Appendix II
Thermal Comfort Analysis

Matrix T with fabric thermal parameters:

j = 5 i=24	P $m^3m^{-2}hr^{-1}$	R clo	MVTR $mgm/cm^2/hr$	wc $cm\text{-}min^{-1/2}$	f
A1	774	0.5	40.42	2.98	1.15
A2	583	0.49	34.39	1.87	0.65
A3	648	0.493	28.65	2.49	0.98
A4	751	0.485	31.7	1.76	0.8
A5	492	0.472	32.64	1.65	0.96
A6	252	0.491	25.16	1.8	0.72
A7	573	0.477	31.42	1.98	0.95
A8	429	0.47	35.79	0.84	1.58
A9	1913	0.475	39.49	1.9	1.5
A10	117	0.477	18.79	0.85	2.26
A11	573	0.472	29.26	0.89	2.27
B1	588	0.501	31.85	1.82	0.8
B2	498	0.498	29.32	1.51	1.05
B3	378	0.494	24.2	2.54	0.78
B4	708	0.486	39.81	2.21	1.15
B5	405	0.494	34.91	1.61	1.21
C1	478	0.486	27.96	0.81	1.23
C2	166	0.481	26.47	1.39	1.53
C3	157	0.487	32.32	1.33	1.21
C4	212	0.491	17.52	0.84	2.4
D1	288	0.481	33.76	1.58	0.87
D2	181	0.479	32.33	0.91	1.3
D3	335	0.485	31.9	1.07	1.64
D4	206	0.486	21.34	1.57	1.69
Mean	487	0.485	30.47	1.59	1.28
Var	131812	7.97E-05	36.66	0.35	0.247

STANDARDISED MATRIX T_s OF THE ORIGINAL MATRIX T

A1	0.00217196	182.3696467	0.271286	3.940365	-0.51934
A2	0.000722933	56.95785528	0.106796	0.789965	-2.54273
A3	0.001216058	94.58139271	-0.04978	2.549648	-1.20729
A4	0.00199747	-5.748040441	0.033416	0.477763	-1.93571
A5	3.25589E-05	-168.7833693	0.059058	0.165562	-1.28822
A6	-0.001788208	69.49903442	-0.14499	0.591291	-2.25945
A7	0.000647068	-106.0774736	0.025778	1.102167	-1.32869
A8	-0.000445393	-193.8657276	0.144986	-2.13338	1.220778
A9	0.010813018	-131.1598319	0.245917	0.875111	0.897036
A10	-0.00281239	-106.0774736	-0.31875	-2.105	3.972587
A11	0.000647068	-168.7833693	-0.03314	-1.99147	4.013055
B1	0.000760866	194.9108259	0.037508	0.648055	-1.93571
B2	7.8078E-05	157.2872884	-0.03151	-0.23179	-0.92401
B3	-0.000832306	107.1225719	-0.17117	2.691558	-2.01664
B4	0.001671249	6.793138703	0.254646	1.754952	-0.51934
B5	-0.000627469	107.1225719	0.120981	0.052034	-0.27653
C1	-7.36526E-05	6.793138703	-0.06861	-2.21852	-0.19559
C2	-0.00244065	-55.91275701	-0.10925	-0.57237	1.018439
C3	-0.002508929	19.33431785	0.050329	-0.74266	-0.27653
C4	-0.00209167	69.49903442	-0.3534	-2.13338	4.539136
D1	-0.001515093	-55.91275701	0.08961	-0.03311	-1.65243
D2	-0.002326852	-80.9951153	0.050602	-1.9347	0.08768
D3	-0.001158526	-5.748040441	0.038872	-1.48059	1.463585
D4	-0.002137189	6.793138703	-0.24919	-0.06149	1.665924

Covariance matrix V_T of Standard matrix T_s

7.27042E-06	-0.024058722	0.000252	0.001805	-0.00081
-0.024058722	12018.63001	-0.97251	90.5456	-84.42
0.00025237	-0.972509082	0.026142	0.102082	-0.1368
0.00180456	90.54559956	0.102082	2.71994	-2.02712
-0.000807132	-84.41997487	-0.1368	-2.02712	3.878163

Eigen vectors analysis:

Approximate error bound - 0.001,

Maximum no. of iterations - 100,

i	5	4	1	3	2
Ci	3.90E-06	1.81E-02	12019.91	1.137114	4.193388
ci/tr Vm	3.24E-10	1.51E-06	1.00E+00	9.46E-05	3.49E-04
Wi =sqrt(Ci / tr V_T)	1.80125E-05	0.0012275	0.999778	0.009724	0.018674
Ri					
	-0.999963109	-8.51E-03	-2.00E-06	-1.00E-03	4.55E-04
	-4.42E-06	-5.43E-04	0.999947	2.50E-03	-9.98E-03
	8.54E-03	-0.998956395	-8.08E-05	-1.23E-02	4.32E-02
	7.99E-04	3.38E-02	7.54E-03	-0.83892	0.543151
	4.15E-04	-2.95E-02	-7.03E-03	-0.54411	-0.83847

*** Wi = sqrt(Ci / tr V_T) where tr V_T = $\sum$ Ci, is the weight of i^{th} component of Y_T**

Feature matrix T_F

	5	4	1	3	2
A1	-773.62	-46.90	0.51	-4.40	2.75
A2	-582.68	-39.27	0.50	-2.93	2.22
A3	-647.73	-34.08	0.50	-3.62	2.06
A4	-750.70	-38.02	0.49	-3.05	1.99
A5	-491.70	-36.77	0.47	-2.80	1.72
A6	-251.77	-27.24	0.50	-2.46	1.57
A7	-572.71	-36.22	0.48	-3.14	1.89
A8	-428.68	-39.42	0.46	-2.43	0.87
A9	-1912.59	-55.71	0.47	-4.81	2.35
A10	-116.83	-19.80	0.47	-2.29	-0.57
A11	-572.73	-34.14	0.46	-2.91	0.10
B1	-587.70	-36.78	0.51	-2.94	1.96
B2	-497.73	-33.51	0.50	-2.70	1.43
B3	-377.78	-27.33	0.50	-3.23	1.94
B4	-707.63	-45.75	0.49	-3.68	2.27
B5	-404.69	-38.30	0.49	-2.84	1.55
C1	-477.74	-32.01	0.48	-2.17	0.83
C2	-165.77	-27.85	0.48	-2.49	0.69
C3	-156.72	-33.61	0.49	-2.33	1.17
C4	-211.84	-19.35	0.48	-2.44	-0.71
D1	-287.70	-36.15	0.48	-2.50	1.71
D2	-180.72	-33.84	0.47	-2.05	0.88
D3	-334.71	-34.73	0.48	-2.52	0.73
D4	-205.81	-23.07	0.48	-2.70	0.45

Correlation coefficients

	5	4	1	3	2
P $m^3m^{-2}hr^{-1}$	-0.99	**-0.80**	0.04	-0.85	0.57
r clo	0.08	0.07	**0.91**	-0.16	0.33
MVTR $mgm/cm^2/hr$	-0.57	**-0.95**	0.13	-0.54	**0.73**
wc $cm\text{-}min^{-1/2}$	-0.41	-0.43	**0.77**	-0.75	**0.83**
f	0.15	0.37	**-0.68**	0.19	**-0.84**

Regression summery:

Factor 1 - Impermeability factor:

Dependent variable - Component 4 of the Feature matrix.

Independent variable – P $m^3m^{-2}hr^{-1}$, MVTR $mgm/hr/cm^2$

Regression Statistics	
Multiple R	0.999994
R Square	0.999988
Adjusted R Square	0.999987
Standard Error	0.029254
Observations	24

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	2	1553.197	776.5987	907426.5	1.46E-52
Residual	21	0.017972	0.000856		
Total	23	1553.215			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-0.04917	0.033412	-1.47161
X Variable 1	-0.0085	2.06E-05	-412.548
X Variable 2	-0.99697	0.001236	-806.903

Factor 2 - Insulation factor:

Dependent variable - Component 1 of the Feature matrix.

Independent variable – r in clo, wc cm-min$^{-1/2}$, f-fluid filling fraction

Regression Statistics	
Multiple R	0.997921
R Square	0.995847
Adjusted R Square	0.995224
Standard Error	0.000958
Observations	24

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.0044	0.001467	1598.533	5.64E-24
Residual	20	1.83E-05	9.17E-07		
Total	23	0.004418			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-0.02619	0.012504	-2.09426
X Variable 1	1.049921	0.026015	40.35757
X Variable 2	0.006446	0.000461	13.98154
X Variable 3	-0.00685	0.000518	-13.2301

Factor 3. Wicking factor:

Dependent variable - Component 2 from Feature matrix.

Independent variable – wc cm-min$^{-1/2}$, Fluid filling fraction (f), MVTR mgm/cm^2/hr

Regression Statistics	
Multiple R	0.990602
R Square	0.981293
Adjusted R Square	0.978487
Standard Error	0.132291
Observations	24

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	3	18.36013	6.120045	349.6989	1.93E-17
Residual	20	0.350018	0.017501		
Total	23	18.71015			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-0.58423	0.236483	-2.47051
X Variable 1	0.654857	0.060281	10.86344
X Variable 2	-0.72377	0.07364	-9.82852
X Variable 3	0.058848	0.005113	11.50881

Over all thermal comfort:

Dependent variable - WD_{0T} value from table 24.

Independent variable – predicted values of permeability factor, insulation factor and wicking factor.

Regression Statistics	
Multiple R	0.99934
R Square	0.99868
Adjusted R Square	0.998482
Standard Error	0.010649
Observations	24

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1.715709	0.571903	5042.834	5.95E-29
Residual	20	0.002268	0.000113		
Total	23	1.717977			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-0.19435	0.142408	-1.36477
X Variable 1	-0.03297	0.000504	-65.4659
X Variable 2	0.783275	0.283884	2.759136
X Variable 3	0.000298	0.006232	0.04778

Percentage rank of the Thermal comfort factors:

Fabric code	Impermeability factor	rank(r_{T1})	insulation factor	rank(r_{T2})	wicking factor	rank(r_{T3})	Thermal comfort value	Rank(r_T)
A1	-46.90	0.043	0.510	1	2.91	1	1.76	0.956
A2	-39.27	0.173	0.496	0.739	2.19	0.913	1.49	0.869
A3	-34.08	0.521	0.501	0.869	2.02	0.869	1.33	0.521
A4	-38.02	0.26	0.489	0.608	1.85	0.652	1.44	0.739
A5	-36.77	0.347	0.474	0.13	1.72	0.565	1.39	0.652
A6	-27.24	0.869	0.497	0.782	1.55	0.478	1.10	0.173
A7	-36.22	0.391	0.482	0.434	1.87	0.695	1.38	0.608
A8	-39.42	0.13	0.461	0.043	0.93	0.304	1.46	0.826
A9	-55.71	0	0.472	0.217	1.90	0.739	2.03	1
A10	-19.80	0.956	0.466	0.086	-0.56	0.043	0.84	0.043
A11	-34.14	0.565	0.459	0	0.08	0.086	1.28	0.304
B1	-36.78	0.304	0.505	0.956	1.90	0.782	1.41	0.695
B2	-33.51	0.695	0.499	0.826	1.37	0.434	1.29	0.434
B3	-27.33	0.826	0.505	0.913	1.94	0.826	1.11	0.217
B4	-45.75	0.086	0.490	0.652	2.37	0.956	1.70	0.913
B5	-38.30	0.217	0.494	0.695	1.65	0.521	1.45	0.782
C1	-32.01	0.739	0.480	0.391	0.70	0.173	1.23	0.26
C2	-27.85	0.782	0.478	0.26	0.78	0.217	1.09	0.13
C3	-33.61	0.652	0.486	0.565	1.31	0.391	1.28	0.391
C4	-19.35	1	0.479	0.304	-0.74	0	0.84	0
D1	-36.15	0.434	0.483	0.521	1.81	0.608	1.38	0.565
D2	-33.84	0.608	0.474	0.173	0.97	0.347	1.28	0.347
D3	-34.73	0.478	0.478	0.347	0.81	0.26	1.31	0.478
D4	-23.07	0.913	0.484	0.478	0.48	0.13	0.94	0.086