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	.....	5,000	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	.....	.....

For THE CANADIAN ENGINEER

CONCRETE CONSTRUCTION.

BY MAJOR HENRY A. GRAY, M. INST. C.E., M. CAN. SOC. C.E., ENGINEER IN CHARGE PUBLIC WORKS OF CANADA, DISTRICT OF WESTERN ONTARIO.

During my visit to the old country this last summer I visited several works and places where concrete was being used for different structures—especially breakwaters, piers and docks—and I succeeded in obtaining a large and valuable amount of information with respect to the same, which I have endeavored to give from my notes in the following form: I acknowledge with many thanks the aid given me by James Forrest, secretary of the Institution of Civil Engineers, London, who directed my attention to the best sources, *i.e.*, papers presented to the institution, from which to obtain accurate and reliable data, as well as to a number of my professional friends, civil and military, who gave me the result of their experience.

Concrete was extensively employed by the Romans for building purposes, but for some unexplained cause fell into disuse, and until the last few years its use has been almost entirely confined to the making of monolithic masses placed underground to act as foundation substructures for stone or brick superstructure. The French engineers appear to have been the first to discover the value of beton or concrete, for harbor works on the sea coast. At first, in its use for such works, natural hydraulic limes were employed as the cementing material with the addition of pozzolana. In the course of time, and when the manufacture of Portland cement had improved, the use of concrete in the con-