WORK LIFE EXPECTANCY AS A MEASURE OF DAMAGES

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FOR many years the Courts, legal counsel, and others concerned with damage suits involving the loss of earnings have been handicapped by the lack of an appropriate basis for use in making a fair and reasonable measurement of such losses. The fact that life expectancies are not an appropriate basis for this purpose has long been recognized not only by actuaries but also by the Courts and many of the legal profession, because, obviously, there can be no loss of earnings beyond an employee's *working lifetime* as contrasted with his *physical lifetime*.

This paper is presented in the belief that it will be of interest to actuaries who are called upon to testify in actions to recover damages based upon the present worth of earnings lost, and of specific assistance to the Courts in cases involving railroad company employees, with respect to whom special tables have been constructed and are included herein. While the techniques illustrated in this paper have, because of voluminous statistics compiled and recently published by the Railroad Retirement Board, had occasion to be applied to employees of railroad companies, there is every reason why, under comparable conditions, they should be given more general application.

Briefly stated, the premise underlying the method illustrated is simply that, in a suit for damages based on earnings lost by reason of premature death or permanent disability, the value of future earnings should not be measured in terms of the whole of life but rather in terms of a more realistic "work life expectancy." The latter term can be taken to mean the duration of an employee's working life, which terminates not only upon death but also upon retirement for age or permanent disability in the case of any company or industry which makes formal provision for such retirement.

Before proceeding further, it would be well to review the situation which existed prior to the introduction, and almost universal acceptance in railroad cases, of the methods outlined in this paper.

The laws of seventeen states provide a maximum limit for damages recoverable in actions for wrongful death (ranging from $7,500 to $20,000) but no such statutory limit exists in the other thirty-one states, nor in any of the forty-eight states where the action is brought under the Federal

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Employers Liability Act (hereafter referred to as F.E.L.A.). Therefore, when a railroad company employee is either killed or injured from a cause involving negligence on the part of the railroad company,[1] both the plaintiff and the railroad company are confronted with an important problem: namely, to establish through clear and convincing evidence the present worth of earnings which the deceased employee would have contributed to his dependents, or, in the case of personal injuries, the present worth of the earnings which the injured employee, except for his disablement, would himself have received. Earnings lost, whether it be the loss of the decedent employee's dependents or whether it be the loss of the disabled employee himself, constitute the principal ingredient of recoverable damages in any F.E.L.A. case.

In practice, the plaintiff's attorney usually employs an actuary by whom he establishes the plaintiff's expectation of life according to some mortality table, such as the 1941 CSO, the 1939-1941 United States Life and Actuarial Tables or the American Experience Table of Mortality. Plaintiff's actuary (upon direction of Counsel) will then compute, as of the day prior to the date of accident, the present worth of an annuity certain (for a term certain equal to the expectation of life, computed at a low rate of interest such as $1\frac{1}{4}\%$, $1\frac{1}{2}\%$ or 2%). The railroad employee's average monthly wage is next computed and capitalized by means of the annuity referred to in the preceding sentence. The resulting single sum amount constitutes the plaintiff's determination of the present worth of earnings lost.

The foregoing method of determining the present worth of earnings lost, which we have called the "life expectancy" method, is greatly favored by plaintiff's attorneys, because it is readily understood by the layman and by the Courts. Aside from its understandability, there is nothing to recommend the life expectancy method. The life expectancy method has been condemned both by the Courts[2] and by the actuarial profession.[3] As is clearly demonstrated in Spurgeon's *Life Contingencies*, the use of an annuity certain for the expectation of life overstates the true value of a life annuity. Moreover, in addition to this theoretical deficiency, the life expectancy method substantially overstates the present worth of earnings lost,

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[1] See Section 5, Title 45 U.S.C.A.

[2] *Avance v. Thompson*, 387 Ill. 77 (1944). *Weatherbee v. Elgin, Joliet & Eastern Ry. Co.*, 191 Fed. 2d 302 (1951), at pages 310-11.

[3] Augustus F. Harvey, Discussion of "The Value of Actuarial Testimony in the Courts," Sydney N. Ogden, *TASA*, VI (1899). See comments commencing on l. 33 of p.232. Miles M. Dawson, "Valuation, in Actions for Damages for Negligence, of Human Life, Destroyed or Impaired," *4th T.I.C.* (1904). See bottom of p. 930 and top of p. 931. L. A. Anderson, "Expectancy of Life and Other Fallacies," *RAIA* X (1921), 39. S. Shannon, "Admissibility of Mortality Tables in Evidence in Court Cases," *RAIA* XXVII (1938). See Sec. 11 on p. 148, also concluding remarks.

because it makes no allowance for the probabilities: (1) that the railroad employee might on some future day become permanently disabled, (2) that such employee might voluntarily retire on an age pension under the Railroad Retirement Act, and (3) that in the normal course of employment, such employee will lose time from work because of sickness, lay-offs or other causes for which he will receive no compensation.

In order to make a truly scientific determination of earnings lost, *all durations* of time with respect to which a railroad employee would not be expected to receive his earnings should be excluded from the capitalization factor. While it would probably be impossible to make scientific allowance for all such durations, some such durations are capable of estimation on the basis of tables derived from actual experience. The three particular durations which can properly be excluded in this manner commence respectively: (a) upon the employee's death while at work, (b) at the inception of such employee's permanent disability while at work, and (c) at the inception of such employee's retirement from active duty on an age pension under the Railroad Retirement Act. To contrast with the life expectancy method, we have designated the method which allows for all three of the foregoing contingencies the work life expectancy method.

The following short table compares certain values obtained by both the life expectancy and work life expectancy methods and demonstrates the considerable overstatement inherent in the use of the former.

DETERMINATION OF EARNINGS LOST BASED ON INTEREST AT
3% AND MORTALITY ACCORDING TO THE RAILWAY
EMPLOYEES MORTALITY TABLE

AGE OF THE EM-PLOYEE	LIFE EXPECTANCY (YEARS)	WORK LIFE EXPECTANCY (YEARS)	PRESENT WORTH OF $1.00 PER MONTH EARNINGS LOST AT 3% PER ANNUM INTEREST		PERCENTAGE OF WORK LIFE EX-PECTANCY TO LIFE EX-PECTANCY METHOD VALUES
			Life Expectancy Method	Work Life Expectancy Method	
25.....	44.19	34.07	$295.65	$248.88	84.18%
35.....	35.20	25.54	262.22	208.19	79.40
45.....	26.61	17.13	220.82	156.23	70.75
55.....	18.87	9.32	173.35	94.91	54.75
65.....	12.42	2.39	124.59	26.38	21.17
75.....	7.54	1.85	81.01	20.67	25.52

The work life expectancy method affords a much closer approximation to the true value of earnings lost than does any other method thus far used in the Courts as evidence of earnings lost. Moreover, the work life expectancy method still favors the plaintiff (though to a lesser degree than the

TABLE 1

RAILROAD EMPLOYEES WORK LIFE EXPECTANCY TABLE

Exact Age in Years	Number Living and at Work	Number Withdrawing from Work before Next Exact Age Because of			Expectancy in Years of Life at Work
		Death	Disability	Retirement	
18......	1,318,040	2,054	2,397	0	40.11
19......	1,313,589	2,126	2,467	0	39.24
20......	1,308,996	2,171	2,550	0	38.38
21......	1,304,275	2,241	2,606	0	37.51
22......	1,299,428	2,311	2,687	0	36.65
23......	1,294,430	2,392	2,742	0	35.79
24......	1,289,296	2,498	2,795	0	34.93
25......	1,284,003	2,617	2,873	0	34.07
26......	1,278,513	2,733	2,925	0	33.22
27......	1,272,855	2,873	2,975	0	32.36
28......	1,267,007	2,999	2,999	0	31.51
29......	1,261,009	3,136	2,997	0	30.66
30......	1,254,876	3,271	3,008	0	29.81
31......	1,248,597	3,417	3,018	0	28.95
32......	1,242,162	3,561	3,026	0	28.10
33......	1,235,575	3,727	3,047	0	27.25
34......	1,228,801	3,903	3,080	0	26.40
35......	1,221,818	4,100	3,111	0	25.54
36......	1,214,607	4,330	3,152	0	24.69
37......	1,207,125	4,581	3,205	0	23.84
38......	1,199,339	4,851	3,279	0	22.99
39......	1,191,209	5,139	3,376	0	22.15
40......	1,182,694	5,480	3,469	0	21.30
41......	1,173,745	5,836	3,582	0	20.46
42......	1,164,327	6,254	3,693	0	19.62
43......	1,154,380	6,696	3,891	0	18.79
44......	1,143,793	7,193	4,173	0	17.96
45......	1,132,427	7,719	4,458	0	17.13
46......	1,120,250	8,294	4,933	0	16.31
47......	1,107,023	8,878	5,490	0	15.50
48......	1,092,655	9,512	6,103	0	14.70
49......	1,077,040	10,178	6,753	0	13.91
50......	1,060,109	10,859	7,519	0	13.12
51......	1,041,731	11,599	8,391	0	12.34
52......	1,021,741	12,347	9,394	0	11.57
53......	1,000,000	13,131	10,381	0	10.81
54......	976,488	13,930	11,488	0	10.06
55......	951,070	14,736	12,853	0	9.32
56......	923,481	15,538	14,485	0	8.58
57......	893,458	16,305	16,456	0	7.85
58......	860,697	17,006	18,916	0	7.13
59......	824,775	17,656	20,559	0	6.42
60......	786,560	18,060	21,237	15,329	5.71
61......	731,934	18,279	21,090	10,677	5.10
62......	681,888	18,435	20,527	13,239	4.44
63......	629,687	18,397	19,520	18,304	3.76
64......	573,466	18,073	18,078	24,960	3.08
65......	512,355	14,517	0	206,323	2.39
66......	291,515	10,097	0	60,033	2.82
67......	221,385	8,267	0	47,683	2.56
68......	165,435	6,608	0	38,803	2.26
69......	120,024	5,018	0	34,539	1.92

TABLE 1—*Continued*

EXACT AGE IN YEARS	NUMBER LIVING AND AT WORK	NUMBER WITHDRAWING FROM WORK BEFORE NEXT EXACT AGE BECAUSE OF			EXPECT- ANCY IN YEARS OF LIFE AT WORK
		Death	Disability	Retirement	
70.......	80,467	3,163	0	40,344	1.62
71.......	36,960	1,722	0	13,284	1.94
72.......	21,954	1,105	0	7,872	1.92
73.......	12,977	706	0	4,641	1.90
74.......	7,630	449	0	2,721	1.87
75.......	4,460	284	0	1,586	1.85
76.......	2,590	179	0	917	1.83
77.......	1,494	112	0	528	1.80
78.......	854	69	0	300	1.78
79.......	485	42	0	169	1.75
80.......	274	26	0	95	1.70
81.......	153	16	0	53	1.66
82.......	84	9	0	29	1.61
83.......	46	6	0	16	1.52
84.......	24	3	0	8	1.46
85.......	13	2	0	5	1.27
86.......	6	1	0	2	1.17
87.......	3	1	0	1	.83
88.......	1	0	0	1	.50

life expectancy method) through a certain amount of unavoidable over-statement of earnings lost. For example, there are *further* reductions in working time which, theoretically, should be allowed for (such as uncompensated leaves of absence, illness without pay, lay-offs, strikes, etc.). Erring, as it does, in favor of the plaintiff, the work life expectancy method cannot be said to work any injustice on the injured person and should certainly supplant the inferior and theoretically indefensible life expectancy method.

A different method of determination, embracing different contingencies, applies to the valuation of earnings lost by the disabled employee himself than would apply to the valuation of such employee's anticipated contributions to his dependents if such employee's injuries had been fatal. Both types of cases (personal injury and death) are illustrated in this paper. Because the table, by means of which the present worth of earnings lost may be determined in the case of permanent incapacity, forms the backbone of the tables by means of which the present worth of earnings lost may be determined in the case of wrongful death, the former is logically developed first, with extension of similar principles to death cases under the F.E.L.A.

Table 1, entitled "Railroad Employees Work Life Expectancy Table,"

is a multiple decrement table under which three decremental forces are operating, namely, (1) mortality, (2) permanent disability, and (3) voluntary retirement on an age pension under the Railroad Retirement Act. The statistics necessary to construct Table 1 were obtained from the 1946 Annual Report of the Railroad Retirement Board. This table was constructed from the absolute rates of mortality, disability and voluntary retirement therein shown, converted to annual probabilities by means of the usual formula (see *RAIA* XXI, 44, formula (7)). Table 2 illustrates such annual probabilities for ages 53 to 89 inclusive. Table 3 sets forth the D_x^z and N_x^z functions from ages 18 to 88 at seven different rates of interest, ranging from $1\frac{1}{4}\%$ to 5%.

The development of information for two personal injury cases is now illustrated. The calculation for Illustrative Case 1 is a simple one involving only the working lifetime of the employee himself, whereas the calculation for Illustrative Case 2 also involves a matter of job succession and, consequently, also the working lifetimes of five employees who precede the injured employee either in actual possession of the job in question or in order of seniority to possess such job.

Illustrative Case No. 1

The development of the present worth of earnings lost in a simple F.E.L.A. case involving nonfatal injuries which the plaintiff alleged had permanently and totally incapacitated him from work is shown hereunder. The railroad company furnished their records showing their employee's date of birth, date of injury and average monthly earnings and deductions for a duration of thirty-six months immediately prior to date of injury. These data were tabulated and arranged in the following convenient form.

<div align="center">

Date of birth: November 12, 1884

Date of injury: March 1, 1950

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DURATIONS IMMEDIATELY PRECEDING MARCH 1, 1950	AVERAGE MONTHLY AMOUNTS			
	Gross Earnings	Withholding Tax	Railroad Retirement Act Tax	Net Earnings
6 months......	$495.36	$66.13	$18.00	$411.23
12 months......	475.01	62.88	18.00	394.13
24 months......	453.01	52.10	17.69	383.30
36 months......	436.27	50.26	17.52	368.49

TABLE 2

DEVELOPMENT OF PROBABILITIES FROM ABSOLUTE RATES OF MORTALITY, DISABILITY AND VOLUNTARY RETIREMENT ON AN AGE PENSION UNDER THE RAILROAD RETIREMENT ACT

x	ABSOLUTE RATES OF MORTALITY, DISABILITY, AND RETIREMENT			PROBABILITIES DEVELOPED FROM ABSOLUTE RATES				
	q'_x	q'^i_x	q'^r_x	q_x	q^i_x	q^r_x	q_x	p^s_x
53..	.01320	.01045	......	.013131	.010381	....	.023512	.976488
54..	.01435	.01185	......	.014265	.011765	....	.026030	.973970
55..	.01560	.01362	......	.015494	.013514	....	.029008	.970992
56..	.01696	.01582	......	.016826	.015686	....	.032512	.967488
57..	.01842	.01859	......	.018249	.018419	....	.036668	.963332
58..	.01998	.02220	......	.019758	.021978	....	.041736	.958264
59..	.02168	.02520	......	.021407	.024927	....	.046334	.953666
60..	.02352	.02760	.020	.022960	.026999	.019489	.069448	.930552
61..	.02554	.02941	.015	.024973	.028814	.014588	.068375	.931625
62..	.02774	.03084	.020	.027035	.030104	.019414	.076553	.923447
63..	.03015	.03196	.030	.029216	.030999	.029068	.089283	.910717
64..	.03279	.03280	.045	.031514	.031524	.043524	.106562	.893438
65..	.03564	....	.410	.028334	....	.402694	.431028	.568972
66..	.03870	....	.210	.034637	....	.205937	.240574	.759426
67..	.04196	....	.220	.037344	....	.215384	.252728	.747272
68..	.04539	....	.240	.039943	....	.234553	.274496	.725504
69..	.04904	....	.295	.041807	....	.287767	.329574	.670426
70..	.05294	....	.515	.039308	....	.501368	.540676	.459324
71..	.05716	....	.370	.046585	....	.359425	.406010	.593990
72..	.06176	....	.370	.050334	....	.358574	.408908	.591092
73..	.06677	....	.370	.054418	....	.357648	.412066	.587934
74..	.07224	....	.370	.058876	....	.356636	.415512	.584488
75..	.07818	....	.370	.063717	....	.355537	.419254	.580746
76..	.08463	....	.370	.068973	....	.354343	.423316	.576684
77..	.09156	....	.370	.074621	....	.353061	.427682	.572318
78..	.09898	....	.370	.080669	....	.351689	.432358	.567642
79..	.10694	....	.370	.087156	....	.350216	.437372	.562628
80..	.11546	....	.370	.094100	....	.348640	.442740	.557260
81..	.12460	....	.370	.101549	....	.346949	.448498	.551502
82..	.13434	....	.370	.109487	....	.345147	.454634	.545366
83..	.14473	....	.370	.117955	....	.343225	.461180	.538820
84..	.15581	....	.370	.126985	....	.341175	.468160	.531840
85..	.16760	....	.370	.136594	....	.338994	.475588	.524412
86..	.18021	....	.370	.146871	....	.336661	.483532	.516468
87..	.19358	....	.370	.157768	....	.334188	.491956	.508044
88..	.20776	....	.370	.169324	....	.331564	.500888	.499112
89..	.22280	....	.370	.181582	....	.328782	.510364	.489636

q' = absolute rates of mortality published in Table A-7 of the 1946 Report of the Railroad Retirement Board.

q'^i = absolute rates of disability published in Table A-13 of the 1946 Report of the Railroad Retirement Board.

q'^r = absolute rates of retirement published in Table A-16 of the 1946 Report of the Railroad Retirement Board.

TABLE 3

COMMUTATION COLUMNS

RAILROAD EMPLOYEES WORK LIFE EXPECTANCY TABLE—WORK LIFE ANNUITIES

z	INTEREST AT 1.25%		INTEREST AT 2%		INTEREST AT 2.5%		INTEREST AT 3%		INTEREST AT 3.5%		INTEREST AT 4%		INTEREST AT 5%	
	D_z	N_z	D_z	N_z	D_z	N_z	D_z	N_z	D_z	N_z	D_z	N_z	D_z	N_z
18	1053945.6	33208410.9	922837.6	25336368.1	845082.4	21286314.3	774210.1	17968344.1	709581.3	15236236.6	650621.4	12975357.8	547673.3	9524874.1
19	1037418.7	32154465.3	901688.2	24413530.5	821686.7	20441231.9	749121.4	17194134.0	683271.2	14526655.3	623484.5	12324736.4	519831.8	8977200.8
20	1021028.7	31117046.6	880916.3	23511842.3	798842.3	19619545.2	724759.7	16445012.6	657856.9	13843384.1	597408.8	11701251.9	493346.2	8457369.0
21	1004786.1	30096017.9	860529.3	22630926.0	776547.1	18820702.9	701111.7	15720252.9	633318.1	13185527.2	572360.2	11103843.1	468159.1	7964022.8
22	988693.2	29091231.8	840520.7	21770396.7	754792.2	18044155.8	678162.4	15019141.2	609627.9	12552209.1	548300.1	10531482.9	444209.5	7495863.7
23	972731.8	28102538.6	820870.6	20929876.0	733549.6	17289363.6	655877.3	14340978.8	586747.0	11942581.2	525183.9	9983182.8	421428.9	7051654.2
24	956911.6	27129806.8	801582.4	20109005.4	712819.5	16555814.0	634248.5	13685101.5	564656.2	11355834.2	502981.4	9457998.9	399769.4	6630225.3
25	941217.9	26172895.2	782639.6	19307423.0	692579.7	15842994.5	613247.5	13050853.0	543322.0	10791178.0	481651.4	8955017.5	379169.9	6230455.9
26	925623.0	25231677.3	764012.5	18524783.4	672798.3	15150414.8	592840.1	12437605.5	522704.7	10247856.0	461145.6	8473366.1	359570.3	5851286.0
27	910149.9	24306054.3	745717.4	17780770.9	653483.8	14477816.5	573025.3	11844785.4	502793.0	9725151.3	441447.8	8012220.5	340931.7	5491715.7
28	894784.4	23395904.4	727737.1	17015053.5	634615.9	13824132.7	553779.6	11271740.1	483558.3	9222358.3	422517.7	7570772.7	323205.9	5150784.0
29	879553.8	22501120.0	710089.3	16287316.4	616205.9	13189516.8	535104.1	10717960.5	464994.5	8738800.0	404343.8	7148255.0	306357.1	4827578.1
30	864470.3	21621566.2	692780.6	15577227.1	598253.3	12573310.9	516992.6	10182856.4	447084.7	8273805.5	386902.1	6743911.2	290349.4	4521221.0
31	849525.4	20757095.9	675798.1	14884446.5	580741.2	11975057.6	499422.6	9665863.8	429804.5	7826720.8	370159.1	6357009.1	275139.6	4230871.6
32	834713.0	19907570.5	659132.1	14208648.4	563657.1	11394316.4	482377.5	9166441.2	413130.7	7396916.3	354088.2	5986850.0	260687.6	3955732.0
33	820036.3	19072857.5	642781.9	13549516.3	546992.8	10830669.3	465843.9	8684063.7	397043.4	6983785.6	338663.7	5632761.8	246958.1	3695044.4
34	805471.7	18252821.2	626722.9	12906734.4	530725.3	10283666.5	449796.5	8218219.8	381513.2	6586742.2	323853.0	5294098.1	233908.4	3448086.3
35	791007.4	17447349.5	610943.2	12280011.5	514338.7	9752941.2	434213.3	7768423.3	366517.3	6205229.0	309627.0	4970245.1	221503.4	3214177.9
36	776630.6	16656342.1	595428.3	11669068.3	499317.7	9238102.5	419078.3	7334210.0	352033.2	5838711.7	295962.1	4660618.1	209710.4	2992874.5
37	762317.5	15879711.5	580157.6	11073640.0	484138.0	8738784.8	404366.4	6915131.7	338033.6	5486678.5	282825.8	4364656.0	198494.8	2782964.1
38	748050.5	15117394.0	565112.9	10493482.4	469283.4	8254646.8	390056.2	6510765.3	324495.0	5148644.9	270193.1	4081830.2	187822.5	2584469.3
39	733807.4	14369343.5	550276.6	9928369.5	454733.3	7785363.4	376129.0	6120709.1	311397.5	4824149.3	258040.9	3811637.1	177666.4	2396646.8
40	719566.4	13635536.1	535630.3	9378092.9	440471.9	7330630.1	362563.1	5744580.1	298715.4	4512751.8	246342.2	3553596.2	167997.0	2218980.4
41	705305.7	12915969.7	521154.5	8842462.6	426476.7	6890158.2	349339.4	5382017.0	286430.2	4214036.4	235075.3	3307254.0	158786.6	2050983.4
42	691009.4	12210664.0	506836.2	8321308.1	412736.5	6463681.5	336442.8	5032677.6	274523.9	3927606.2	224220.3	3072178.7	150011.9	1892196.8
43	676647.9	11519654.6	492653.6	7814471.9	399229.6	6050945.0	323853.2	4696234.8	262974.7	3653082.3	213754.2	2847958.4	141647.0	1742184.9
44	662164.6	10843006.7	478564.1	7321818.3	385920.3	5651715.4	311537.2	4372381.6	251751.1	3390107.6	203647.8	2634204.2	133664.8	1600537.9
45	647491.2	10180842.1	464518.2	6843254.2	372765.5	5265795.1	299457.9	4060844.4	240820.8	3138356.5	193869.2	2430556.4	126035.7	1466873.1
46	632620.9	9533350.9	450513.0	6378736.0	359763.8	4893020.6	287609.6	3761386.5	230175.5	2897535.7	184408.8	2236687.2	118743.1	1340837.4
47	617433.2	8900730.0	436463.7	5928223.0	346844.7	4533285.8	275935.4	3473778.9	219766.2	2667380.2	175222.9	2052278.4	111752.9	1222094.3
48	601895.6	8283296.8	422352.7	5491759.3	333992.9	4186421.1	264421.4	3197841.5	209577.8	2447594.0	166296.6	1877055.5	105050.0	1110341.4
49	585970.1	7681401.2	408152.9	5069406.6	321190.6	3852428.2	253050.5	2933420.1	199597.1	2238016.2	157615.1	1710758.9	98618.1	1005291.4
50	569637.9	7095431.1	393860.2	4661253.7	308430.2	3531237.6	241818.3	2680369.6	189815.7	2038419.1	149171.1	1553143.8	92445.7	906673.3
51	552851.9	6525793.2	379443.2	4267393.5	295691.2	3222807.4	230704.9	2438551.3	180217.4	1848603.4	140947.2	1403972.7	86516.8	814227.6
52	535548.6	5972941.3	364864.7	3887950.3	282943.6	2927116.2	219687.6	2207846.4	170782.0	1668386.0	132925.4	1263025.5	80815.6	727710.8

TABLE 3—*Continued*

x	INTEREST AT 1.25%		INTEREST AT 2%		INTEREST AT 2.5%		INTEREST AT 3%		INTEREST AT 3.5%		INTEREST AT 4%		INTEREST AT 5%	
	D_x	N_x	D_x	N_x	D_x	N_x	D_x	N_x	D_x	N_x	D_x	N_x	D_x	N_x
53...	517682.0	5437392.7	350099.0	3523085.6	270169.0	2644172.6	208750.0	1988158.8	161496.0	1497604.0	125093.0	1130100.1	75330.0	646895.2
54...	499269.5	4919710.7	335163.9	3172986.6	257381.7	2374003.6	197904.8	1779408.8	152366.3	1336108.0	117453.9	1005007.1	70056.2	571565.2
55...	480270.4	4420441.2	320038.9	2837822.7	244568.6	2116621.9	187139.2	1581504.0	143381.4	1183741.7	109997.0	887553.2	64982.8	501509.0
56...	460581.5	3940170.8	304661.9	2517783.8	231681.9	1872053.3	176418.1	1394364.8	134514.2	1040360.3	102697.6	777556.2	60093.7	436526.2
57...	440105.8	3479589.3	288977.4	2213121.9	218682.8	1640371.4	165711.4	1217946.7	125739.9	905846.1	95537.5	674858.6	55371.2	376432.5
58...	418734.3	3039483.5	272922.7	1924144.5	205525.8	1421688.6	154985.7	1052235.2	117033.3	780106.2	88494.3	579321.1	50800.9	321061.3
59...	396304.4	2620749.2	256404.1	1651221.8	192144.3	1216162.8	144191.3	897249.6	103356.3	663072.9	81539.7	490826.8	46362.3	270260.4
60...	373276.2	2224444.8	239729.3	1394817.7	178772.5	1024018.5	133505.2	753058.3	99841.2	554716.6	74770.4	409287.1	42109.3	223898.1
61...	343064.1	1851168.6	218706.3	1155088.4	162299.0	845246.0	120614.7	619553.1	89765.8	454875.4	66901.7	334516.7	37318.4	181788.8
62...	315661.0	1508104.5	199757.0	936382.1	147514.2	682947.0	109095.3	498938.4	80800.3	365109.6	59930.5	267615.0	33111.1	144470.4
63...	287897.3	1192443.5	180848.0	736625.1	132898.6	535432.8	97809.3	389843.1	72091.0	284309.3	53213.6	207684.5	29120.5	111359.3
64...	258956.0	904546.2	161472.0	555777.1	118081.2	402534.2	86432.1	292033.8	63434.5	212218.3	46598.7	154470.9	25257.7	82238.8
65...	228504.2	645590.2	141436.1	394305.1	102924.9	284453.0	75015.4	205551.7	54757.9	148783.8	40031.8	107872.2	21491.2	56981.1
66...	128407.1	417086.0	78995.0	252869.0	57132.9	181528.1	41438.6	130536.3	30102.1	94025.9	21900.9	67840.4	11645.7	35489.9
67...	96312.2	288678.9	58740.3	173974.0	42330.1	124395.2	30553.1	89097.7	22087.4	63923.8	15992.4	45939.5	8423.0	23844.2
68...	71083.0	192366.7	43034.4	115233.7	30860.6	82065.1	22166.5	58544.6	15947.1	41836.4	11491.1	29947.1	5994.5	15421.2
69...	50934.3	121283.7	30609.5	72199.3	21843.4	51204.5	15613.4	36378.1	11178.6	25889.3	8016.2	18456.0	4141.9	9426.7
70...	33726.1	70349.4	20119.0	41589.8	14287.2	29361.1	10162.7	20764.7	7240.9	14710.7	5167.5	10439.8	2644.6	5284.8
71...	15299.8	36623.3	9059.8	21470.8	6402.3	15073.9	4532.0	10602.0	3213.4	7469.8	2282.2	5272.3	1156.9	2640.2
72...	8975.8	21323.5	5276.0	12411.0	3710.2	8671.6	2613.6	6070.0	1844.2	4256.4	1303.5	2990.1	654.50	1483.3
73...	5240.1	12347.7	3057.5	7135.0	2139.6	4961.4	1499.9	3456.4	1053.2	2412.2	740.87	1686.6	368.43	828.84
74...	3042.9	7107.6	1762.4	4077.5	1227.3	2821.8	856.19	1956.5	598.33	1359.0	418.85	945.69	206.31	460.41
75...	1756.7	4064.7	1010.0	2315.1	699.91	1594.5	485.89	1100.3	337.92	760.67	235.42	526.84	114.85	254.10
76...	1007.6	2308.0	575.02	1305.1	396.54	894.62	273.95	614.40	189.60	422.75	131.45	291.42	63.520	139.25
77...	574.03	1300.4	325.19	730.08	223.16	498.08	153.42	340.45	105.67	233.15	72.909	159.97	34.895	75.726
78...	324.08	726.35	182.24	404.89	124.45	274.92	85.144	187.03	58.359	127.48	40.073	87.059	18.997	40.831
79...	181.78	402.27	101.47	222.65	68.953	150.47	46.946	101.89	32.023	69.124	21.883	46.986	10.275	21.834
80...	101.43	220.49	56.200	121.18	38.005	81.515	25.750	54.940	17.479	37.101	11.857	25.103	5.5235	11.559
81...	55.936	119.06	30.766	64.983	20.704	43.510	13.960	29.190	9.4303	19.622	6.3825	13.216	2.9400	6.0300
82...	30.331	63.126	16.560	34.217	11.090	22.806	7.4409	15.230	5.0023	10.192	3.3693	6.8334	1.5373	3.0900
83...	16.405	32.795	8.8908	17.657	5.9249	11.716	3.9561	7.7895	2.6467	5.1894	1.7742	3.4641	.80178	1.5527
84...	8.4534	16.390	4.5478	8.7664	3.0158	5.7910	2.0039	3.8334	1.3342	2.5427	.89004	1.6899	.39840	.75093
85...	4.5224	7.9371	2.4151	4.2186	1.5937	2.7752	1.0538	1.8295	.69826	1.2085	.46357	.79990	.20552	.35253
86...	2.0615	3.4147	1.0928	1.8035	.71763	1.1815	.47222	.77565	.31138	.51025	.20572	.33633	.09034	.14701
87...	1.0180	1.3532	.53568	.71074	.35006	.46390	.22924	.30343	.15042	.19887	.09891	.13061	.04302	.05667
88...	.33515	.33515	.17506	.17506	.11384	.11384	.07419	.07419	.04845	.04845	.03170	.03170	.01366	.01366

The particular railroad company of which the plaintiff in this case was an employee when injured on March 1, 1950 had a contract with the labor union making retirement on a pension under the Railroad Retirement Act compulsory at age 70. Because the injured railroad employee was 65 years and 109 days of age on the date of his injury, a temporary annuity, computed by means of Table 3, running for 4 years and 256 days expresses the capitalization factor in this case. The present worth of $1.00 per month earning lost in this case is determined to be $24.83 if 3% per annum interest is selected for the purpose of effecting such a valuation. Earnings of $475.01 were adopted for the purpose of effecting the capitalization which resulted in $11,794.50. (The corresponding figure by the life expectancy method would have been $57,794.24.) It is good practice to round off the result in such cases to an even number of thousands, namely, $12,000.00, because such a figure is sufficiently accurate for the purposes at hand and is more easily remembered and handled by everybody involved; furthermore, $11,794.50 implies a degree of exactness which is not inherent in the basic tables. This case was most bitterly contested. Judgment on the $150,000.00 suit was for $27,000.00 (including an unspecified amount for "pain and suffering" and expenses). The railroad company felt that the verdict was reasonable and that the actuarial testimony "did much towards keeping the verdict down as low as it was."

Illustrative Case No. 2

The present worth of earnings lost in a more complicated F.E.L.A.case involving nonfatal injuries which the plaintiff alleged had permanently and totally incapacitated him from work is shown hereunder. The complications in this case arise from the difficulty of placing a value upon the vested right which the injured employee, a railroad switchman, possessed to occupy the position of yardmaster, subject only to the contingencies about to be described.

The injured employee was permanently physically disabled and disqualified from performing any duties as a railroad switchman but his disability was of such a nature that it did not disqualify him from performing the duties pertaining to the position of yardmaster.

The injured employee was the third applicant in line of seniority to possess the position of yardmaster (of which there were three). The withdrawal from the service of the railroad company (because of death, disability or voluntary retirement on a pension under the Railroad Retirement Act as shown in Table 1) of any two of the other five (namely, the three yardmasters and the other two applicants) would at once place the injured employee in first position of seniority to possess the position of

yardmaster upon the withdrawal thereafter from the service of the railroad company of any yardmaster. Because there are ten combinations of two out of five lives, the injured employee could ascend to first position of seniority in ten ways and for each such way there are three ways in which he can actually possess the position of yardmaster. This analysis yields thirty contingencies to be valued.

Let u, v, w = the existing yardmasters ages 64, 65, 54 respectively.

Let x, y, z = the applicants 36, 44, 40 respectively in reverse order of seniority (the injured employee is denoted by x).

The present worth of \$1.00 per month earnings of the injured employee as a yardmaster would be constituted of the sum of the values of thirty integrals similar to the following:

$$12 \int v_t^l {}_t p_{uxyz}^s \left(1 - {}_t p_w^s\right) \left(1 - {}_t p_v^s\right) \mu_{z+t}^s a_{z+t}^{s(12)} dt$$

The lack of smooth progression in decrement rates in Table 1, occasioned by concentrations of retirements about the ages 65 and 70, demand that these thirty integrals be valued term by term. These thirty integrals were valued by Simpson's Rule and the sum of such values was found to be \$105.17 per \$1.00 of monthly earnings as yardmaster, based on interest at the rate of 3% per annum. The difficult part has now been accomplished and the remainder of the determination follows from the application of the data furnished by the railroad company.

Date of birth:	May 26, 1913
Date of injury:	June 14, 1949
Rate of pay:	\$322.43 per month
Rate of pay of a Yardmaster:	\$344.54 per month

The present worth of \$1.00 per month earnings lost as a switchman is \$203.10 (computed from Table 3) and the present worth of \$1.00 per month future earnings by reason of the injured employee's vested right to the position of yardmaster is \$105.17 (both values computed at 3% per annum interest); therefore, the present net worth of earnings lost is computed as follows:

$65,485.53 = Present worth of earnings lost as a switchman
$36,235.27 = Present worth of future earnings as a yardmaster
$29,250.26 = Net present worth of earnings lost

The outcome of this case is unknown at this writing.

DEATH CASES UNDER THE F.E.L.A.

The F.E.L.A. provides an action in the decedent's personal representatives for the benefit of decedent's wife and children for damages recoverable. The Federal Statutes creating such action read in part as follows:

Every common carrier by railroad while engaging in commerce between any of the several States . . . shall be liable in damages to any person suffering injury while he is employed by such carrier in such commerce, or, in case of the death of such employee, to his or her personal representative, for the benefit of the surviving widow or husband and children of such employee; and, if none, then of such employee's parents; and, if none, then of the next of kin dependent upon such employee, for such injury or death resulting in whole or in part from the negligence of any of the officers, agents, or employees of such carrier. . . .

Chapter 2 of Title 45 of the United States Code Annotated, insofar as it provides for recovery for death, follows the lines of Lord Campbell's Act in England, and in its distinguishing features is identical with that Act. It creates a right of action where there was none at common law, and one which is entirely independent of any which the deceased may have had in life, and which comes originally to the personal representatives by the operation of the statute and not by the process of survival. It is one for the exclusive benefit of certain specified persons, and the damages recoverable are such as result to them by reason of their having been deprived, through the wrongful death of the deceased, of a reasonable expectation of pecuniary benefits attendant upon his continuance in life. The measure of damages for death of a railroad company employee is the amount he would have contributed to his wife during their joint lives (*Berry v. St. Louis-San Francisco Railway Company*, 1929, 26 S.W. 2nd 988, 324 Mo. 777, certiorari denied, 1930, 281 U.S. 765).

At this juncture we reiterate that the contingencies embraced in the preparation of a death case are entirely different from those involved in the preparation of a personal injury case. The age of the decedent employee's wife on the day of his fatal injury has a bearing upon the amount of his anticipated contributions because damages in such a case are measured by the present worth of the periodic amounts which the deceased railroad company employee would have reasonably been expected to contribute to his wife during their joint lifetime.

The basic tables of factors necessary to prepare a death case under the F.E.L.A. are discussed below:

a) The first factor needed is a joint life annuity value pertaining to an immediate annuity which is payable during the joint lifetime of husband and wife; provided that, in addition to terminating at the first to die of husband and wife, such an annuity will also terminate upon the husband's withdrawal from the railroad company's service in the event he becomes

TABLE 4

Basis 3% Interest

PRESENT WORTH OF $1.00 PER MONTH PAYABLE DURING JOINT LIFETIME
OF HUSBAND AND WIFE ONLY WHILE HUSBAND REMAINS
IN EMPLOYMENT OF RAILROAD

Age of Husband	Wife 5 Years Older	Wife Same Age As Husband	Wife 5 Years Younger	Wife 10 Years Younger	Wife 15 Years Younger	Wife 20 Years Younger
18.........	$254.97	$259.23	....	....	....	....
19.........	251.77	256.06	....	....	....	....
20.........	248.49	252.83	....	....	....	....
21.........	245.15	249.55	....	....	....	....
22.........	241.72	246.20	....	....	....	....
23.........	238.23	242.78	$245.96	....	....	....
24.........	234.65	239.29	242.47	....	....	....
25.........	231.00	235.72	238.92	....	....	....
26.........	227.28	232.08	235.31	....	....	....
27.........	223.48	228.35	231.62	....	....	....
28.........	219.59	224.55	227.86	$230.17	....	....
29.........	215.63	220.65	224.01	226.30	....	....
30.........	211.56	216.66	220.06	222.35	....	....
31.........	207.41	212.58	216.02	218.30	....	....
32.........	203.15	208.39	211.86	214.16	....	....
33.........	198.80	204.09	207.61	209.92	$211.54	....
34.........	194.35	199.70	203.24	205.57	207.16	....
35.........	189.81	195.20	198.77	201.12	202.68	....
36.........	185.17	190.60	194.19	196.55	198.10	....
37.........	180.44	185.89	189.51	191.87	193.42	....
38.........	175.63	181.09	184.72	187.09	188.63	$189.73
39.........	170.73	176.19	179.83	182 19	183.73	184.79
40.........	165.74	171.19	174.83	177.19	178.73	179.75
41.........	160.68	166.10	169.73	172.09	173.61	174.61
42.........	155.55	160.91	164.52	166.87	168.38	169.36
43.........	150.33	155.63	159.21	161.55	163.04	164.01
44.........	145.05	150.28	153.81	156.13	157.61	158.56
45.........	139.71	144.85	148.33	150.62	152.08	153.01
46.........	134.31	139.36	142.77	145.02	146.45	147.37
47.........	128.87	133.81	137.14	139.34	140.75	141.65
48.........	123.40	128.21	131.45	133.61	134.98	135.85
49.........	117.89	122.57	125.70	127.80	129.14	129.99
50.........	112.35	116.88	119.90	121.93	123.23	124.05
51.........	106.78	111.14	114.05	115.98	117.24	118.03
52.........	101.17	105.36	108.13	109.98	111.19	111.95
53.........	95.54	99.54	102.17	103.92	105.07	105.79
54.........	89.87	93.65	96.14	97.78	98.87	99.56
55.........	84.15	87.70	90.04	91.57	92.59	93.23
56.........	78.39	81.69	83.86	85.28	86.22	86.82
57.........	72.57	75.62	77.62	78.92	79.78	80.33
58.........	66.70	69.48	71.30	72.48	73.25	73.76
59.........	60.78	63.28	64.91	65.96	66.65	67.11
60.........	54.68	56.91	58.34	59.27	59.87	60.27
61.........	49.42	51.39	52.66	53.47	54.00	54.35
62.........	43.50	45.21	46.28	46.98	47.42	47.72
63.........	37.27	38.71	39.60	40.18	40.55	40.79
64.........	30.73	31.91	32.63	33.10	33.40	33.59
65.........	23.75	24.70	25.28	25.65	25.89	26.04
66.........	28.01	29.20	29.93	30.40	30.69	30.89

TABLE 4—*Continued*

Age of Husband	Wife 5 Years Older	Wife Same Age As Husband	Wife 5 Years Younger	Wife 10 Years Younger	Wife 15 Years Younger	Wife 20 Years Younger
67.	25.52	26.60	27.27	27.69	27.95	28.13
68.	22.59	23.53	24 13	24.49	24.73	24.88
69.	19.23	20.03	20.54	20.86	21.06	21.19
70.	15.99	16.71	17.18	17.47	17.66	17.78
71.	18.77	19.75	20.41	20.82	21.07	21.24
72.	18.40	19.42	20.13	20.57	20.84	21.02
73.	18.02	19.07	19.83	20.30	20.59	20.78
74.	17.62	18.71	19.51	20.02	20.33	20.53
75.	17.21	18.33	19.17	19.72	20.05	20.26
76.	16.80	17.94	18.81	19.40	19.75	19.98
77.	16.37	17.53	18.43	19.06	19.44	19.67
78.	15.96	17.14	18.07	18.73	19.13	19.38
79.	15.54	16.73	17.68	18.36	18.79	19.05
80.	15.04	16.24	17.18	17.88	18.33	18.60
81.	14.53	15.70	16.64	17.34	17.81	18.08
82.	14.06	15.18	16.11	16.81	17.28	17.56
83.	13.34	14.42	15.26	15.93	16.38	16.65
84.	12.92	13.89	14.70	15.32	15.75	16.01
85.	11.51	12.16	12.93	13.42	13.76	13.98
86.	10.94	12.11	12.09	12.48	12.76	12.93
87.	8.37	9.38	8.89	9.06	9.18	9.26
88.	5.50	5.50	5.50	5.50	5.50	5.50

permanently incapacitated or in the event that he voluntarily retires on an age pension under the Railroad Retirement Act. Table 4 contains the factors for computation of the present worth of the decedent employee's contributions to his dependents out of earnings while at work in the employment of the railroad company.

b) The second factor needed is a joint life annuity value pertaining to a contingent annuity which is to commence at the inception of the permanent disability of the husband only, if the wife be then alive, and is to continue for the duration of the joint lifetime of the disabled husband and his wife. Table 5 contains the factors for computation of the present worth of the decedent employee's contribution to his dependents out of his disability pension income while drawing such a pension under the Railroad Retirement Act.

c) The third factor needed is a joint life annuity value pertaining to a contingent annuity which is to commence upon the voluntary retirement of the husband on a pension under the Railroad Retirement Act and is to continue for the duration of the joint lifetime of the retired husband and his wife. Table 6 contains the factors for computation of the present worth of the decedent employee's contribution to his dependents out of his old-age pension while drawing such a pension under the Railroad Retirement Act.

TABLE 5

CONTINGENT ANNUITIES
Basis 3% Interest

PRESENT WORTH OF $1.00 PER MONTH PAYABLE DURING JOINT LIFE-
TIME OF HUSBAND AND WIFE ONLY IF HUSBAND
BECOMES PERMANENTLY DISABLED

Age of Husband	Wife 5 Years Older	Wife Same Age As Husband	Wife 5 Years Younger	Wife 10 Years Younger	Wife 15 Years Younger	Wife 20 Years Younger
18.....	$5.61	$ 6.27	....	....	....	....
19.....	5.80	6.49	....	....	....	....
20.....	6.01	6.71	....	....	....	....
21.....	6.22	6.95	....	....	....	....
22.....	6.45	7.20	....	....	....	....
23.....	6.68	7.45	$ 8.04	....	....	....
24.....	6.92	7.72	8.33	....	....	....
25.....	7.17	8.00	8.62	....	....	....
26.....	7.44	8.29	8.93	....	....	....
27.....	7.71	8.59	9.26	....	....	....
28.....	8.00	8.91	9.59	$10.09	....	....
29.....	8.30	9.24	9.95	10.46	....	....
30.....	8.61	9.58	10.31	10.84	....	....
31.....	8.65	9.64	10.39	10.93	....	....
32.....	8.69	9.71	10.47	11.02	....	....
33.....	8.73	9.77	10.56	11.12	$11.52	....
34.....	8.78	9.85	10.65	11.23	11.63	....
35.....	8.83	9.92	10.74	11.33	11.74	....
36.....	8.88	10.00	10.84	11.45	11.86	....
37.....	8.94	10.08	10.95	11.56	11.99	....
38.....	9.00	10.17	11.05	11.68	12.12	$12.42
39.....	9.07	10.27	11.17	11.81	12.25	12.56
40.....	9.14	10.36	11.28	11.94	12.39	12.70
41.....	9.22	10.46	11.40	12.07	12.54	12.85
42.....	9.31	10.57	11.53	12.21	12.69	13.00
43.....	9.40	10.69	11.67	12.36	12.84	13.16
44.....	9.50	10.81	11.80	12.52	13.00	13.33
45.....	9.60	10.93	11.94	12.67	13.16	13.49
46.....	9.71	11.05	12.08	12.82	13.32	13.66
47.....	9.80	11.16	12.21	12.95	13.46	13.81
48.....	9.88	11.26	12.31	13.07	13.59	13.93
49.....	9.94	11.33	12.40	13.16	13.68	14.03
50.....	9.98	11.38	12.45	13.22	13.75	14.10
51.....	9.99	11.40	12.48	13.25	13.78	14.13
52.....	9.97	11.38	12.46	13.22	13.75	14.11
53.....	9.91	11.31	12.38	13.14	13.67	14.02
54.....	9.79	11.18	12.23	12.99	13.51	13.86
55.....	9.62	10.98	12.02	12.75	13.27	13.61
56.....	9.36	10.69	11.69	12.41	12.91	13.24
57.....	9.00	10.26	11.23	11.91	12.39	12.71
58.....	8.48	9.67	10.58	11.22	11.67	11.97
59.....	7.73	8.82	9.65	10.24	10.65	10.92
60.....	6.79	7.75	8.48	9.00	9.36	9.60
61.....	5.80	6.63	7.25	7.69	7.99	8.20
62.....	4.62	5.27	5.76	6.11	6.35	6.51
63.....	3.27	3.73	4.08	4.33	4.50	4.61
64.....	1.77	2.02	2.20	2.33	2.42	2.49

TABLE 6

CONTINGENT ANNUITIES
Basis 3% Interest

PRESENT WORTH OF $1.00 PER MONTH PAYABLE DURING JOINT LIFE-
TIME OF HUSBAND AND WIFE ONLY IF HUSBAND
RETIRES ON A PENSION

Age of Husband	Wife 5 Years Older	Wife Same Age As Husband	Wife 5 Years Younger	Wife 10 Years Younger	Wife 15 Years Younger	Wife 20 Years Younger
18.....	$ 3.85	$ 5.35	....	....	....	....
19.....	3.99	5.54	....	....	....	....
20.....	4.13	5.73	....	....	....	....
21.....	4.28	5.93	....	....	....	....
22.....	4.43	6.14	....	....	....	....
23.....	4.59	6.36	$ 7.92	....	....	....
24.....	4.75	6.59	8.20	....	....	....
25.....	4.93	6.83	8.49	....	....	....
26.....	5.11	7.07	8.80	....	....	....
27.....	5.30	7.33	9.12	....	....	....
28.....	5.49	7.60	9.45	$10.91	....	....
29.....	5.70	7.88	9.79	11.31	....	....
30.....	5.92	8.18	10.15	11.72	....	....
31.....	6.14	8.48	10.53	12.15	....	....
32.....	6.38	8.80	10.92	12.60	....	....
33.....	6.62	9.14	11.33	13.07	$14.36	....
34.....	6.88	9.49	11.76	13.56	14.89	....
35.....	7.15	9.85	12.21	14.07	15.44	....
36.....	7.44	10.24	12.68	14.60	16.02	....
37.....	7.74	10.64	13.17	15.16	16.63	....
38.....	8.06	11.07	13.69	15.75	17.27	$18.34
39.....	8.39	11.51	14.23	16.37	17.94	19.05
40.....	8.75	11.99	14.80	17.02	18.64	19.79
41.....	9.13	12.48	15.40	17.70	19.38	20.57
42.....	9.53	13.01	16.04	18.42	20.16	21.39
43.....	9.96	13.58	16.72	19.18	20.99	22.26
44.....	10.43	14.18	17.43	19.99	21.86	23.17
45.....	10.92	14.82	18.20	20.85	22.79	24.15
46.....	11.46	15.51	19.02	21.77	23.78	25.19
47.....	12.05	16.26	19.90	22.76	24.85	26.31
48.....	12.68	17.07	20.86	23.82	25.99	27.51
49.....	13.38	17.96	21.89	24.97	27.23	28.80
50.....	14.15	18.93	23.02	26.23	28.57	30.20
51.....	15.00	19.99	24.26	27.59	30.03	31.73
52.....	15.95	21.17	25.62	29.09	31.63	33.40
53.....	17.01	22.48	27.12	30.74	33.39	35.23
54.....	18.21	23.94	28.80	32.57	35.33	37.25
55.....	19.56	25.58	30.67	34.61	37.49	39.50
56.....	21.11	27.44	32.79	36.91	39.92	42.02
57.....	22.90	29.58	35.19	39.52	42.67	44.87
58.....	25.00	32.05	37.97	42.51	45.81	48.12
59.....	27.48	34.96	41.20	46.00	49.46	51.89
60.....	30.41	38.36	44.97	50.03	53.68	56.24
61.....	32.62	40.99	47.94	53.25	57.08	59.75
62.....	35.74	44.60	51.93	57.52	61.55	64.35
63.....	39.39	48.76	56.48	62.37	66.60	69.54
64.....	43.60	53.47	61.60	67.79	72.23	75.31
65.....	48.58	58.92	67.46	73.95	78.60	81.82

TABLE 6—*Continued*

Age of Husband	Wife 5 Years Older	Wife Same Age As Husband	Wife 5 Years Younger	Wife 10 Years Younger	Wife 15 Years Younger	Wife 20 Years Younger
66.....	$40.87	$50.75	$59.07	$65.43	$70.00	$73.16
67.....	39.64	49.43	57.76	64.13	68.72	71.89
68.....	38.94	48.63	56.97	63.37	67.97	71.15
69.....	38.77	48.33	56.67	63.08	67.69	70.88
70.....	38.58	47.93	56.20	62.60	67.20	70.38
71.....	32.86	41.54	49.43	55.63	60.11	63.20
72.....	30.21	38.47	46.11	52.21	56.61	59.66
73.....	27.71	35.53	42.89	48.88	53.21	56.21
74.....	25.36	32.74	39.81	45.66	49.92	52.87
75.....	23.17	30.11	36.88	42.58	46.77	49.66
76.....	21.13	27.65	34.09	39.63	43.75	46.59
77.....	19.26	25.36	31.48	36.85	40.89	43.67
78.....	17.52	23.22	29.01	34.18	38.14	40.87
79.....	15.91	21.21	26.67	31.62	35.49	38.16
80.....	14.44	19.34	24.45	29.17	32.92	35.53
81.....	13.10	17.57	22.39	26.86	30.48	33.03
82.....	11.90	16.01	20.50	24.72	28.21	30.69
83.....	10.73	14.62	18.59	22.52	25.83	28.22
84.....	9.79	13.70	17.07	20.78	23.96	26.29
85.....	9.17	12.69	15.85	19.30	22.28	24.51
86.....	8.01	12.83	14.02	17.19	19.97	22.08
87.....	7.85	14.33	13.53	16.54	19.17	21.20
88.....	13.05	21.09	21.02	25.18	28.80	31.61

The development of information for two death cases is now illustrated. The calculation for Illustrative Case 3 is a simple one involving the circumstance where the decedent employee leaves only a wife surviving him and no other dependents, whereas Illustrative Case 4 involves the condition where the decedent employee leaves not only a surviving wife but also several minor children.

Illustrative Case No. 3

The development of the present worth of a widow's loss in a simple F.E.L.A. case involving fatal injuries where there were no minor children surviving the deceased railroad employee is shown hereunder. The railroad company furnished their records showing their deceased employee's date of birth; date of fatal injury; age of wife on date of fatal injury; number of months of credited service and earnings; and average monthly earnings and deductions for a duration of two years immediately prior to

date of fatal injury. These data were tabulated and arranged in the following convenient form:

Date of birth: April 29, 1887
Date of fatal injury: December 16, 1948
Dependents: wife age 58 years
Months of credited service and earnings:

a) Prior to 1937	174 months	$22,237.20
b) After January 1, 1937	144 months	31,985.09
	318 months	$54,222.29

Average monthly earnings and deductions for two years prior to death:

a) Gross basis	$365.68
b) Income tax	44.60
c) Railroad Retirement Act tax	17.34
d) Net basis	$303.74

1. The deceased employee was 61 years and 231 days of age when he was fatally injured and his wife was 58 years of age. Therefore, by interpolation from Tables 4, 5 and 6, the respective factors of $48.36, $6.18 and $48.67 are determined, based on interest at the assumed rate of 3% per annum.
2. The average monthly wage for pension purposes is $170.51 and the monthly credit for each year of credited service is $3.25. Allowing the maximum number of 30 years, the maximum pension would be $97.50 per month based on the foregoing factors.
3. The ratio of the maximum pension to the average net monthly wage prior to death is 32.09982%. This is the relationship we seek and will now use to make a composite capitalization factor to be applied to monthly earnings.
4. The composite capitalization factor is computed as follows:

Table 4 factor is $48.36 × 100%   = $48.36
Table 5 factor is   6.18 × 32.09982% =   1.98
Table 6 factor is 48.67 × 32.09982% = 15.62

Composite Capitalization Factor......... $65.96

5. In this case Counsel specified that 80% of the average net monthly earnings would have been contributed by the deceased employee to his wife, therefore, the average monthly contribution would be $242.99 which capitalized at $65.96 for each $1.00 thereof would result in a lump sum loss to the widow of $16,027.62. Rounding off to the nearest $1,000 results in $16,000 as the widow's loss in this case.

Plaintiff's actuary (by the life expectancy method) determined the widow's loss to be $62,000.00. During the course of the trial and while on

the witness stand, defendant requested his actuarial witness to refigure his determination based upon an average monthly contribution of $344.84. The recomputed figure after rounding off is $18,000.00. The jury brought in a verdict for $40,000.00. Apparently they averaged the contention of both sides and gave one-half weight to each.

Illustrative Case No. 4

The development of the present worth of the loss of a widow and four minor children, a more complicated determination under a F.E.L.A. case involving fatal injuries to a railroad company employee, is shown hereunder. The railroad company furnished their records showing their deceased employee's date of birth; date of fatal injury; number, relationship and ages of dependents on date of fatal injury; number of months of credited service and earnings; and average monthly net earnings for duration of one year immediately prior to date of fatal injury. These data were tabulated and arranged in the following convenient form:

Date of birth: August 17, 1900
Date of fatal injury: August 27, 1947
Dependents: wife 47; sons 12, 15 and 17; daughter 10
Months of credited service and earnings:

a) Prior to 1937	62	$ 3,773.29
b) After January 1, 1937	128	14,328.65
	190	$18,101.94

Average net monthly earnings: $162.11

1. The deceased employee and his wife were almost of an equal age on the date of his fatal injury and for sake of facility of computation were assumed to be the same age, namely, 47.0274 years. Unfortunately in this case we can not use the factors of Tables 4, 5 and 6 but must resort to commutation functions for the required calculation. Defendant's Counsel wanted computations to show a contribution of 5/6 of the monthly wage for four years until the eldest son attained age 21; of 2/3 of the monthly wage for two additional years until the next younger son attained the age of 21; 1/2 of the monthly wage for two additional years until the daughter attained the age of 18; 1/3 of the monthly wage for one additional year until the youngest son attained the age of 21; and 1/6 of the monthly wage thereafter for the life of the wife. The theory here involved was that the income was used up in equal portions by the mother, father and four minor children; therefore, as each child attained his (or her) legal majority, the father's contribution would fall off 1/6 part. (NOTE.—The theoretically correct fractions above would be 5/6, 4/5, 3/4, 2/3 and 1/2; the developments in the case are reported, however, just as they occurred.)

Such a calculation represented more work than the railroad company felt was warranted. Consequently, the railroad company contented itself with assuming a contribution of 5/6 of the monthly wage until the youngest son (age 12 years) should attain age 21 years and 1/2 of the monthly wage for the life of the widow thereafter. Such an arrangement impressed us as being fair and the annuity values of Tables 4, 5 and 6 were split into temporary and deferred portions as follows:

EQUAL AGES	NINE YEAR TEMPORARY ANNUITY	NINE YEAR DEFERRED ANNUITY	TOTAL VALUES	5/6 TEMPORARY PLUS 1/2 DEFERRED ANNUITY VALUES	APPLICABLE INTERPOLATED VALUES TO GIVE EQUAL AGES 47.0274 YEARS
		Table 4 Factors			
47:47.....	$85.40	$48.41	$133.81	$95.37	$95.29
48:48.....	84.56	43.65	128.21	92.29	....
		Table 5 Factors			
47:47.....	$ 4.83	$ 6.33	$ 11.16	$ 7.19	$ 7.19
48:48.....	5.34	5.92	11.26	7.41	....
		Table 6 Factors			
47:47.....	....	....	$ 16.26	$ 8.13	$ 8.14
48:48.....	....	....	17.27	8.64	....

2. The average monthly wage for pension purposes is $94.80 and the monthly credit for each year of credited service $2.01. Allowing the maximum number of 30 years, the maximum pension would be $60.30 per month based on the foregoing factors.

3. The ratio of the maximum pension to the average net monthly wage prior to death is 37.19696%.

4. The composite capitalization factor is computed as follows:

$$
\begin{aligned}
\text{Table 4 factor is } \$95.29 \times 100\% &= \$95.29 \\
\text{Table 5 factor is } 7.19 \times 37.19696\% &= 2.67 \\
\text{Table 6 factor is } 8.14 \times 37.19696\% &= 3.03 \\
\hline
\text{Composite Capitalization Factor} \ldots \ldots \ldots &\ \$100.99
\end{aligned}
$$

5. In this case the composite capitalization factor must be applied to the entire net average monthly wage of $162.11 resulting in a total value of $16,371.49 which after rounding reduces to $16,000.00.

In the foregoing case plaintiff employed no actuarial witness but defendant applied the method herein described, thereby supplying the Court and the jury with reliable and scientific evidence to assist them in arriving at a verdict. The first named writer testified in this case and in many other F.E.L.A. cases. Up to the moment of the present writing, no one has been able to argue effectively, or to validly demonstrate, that the techniques or the method herein described are inequitable in any respect. The statistics, upon which application of the work life expectancy method to railroad employees depends, were compiled by the actuaries of the Railroad Retirement Board and such compilation, constituting as it does a most detailed and exhaustive study of a specific major industry, makes a scientific approach to this problem possible.

The problem of establishing the value of earnings lost attributable to personal injury or wrongful death is not peculiar to any one industry or group of individuals. For this reason it would be desirable to establish an acceptable standard table or tables for use generally in the Courts and by counsel, in the absence of evidence introduced to warrant the use of a different table. The authors hope that the presentation of this paper, together with discussion by other actuaries, will be the first step in obtaining more widespread recognition of the method and in the acceptance of "standard" tables for application to specific cases.