tion of personal judgment and experience, and offers the best opportunity for the display of analytical and practical ability on the part of the designer. It is difficult to give specific rules. The following are some of the controlling questions to be considered.

The class of structure, whether temporary or permanent, and the nature of the loading, whether dead or live. If live, then whether the application of the load is accompanied by severe dynamic shocks and pounding of the structure. Whether the assumed loading for calculations is the absolute maximum, rarely to be applied in practice, or a possibility that may frequently take place. Prolonged heavy steady loading, and also alternate tensile and compressive stresses in the same piece, will call for lower averages. Information as to whether the assumed breaking stresses are based on full-size or small-size tests or only on interpolated values, averaged from tests of similar species of timber, is valuable in order to attribute the proper degree of importance to recommended average values. The class of timber to be used and its condition and quality. Finally, the particular kind of strain the stick is to be subjected to, and its position in the structure with regard to its importance and the possible damage that might be caused by its failure.

In order to present something definite on this subject, your committee presents the accompanying table, showing the average safe allowable working unit stresses for the principal bridge and trestle timbers, prepared to meet the average conditions existing in railroad timber structures, the units being based upon the ultimate breaking unit stresses recommended by your committee and the following factors-of-safety, viz :

Tension, with and across grain	Ten.
Compression, with grain	Five.
" across grain	Four.
Transverse Rupture, Extreme Fibre Stress	Six.
" " Modulus of Elasticity	Two.
Shearing, with and across grain	Four.

In conclusion your committee desires to emphasize the importance and great value to the railroad companies of the country of the experimental work on the strength of American timbers being conducted by the Forestry Division of the U. S. Department of Agriculture, and to suggest that the American Association of Railway Superintendents of Bridges and Buildings endorse this view by official action, and lends its aid in every way possible to encourage the vigorous continuance of this series of government tests, which bids fair to become the most reliable and useful work on the subject of strength of American timbers ever undertaken. With additional and reliable information on this subject, far-reaching economies in the designing of timber structures can be introduced, resulting not only in a great pecuniary saving to the railroad companies, but also offering a partial check to the enormous consumption of timber, and the gradual diminution of our structural timber supply.

WALTER G. BERG, Chairman,
J. H. CUMMIN,
JOHN FOREMAN,
H. L. FRY,
} Committee.

AVERAGE ULTIMATE BREAKING UNIT STRESSES IN POUNDS PER SQUARE INCH.

Recommended by the Committee on "Strength of Bridge and Trestle Timbers."

AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS BRIDGES AND BUILDINGS.—5TH ANNUAL CONVENTION, NEW ORLEANS, OCT., 1895.

KIND OF TIMBER.	TENSION.		COMPRESSION.			TRANSVERSE RUPTURE.		SHEARING.	
			With Grain.						
	With Grain.	Across Grain.	End Bearing.	Columns under 15 Diams.	Across Grain.	Extreme Fibre Stress.	Modulus of Elasticity.	With Grain.	Across Grain.
White Oak	10,000	2,000	7,000	4,500	2,000	6,000	1,100,000	800	4,000
White Pine	7,000	500	5,500	3,500	800	4,000	1,000,000	400	2 000
Southern, Long-Leaf or Georgia Yellow Pine	12,000	600	8,000	5,000	1,400	7,000	1,700,000	600	5,000
Douglas, Oregon and Washington Fir or Pine. Yellow Fir	12,000		8,000	6,000	1,200	6,500	1,400,000	600	
Douglas, Oregon and Washington Fir or Pine. Red Fir	10,000					5.000			
Northern or Short Leaf Yellow Pine	9,000	500	6,000	4,000	1,000	6,000	1,200,000	400	4,000
Red Pine	9,000	500	6,000	4,000	800	5,000	1,200,000		
Norway Pine	8,000		6,000	4,000	800	4,000	1,200,000		
Canadian (Ottawa) White Pine	10,000			5.000				350	
Canadian (Ontario) Red Pine	10,000			5,000		5,000	1,400,000	400	
Spruce and Eastern Fir	8,000	500	6,000	4,000	700	4,000	1.200,000	400	3,000
Hemlock	6,000			4,000	600	3.500	900,000	350	2,500
Cypress	6,000		6,000	4,000	700	5 000	900,000		
Cedar	8,000		6,000	4,000	700	5,000	700,000		1,500
Chestnut	9 000			5,000	900	5,000	1,000,000	600	1,500
California Redwood	7,000			4,000	800	4,500	700,000	400	
California Spruce				4,000		50 0 0	1,200,000		

AVERAGE SAFE ALLOWABLE WORKING UNIT STRESSES IN POUNDS PER SQUARE INCH.

Recommended by the Committee on "Strength of Bridge and Trestle Timbers."

AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS BRIDGES AND BUILDINGS.—5TH ANNUAL CONVENTION, NEW ORLEANS, OCT., 1895.

KIND OF TIMBER.	TENSION.		COMPRESSION.			TRANSVERSE RUPTURE.		SHEARING.	
			With Grain.						
	With Grain.	Across Grain.	End Bearing.	Columns under 15 Diams.	Across Grain.	Extreme Fibre Stress.	Modulus of Elasticity.	With Grain.	Across Grain.
Factor of Safety.	Ten.	Ten.	Five.	Five.	Four.	Six.	Two.	Four.	Four.
White Oak	1,000	200	1,400	900	500	1,000	550,000	200	1,000
White Pine	700	50	1,100	700	200	700	500,000	100	500
Southern Long-Leaf or Georgia Yellow Pine	1,200	60	1,600	1,000	350	1,200	850,000	150	1,250
Douglas, Oregon and Washington Fir or Pine. Yellow Fir	1,200		1,600	1,200	300	1,100	700,000	150	
Douglas, Oregon and Washington Fir or Pine. Red Fir	1,000					800			
Northern or Short-Leaf Yellow Pine	900	50	1,200	800	250	1,000	600,000	100	1,000
Red Pine	900	50	1,200	800	200	800	600,000		
Norway Pine	800		1,200	800	200	700	600,000		
Canadian (Ottawa) White Pine	1,000			1,000				100	
Canadian (Ontario) Red Pine	1,000			1,000		800	700,000	100	
Spruce and Eastern Fir	800	50	1,200	800	200	700	600,000	100	750
Hemlock	600			800	150	600	450,000	100	600
Cypress	600		1,200	800	200	800	450,000		
Cedar	800		1,200	800	200	800	350,000		400
Chestnut	900			1,000	250	800	500,000	150	400
California Redwood	700			800	200	750	350,000	100	
California Spruce				800		800	600,000		