapse

Whether FIFO or LIFO is immaterial.

A FIFO 1-year c/f is effectively a LTCA

with cap of 2 years' entitlement

Accounting Standards Board's Guidance (Para 4) :

Salary for calculating encashment benefit may differ from that for calculating availment benefits (CTC)

2 Parameters / company data

Date of valuation	31-3-2013
Retirement Age	58 years
Vesting (1:Encashment allowed;0:not allowed)	1
Days per month	26
Maximum Accumulation	60 days
Total Leave days Valued (TLVAL)	400 days
Total Excess leave availed (TXSL) :	(i) 5 (ii) 60 (days)
Number of employees	12
Average Excess leave availed (AVXSL)	(i) 0.5 (ii) 5 (days)
$\text{AVXSL} = \text{TXSL} / \text{No Of Employees} \quad (\text{rounded to nearest .5})$	

3 Employee data needed

(i) Name/Id	(ii) DOB	(iii)DOJ
(iv) Eligible salary	(v)CTC	
(vi) Leave balance	(opening balance, accrued,availed , closing balance)	

4 Assumptions

Mortality rate	LIC 94-96
Withdrawal rate	5 % p.a.
(Wx experience analysis & Employer's views)	
(may use rates varying with age)	
Discount rate	8 % p.a.
(Single Rate throughout projection period)	
Sal Esc Rate	10 % p.a. (Employer's long term view)
Availment (average)	0.5 days (Excess)

5 The Model

Generate :

- a) dependent rates : aL_{x+t} , aD_{x+t} and withdrawal rates vary by ages
- b) discount factors for years 1 to 50
- c) salary escalation factors for years 1 to 50

Formula: $E_1 = (1 + ESC_1)^{0.5}$ $E_t = E_{t-1} \times (1 + ESC_{t-1})^{0.5} \times (1 + ESC_t)^{0.5}$

- d) Expected encashement /availmemt salary
in year t $Sal(t) = Sal * E_t$ $CTC(t) = CTC * E_t$
- e) survival, death and wx probabilities
for given age (current) in each future year until ret

5 The Model (contd)

f) Expected leave (days) :

opening balance, availed and encashed during year t ($t = 1$ to 50)

$LVAL_1$ = leave valued ($0 \leq LVAL_1 \leq \text{Max}$)

$$LVAL_t = LVAL_{t-1} - AVL_{t-1} - ENC_{t-1} \quad (t=2,3,\dots)$$

$$AVL_t = \text{MIN}(LVAL, aL_{x+t-1} * AVXSL) \quad (t=1,2,\dots)$$

$$ENC_t = \text{MIN}(LVAL_t - AVL_t, LVAL_t * \text{Pr}(ad_{x+t-1} + aw_{x+t-1} + ar_{x+t-1})) \quad (t=1,2,\dots)$$

Where

$LVAL_t$ = Expected Leavebalance(days) at beginning of year t

AVL_t = Expected excess Leave(days) availed during year t

ENC_t = Expected Leave(days) encashed during year t

5 The Model (contd)

g) Expected Cash Flows:

$$AVL_CF_t = AVL_t * CTC_t \quad ; \quad ENC_CF_t = ENC_t * SAL_t$$

$$CF_t = AVL_CF_t + ENC_CF_t$$

h) Liability:

$$L(AVL_CF) = \sum AVL_CF_t * v^{t-0.5}$$

$$L(ENC_CF) = \sum ENC_CF_t * v^{t-0.5}$$

$$L(CF) = \sum CF_t * v^{t-0.5}$$

i) Current Service Cost =

$$SC = \frac{L(CF)}{PS}$$

j) Expected FY outgo = CF_1

k) Accrued benefit =

$$CTC_t \times \sum_{t=1}^{50} AVL_t + SAL_1 \times \sum_{t=1}^{50} ENC_t$$

6 Explanations and comments

a)

1 Illustration :Employee data

Age Yrs	Nos	PS Yrs	LBAL Days	SAL	PS Yrs	LBAL Days	SAL	PS Yrs	LBAL Days	SAL
27	2	0.8	12	9000	2.8	30	10000	...		
33	3	0.8	4	10000	2.8	30	12000	5.8	60	30000
40	3	0.8	-3	40000	7.8	25.5	85000	7.8	55	85000
50	3	1.8	15	25000	10.8	49.5	70000	10.8	60	85000
57	1	12.8	59	50000		

Choice of data, though arbitrary, is aimed at:

(i) Ensuring that CFs are generated error-free

Leave valued: capped at Max ; no negative leave balances

Total probabilities of exit (t=1 to 50) =1 for each record;

leave days (encashed + availed,t=1 to 50) = leave valued

CFs cease at retirement /when leave exhausted

6 Explanations and comments (contd)

(ii)The effect of low/medium/near maximum leave on CFs

Both AVL and ENC will reduce LBAL year by year.

If small LBAL will exhaust earlier than retirement.

(iii) Age-effect on cash flows

(iv)Impact of other factors:

CF will also be influenced by:

proportion availed , W_x , Sal_esc & Discount rate

Their effects can be studied by varying parameters :

Leave availment pattern is difficult to predict

In most companies some employees do avail excess leave

Reasonable to believe :

excess leave is availed, usually, to face difficult situations

Very probable:such employees will have small leave balance

7 LIABILITIES(indvdl) : (AVXSL LOW)

		Vesting Code	Wx	Disc %	ESC%	TXSL	AVXSL
1		1	5.00%	8.00%	10.00%	5.0	0.5
REC NO	Age	Scheme Salary per day	CTC per day	LVAL	Liability (Total) 1	Liability (AVL) 1	liability (ENC) 1
1	27	300	539	12	6593	5141	1452
2	27	333	600	30	16166	5924	10242
3	33	333	600	4	2359	2112	247
4	33	400	719	30	18404	6268	12136
5	33	1000	1800	60	87229	15692	71537
6	40	1333	2400	0	0	0	0
7	40	2833	5100	25.5	104726	35743	68984
8	40	2833	5100	55	211386	35743	175643
9	50	833	1500	15	16551	5829	10723
10	50	2333	4200	49.5	137812	16320	121492
11	50	2833	5100	60	201141	19817	181323
12	57	1667	3000	59	102277	2963	99314

Table 1 Base Assumptions

7 LIABILITIES(indvdl) : (AVXSL HIGH)

		Vesting Code	Wx	Disc %	ESC%	TXSL	AVXSL
		1	5.00%	8.00%	10.00%	60.0	5
REC NO	Age	Scheme Salary per day	CTC per day	LVAL	Liability (Total) 1	Liability (AVL) 1	liability (ENC) 1
1	27	300	539	12	6382	6101	280
2	27	333	600	30	17699	16209	1490
3	33	333	600	4	2421	2421	0
4	33	400	719	30	21215	19420	1795
5	33	1000	1800	60	106319	91169	15150
6	40	1333	2400	0	0	0	0
7	40	2833	5100	25.5	127964	118438	9526
8	40	2833	5100	55	275475	238171	37304
9	50	833	1500	15	22199	21099	1101
10	50	2333	4200	49.5	197229	163583	33646
11	50	2833	5100	60	273291	198640	74651
12	57	1667	3000	59	113986	29629	84357

Table 2 Average excess leave high

8 Cash Flow Generation: Illustration

			RECORD 9 AVXSL = 5 days								
YR	AGE	Prob (Survival)	Prob (Death)	Prob (WX)	Prob (RET)	L_BAL (days)	AVL (days)	ENC (days)	AVL_CF	ENC_CF	TOT_CF
1	50	1.00000	0.00511	0.04987	-	15.00	5.00	0.82	7865	717	8582
2	51	0.94502	0.00536	0.04711	-	9.18	4.73	0.48	8188	461	8649
3	52	0.89254	0.00561	0.04448	-	3.97	3.97	-	7559	0	7559
4	53	0.84245	0.00585	0.04197	-	-	-	-	0	0	0
5	54	0.79464	0.00607	0.03958	-	-	-	-	0	0	0
6	55	0.74899	0.00629	0.03729	-	-	-	-	0	0	0
7	56	0.70541	0.00649	0.03510	-	-	-	-	0	0	0
8	57	0.66382	0.00666	0.03302	-	-	-	-	0	0	0
9	58	0.62413	-	-	0.62413	-	-	-	0	0	0
10			TotalProb (exits)		1.00000	Total	13.70	1.30			

8 Cash Flow Generation: Illustration (Contd)

			RECORD 10 AVXSL = 5 days								
YR	AGE	Prob (Survival)	Prob (Death)	Prob (WX)	Prob (RET)	L_BAL (days)	AVL (days)	ENC (days)	AVL_CF	ENC_CF	TOT_CF
1	50	1.00000	0.00511	0.04987	-	49.50	5.00	2.72	22025	6656	28681
2	51	0.94502	0.00536	0.04711	-	41.78	4.73	2.19	22917	5895	28812
3	52	0.89254	0.00561	0.04448	-	34.86	4.46	1.75	23772	5182	28954
4	53	0.84245	0.00585	0.04197	-	28.65	4.21	1.37	24683	4462	29145
5	54	0.79464	0.00607	0.03958	-	23.07	3.97	1.05	25603	3761	29364
6	55	0.74899	0.00629	0.03729	-	18.05	3.74	0.79	26532	3113	29645
7	56	0.70541	0.00649	0.03510	-	13.52	3.53	0.56	27548	2428	29976
8	57	0.66382	0.00666	0.03302	-	9.43	3.32	0.37	28499	1764	30263
9	58	0.62413	-	-	0.62413	5.74	3.12	2.62	29462	13742	43204
10			TotalProb (exits)		1.00000	Total	36.08	13.42			

8 Cash Flow Generation: Illustration (Contd)

		RECORD 11 (Z4:AN54) AVXSL = 5 days									
YR	AGE	Prob (Survival)	Prob (Death)	Prob (WX)	Prob (RET)	L_BAL (days)	AVL (days)	ENC (days)	AVL_CF	ENC_CF	TOT_CF
1	50	1.00000	0.00511	0.04987	-	60.00	5.00	3.30	26745	9804	36549
2	51	0.94502	0.00536	0.04711	-	51.70	4.73	2.71	27831	8856	36688
3	52	0.89254	0.00561	0.04448	-	44.26	4.46	2.22	28865	7981	36846
4	53	0.84245	0.00585	0.04197	-	37.58	4.21	1.80	29971	7119	37090
5	54	0.79464	0.00607	0.03958	-	31.57	3.97	1.44	31089	6264	37353
6	55	0.74899	0.00629	0.03729	-	26.16	3.74	1.14	32220	5455	37675
7	56	0.70541	0.00649	0.03510	-	21.28	3.53	0.89	33450	4685	38135
8	57	0.66382	0.00666	0.03302	-	16.86	3.32	0.67	34608	3879	38487
9	58	0.62413	-	-	0.62413	12.87	3.12	9.75	35774	62098	97872
10			TotalProb (exits)		1.00000	Total	36.08	23.92			

9 SCENARIOS Considered

Following Scenarios are considered

Scen ario	Vesti ng	Wx	Disc	Esc	Tot XSL	Description
1	1	5.0%	8.0%	10.0%	5	BASE ASSUMPTIONS
2	1	5.0%	8.0%	10.0%	60	AVL HIGH
3	1	20.0%	8.0%	10.0%	5	Wx HIGH
4	1	20.0%	8.0%	10.0%	60	Wx HIGH AVL HIGH
5	1	5.0%	8.0%	6.0%	5	ESC LOW
6	1	5.0%	8.0%	6.0%	60	ESC LOW AVL HIGH
7	0	5.0%	8.0%	10.0%	5	NO ENC
8	0	5.0%	8.0%	10.0%	60	NO ENC AVL HIGH
9	1	5.0%	8.0%	12.0%	5	ESC HIGH
10	1	5.0%	8.0%	12.0%	60	ESC HIGH AVL HIGH
11	1	5.0%	6.0%	10.0%	5	Disc LOW
12	1	5.0%	6.0%	10.0%	60	DISC LOW AVL HIGH

10 SCENARIOS : LIABILITIES

EXCESS LEAVE LOW : AVXSL =

0.5 days

Rec	Age	L VAL	BASE	High AVL	High Wx	Low ESC	High ESC	NO ENC
			(000)	(000)	(000)	(000)	(000)	(000)
1	27	12	7	6	5	5	8	8
2	27	30	16	18	13	9	22	19
3	33	4	2	2	2	2	3	3
4	33	30	18	21	15	11	24	21
5	33	60	87	106	76	51	119	100
6	40	0	0	0	0	0	0	0
7	40	26	105	128	90	71	129	113
8	40	55	211	275	188	138	266	231
9	50	15	17	22	15	13	18	17
10	50	50	138	197	130	108	155	141
11	50	60	201	273	191	158	227	207
12	57	59	102	114	102	97	105	102

10 SCENARIOS : LIABILITIES (Contd)

VARIATION(%)IN LIAB:SCENARIO								
Rec	Age	L VAL	BASE	High AVL	High Wx	Low ESC	High ESC	NO ENC
				%	%	%	%	%
1	27	12	100	86	71	71	114	114
2	27	30	100	113	81	56	138	119
3	33	4	100	100	100	100	150	150
4	33	30	100	117	83	61	133	117
5	33	60	100	122	87	59	137	115
6	40	0	0	0	0	0	0	0
7	40	26	100	122	86	68	123	108
8	40	55	100	130	89	65	126	109
9	50	15	100	129	88	76	106	100
10	50	50	100	143	94	78	112	102
11	50	60	100	136	95	79	113	103
12	57	59	100	112	100	95	103	100

10 SCENARIOS : LIABILITIES (Contd)

EXCESS LEAVE HIGH : AVXSL =					5 days			
Rec	Age	L VAL	BASE (000)	High Wx (000)	Low ESC (000)	High ESC (000)	No ENC (000)	Low Disc (000)
1	27	12	7	6	6	8	7	7
2	27	30	16	15	16	23	19	19
3	33	4	2	2	2	3	2	2
4	33	30	18	19	19	25	23	22
5	33	60	87	88	88	120	125	118
6	40	0	0	0	0	0	0	0
7	40	25.5	105	113	118	130	137	134
8	40	55	211	228	232	269	319	302
9	50	15	17	20	21	18	23	23
10	50	49.5	138	164	170	156	200	214
11	50	60	201	232	232	228	278	298
12	57	59	102	113	109	105	114	117

10 SCENARIOS : LIABILITIES (Contd)

VARIATION(%)IN LIAB:SCENARIO (CONTD)								
Rec	Age	L VAL	BASE	High AVL %	High Wx %	Low ESC %	High ESC %	NO ENC %
1	27	12	100	86	86	114	100	100
2	27	30	100	94	100	144	119	119
3	33	4	100	100	100	150	100	100
4	33	30	100	106	106	139	128	122
5	33	60	100	101	101	138	144	136
6	40	0						
7	40	25.5	100	108	112	124	130	128
8	40	55	100	108	110	127	151	143
9	50	15	100	118	124	106	135	135
10	50	49.5	100	119	123	113	145	155
11	50	60	100	115	115	113	138	148
12	57	59	100	111	107	103	112	115

10 SCENARIOS : LIABILITIES (Contd)

OBSERVATIONS

SCENARIOS: LIAB AS % OF LIAB (BASE)

BLUE BACKGROUND : LIAB $\geq 115\%$

GREEN BACKGROUND : LIAB $\leq 85\%$

1 AVL HIGH

GENERALLY LIABILITY INCREASES

AT HIGHER AGES IMPACT IS SIGNIFICANT

RECORD 1; LIABILITY DECREASED

(ACCUMULATION EXHAUSTED IN 3 YEARS)

10 SCENARIOS : LIABILITIES (Contd)

OBSERVATIONS (Contd)

IMPACT WHEN AVL IS LOW

2 HIGH W_x RATE

LIAB REDUCED : SIGNIFICANT FOR SMALL LVAL

3 ESC LOW

LIABILITY TENDS TO DECREASE

4 ESC HIGH

LIABILITY INCREASED IN ALL CASES

AT YOUNGER AGES

IMPACT IS LARGER ON SMALL LVAL

5 NO ENC

LIABILITY INCREASED IN ALL CASES

10 SCENARIOS : LIABILITIES (Contd)

OBSERVATIONS (Contd)

IMPACT WHEN AVL IS HIGH

6 WX & AVL HIGH

LIABILITY INCREASED

EXCEPT IN 2 CASES (YOUNGER AGES)

SIGNIFICANT AT AT OLDER AGES

7 ESC LOW, AVL HIGH

LIABILITY INCREASED EXCEPT 2 CASES

8 NO ENC ESC HIGH

MORE PROMINENT INCREASES

10 SCENARIOS : LIABILITIES (Contd)

OBSERVATIONS (Contd)

9 ESC HIGH AVL HIGH

SIGNIFICANT INCREASES IN MOST CASES

10 Disc LOWER

LIABILITY INCREASED

11 DISC LOWER AVL HIGH

INCREASES : ESPECIALLY AT OLDER AGES

11 Alternative Approaches

1 Availment Ratios (AVXSLR)

$(\text{Total Excss Leave Aailed}) / (\text{Total leave valued})$

It may be reasonable to believe that:

- (a) XSL is availed to meet emergencies
- (b) Availing XSL may imply small LBAL
- (c) Lapse situation may lead to availing XSL

1 Use of AVXSLR mean:

More XSL availed when LBAL is large

-Not consistent with (b) above

To avoid under/over estimation, ensure

Total leave (AVL+ENC) during projection
adds up to LVAL (for each record)

11 Alternative Approaches_(Contd)

2 AVXSLR as a decrement : This will
affect probability of survival/death/Wx
Will lead to significant underestimation

3 Next slide shows the impacts

Approach (a): No wide variations.

Approach (b): Understatement of liabilities

approach (c): Significant reduction in liabilities

11 Alternative Approaches(Contd)

VARIATIONS IN LIABILITIES

	Availment Ratio (leave balance reconciled)			Availment Ratio (leave balance not reconciled)			Availment Ratio as decrement (leave balance		
	BASE	High AVL	High Wx High AVL	BASE	High AVL	High Wx High AVL	BASE	High AVL	High Wx High AVL
	%	%	%	%	%	%	%	%	%
1	87	100	95	57	96	74	50	63	57
2	99	100	99	64	97	78	56	63	60
3	86	97	85	58	93	66	51	61	51
4	99	100	99	66	95	78	58	63	60
5	104	100	105	70	95	82	61	63	64
6	0	0	0	0	0		0	0	0
7	97	100	98	67	93	77	60	63	59
8	104	100	105	72	93	82	64	63	63
9	92	99	95	71	84	73	65	60	57
10	102	103	108	79	88	82	72	62	65
11	103	109	112	79	93	86	73	66	68
12	101	109	108	97	112	100	93	84	80

THANK YOU