RTA, ZETA-TECH Associates Update SelecTie Model For 2006



2006, ZETA-TECH Associates Inc. updated the Railway Tie Association's (RTA)

SelecTie crosstie economic analysis model.

The *SelecTie* model incorporates all of the key input and influence factors, including costs (materials, labor and equipment), maintenance activities, and engineering equations for component life prediction. The *SelecTie* model has been used as a decision-making tool by railroads, transits and consultants.

The *SelecTie* model provides an economic benefit analysis of alternate crosstie configurations. While the focus is on wood vs. concrete ties, the model can be used for alternate materials. The model features user selection of maintenance activities and cost categories and has the capability for detailed cost inputs at the individual gang and equipment level. The model uses a Present Value Life Cycle Cost analysis, and the results are shown as net benefit and return on investment (ROI).

The model incorporates default values for all of the inputs so as to allow for easy use and also to provide a baseline number when the model is used. These default values were last updated in 1996 and required updating.

In order to ensure accurate input values, this update was performed with a major U.S. Class I railroad. These revised default values addressed the range of different track maintenance activities and include:

- Equipment, Labor and Material Costs
- Labor Gang Composition
- Productivity Rates for Different Activities
- Material Requirements

Figure 1 shows the material requirement updates that included the number of wood ties replaced each replacement cycle, ballast type, probability of derailment and derailment characteristics.

Figure 2 shows the unit cost for different materials, including

■ Wood and Concrete Ties ►

Figure 1

Tie Dimensions			Wood Tie Gang	-1
	Wood	Concrete	No of Wood Ties Replaced Each Tie	
Width (m)	14	III	Replacement Cycle	
Height (in)	9	9.5	1000	
Length (ft)	8.5	9		
Tie Spacing				
	Wood	Concrete	Third Rail Support	
Tie Spacing (in)	20	24		
Ties/Supports Per M	file 3168	2640	0	
Concrete Tie Ab Probability of Rail :	rasion Seat Abrasion	14.3		
Tie Characteristics	Tie Compon	ients Ballast	Fuel Derailment	
			Apply Exi	t
				-

SelecTie Upgrade Available All current SelecTie

licensees are eligible for the 2006 default value upgrade based on member status. Contact RTA offices at (770) 460-5553 or via email at ties@rta.org for more information.

Figure 2

Material Costs					(and the second s		_				_	
					Tie Rep	lacement					-	
		Salvage	Pet		W	boo		Pot		Concre	ete	
Item	Unit Cost	Pot	Repl	No/M	Cost/Mi	Sal/Mi	<u>s/Mi</u>	Repl	No/M	Cost/Mi	Sal/Mi	<u>s/Mi</u>
Conorete tie	\$50.00	0.0	0.0	0	\$0	\$0	\$0	100.0	2640	\$132,000	\$0	\$132,000
Elastic Fastener	\$1.65	5.0	15.0	0	\$0	\$0	\$0	100.0	10560	\$17,424	\$871	\$16,553
Tie Pad	\$3.10	0.0	0.0	0	\$0	\$0	\$0	100.0	5280	\$16,368	\$0	\$16,368
Insulator	\$0.40	0.0	0.0	0	\$0	\$0	\$0	100.0	10560	\$4,224	\$0	\$4,224
WoodTie	\$40.00	0.0	100.0	1000	\$40,000	\$0	\$40,000	0.0	0	\$0	\$0	\$0
Cut Spike Plate	\$9.00	20.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Elastic Fastener Plate	\$9.00	20.0	15.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Cut Spike	\$0.34	20.0	25.0	2000	\$680	\$136	\$544	0.0	0	\$0	\$0	\$0
Look Spike	\$0.49	20.0	25.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Anohor	\$0.84	20.0	25.0	500	\$420	\$84	\$336	0.0	0	\$0	\$0	\$0
Tie Plug	\$0.25	0.0	100.0	8000	\$2,000	\$0	\$2,000	100.0	0	\$0	\$0	\$0
Wood Tie Disposal	\$2.00	0.0	100.0	1000	\$2,000	\$0	\$2,000	0.0	0	\$0	\$0	\$0
Conc Tie Disposal	\$6.00	0.0	0.0	0	\$0	\$0	\$0	100.0	2640	\$15,840	\$0	\$15,840
Standard Rail (/ton)	\$800.00	10.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Premium Rail (/ton)	\$850.00	10.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Conc Tie Repair (/tie)	\$20.55	0.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Ballast (/ton)	\$11.00	0.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Fuel (/gal)	\$2.00	0.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Third Rail Tie	\$75.50	0.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
Overhang Plate	\$20.55	0.0	0.0	0	\$0	\$0	\$0	0.0	0	\$0	\$0	\$0
					\$45,100	\$220	\$44.990			\$185,856	\$871	\$184,98

Figure 3

- Daily Equipme	mt Costs		Tie R	eplacen	ment			-			
	Unit Cost	No	Wood Daily Amt	C <u>No</u>	Daily Amt		Unit Cost	No	Wood Daily Amt	C. No	Daily Am
Adzer	\$93.22	0	\$0.00	0	\$0.00	Tie Crane	\$149.82	3	\$449.46	0	\$0.00
Air Comp	\$63.08	0	\$0.00	0	\$0.00	Tie Cribber	\$96.16	0	\$0.00	0	\$0.00
Anohor Adj	\$160.29	0	\$0.00	0	\$0.00	Tie Drill	\$34.17	0	\$0.00	0	\$0.00
Anchor App	\$108.85	2	\$217.70	0	\$0.00	Tie Inserter	\$379.18	3	\$1,137.54	0	\$0.00
Ballast Reg	\$299.00	2	\$598.00	1	\$299.00	Tie Scarifier	\$189.58	1	\$189.58	0	\$0.00
P811	\$27,400.00	0	\$0.00	1	\$27,400.00	Tie Shear	\$374.67	0	\$0.00	0	\$0.00
Bolt Tightener	\$22.03	0	\$0.00	0	\$0.00	Tie Plug	\$39.73	0	\$0.00	0	\$0.00
Burro Crane	\$726.36	0	\$0.00	2	\$1,452.72	HandTools	\$13.70	0	\$0.00	2	\$27.40
Gager	\$139.84	0	\$0.00	0	\$0.00	Ondercutter	\$13,700.00	0	\$0.00	0	\$0.00
Gondola	\$12.33	0	\$0.00	0	\$0.00	Grinder	\$27,400.00	0	\$0.00	0	\$0.00
Clipp App	\$109.60	0	\$0.00	4	\$438.40	Derail Cleanup	\$28,270.00	0	\$0.00	0	\$0.00
Clip Remover	\$109.60	0	\$0.00	0	\$0.00	Pan Setter	\$10.96	3	\$32.88	0	\$0.00
Rail Heater	\$139.84	0	\$0.00	1	\$139.84	Pan Puller	\$10.96	0	\$0.00	0	\$0.00
RailLifter	\$26.62	1	\$26.62	0	\$0.00	Backhoe	\$726.36	0	\$0.00	1	\$726.36
Spot Tamper	\$187.62	2	\$375.24	0	\$0.00	Double Broom	\$299.00	0	\$0.00	0	\$0.00
Speed Swing	\$550.14	0	\$0.00	0	\$0.00	Track Stabilizer	\$558.58	0	\$0.00	0	\$0.00
Spike Drive	\$379.18	4	\$1,516.72	0	\$0.00	Welding Truck	\$0.00	0	\$0.00	0	\$0.00
Spike Puller	\$94.98	2	\$189.96	0	\$0.00	Miso 1	\$0.00	0	\$0.00	0	\$0.00
Tamp-Liner	\$558.58	0	\$0.00	0	\$0.00	Miso 2	\$0.00	0	\$0.00	0	\$0.00
Camper	\$437.44	2	\$874.88	1	\$437.44			55	608.58	53	0,921.16

- Elastic Fastener
- Tie Pad
- Insulator
- Elastic Fastener Plate
- Standard and Premium Rail
- Concrete Tie Repair
- Ballast (per ton)
- Fuel Cost (per gallon)

Figure 3 shows the equipment unit costs, which were increased to reflect current costs in the industry. The model also includes the number of units in a gang, required for both tie types updated for different maintenance activities.

Figure 4 shows the updated daily wages for each labor group that were increased to reflect current labor costs. The model also includes the number of persons in each labor group by maintenance activities (e.g., rail replacement, rail transposing, tie installation, surfacing, undercutting and gaging).

Figure 5 shows the productivity rates that were updated for the key maintenance activities to include rail replacement, rail transposition, tie installation (ties/day), rail grinding, concrete tie repair, gaging (wood ties), and undercutting (maintenance and conversion).

The updated SelecTie model retains all of the flexibility and accuracy of the original model and will allow *SelecTie* to continue to be an effective tool for analyzing wood, concrete, and alternate tie material costs and benefits. **Figure 6** and **Table 1** show one sample case result incorporating most of the major maintenance functions included in the model. §

Figure 4

Daily Labor Costs					
	Tie Replacen	nent			•
			Wood	(Concrete
	Daily Wage	No	Daily Amt	No	Daily Amt
Laborer Group 1	\$180.00	23	\$4,140.00	20	\$3,600.00
Operator Group 2	\$200.00	1	\$200.00	5	\$1,000.00
Operator Group 3	\$200.00	18	\$3,600.00	10	\$2,000.00
Production Foreman	\$225.00	4	\$900.00	5	\$1,125.00
Engineer	\$272.00	0	\$0.00	0	\$0.00
		R	\$8,840.00	F	\$7,725.00
				A.,	alu I Fret

Figure 5

Basic Force: 0.192 0.192 Rail Replacement: 0.270 0.270 Rail Transposing: 0.270 0.270 Ite Installation (ties/day): 1600.000 2000.000 Concrete Tie Repair: N/A 0.270 Surfacing: 2.000 2.490 Ondercoutting (Maint): 0.500 0.800 Rail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Usage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800		Wood	Concrete
Rail Replacement: 0.270 0.270 Rail Transposing: 0.270 0.270 Die Installation (ties/day): 1600.000 2000.000 Concrete Tie Repair: N/A 0.270 Surfacing: 2.000 2.490 Ondercutting (Maint): 0.500 0.800 Bail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Usage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Basic Force:	0.192	0.192
Rail Transposing: 0.270 0.270 Tie Installation (ties/day): 1600.000 2000.000 Concrete Tie Repair: N/A 0.270 Surfacing: 2.000 2.490 Ondercutting (Maint): 0.500 0.800 Rail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Osage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Rail Replacement:	0.270	0.270
Tie Installation (ties/day): 1600.000 2000.000 Concrete Tie Repair: N/A 0.270 Surfacing: 2.000 2.490 Ondercutting (Maint): 0.500 0.800 Rail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Usage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Rail Transposing:	0.270	0.270
Concrete Tie Repair: N/A 0.270 Surfacing: 2.000 2.490 Ondercutting (Maint): 0.500 0.800 Rail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Usage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Fie Installation (ties/day):	1600.000	2000.000
Surfacing: 2.000 2.490 Ondercutting (Maint): 0.500 0.800 Rail Grinding: 20.000 20.000 Gaging: 0.270 M/A Anchor Adjustment: 1.000 M/A Fuel Dsage: M/A M/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): M/A 2640.000 Undercutting (Conversion): M/A 0.800	Concrete Tie Repair:	N/A	0.270
Ondercutting (Maint): 0.500 0.800 Rail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1000 N/A Fuel Dsage: M/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Surfacing:	2.000	2.490
Rail Grinding: 20.000 20.000 Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Dsage: M/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Dindercutting (Conversion): N/A 0.800	Undercutting (Maint):	0.500	0.800
Gaging: 0.270 N/A Anchor Adjustment: 1.000 N/A Fuel Usage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Rail Grinding:	20.000	20.000
Anchor Adjustment: 1.000 N/A Fuel Osage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Ondercutting (Conversion): N/A 0.800	Gaging:	0.270	N/A
Fuel Usage: N/A N/A Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): N/A 2640.000 Undercutting (Conversion): N/A 0.800	Anchor Adjustment:	1.000	N/A
Derailment: 1.000 1.000 Conversion to Concrete Ties(ties/day): 1/A 2640.000 Undercutting (Conversion): 1/A 0.800	Fuel Usage:	M/A	N/A
Conversion to Concrete Ties(ties/day): 21/A 2640.000 Undercutting (Conversion): 21/A 0.800	Derailment:	1.000	1.000
Undercutting (Conversion): M/A 0.800	Conversion to Concrete Ties(ties/day):	N/A	2640.000
	Undercutting (Conversion):	N/A	0.800

Untitled 1					States Second	time i li l
					[
Input Summary			Economic Summary			
Curvature: 3.00	Annual MGT:	25		PV	Costs/M	ile
Grade: 0	Wheel Load:	33000	Activity	Wood	Concrete	Delta
Speed: 45	Rail Wt:	132	Basic Force:	\$46,875	\$39,094	-\$7,781
Enter Comments for your I	Comment Salas Tin S	errico	Rail Replacement	\$44,406	\$31,866	-\$12,540
sincer comments for your i	SULTON PERCINE 2	633101L	Rail Transposing:	\$18,909	\$6,307	-\$12,602
			Tie Installation:	\$89,821	\$2,731	-\$87,090
		<u> </u>	Concrete Tie Repair:	\$0	\$9,463	\$9,463
Economic Results by Cos	t Category		Surfacing:	\$15,680	\$12,583	-\$3,097
Basic Force		-	Undercutting (Maint):	\$30,347	\$21,834	-\$8,512
Cost Item	Wood	Concrete	Rail Grinding:	\$14,885	\$22,662	\$7,777
Daily Faring out Caster	len	len	Gaging:	\$24,527	\$0	-\$24,527
Daily Equipment Costs.	6900	\$751	Anchor Adjustment:	\$1,224	\$0	-\$1,224
Productivity Pater	0.19	0.19	Fuel Usage:	\$1,060,000	\$1,038,800	-\$21,200
Material Costs	\$0	SO	Deraiment.	\$1,963	\$2,038	\$75
Date Catality		-	Conv. to Concrete Ties.	\$48,709	\$223,231	\$174,523
Daily Costs/Mile:	\$4,688	\$3,909	Undercutung (Lonversion):	150	1\$34,708	\$34,708
Life Cucles:	1.00	1.00	Totals:	\$1,397,346	\$1,445,318	
Present Value Costs	\$46.875	\$39,094	Net Benefit of Mond Ties	\$47 972		

Table 1

Activity	Wood	Concrete	Difference
Basic Force	46,875	39,094	-7,781
Rail Replacement	44,406	31,866	-12,540
Rail Transposing	18,909	6,307	-12,602
Tie Installation	89,821	2,731	-87,090
Concrete Tie Repair	-	9,463	9,463
Surfacing	15,680	12,583	-3,097
Undercutting (Maintenance)	30,347	21,834	-8,512
Rail Grinding	14,885	22,662	7,777
Gaging	24,527	_	-24,527
Anchor Adjustment	1,224	-	-1,224
Fuel Usage	1,060,000	1,038,800	-21,200
Derailment	1,963	2,038	75
Conversion to Concrete Ties	48,709	223,231	174,523
Undercutting (Conversion)	_	34,708	34,708
Totals	1,397,346	1,445,318	47,972
ROI for Concrete Ties			-22.93