

Tables

Table 1: Total Changes in Bridge Market from 1986 to 1992 for Federal Highway and Off System Highway Bridges

Material Type	Concrete	Steel	Prestressed Concrete	Timber	Other**	Total
Total Number in 1986	222017	223709	63945	60578	4676	574925
Total Number in 1992	229946	209598	85434	45684	4619	575281
Percent Change	3%	-6%	33%	-24%	-1%	0%

** Other materials include bridges constructed of masonry and metals other than steel.

Source: U.S. Department of Transportation, 1992.

Table 2: Noise Barriers Constructed in the United States through 1990

Material Type	Total Length (mi)	Percent
Block/Concrete	148.1	32%
Concrete	91.2	20%
Wood	68.2	15%
Berm	47.4	10%
Metal	22.6	5%
Berm/concrete	18.0	4%
Berm/wood	9.8	2%
Berm/metal	6.7	1%
Other	54.2	11%
Total	466.9	100%

Source: Cohn and Harris, 1990.

Table 3: Percent of Material Used in Single Post Sign Installations in 1979

Material Type and Shape	State	City	County	Other	Total
Steel or Aluminum					
U single	29.8%	48.6%	48.3%	36.6%	34.0%
U back-back	1.2%	0%	0%	0%	0.9%
Square tube	13.6%	10.1%	13.4%	2.9%	12.7%
Round pipe	25.8%	33.3%	5.8%	12.2%	25.6%
Beam	0.2%	0%	0%	NA	0.3%
Angle	NA	1.3%	0%	0%	0.2%
Wood					
Square	28.9%	6.3%	32.5%	38.0%	25.6%
Round	0.5%	0%	0%	4.2%	0.5%
Combination	0%	0%	0%	6.1%	0.1%
Plastic Pipe	0%	0.4%	0%	0%	0.1%

Source: Cunard, 1990.

Table 4: Percent of Material Used in Multiple Post Sign Installations in 1979

Material Type and Shape	State	City	County	Other	Total
Steel or Aluminum					
U single	32.4%	1.8%	97.8%	4.5%	29.7%
U back-back	3.4%	0%	NA	0%	3.0%
Square tube	7.0%	11.1%	NA	NA	7.2%
Round pipe	5.6%	83.6%	2.2%	0.3%	13.3%
Beam	23.3%	0%	0%	3.8%	20.4%
Angle	0%	0%	0%	0%	0%
Wood					
Square	27.4%	3.5%	0%	53.6%	25.1%
Round	0.9%	0%	0%	15.5%	1.0%
Combination	NA	0%	0%	20.1%	0.3%
Plastic Pipe	0%	0%	0%	0%	0%

Source: Cunard, 1990.

Table 5: Crosstie Installation History

Year	Millions of Crossties
1900	100
1921	86
1936	47
1944	51
1961	12
1979	25
1980	23

Source: RTA, Railway Tie Association, 1986.

Table 6: Percentage of Purchasing Decisions Made by Branches/Offices within an Organization.

Final Decision Makers on Purchases	Size – number of employees at organization						
	All Sizes	1-19	20-49	50-99	100-249	250-499	>500
Central Purchasing	70%	47%	54%	62%	76%	77%	74%
Individuals/departments	24%	47%	42%	28%	20%	22%	17%
Unclear	6%	6%	4%	10%	4%	2%	9%
Sample Sizes Numbers	(250)	(32)	(28)	(37)	(49)	(29)	(85)

Source: Berkowitz, 1986.

Table 7: Percentage of Purchase Orders Placed by Organization Size and Industry

Final Decision Responsibility	Manufacturing (Number of Employees)				Non-manufacturing (Number of Employees)		
	All	1-99	100-499	500 or greater	All	1-99	100 or greater
Number of Employees at Location							
Central purchasing	68%	51%	74%	73%	76%	67%	79%
Individuals/departments	27%	40%	23%	15%	21%	29%	18%
Unclear	5%	9%	3%	12%	3%	4%	3%
Sample Size	(197)	(71)	(66)	(58)	(53)	(21)	(32)

Source: Berkowitz, 1986.

Table 8: Material Attributes Used by Industrial Purchasing Agents to Rate Products.

1. Overall reputation of the supplier
2. Financing terms
3. Supplier's flexibility in adjusting to your company's needs
4. Experience with the supplier in analogous situations
5. Technical service offered
6. Confidence in sales people
7. Convenience of placing order
8. Data on product reliability
9. Price
10. Technical specifications
11. Ease of operations or use
12. Preferences of the principal user of the product
13. Training offered by the supplier
14. Training time required
15. Reliability of the delivery date specified
16. Ease of Maintenance
17. Sales service expected after date of purchase

Source: Lehman and O'Shaughnessy, 1974.

Table 9: Cost of Upgrading Highway Guardrails, 1974 to 1992.

Construction Upgrade	Cost (\$ millions)	Reduced Percentage of Fatal Accidents	Reduced Percentage of Non-fatal Injury	Combined Reduction in Percentage of Fatal and Non-fatal Injury	Benefit-Cost Ratio
Bridge Rail	8.0	75%	29%	33%	7.1
Guardrail End Treatment	6.4	52%	15%	16%	3.0
Guardrail	178.3	37%	8%	9%	7.9

Source U.S.Department of Transportation, Office of Highway Safety, 1993.

Table 10: A Comparison of Steel and Wood Post Use in Guardrail Construction.

<p><u>Advantages of Steel Posts:</u></p> <p>Drives easier in all soils, especially in hard materials (asphalt, soil cement)</p> <p>Drives faster</p> <p>Weigh less</p> <p>Handle easier</p> <p>Easier to bolt guardrail to</p> <p>Haul a greater number per load (850/load)</p> <p>Less likely to damage a tight shoulder</p> <p>Drives in rocky soil and will split or drive around rock, may split soft rock, and will drive through shale</p> <p>Bends upon impact, rather than breaking; this allows a secure hold for removal</p> <p><u>Disadvantages of Steel Posts:</u></p> <p>More expensive</p> <p>May become cemented in soil and be difficult to Remove</p>	<p><u>Advantages of Wood Posts:</u></p> <p>Less expensive</p> <p>Don't become cemented in place</p> <p>Better Appearance</p> <p>Drive well in loose fill or clay</p> <p><u>Disadvantages of Wood Posts:</u></p> <p>Not economical unless conditions are right for driving</p> <p>Difficult to install in straight line, so guardrail may not be straight</p> <p>Must drill rocky soil</p> <p>May break off at ground level on vehicle impact, making replacement difficult</p> <p>Difficult to drive in granular soils</p> <p>Haul less per load (300/load)</p> <p>May damage a poorly compacted or tight shoulder</p> <p>Decreases production 25 to 30 percent</p>
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Source: Punches, 1993

Table 11: Materials Used in Noise Barriers, 1981.

Barrier Type	Length (ft.)	Cost in 1980 Dollars
Concrete	464,475	48,600,000
Combination	232,759	33,500,000
Wood	157,746	16,600,000
Earth Berm	128,711	5,900,000
Metal	142,298	2,000,000
Other	2,474	500,000
Total	100,463	107,100,000

Source: Cohn, 1981.

Table 12: Noise Barrier Construction by State, 1986.

Construction by Length		Construction by Cost	
State	Length (Linear Miles)	State	Cost (1986 \$ millions)
California	148.1	California	1165
Minnesota	47.6	Minnesota	41.6
Colorado	31.2	Virginia	26.6
Virginia	26.1	New Jersey	21.5
Oregon	20.8	Michigan	16.3
Michigan	1.6	Tennessee	13.2
Arizona	7.1	New York	13.0
New York	17.1	Illinois	10.1
New Jersey	15.8	Pennsylvania	8.9
Washington	14.5	Oregon	8.7
10-State Total	356.9	10-State Total	276.4

Source: Weiss, 1988.

Table 13: Plywood Concrete Formwork Manufactured Annually by APA Member Companies in 1995.

Plywood Type/Grade	Million Sq. Ft. Manufactured
B-B Plyform	240
MDO Plyform	75
HDO Plyform	35
Other Grades	250

Source: Personal Communication, Bruce Cordova, 1995.

Table 14: Railroads in the United States in 1994.

Railroad	Number	Miles Operated	Employees	Freight Revenue (\$ Thousands)
Class I	12	123,335	189,240	29,930,893
Class II	32	19,842	10,701	1,744,893
Class III	487	25,599	13,070	1,422,285
Total	531	168,776	213,011	33,098,071

Source: Association of American Railroads, 1995.

Table 15: Preservative Treated Tie Production in the United States.

Preservative Treatment	Crossties 1000 Cubic Feet	Switch and Bridge Ties 1000 Cubic Feet
Creosote Solutions 1993	63,553	6,580
Waterborne Solutions 1993	33	31
All Chemicals 1993	63,586	6,611
All Chemicals 1991	60,972	6,230

Source: Micklewright, 1994.

Table 16: Costs for Different Grades of Tie in 1987 Dollars.

Grade	8 ft. 0 ins.	8 ft. 6 ins.	9 ft. 0 ins.
Grade 5: Mainline Ties	18.09	18.94	19.79
Grade 3: Branchline Ties	14.29	14.65	
Industrial Ties	11.77	12.19	

Source: Burns, 1987.

Table 17: U.S. Army Corps of Engineers Harbor Improvement Expenditures from 1985 to 1990

Year	Construction (\$ millions)	Operations and Maintenance (\$ millions)
1985	83.0	382.0
1986	66.0	333.0
1987	80.0	320.0
1988	114.0	317.0
1989	115.0	361.0
1990	128.0	343.0

Source: National Transportation Strategic Planning Study, 1991.

Table 18: Estimated Volumes of Treated Pilings Produced in the United States.

Preservative Treatment	Piling Volume Produced (1000 cubic feet)
Creosote Solutions 1993	2,944
Oil-borne Solutions 1993	12
Waterborne Solutions 1993	5,775
All Chemicals 1993	8,731
All Chemicals 1991	6,770

Source: Micklewright, 1994.

Table 19: Estimated Volume of Treated Poles Produced in the United States.

Chemical Treatment	1000 Cubic Feet Volume
Creosote Solutions 1993	10,957
Oil-borne Solutions 1993	32,757
Waterborne Solutions 1993	19,984
All Chemicals 1993	63,698
All Chemicals 1991	71,734

Source: Micklewright, 1994.

Table 20: Concrete, Wood and Steel Pole Costs Comparisons (1967 dollars).

Pole Type	Cost per Mile
Concrete	\$13,200
Natural Wood	\$8,500
Laminated Wood	\$12,800
Steel Lattice	\$26,000

Source: Taylor, 1988.