

Breuer Marcell Doctoral School
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Climate Change Impacts on Heritage Timber Structures

Appendix A

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Pécs

2023

Table A.1: Meteorological data set for Pécs (1901-2020)

Where:

- Y_{txx} : yearly maximum temperature;
- Y_{dtx25} : number of summer days with a maximum temperature of ≥ 25 °C;
- Y_{dtx30} : number of heat days with a maximum temperature of ≥ 30 °C;
- Y_{tnn} : yearly minimum temperature;
- Y_{dtn0} : number of winter days with a minimum temperature of ≤ 0 °C;
- Y_{dtn10} : number of frost days with a minimum temperature of ≤ -10 °C;
- Y_{rs} : yearly precipitation amount;
- Y_{rsh} : yearly precipitation amounts from snow.

Year	Y_{txx} (°C)	Y_{dtx25}	Y_{dtx30}	Y_{tnn} (°C)	Y_{dtn0}	Y_{dtn10}	Y_{rs} (mm)	Y_{rsh} (mm)
1901	33.8	70	12	-16.8	95	18	740.2	138.2
1902	32.5	55	13	-13.6	76	6	715.5	122.6
1903	33.2	51	9	-16	54	10	733	92
1904	33.7	74	21	-9.7	79	0	705.5	71.9
1905	34.9	85	28	-16	83	7	752.9	97.2
1906	31.6	65	7	-13	88	4	931.6	179.5
1907	32.8	77	13	-16.6	92	7	516	60.8
1908	34	73	17	-10	108	1	625.9	174.1
1909	32.8	62	7	-14.2	85	9	770.8	71.8
1910	31.4	57	5	-5	49	0	834.8	73.8
1911	32.9	76	18	-11.6	75	3	625.1	55.9
1912	30.1	49	3	-13.9	75	9	778	110
1913	29.7	41	0	-11	86	1	647.1	60.4
1914	31.2	37	1	-18	78	20	765.2	64.5
1915	31	37	2	-12.4	56	3	877.2	65.7
1916	33.2	58	8	-5	39	0	639.2	71.5
1917	36.2	115	44	-23.2	103	17	519	153
1918	36.1	72	22	-13.4	89	6	628.2	105.2
1919	31	34	1	-16.4	63	3	901.1	128.5
1920	31	69	4	-9	86	0	656.2	74.4
1921	37.5	79	23	-14.3	89	3	436.6	80.3
1922	37.4	82	31	-19.6	76	9	786.4	40
1923	35.6	86	29	-14	55	3	716.1	133.9
1924	34.6	75	14	-13.6	106	5	623.4	62.9
1925	32.5	66	12	-15.5	80	9	801.2	34
1926	32	60	7	-15.5	60	2	666.6	53.3
1927	36.2	89	44	-21.2	80	9	730	82
1928	38.2	80	48	-14.6	83	3	554.5	20.2
1929	35.2	96	32	-24.1	97	41	537.2	118.3
1930	33.9	86	24	-8.6	62	0	605.6	46.1
1931	37.6	92	34	-16	108	7	607.1	104.6
1932	33.7	102	26	-24.1	106	20	753.1	86.8

1933	37.1	56	21	-17.2	89	15	666.6	102.2
1934	33.8	106	17	-12.4	51	4	635.4	32.8
1935	38	96	31	-20.8	80	8	619.5	151.6
1936	37	84	28	-13.8	53	2	820.4	105
1937	32.6	90	11	-15.3	61	6	952.2	163.3
1938	35.1	81	27	-19.2	69	14	535.7	25.8
1939	38.4	91	30	-13.9	64	4	535.8	40.1
1940	31.2	70	7	-19.2	110	37	915.9	130.1
1941	33	62	13	-13.1	79	6	706.7	82.9
1942	34.2	108	40	-27	103	21	594.9	138.8
1943	36.9	89	31	-12.5	71	5	693	68.4
1944	34.3	89	36	-12.5	89	3	819.6	122.3
1945	37	112	46	-13.8	87	3	544.2	118.8
1946	39.2	126	53	-12.1	79	7	490	72.1
1947	39.6	120	46	-23.5	87	17	498.4	93.5
1948	36.2	87	28	-12.6	85	9	572	36.8
1949	36.3	82	32	-15.4	83	3	506.6	35.5
1950	41.3	107	50	-20.7	68	14	668.5	46.5
1951	33.7	81	23	-5.8	63	0	783.4	29.1
1952	38.6	105	46	-10.6	93	2	723.7	98.7
1953	33.5	99	20	-13.8	105	5	506.1	77.5
1954	35.3	88	15	-22.2	89	25	653	94.8
1955	32.1	68	5	-14.1	91	2	867.2	135.9
1956	34.5	74	10	-20.8	114	23	545	138
1957	36.9	67	23	-16.1	84	7	447.1	30.1
1958	34.4	79	19	-17.4	79	8	458.8	66.1
1959	32.7	46	5	-11.4	64	2	669.6	57.3
1960	33.3	59	6	-16.8	59	17	801.4	77
1961	35.3	78	15	-12.8	66	10	497.4	44.7
1962	33.2	64	17	-13	110	3	513.2	135.2
1963	34.3	78	24	-20.8	105	35	709.1	147.3
1964	32.2	72	5	-21.2	103	17	828.3	94.8
1965	32.2	54	11	-14	98	6	815	136.4
1966	30.6	69	4	-14.5	68	4	639.4	72.5
1967	33.3	73	17	-17	80	10	659.4	68.9
1968	37.8	62	15	-16.4	89	7	562.9	66.1
1969	31.9	65	7	-18.4	98	14	727.3	233.2
1970	32.1	64	15	-10.6	88	3	573.7	140
1971	35.7	74	21	-14.5	78	5	398.3	63.6
1972	32.3	60	6	-13.1	66	4	858.6	43.7
1973	34	73	15	-13.4	95	6	527.4	164.2
1974	34.2	54	19	-5.8	55	0	854.2	71.7
1975	29.9	75	0	-8.3	77	0	629.9	57.9
1976	33.2	49	7	-13.2	95	8	603.4	68.2

1977	32.1	74	6	-11.3	73	2	535.5	81.1
1978	32.2	52	7	-18.2	90	4	515.2	67.9
1979	33.5	75	16	-13.4	63	7	641.9	95.2
1980	31.9	45	7	-18	85	7	731.3	127.6
1981	35.8	66	15	-12.5	83	3	650.1	146.7
1982	32.3	92	10	-14	75	2	544.6	29.8
1983	35.3	90	22	-10.4	76	2	440.7	61.5
1984	32.6	54	7	-10.3	91	1	662.4	119.8
1985	35.1	75	19	-20.4	82	28	615.3	155
1986	33.2	85	22	-16.1	99	7	529	119.3
1987	35	72	18	-19	86	18	685.2	94.4
1988	36.7	72	26	-13	92	2	484.7	57.6
1989	34.1	55	13	-10.8	71	2	680.6	25
1990	34.5	72	20	-11.8	59	4	458.2	10.9
1991	34	67	16	-14.9	88	13	618.2	66.3
1992	36.7	98	30	-11.4	62	2	695	31.8
1993	34.6	85	27	-14.4	101	10	673.9	170.5
1994	35.6	98	38	-10.4	56	3	583.1	43.6
1995	35.6	81	31	-9.4	89	0	828.8	135.9
1996	33.5	62	10	-22.1	106	13	695.4	117.1
1997	31.8	82	5	-13.4	93	1	553.6	44.2
1998	35.1	74	26	-11.6	82	5	752.9	47
1999	33.7	73	11	-14	90	2	823.1	111.6
2000	37	92	31	-11.2	71	2	473.9	21.1
2001	36	79	19	-17.9	84	13	651.3	65.4
2002	34.8	87	18	-13.8	57	3	697.7	8.9
2003	36	123	55	-16.9	101	12	501.2	57.2
2004	33.9	56	13	-12	84	4	821.6	111.5
2005	32.6	60	8	-14.3	104	12	685.4	81.6
2006	34	64	27	-13.7	90	7	602	23.5
2007	38.6	91	29	-6.8	49	0	657.2	72.7
2008	34.6	91	28	-12.4	53	1	615.2	10.6
2009	34.2	100	27	-16.3	62	6	626.3	66.7
2010	33.5	67	21	-15.4	87	4	980.5	96.3
2011	36.3	107	32	-8.9	95	0	405.2	24.9
2012	38.2	102	49	-18.9	75	14	633.4	81.2
2013	36.9	79	28	-10.9	87	1	687.2	83.8
2014	33	72	11	-14.7	32	3	917.8	17.7
2015	36.4	82	39	-14.9	61	1	615.6	43.4
2016	33.8	93	16	-10.7	63	1	788.1	42.7
2017	36	88	37	-14.4	65	6	671.9	81.9
2018	32.4	117	24	-16.2	76	3	664.7	102.1
2019	34	92	34	-9	58	0	721.2	28.3
2020	34	95	34	-6.6	63	0	514.1	19.1

Table A.2: On-site measurements of the Civil Community house

Where:

- T_{out} : measured temperature outside the roof;
- T_{in} : measured temperature inside the roof;
- RH_{out} : measured relative humidity outside the roof;
- RH_{in} : measured relative humidity inside the roof;
- $MC_{UND-Beam}$: measured moisture content of the undamaged beams;
- MC_{D-Beam} : measured moisture content of the damaged beams;
- $MC_{UND-Rafters}$: measured moisture content of the undamaged rafters;
- $MC_{D-Rafters}$: measured moisture content of the damaged rafters;
- $MC_{UND-Column}$: measured moisture content of the undamaged columns;
- $MC_{D-Column}$: measured moisture content of the damaged columns;

Date	T_{out} (°C)	T_{in} (°C)	RH_{out} %	RH_{in} %	MC % (UND Beam)	MC% (D Beam)	MC% (UND Rafter)	MC% (D Rafter)	MC% (UND Column)	MC% (D Column)
9.7.20	27	25	33.00	40.00	10.7	11.1	10.9	11.8	12.1	12.3
10.7.20	26	25	37.00	41.00	10.7	11.2	10.9	11.8	12.1	12.3
13.7.20	24	21	52.00	58.00	11.1	11.5	11.2	11.8	11.3	11.9
14.7.20	24	22	43.00	47.00	11.0	11.4	11.1	11.7	11.2	11.8
15.7.20	26	25	41.00	47.00	11.0	11.4	11.8	12.4	11.9	12.5
16.7.20	26	25	60.00	66.00	11.8	12.2	11.8	12.4	11.9	12.5
17.7.20	18	16	80.00	82.00	12.1	12.5	13.6	14.2	13.7	14.3
20.7.20	28	27	65.00	68.00	11.7	12.0	13.8	14.4	13.9	14.5
21.7.20	31	30	45.00	51.00	11.8	12.1	13.8	14.4	13.9	14.5
22.7.20	30	30	48.00	53.00	12.4	12.7	14.0	14.6	14.1	14.7
23.7.20	28	28	67.00	70.00	12.7	13.0	13.9	14.5	14.0	14.6
27.7.20	27	27	50.00	61.00	13.9	14.2	14.2	15.0	14.3	15.1
28.7.20	28	27	40.00	57.00	13.5	13.8	14.3	15.1	14.4	15.2
29.7.20	28	27	52.00	63.00	13.5	13.9	14.3	15.1	14.4	15.2
30.7.20	26	26	59.00	70.00	13.6	14.0	14.4	15.2	14.5	15.3
31.7.20	24	24	51.00	60.00	13.2	13.6	14.4	15.2	14.5	15.3
3.8.20	27	25	48.00	64.00	13.2	13.7	14.1	15.0	14.2	15.1
4.8.20	26	25	67.00	72.00	13.6	14.1	14.5	15.4	14.6	15.5
5.8.20	26	26	68.00	75.00	13.6	14.1	14.4	15.3	14.5	15.4
6.8.20	27	26	68.00	74.00	13.6	14.1	14.6	15.5	14.7	15.6
7.8.20	26	25	61.00	70.00	13.6	14.1	14.4	15.3	14.5	15.4
10.8.20	24	23	59.00	70.00	13.8	14.4	14.6	16.0	14.7	16.1
11.8.20	24	22	61.00	71.00	13.9	14.5	14.8	16.2	14.9	16.3
12.8.20	24	23	62.00	71.00	14.0	14.8	15.0	16.4	15.1	16.5
13.8.20	24	23	52.00	68.00	14.0	14.6	14.6	16.0	14.7	16.1
14.8.20	24	22	66.00	71.00	13.9	14.5	14.6	16.0	14.7	16.1

17.8.20	25	25	75.00	81.00	14.2	14.6	14.5	15.5	14.6	15.6
18.8.20	26	25	73.00	81.00	14.2	14.6	14.5	15.5	14.6	15.6
19.8.20	27	26	62.00	70.00	13.7	14.1	14.1	15.1	14.2	15.2
24.8.20	27	27	52.00	63.00	13.3	13.6	13.9	15.1	14.0	15.2
25.8.20	27	26	47.00	62.00	13.3	13.4	13.9	15.1	14.0	15.2
26.8.20	27	26	48.00	62.00	13.1	13.7	13.9	15.1	14.0	15.2
27.8.20	27	25	48.00	61.00	13.4	13.7	13.7	14.9	13.8	15.0
28.8.20	22	20	51.00	61.00	13.2	13.5	13.7	14.9	13.8	15.0
2.11.20	14	11	67.00	68.00	12.7	14.3	18.0	21.2	15.4	18.0
3.11.20	15	14	73.00	78.00	13.2	15.2	18.2	20.4	17.8	19.1
4.11.20	14	13.5	79.00	82.00	13.8	15.40	18.5	22.2	18.2	19.4
5.11.20	15	13	62.00	68.00	12.8	14.9	17.8	19.5	15.9	18.8
6.11.20	12.5	10	74.00	77.00	13.3	15.0	18.3	20.2	17.8	19.0
9.11.20	9.5	8	86.00	90.00	15.0	17.2	19.1	23.1	19.2	23.2
10.11.20	8	7.5	88.00	91.00	15.5	17.9	20.0	23.5	19.5	23.4
11.11.20	7	6	81.00	84.00	14.4	16.3	17.8	21.2	19.0	22.7
12.11.20	7	6.5	81.00	84.00	14.5	16.5	17.8	21.4	19.0	22.6
13.11.20	7	7	82.00	84.00	14.6	16.7	18.0	21.6	19.3	22.8
16.11.20	10	9	76.00	79.00	14.0	16.6	18.1	21.3	19.1	22.8
17.11.20	11	9.5	80.00	83.00	14.5	16.90	18.50	21.6	19.6	23.0
19.11.20	5	4	90.00	93.00	15.2	18.2	20.2	23.8	19.8	23.7
20.11.20	5	3.5	91.00	93.00	15.3	18.2	20.3	23.9	19.8	23.9
23.11.20	8	7	78.00	82.00	14.5	14.9	18.1	21.0	19.0	22.6
24.11.20	2	2	83.00	86.00	14.8	15.2	18.5	21.1	19.6	21.2
25.11.20	3	2	87.00	90.00	15.3	15.4	19.4	22.2	20.2	22.3
26.11.20	3	2	93.00	96.00	15.8	16.0	20.5	24.2	21.4	23.6
27.11.20	2	1.5	95.00	96.00	16.4	16.9	20.8	25.5	22.0	24.4
30.11.20	6	4.5	70.00	74.00	13.6	14.1	17.4	20.0	17.5	20.1
1.12.20	5	3	67.00	73.00	13.6	14.1	17.3	20.0	17.4	20.0
4.12.20	4	2	94.00	96.00	15.8	16.0	20.5	24.2	21.4	23.6
7.12.20	7	5	88.00	90.00	15.3	15.4	19.4	22.2	20.2	22.3
8.12.20	5	4	90.00	93.00	15.3	18.2	20.3	23.9	19.8	23.9
4.1.21	7	5.5	96.00	97.00	17.1	17.7	21.1	25.7	22.3	25.6
5.1.21	5	4	99.00	99.00	17.3	17.8	21.2	25.8	22.5	25.6
6.1.21	5	4	99.00	99.00	17.3	17.8	21.2	25.8	22.5	25.6
7.1.21	3	3	98.00	99.00	17.2	17.6	21.0	25.6	22.2	25.5
8.1.21	1	1	95.00	96.00	16.9	17.2	20.8	25.1	21.8	25.2
11.1.21	0	-1	95.00	96.00	16.9	17.2	20.8	25.1	21.8	25.2
12.1.21	0	-1	96.00	96.00	17.0	17.2	21.0	25.1	21.9	25.3
13.1.21	3	1	88.00	90.00	15.3	16.6	19.4	22.2	20.2	23.4
14.1.21	2	0	81.00	84.00	14.5	15.8	17.8	21.4	19.0	22.6
15.1.21	1	0	84.00	84.00	14.6	16.2	18.0	21.6	19.3	22.8
18.1.21	-2	-4	90.00	91.00	15.8	16.0	20.5	24.2	21.4	23.6

19.1.21	0	-1	77.00	80.00	14.5	15.20	18.10	21.2	18.8	22.2
20.1.21	7	5	75.00	78.00	14.3	15.00	17.90	20.80	18.70	22.00
21.1.21	7	6	75.00	78.00	14.3	15.00	17.90	20.80	18.70	22.00
22.1.21	9	7.5	72.00	74.00	13.6	14.4	17.4	20.2	17.9	21.6
25.1.21	1	1	95.00	96.00	15.5	16.0	18.3	21.8	19.1	22.9
26.1.21	0	0	88.00	90.00	15.4	15.8	18.2	21.6	19.0	22.7
1.2.21	2	1	88.00	90.00	15.3	15.8	18.1	22.2	20.2	22.4
2.2.21	-1	-2	97.00	98.00	16.8	17.2	20.6	24.4	22.3	23.9
3.2.21	8	5.5	98.00	98.00	16.7	17.0	20.4	24.2	22.0	23.5
4.2.21	11	8	78.00	80.00	15.1	15.7	18.2	20.1	18.9	21.1
5.2.21	12	8	76.00	77.00	15.0	15.3	17.9	19.7	18.6	20.7
8.2.21	10	7	97.00	97.00	16.7	17.0	20.4	24.2	22.0	23.5
9.2.21	5	3	98.00	99.00	17.3	17.8	21.2	25.8	22.5	25.6
10.2.21	5	3	98.00	99.00	17.3	17.8	21.2	25.8	22.5	25.6
11.2.21	-1	0	70.00	72.00	13.20	14.10	18.30	22.20	19.90	21.70
12.2.21	-4	-5	65.00	68.00	14.10	15.00	18.50	22.00	20.10	22.00
17.2.21	4	1	72.00	73.00	14.00	14.90	18.60	20.40	20.20	22.10
18.2.21	6	2	90.00	92.00	16.50	17.60	20.00	22.00	22.30	24.20
19.2.21	7	4	84.00	88.00	15.20	16.30	18.80	20.60	21.10	22.50
22.2.21	12	9	79.00	80.00	14.0	16.6	18.1	21.3	19.1	22.8
23.2.21	12	10	75.00	78.00	13.0	14.2	16.5	18.2	17.4	18.6
24.2.21	15	11	77.00	80.00	13.0	14.2	16.5	18.2	17.4	18.6
25.2.21	16	13	65.00	68.00	12.8	13.8	14.5	16.6	16.4	17.1
26.2.21	16	14	66.00	68.00	12.7	13.8	14.6	16.6	16.4	17.1
1.3.21	10	5	73.00	76.00	13.3	14.4	16.5	18.3	17.7	19.0
2.3.21	11	5	73.00	76.00	13.3	14.4	16.5	18.3	17.7	19.0
3.3.21	12	6	70.00	74.00	13.1	14.2	16.2	17.9	17.3	18.9
4.3.21	11	4	59.00	60.00	12.3	13.2	14.2	16.1	16.1	16.8
5.3.21	12	5	56.00	58.00	12.1	12.9	14.0	15.8	15.9	16.2
8.3.21	10	4	54.00	57.00	12.1	12.9	14.0	15.8	15.9	16.2
9.3.21	7	1	50.00	55.00	11.8	12.6	13.6	15.2	15.3	15.7
10.3.21	5	0	50.00	55.00	11.9	12.6	13.6	15.4	15.5	15.6
11.3.21	8	2	48.00	52.00	11.2	11.8	13.1	14.8	15.1	15.2
12.3.21	9	6	73.00	73.00	14.1	15.0	16.5	18.2	17.4	18.6
16.3.21	8	4	57.00	58.00	12.1	12.9	14.0	15.8	15.9	16.2
17.3.21	7	3	65.00	66.00	12.9	13.9	14.7	16.8	16.5	17.3
18.3.21	4	0	77.00	78.00	14.1	15.0	16.5	18.2	17.4	18.6
19.3.21	5	1	72.00	74.00	14.00	14.90	15.80	17.70	17.20	18.50
6.4.21	6	5	52.00	55.00	11.2	11.8	13.1	14.8	15.1	15.2
7.4.21	7	5	60.00	67.00	12.3	12.9	13.8	15.7	15.8	16.0
8.4.21	7	5	61.00	66.00	12.3	12.9	13.8	15.7	15.8	16.0
9.4.21	15	12	29.00	32.00	9.8	10.5	9.9	10.5	10.7	11.0
12.4.21	19	17	34.00	37.00	10.0	10.5	10.1	10.5	10.8	11.0

13.4.21	4	2	82.00	88.00	15.3	17.2	14.8	18.2	18.1	19.2
14.4.21	6	4	82.00	87.00	15.3	16.6	14.6	18.0	18.3	19.1
15.4.21	7	5	58.00	62.00	12.5	13.5	13.8	16.2	15.9	16.4
16.4.21	9	7	60.00	62.00	12.3	13.3	13.5	16.1	15.7	16.2
19.4.21	8	8	86.00	89.00	15.8	16.0	17.7	20.2	21.4	22.6
20.4.21	12	10	77.00	83.00	14.5	15.20	17.20	19.7	20.3	22.2
21.4.21	17	16	51.00	51.00	11.3	12.60	11.50	12.40	13.60	15.10
22.4.21	19	16	45.00	48.00	11.2	12.30	11.30	12.10	13.20	14.60
23.4.21	15	13	50.00	52.00	11.6	12.7	11.7	12.5	13.8	15.3
26.4.21	15	12	50.00	52.00	11.6	12.7	11.7	12.5	13.8	15.3
27.4.21	10	8	81.00	86.00	13.2	14.1	13.4	14.7	16.1	17.2
28.4.21	13	11	80.00	83.00	13.2	14.1	13.4	14.7	16.1	17.2
3.5.21	10	7	46.00	48.00	13.4	14.4	13.6	14.8	16.2	17.6
4.5.21	20	16	37.00	40.00	12.3	13.3	13.5	16.1	15.7	16.2
5.5.21	20	17	35.00	38.00	12.3	13.3	13.5	16.1	15.7	16.2
6.5.21	15	12	50.00	55.00	12.6	13.7	13.8	16.4	16.2	16.8
7.5.21	13	10	77.00	85.00	14.0	15.3	15.6	17.7	17.9	18.7
10.5.21	25	22	41.00	44.00	13.5	13.8	14.3	15.1	14.4	15.2
11.5.21	20	17	66.00	70.00	13.5	13.8	14.3	15.1	14.4	15.2
12.5.21	18	15	70.00	72.00	14.4	14.8	15.6	16.0	16.2	17.1
13.5.21	17	15	69.00	72.00	14.4	14.8	15.6	16.0	16.2	17.1
19.5.21	14	12	90.00	95.00	16.9	17.2	18.8	20.2	21.8	23.2
20.5.21	10	8	92.00	95.00	17.00	17.50	19.20	20.50	22.10	24.10
21.5.21	19	15	56.00	60.00	15.20	16.30	17.20	18.10	18.10	21.00
25.5.21	12	10	75.00	78.00	15.4	16.2	16.5	18.2	17.4	20.5
26.5.21	20	17	34.00	36.00	13.0	14.2	15.2	16.2	16.2	17.8
27.5.21	22	19	36.00	36.00	12.8	13.8	14.5	15.9	15.8	17.1
28.5.21	21	18	47.00	60.00	13.2	13.8	14.6	16.6	16.4	17.1
9.6.21	28	25	42.00	50.00	11.0	11.4	11.8	12.4	11.9	12.5
10.6.21	27	25	48.00	56.00	11.2	11.8	12.5	13.1	12.7	13.6
11.6.21	26	23	46.00	52.00	11.0	11.4	11.8	12.4	11.9	12.5
14.6.21	21	19	39.00	42.00	10.7	11.2	10.9	11.7	10.8	11.4
15.6.21	26	23	34.00	40.00	10.4	10.8	10.4	10.9	10.4	10.8
16.6.21	29	26	38.00	42.00	10.5	10.9	10.5	11.0	10.5	11.0
17.6.21	30	28	36.00	42.00	10.1	10.6	10.2	10.7	10.2	10.7
18.6.21	32	29	33.00	39.00	9.6	10.2	9.8	10.3	10.0	10.2
21.6.21	32	29	33.00	39.00	9.6	10.2	9.8	10.3	10.0	10.2
22.6.21	33	30	34.00	39.00	9.6	10.2	9.8	10.3	10.0	10.2
23.6.21	33	30	34.00	39.00	9.6	10.2	9.8	10.3	10.0	10.2
24.6.21	35	32	41.00	48.00	9.8	10.5	10.2	10.4	10.4	10.7
25.6.21	32	30	50.00	52.00	10.1	10.8	10.5	10.9	10.9	11.4
28.6.21	31	30	50.00	52.00	10.1	10.8	10.5	10.9	10.9	11.4
29.6.21	34	33	27.00	33.00	9.4	10.0	9.6	10.0	9.9	10.1

Table A.3: Meteorological data set for Budapest (1901-2020)

Where:

- Y_{txx} : yearly maximum temperature;
- Y_{dtx25} : number of summer days with a maximum temperature of ≥ 25 °C;
- Y_{dtx30} : number of heat days with a maximum temperature of ≥ 30 °C;
- Y_{tnn} : yearly minimum temperature;
- Y_{dtn0} : number of winter days with a minimum temperature of ≤ 0 °C;
- Y_{dtn-10} : number of frost days with a minimum temperature of ≤ -10 °C;
- Y_{rs} : yearly precipitation amount;
- Y_{rsh} : yearly precipitation amounts from snow.

Year	Y_{txx} (°C)	Y_{dtx25}	Y_{dtx30}	Y_{tnn} (°C)	Y_{dtn0}	Y_{dtn-10}	Y_{rs} (mm)	Y_{rsh} (mm)
1901	34	77	20	-16.9	80	21	565.4	84.7
1902	32	61	10	-18.9	61	7	578.3	102.7
1903	35.2	61	8	-12.6	37	5	497.2	36.4
1904	35	81	26	-9.8	67	0	423.7	49.6
1905	35	79	26	-13.2	60	10	610.2	52.4
1906	33.3	74	15	-10.3	61	1	735.4	101.9
1907	33	71	7	-15	82	11	454.7	92.8
1908	35.1	77	13	-10.8	83	2	453.8	156.0
1909	33.9	69	11	-11.4	79	4	515	82.7
1910	34.9	63	11	-7	44	0	691.7	71.5
1911	34.1	78	22	-15.2	67	7	539.1	53.1
1912	33.3	60	7	-16.4	86	11	690.3	107.2
1913	31.2	54	2	-14.7	89	5	588.6	105.0
1914	33.2	74	10	-13.8	83	10	785.4	22.0
1915	32.3	66	11	-11.9	64	3	939.9	128.3
1916	34.2	74	14	-5.5	41	0	675.1	69.5
1917	36.4	116	42	-19	93	13	445.8	161.1
1918	35.2	72	20	-9.3	74	0	647.2	99.7
1919	33.6	76	20	-12.2	61	3	661	164.8
1920	34.9	84	26	-9.5	72	0	647.4	113.4
1921	38.7	96	30	-9.3	75	0	478.2	86.4
1922	36.7	81	29	-12.8	94	11	656	123.1
1923	35.1	89	25	-15.5	52	4	627.5	129.9
1924	34.1	94	17	-13.1	107	3	658.4	101.2
1925	32.2	79	19	-16.3	79	12	657.1	71.1
1926	31.5	74	6	-12.7	47	3	631.1	60.1
1927	35.2	91	35	-19.1	77	9	587.6	64.9
1928	38.4	85	48	-14.8	73	5	434.3	59.7
1929	36.8	99	35	-23.4	95	25	693.6	140.0
1930	34.5	94	37	-9.6	56	0	720.3	137.0
1931	37.4	91	39	-10.3	100	1	615	114.3
1932	35.8	104	48	-11.5	108	3	548.1	42.2

1933	37.2	74	28	-12.6	79	9	672.6	74.0
1934	35.4	118	21	-10.9	55	2	603.7	62.1
1935	39.5	94	27	-16.6	82	8	621.4	213.1
1936	37	85	25	-11.9	49	1	770.6	90.6
1937	34.7	99	28	-11.9	63	6	987.5	172.0
1938	35.5	79	30	-17.3	59	9	581.8	82.3
1939	35.8	100	29	-12.8	69	4	742	47.9
1940	32.3	72	5	-18.1	111	35	776.2	156.5
1941	33.4	65	12	-14.5	76	6	608.4	100.0
1942	34.4	100	34	-21.7	92	19	559.3	161.7
1943	39	94	32	-16.1	68	4	466	97.2
1944	33.4	75	22	-9.1	66	0	721.3	151.5
1945	35.9	97	30	-14	77	1	584.7	156.5
1946	37.9	116	48	-12.4	71	5	555.3	47.2
1947	37.3	123	53	-18.6	84	16	438.3	180.5
1948	36.9	86	25	-11.9	67	1	532.2	59.8
1949	35.3	81	26	-9.8	56	0	557.2	31.3
1950	38.3	98	48	-15	46	9	619.6	97.9
1951	34.4	85	32	-5.9	33	0	647	73.0
1952	38.5	95	41	-9.4	77	0	787.4	229.6
1953	32.9	96	20	-10	74	1	528	81.7
1954	35.2	82	27	-18.5	73	19	642.8	106.1
1955	32.1	72	5	-11.2	77	1	898.8	117.2
1956	33.5	79	15	-18.8	92	21	567.4	150.7
1957	37.2	72	20	-11.1	67	3	566	57.9
1958	35.3	87	25	-10.1	77	1	556.2	72.6
1959	35.5	68	11	-9	59	0	536	78.6
1960	34.5	68	12	-14	54	10	565.6	52.2
1961	36.7	83	27	-11.5	54	5	400.9	34.3
1962	34.3	73	24	-9.5	90	0	532.5	152.1
1963	35.4	91	25	-16.6	95	20	657.7	150.1
1964	34.3	83	22	-15.9	82	11	621.4	65.0
1965	33.9	58	10	-9.9	84	0	815.9	82.8
1966	32.3	74	12	-11.8	56	1	743.6	59.5
1967	34	86	33	-12.2	66	1	505	69.7
1968	37.4	88	19	-15	69	5	497.9	92.3
1969	35	81	22	-12.7	78	5	682.8	185.9
1970	32.3	68	17	-11	70	1	664.7	179.5
1971	34.4	79	27	-10.5	67	2	460.2	78.4
1972	34.9	69	18	-11.6	49	2	609.2	48.9
1973	33	89	21	-13	70	2	397.7	87.1
1974	35.6	73	22	-4.5	25	0	659	51.2
1975	32	97	12	-8.5	52	0	519.4	69.3
1976	34.9	75	17	-10.8	71	1	668.6	96.3

1977	33.6	85	11	-8.7	56	0	551.4	102.5
1978	32.1	51	4	-9.5	67	0	595.5	81.2
1979	34.9	90	24	-13	61	4	565.7	92.2
1980	33.5	52	8	-13.9	74	3	670.1	205.1
1981	34.5	75	24	-10.4	69	2	513.3	151.7
1982	33.2	101	19	-13.6	62	3	456.2	46.5
1983	36.6	108	42	-9.3	58	0	450.3	82.1
1984	35.4	62	13	-7	72	0	619.4	138.2
1985	34.5	73	21	-15.5	69	15	448.1	66.2
1986	33.5	88	26	-11.8	76	5	414.1	132.1
1987	35.3	72	19	-18.1	72	12	530.5	57.9
1988	36	66	24	-8.4	48	0	659	88.2
1989	34.5	58	9	-7.5	58	0	560.5	8.2
1990	34.6	72	25	-9.7	38	0	415.7	21.4
1991	37.2	69	20	-11.7	70	3	594	66.8
1992	36.5	94	39	-9.6	44	0	364.1	25.7
1993	35	89	28	-9.7	80	0	505.4	103.8
1994	36.5	95	42	-7.2	32	0	481.1	25.9
1995	34.5	81	25	-11.5	66	2	574.9	118.8
1996	33.6	69	15	-11.3	88	6	527.5	132.4
1997	34	95	11	-11.9	72	1	326.6	49.4
1998	37.1	72	31	-10.6	61	3	643	39.3
1999	33.7	86	11	-9.8	61	0	842.2	122.9
2000	36.9	93	34	-10	48	1	388.6	43.0
2001	35.6	82	25	-11.5	71	2	548.2	91.8
2002	35	98	27	-10.2	50	1	494.1	42.5
2003	37.3	116	52	-12.5	86	2	344.7	64.7
2004	33.6	70	16	-9.8	71	0	533.6	85.0
2005	35.1	72	13	-10.9	79	3	696.1	136.0
2006	35.4	78	37	-12	71	5	464	58.0
2007	40.1	99	51	-6.2	28	0	472.2	49.9
2008	36.1	94	43	-8.6	38	0	565	56.1
2009	34.9	116	40	-13.7	49	3	479.1	49.3
2010	35.9	76	31	-10.5	83	2	815.2	133.5
2011	37.1	108	39	-7.5	68	0	290.5	27.6
2012	38.2	114	56	-13.1	63	5	383.6	56.3
2013	38.7	93	42	-5.8	61	0	588.2	137.9
2014	35.8	87	25	-11.1	22	1	664.9	
2015	38	93	52	-7.2	37	0	598.7	
2016	35.7	108	39	-9	45	0	569.4	
2017	39.1	103	52	-15.2	56	4	579.4	
2018	35.9	139	60	-9.8	54	0	492.5	
2019	37.4	114	55	-5.6	39	0	512.4	
2020	35.3	99	38	-3.5	38	0	522.5	

Table A.4: On-site measurements of the Makovecz Imre Lookout Tower

Where:

- T_{out} : measured temperature outside the tower;
- RH_{out} : measured relative humidity outside the tower;
- $MC\%_{Ci}$: measured moisture content of the columns;
- $MC\%_{Fi}$: measured moisture content of the fences;
- $MC\%_{STi}$: measured moisture content of the stairs.

Note: L.O value means the MC is less than 6%.

Date	T_{out}	$RH_{out}(\%)$	$MC\%_{C1}$	$MC\%_{C2}$	$MC\%_{C3}$	$MC\%_{C4}$	$MC\%_{C5}$
10.7.21	29.3	55.00	10.60	10.60	10.80	10.80	10.90
18.7.21	26.6	77.00	11.70	11.60	11.80	11.80	11.90
25.7.21	30.2	70.00	11.10	11.00	11.20	11.10	11.20
31.7.21	27.4	71.00	11.40	11.50	11.50	11.50	11.50
7.8.21	31.3	73.00	11.60	11.70	11.70	11.80	11.80
12.8.21	28.6	58.00	11.00	11.00	11.00	11.00	11.00
19.8.21	23.2	72.00	11.60	11.60	11.70	11.70	11.75
3.9.21	22.5	44.00	10.20	10.30	10.50	10.50	10.50
11.9.21	26.6	31.00	9.60	9.60	9.70	9.80	9.80
18.9.21	20	56.00	10.20	10.20	10.40	10.40	10.50
9.10.21	13	36.00	10.20	10.20	10.40	10.40	10.50
22.10.21	15	65.00	10.30	10.30	10.50	10.60	10.60
30.10.21	16	48.00	10.10	10.10	10.10	10.20	10.20
20.11.21	13	58.00	10.10	10.10	10.10	10.20	10.20
10.12.21	2	87.00	13.10	13.10	13.60	13.80	13.80
17.12.21	7	66.00	12.10	12.10	12.20	12.20	12.30
25.12.21	7	87.00	12.40	12.40	12.50	12.50	12.50
31.12.21	12	94.00	11.80	11.80	12.10	12.20	12.20
14.1.22	6	61.00	12.00	12.00	12.20	12.40	12.50
22.1.22	3	56.00	12.00	12.00	12.20	12.40	12.50
25.1.22	8	53.00	11.70	11.80	11.80	11.90	11.90
20.3.22	6	31.00	12.30	12.30	12.50	12.50	12.60
9.4.22	11	88.00	11.90	11.90	12.00	12.00	12.00
22.4.22	10	82.00	11.70	11.70	11.70	11.80	11.90
29.4.22	18	30.00	9.80	9.80	9.90	9.90	9.90

Date	$MC\%_{ST1}$	$MC\%_{ST2}$	$MC\%_{ST3}$	$MC\%_{ST4}$	$MC\%_{ST5}$	$MC\%_{F1}$	$MC\%_{F2}$	$MC\%_{F3}$	$MC\%_{F4}$	$MC\%_{F5}$
10.7.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
18.7.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
25.7.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
31.7.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
7.8.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
12.8.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
19.8.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O

3.9.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
11.9.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
18.9.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
9.10.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
22.10.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
30.10.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
20.11.21	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O
10.12.21	7.20	7.20	7.40	7.50	7.50	8.20	8.30	8.30	8.50	8.50
17.12.21	7.00	7.00	7.00	7.00	7.00	7.80	7.80	7.90	7.90	8.00
25.12.21	7.30	7.40	7.40	7.40	7.50	8.00	8.00	8.00	8.10	8.10
31.12.21	7.10	7.10	7.20	7.20	7.20	8.10	8.10	8.30	8.30	8.30
14.1.22	7.40	7.40	7.70	7.70	7.90	8.30	8.40	8.50	8.50	8.60
22.1.22	7.40	7.50	7.70	7.90	7.90	8.30	8.50	8.60	8.70	8.70
25.1.22	6.90	7.00	7.10	7.10	7.10	7.70	7.70	7.70	7.80	7.80
20.3.22	7.20	7.30	7.30	7.40	7.50	7.90	7.90	8.00	8.00	8.10
9.4.22	6.80	6.80	6.90	6.90	6.90	7.40	7.40	7.50	7.50	7.60
22.4.22	6.80	6.80	6.90	6.90	6.90	7.10	7.20	7.20	7.30	7.30
29.4.22	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O	L.O

Table A.5: Four points bending tests results

Where:

- CGT: Cross grain tension failure;
- ST: Simple grain tension failure;
- B: Buckling failure;
- BT: Brush tension failure;
- MOR: Modulus of rupture;
- MOE: Modulus of elasticity;
- MOR₁₂: Modulus of rupture at moisture content equal to 12%;
- MOE₁₂: Modulus of elasticity at moisture content equal to 12%.

Sample	Status	Treated	Density (Kg/m ³)	MC%	MOR (MPa)	MOE (GPa)	MOR ₁₂ (MPa)	MOE ₁₂ (GPa)	Failure type	Crack width (mm)	Crack Length (mm)
A01	Natural	No	387.31	10.75	59.15	10.84	56.19	10.58	CGT	40	400
A02	Natural	No	444.62	11.00	66.63	12.88	63.96	12.63	CGT	25	400
A03	Natural	No	439.37	12.12	73.46	13.51	73.81	13.54	CGT	25	450
A04	Natural	No	364.25	13.05	33.87	8.2	35.29	8.38	CGT	30	250
A05	Natural	No	430.57	12.37	50.79	13.15	51.54	13.25	B		
A06	Natural	No	343.41	11.20	26.24	6.29	25.40	6.19	ST	5	150
A07	Natural	No	358.14	13.40	49.4	11.13	52.17	11.45	ST	5	400
A08	Natural	No	358.59	9.38	59.7	10.63	53.43	10.10	CGT	70	150
A09	Natural	No	444.96	9.94	74.53	12.27	68.40	11.79	ST	25	480
A10	Natural	No	371.19	10.62	36.3	8.6	34.30	8.37	CGT	5	60
A11	Natural	No	362.55	9.10	48.11	10.48	42.54	9.91	ST	5	450
A12	Natural	No	352.67	14.20	36.06	9.46	39.23	9.90	CGT	15	300
A13	Natural	No	378.81	12.90	49.73	10.46	51.52	10.65	CGT	40	440
A14	Natural	No	354.82	9.83	36.73	10.17	33.53	9.75	CGT	30	480
A15	Natural	No	378.81	12.90	49.73	10.46	51.52	10.65	B		
A16	Natural	No	369.46	11.30	39.5	9.22	38.39	9.09	B		
A17	Natural	No	433.31	9.33	77.67	12.92	69.39	12.27	ST	20	450
A18	Natural	No	512.05	13.60	76.51	17.86	81.41	18.45	ST	25	300
A19	Natural	No	505.13	9.95	85.05	16.65	78.08	15.99	B		
A20	Natural	No	401.11	14.10	44.15	9.64	47.86	10.06	CGT	30	370
A21	Natural	No	426.85	9.50	79	18.17	71.10	17.30	CGT	25	300
A22	Natural	No	426.03	9.05	58.75	11.82	51.81	11.16	CGT	20	500
A23	Natural	No	353.82	9.61	34.77	8.77	31.45	8.37	CGT	5	130
A24	Natural	No	475.19	9.17	80.76	15.23	71.63	14.42	CGT	35	500
A25	Natural	No	335.39	9.03	47.77	9.12	42.09	8.61	BT		500
A26	Natural	No	364.26	10.68	52.52	10.15	49.74	9.89	CGT	30	550
A27	Natural	No	338.86	9.31	45.93	9.35	40.99	8.87	CGT	60	500
A28	Natural	No	450.59	10.37	54.74	13.12	51.17	12.71	ST	5	130
A29	Natural	No	460.28	10.40	61.85	9.99	57.89	9.68	CGT	25	450
A30	Natural	No	442.05	10.10	63.24	13.43	58.44	12.94	ST	5	220
B1	Wet	No	269.78	46.29	27.21	5.44	64.54	17.32	CGT	25	350

B2	Wet	No	287.11	45.98	37.37	8.28	88.17	25.84	CGT	40	200
B3	Wet	No	322.67	45.45	29.61	10.06	69.23	30.40	B		
B4	Wet	No	263.11	39.86	26.47	5.91	55.99	13.35	B		
B5	Wet	No	272.44	43.88	31.45	7.21	71.57	19.90	B		
B6	Wet	No	320.00	37.78	34.92	7.39	70.94	15.25	B		
B7	Wet	No	315.11	38.50	35.83	7.76	73.83	16.51	CGT	15	210
B8	Wet	No	271.11	43.77	30.89	6.49	70.16	17.80	B		
B9	Wet	No	294.67	40.87	37.41	7.81	80.63	18.49	B		
B10	Wet	No	318.67	38.77	30.88	7.26	63.97	15.63	B		
B11	Wet	No	326.67	36.73	37.23	8.36	74.07	16.54	CGT	40	300
B12	Wet	No	354.22	35.76	24.29	6.49	47.39	12.37	B		
B13	Wet	No	348.00	64.62	36.15	7.21	112.25	-137.43	B		
B14	Wet	No	339.56	59.69	48.45	8.7	140.88	187.98	B		
B15	Wet	No	373.33	36.43	38.05	7.39	75.24	14.45	CGT	10	150
B16	Wet	No	316.00	41.49	29.90	6.7	65.18	16.33	B		
B17	Wet	No	332.44	41.44	43.52	7.23	94.79	17.59	B		
B18	Wet	No	332.44	41.44	16.23	5.05	35.35	12.28	B		
B19	Wet	No	279.56	41.81	39.88	8.78	87.44	21.75	CGT	5	400
B20	Wet	No	346.67	58.72	41.62	8.81	119.40	134.21	B		
B21	Wet	No	332.00	59.97	44.37	8.24	129.52	203.28	CGT	10	370
B22	Wet	No	298.67	55.51	35.56	7.24	97.47	55.74	B		
B23	Wet	No	328.44	41.00	36.98	7.06	79.88	16.81	CGT	25	300
B24	Wet	No	335.56	47.42	25.81	6.98	62.38	23.93	CGT	5	200
B25	Wet	No	281.78	41.96	31.98	5.44	70.30	13.57	ST	5	200
B26	Wet	No	399.56	33.93	24.37	6.16	45.74	10.97	B		
B27	Wet	No	364.00	42.00	38.71	6.97	85.16	17.43	B		
B28	Wet	No	366.67	41.58	31.04	7	67.76	17.14	CGT	10	300
B29	Wet	No	322.22	41.38	41.17	7.16	89.56	17.36	B		
B30	Wet	No	288.44	49.77	28.44	5.41	71.42	22.12	CGT	30	200
C1	Wet	Yes	316.89	18.51	49.06	8.12	61.84	9.34	CGT	50	400
C2	Wet	Yes	358.22	25.68	34.11	8.09	52.78	11.14	ST	7	40
C3	Wet	Yes	327.11	24.18	56.98	11.52	84.75	15.23	ST	5	45
C4	Wet	Yes	377.33	17.08	43.56	10.93	52.41	12.17	B		
C5	Wet	Yes	379.11	14.65	60.68	10.93	67.12	11.54	CGT	1	
C6	Wet	Yes	327.56	18.45	35.88	9.47	45.14	10.87	CGT	10	100
C7	Wet	Yes	393.78	19.19	57.05	12.58	73.45	14.69	CGT	25	70
C8	Wet	Yes	356.00	17.60	35.99	10.01	44.06	11.27	CGT	70	400
C9	Wet	Yes	376.00	26.83	66.78	11.6	106.40	16.49	CGT	25	450
C10	Wet	Yes	340.00	29.80	35.46	8.03	60.71	12.47	CGT	20	150
C11	Wet	Yes	309.78	21.52	37.99	7.98	52.46	9.86	CGT	5	150
C12	Wet	Yes	374.22	19.95	46.25	9.55	60.96	11.36	CGT	25	150
C13	Wet	Yes	303.11	21.55	22.92	5.42	31.68	6.70	CGT	70	300
C14	Wet	Yes	350.67	20.15	37.77	6.87	50.09	8.21	CGT	70	300

C15	Wet	Yes	338.67	19.69	49.88	10.06	65.21	11.89	CGT	30	220
C16	Wet	Yes	429.78	18.51	62.18	13.65	78.37	15.69	B		
C17	Wet	Yes	424.89	18.10	76.53	13.82	95.19	15.74	CGT	20	450
C18	Wet	Yes	352.44	16.14	44.89	8.91	52.33	9.71	CGT	5	200
C19	Wet	Yes	308.44	20.61	28.48	6.05	38.28	7.31	CGT	20	150
C20	Wet	Yes	443.56	14.13	58.95	8.92	63.97	9.32	B		
C21	Wet	Yes	500.00	14.13	42.12	9.8	45.71	10.24	CGT	25	300
C22	Wet	Yes	454.22	14.58	43.8	10.01	48.32	10.55	CGT	5	65
C23	Wet	Yes	404.00	20.46	65.36	12.58	87.48	15.14	B		
C24	Wet	Yes	352.44	21.19	42.81	8.03	58.54	9.84	CGT	15	200
C25	Wet	Yes	375.11	24.17	53.15	9.19	79.02	12.15	B		
C26	Wet	Yes	396.44	17.15	65.14	11.38	78.57	12.69	ST	30	250
C27	Wet	Yes	379.56	19.09	38.65	8.75	49.61	10.19	B		
C28	Wet	Yes	405.33	17.00	36.8	7.99	44.15	8.88	B		
C29	Wet	Yes	416.00	18.38	41.73	7.97	52.37	9.13	ST	5	150
C30	Wet	Yes	410.22	14.73	30.96	9.39	34.35	9.93	CGT	25	250