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Table A1 – SOLAR GAIN RESULTS - Hotel (Cont'd)

Zone Name (Hotel)	Facade Length (m)	Floor Area (m^2)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	g-Value Required	Compliant
L02 Bedroom 14 S	4.0	19.3	284	950	-70	0.38	Yes
L02 Bedroom 15 S	28.5	154.9	2424	6862	-65	0.38	Yes
L02 Bedroom 16 S	6.1	33.6	308	1462	-79	0.38	Yes
L02 Bedroom 17 S	6.0	24.5	329	1450	-77	0.38	Yes
L02 Bedroom 18 S	14.1	74.5	1227	3401	-64	0.38	Yes
L02 Bedroom 19 W	39.1	178.2	3743	9401	-60	0.38	Yes
L02 Bedroom 2 N	7.4	38.6	471	1773	-73	0.38	Yes
L02 Bedroom 20 W	8.2	56.7	881	1969	-55	0.38	Yes
L02 Bedroom 21 W	2.6	30.0	111	634	-82	0.38	Yes
L02 Bedroom 22 N	14.8	79.2	941	3554	-74	0.38	Yes
L02 Bedroom 3 N	3.3	16.7	275	782	-65	0.38	Yes
L02 Bedroom 4 N	3.8	18.9	235	924	-75	0.38	Yes
L02 Bedroom 5 N	12.3	74.9	1463	2968	-51	0.38	Yes
L02 Bedroom 6 NE	8.7	24.0	453	2085	-78	0.38	Yes
L02 Bedroom 9 E	2.0	15.5	173	479	-64	0.38	Yes
L02 Bedroom7 E	25.2	134.6	1600	6070	-74	0.38	Yes
L02 Bedroom8 E	6.2	24.7	454	1487	-69	0.38	Yes
L03 Bedroom 12 E	7.2	36.0	956	1731	-45	0.38	Yes
L03 Bedroom 1 N	13.0	38.4	799	3120	-74	0.38	Yes
L03 Bedroom 10 E	2.0	15.5	184	479	-62	0.38	Yes
L03 Bedroom 11 SE	11.2	26.3	502	2703	-81	0.38	Yes
L03 Bedroom 13 S	4.0	19.3	285	950	-70	0.38	Yes
L03 Bedroom 14 S	28.5	154.9	2435	6862	-65	0.38	Yes
L03 Bedroom 15 S	6.1	33.6	311	1462	-79	0.38	Yes
L03 Bedroom 16 S	14.1	74.5	1236	3401	-64	0.38	Yes
L03 Bedroom 17 S	6.0	24.5	329	1450	-77	0.38	Yes
L03 Bedroom 18 S	5.6	18.8	535	1344	-60	0.38	Yes
L03 Bedroom 19 W	39.1	178.4	3733	9401	-60	0.38	Yes
L03 Bedroom 2 N	25.4	134.5	1685	6108	-72	0.38	Yes
L03 Bedroom 20 W	8.2	56.7	925	1969	-53	0.38	Yes
L03 Bedroom 21 W	2.6	30.0	111	634	-82	0.38	Yes
L03 Bedroom 3 N	3.8	18.9	235	924	-75	0.38	Yes
L03 Bedroom 4 NE	8.7	24.0	453	2085	-78	0.38	Yes
L03 Bedroom 5 N	10.7	55.1	1365	2565	-47	0.38	Yes
L03 Bedroom 6 N	1.7	19.8	141	402	-65	0.38	Yes
L03 Bedroom 7 NE	2.4	21.7	484	585	-17	0.38	Yes
L03 Bedroom 8 E	25.2	134.6	1600	6070	-74	0.38	Yes
L03 Bedroom 9 E	6.2	24.7	454	1487	-69	0.38	Yes
L03 Hallway 1 N	1.6	29.1	352	395	-11	0.38	Yes
L03 Hallway 2 SW	1.7	15.3	310	398	-22	0.38	Yes
L04 Bar	31.3	107.4	7451	7527	-1	**0.34**	Yes
L04 Bedroom 1 N	9.5	21.2	1210	2279	-47	0.38	Yes
L04 Bedroom 11 E	7.2	36.0	1040	1731	-40	0.38	Yes

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Table A1 – SOLAR GAIN RESULTS - Hotel (Cont'd)

Zone Name (Hotel)	Facade Length (m)	Floor Area (m^2)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	g-Value Required	Compliant
L04 Bedroom 12 E	2.0	15.5	198	479	-59	0.38	Yes
L04 Bedroom 13 S	5.6	18.8	533	1344	-60	0.38	Yes
L04 Bedroom 14 S	4.0	19.3	284	950	-70	0.38	Yes
L04 Bedroom 15 S	32.5	173.7	2984	7814	-62	0.38	Yes
L04 Bedroom 16 SW	13.6	35.0	2298	3277	-30	0.38	Yes
L04 Bedroom 17 S	14.1	74.5	1371	3401	-60	0.38	Yes
L04 Bedroom 2 N	14.8	78.8	939	3554	-74	0.38	Yes
L04 Bedroom 3 N	3.8	18.9	234	924	-75	0.38	Yes
L04 Bedroom 4 NE	8.7	24.0	455	2085	-78	0.38	Yes
L04 Bedroom 5 N	10.7	55.1	1391	2565	-46	0.38	Yes
L04 Bedroom 6 N	1.7	19.8	144	402	-64	0.38	Yes
L04 Bedroom 7 E	25.2	134.6	1600	6070	-74	0.38	Yes
L04 Bedroom 8 E	6.2	24.7	452	1488	-70	0.38	Yes
L04 Bedroom 9 SE	11.2	26.5	501	2702	-81	0.38	Yes
L04 Bedroom 10 E	2.4	21.7	506	585	-14	0.38	Yes

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Table A2 – SOLAR GAIN RESULTS - Office

Zone Name (Office)	Facade Length (m)	Floor Area (m^2)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	g-Value Required	Compliant
L00 E1 Office	17.8	89.2	2668	4286	-38%	0.38	Yes
L00 E2 Office	11.3	80.9	506	2720	-81%	0.38	Yes
L00 E3 Office	15.9	71.5	1701	3816	-55%	0.38	Yes
L00 N1 Office	49.0	280.0	11569	11801	-2%	**0.37**	Yes
L00 S1 Office	11.5	62.0	2685	2766	-3%	**0.34**	Yes
L00 S2 Office	10.4	53.7	2102	2492	-16%	0.38	Yes
L00 S3 Office	22.3	84.6	3657	5376	-32%	0.38	Yes
L00 W1 Office	20.1	112.5	4607	4827	-5%	0.38	Yes
L00 W2 Office	25.9	154.1	6019	6242	-4%	**0.37**	Yes
L01 E1 Office	16.5	70.9	2010	3970	-49%	0.38	Yes
L01 E2 Office	13.0	86.3	1826	3131	-42%	0.38	Yes
L01 E3 Office	18.9	90.8	1987	4554	-56%	0.38	Yes
L01 N1 Office	22.3	118.7	2871	5354	-46%	0.38	Yes
L01 N2 Office	18.9	134.0	3251	4537	-28%	0.38	Yes
L01 N3 Office	22.0	128.9	3129	5298	-41%	0.38	Yes
L01 S1 Office	15.1	90.2	2172	3641	-40%	0.38	Yes
L01 S2 Office	10.3	53.4	1955	2478	-21%	0.38	Yes
L01 S3 Office	22.3	84.0	3343	5366	-38%	0.38	Yes
L01 W1 Office	11.3	64.2	764	2710	-72%	0.38	Yes
L01 W2 Office	16.5	125.8	1845	3967	-53%	0.38	Yes
L01 W3 Office	18.2	96.2	1680	4390	-62%	0.38	Yes
L02 E1 Office	15.7	74.0	1877	3778	-50%	0.38	Yes
L02 E2 Office	12.2	85.0	1791	2924	-39%	0.38	Yes
L02 E3 Office	18.9	90.8	1962	4554	-57%	0.38	Yes
L02 N1 Office	22.3	118.7	2936	5354	-45%	0.38	Yes
L02 N2 Office	18.9	134.0	3203	4537	-29%	0.38	Yes
L02 N3 Office	22.0	128.9	3096	5298	-42%	0.38	Yes
L02 S1 Office	15.1	90.2	2250	3641	-38%	0.38	Yes
L02 S2 Office	9.2	62.2	1505	2221	-32%	0.38	Yes
L02 S3 Office	19.7	101.1	2755	4738	-42%	0.38	Yes
L02 W1 Office	11.3	64.2	758	2710	-72%	0.38	Yes
L02 W2 Office	16.5	125.8	1983	3967	-50%	0.38	Yes
L02 W3 Office	18.2	96.2	1704	4390	-61%	0.38	Yes
L03 E1 Office	15.7	74.0	1876	3778	-50%	0.38	Yes
L03 E2 Office	12.2	85.0	1786	2924	-39%	0.38	Yes
L03 E3 Office	18.9	90.8	1952	4554	-57%	0.38	Yes
L03 N1 Office	22.3	118.7	2957	5354	-45%	0.38	Yes
L03 N2 Office	18.9	134.0	3192	4537	-30%	0.38	Yes
L03 N3 Office	22.0	128.9	3159	5298	-40%	0.38	Yes
L03 S1 Office	15.1	90.2	2304	3641	-37%	0.38	Yes
L03 S2 Office	9.3	62.2	1468	2227	-34%	0.38	Yes
L03 S3 Office	19.1	100.3	2699	4594	-41%	0.38	Yes
L03 W1 Office	11.3	64.2	915	2710	-66%	0.38	Yes

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Table A2 – SOLAR GAIN RESULTS – Office (Cont'd)

Zone Name (Office)	Facade Length (m)	Floor Area (m^2)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	g-Value Required	Compliant
L03 W2 Office	16.5	125.8	2477	3967	-38%	0.38	Yes
L03 W3 Office	18.2	96.2	2049	4390	-53%	0.38	Yes
L04 E1 Office	19.9	66.5	2289	4791	-52%	0.38	Yes
L04 E2 Office	14.3	64.0	2003	3440	-42%	0.38	Yes
L04 E3 Office	14.6	39.3	2502	3515	-29%	0.38	Yes
L04 N1 Office	9.2	51.8	2158	2224	-3%	**0.32**	Yes
L04 N2 Office	6.2	33.9	1434	1490	-4%	**0.32**	Yes
L04 NW1 Office	12.3	75.6	2889	2970	-3%	**0.27**	Yes
L04 NW2 Office	9.3	57.1	2135	2228	-4%	**0.29**	Yes
L04 S1 Office	18.6	69.4	4362	4469	-2%	0.38	Yes
L04 S2 Office	14.1	85.3	2499	3393	-26%	0.38	Yes
L04 S3 Office	13.1	61.4	2069	3163	-35%	0.38	Yes
L04 W1 Office	12.4	67.6	2870	2973	-3%	**0.26**	Yes
L04 W2 Office	10.0	63.4	2377	2404	-1%	**0.25**	Yes
L05 E1 Office	20.0	96.7	2545	4802	-47%	0.38	Yes
L05 E2 Office	14.3	92.4	2225	3434	-35%	0.38	Yes
L05 E3 Office	13.9	57.4	2674	3340	-20%	0.38	Yes
L05 N1 Office	7.9	41.1	1865	1890	-1%	**0.34**	Yes
L05 N2 Office	9.4	46.8	2190	2267	-3%	**0.36**	Yes
L05 NW1 Office	12.1	71.7	2830	2919	-3%	**0.32**	Yes
L05 NW2 Office	11.0	66.8	2535	2644	-4%	**0.30**	Yes
L05 S1 Office	17.8	67.2	2242	4277	-48%	0.38	Yes
L05 S2 Office	14.1	84.4	2320	3393	-32%	0.38	Yes
L05 S3 Office	13.1	52.9	1901	3153	-40%	0.38	Yes
L05 W1 Office	12.6	69.7	2047	3034	-33%	0.38	Yes
L05 W2 Office	14.5	88.6	2642	3488	-24%	0.38	Yes
L06 E1 Office	20.0	96.7	2637	4802	-45%	0.38	Yes
L06 E2 Office	14.3	92.4	2237	3434	-35%	0.38	Yes
L06 E3 Office	13.9	57.4	2823	3340	-15%	0.38	Yes
L06 N1 Office	7.9	41.1	1838	1890	-3%	**0.34**	Yes
L06 N2 Office	9.4	46.8	2233	2267	-1%	**0.36**	Yes
L06 NW1 Office	12.1	71.7	2803	2919	-4%	**0.32**	Yes
L06 NW2 Office	11.0	66.8	2543	2644	-4%	**0.30**	Yes
L06 S1 Office	17.8	66.7	2179	4277	-49%	0.38	Yes
L06 S2 Office	14.1	84.9	2305	3393	-32%	0.38	Yes
L06 S3 Office	13.1	52.9	1896	3153	-40%	0.38	Yes
L06 W1 Office	13.1	69.7	2053	3149	-35%	0.38	Yes
L06 W2 Office	14.9	88.6	2638	3580	-26%	0.38	Yes
L07 E1 Office	19.9	96.7	3000	4798	-37%	0.38	Yes
L07 E2 Office	14.3	92.4	2401	3438	-30%	0.38	Yes
L07 E3 Office	14.6	60.4	3369	3521	-4%	0.38	Yes
L07 N1 Office	7.9	45.3	1845	1891	-2%	**0.32**	Yes
L07 N2 Office	9.4	46.5	2199	2266	-3%	**0.34**	Yes

6.0 APPENDIX A

Table A2 – SOLAR GAIN RESULTS – Office (Cont'd)

Zone Name (Office)	Facade Length (m)	Floor Area (m²)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	g-Value Required	Compliant
L07 NW1 Office	9.0	48.2	2047	2171	-6%	0.38	Yes
L07 NW2 Office	13.4	74.0	3178	3230	-2%	**0.34**	Yes
L07 S1 Office	17.2	67.5	2539	4143	-39%	0.38	Yes
L07 S2 Office	14.1	84.7	2371	3393	-30%	0.38	Yes
L07 S3 Office	13.1	52.9	1971	3153	-38%	0.38	Yes
L07 W1 Office	18.6	94.1	2739	4487	-39%	0.38	Yes
L07 W2 Office	11.0	72.4	1886	2637	-28%	0.38	Yes
L08 E1 Office	20.0	96.7	3200	4804	-33%	0.38	Yes
L08 E2 Office	14.2	92.3	2759	3405	-19%	0.38	Yes
L08 E3 Office	14.6	60.4	3455	3521	-2%	**0.37**	Yes
L08 N1 Office	7.9	45.3	1855	1891	-2%	**0.32**	Yes
L08 N2 Office	9.4	46.5	2230	2266	-2%	**0.34**	Yes
L08 NW1 Office	9.0	48.3	2024	2173	-7%	0.38	Yes
L08 NW2 Office	13.4	74.0	3110	3230	-4%	**0.33**	Yes
L08 S1 Office	17.0	67.6	2572	4078	-37%	0.38	Yes
L08 S2 Office	14.2	84.7	2437	3414	-29%	0.38	Yes
L08 S3 Office	13.1	52.9	2016	3153	-36%	0.38	Yes
L08 W1 Office	18.7	94.1	2763	4501	-39%	0.38	Yes
L08 W2 Office	11.0	72.4	1877	2647	-29%	0.38	Yes
L09 E1 Office	20.0	96.8	3270	4806	-32%	0.38	Yes
L09 E2 Office	14.3	92.3	3005	3430	-12%	0.38	Yes
L09 E3 Office	13.9	57.5	3273	3338	-2%	**0.37**	Yes
L09 N1 Office	7.8	44.3	1814	1887	-4%	**0.32**	Yes
L09 N2 Office	9.4	45.9	2231	2270	-2%	**0.34**	Yes
L09 NW1 Office	14.8	79.4	2717	3559	-24%	0.38	Yes
L09 NW2 Office	10.4	61.0	2428	2493	-3%	**0.34**	Yes
L09 S1 Office	16.5	66.0	2223	3975	-44%	0.38	Yes
L09 S2 Office	14.1	84.7	2409	3393	-29%	0.38	Yes
L09 S3 Office	13.1	52.9	2020	3153	-36%	0.38	Yes
L09 W1 Office	13.1	69.5	2121	3144	-33%	0.38	Yes
L09 W2 Office	13.8	85.8	2251	3309	-32%	0.38	Yes
L10 E1 Office	20.0	96.8	3265	4806	-32%	0.38	Yes
L10 E2 Office	14.2	92.4	2985	3419	-13%	0.38	Yes
L10 E3 Office	13.9	57.3	3299	3350	-2%	**0.37**	Yes
L10 N1 Office	7.8	44.3	1863	1887	-1%	**0.33**	Yes
L10 N2 Office	9.4	45.9	2226	2270	-2%	**0.34**	Yes
L10 NW1 Office	14.9	79.4	2730	3589	-24%	0.38	Yes
L10 NW2 Office	10.4	61.0	2418	2493	-3%	**0.34**	Yes
L10 S1 Office	17.0	66.2	2221	4079	-46%	0.38	Yes
L10 S2 Office	14.1	84.7	2392	3393	-30%	0.38	Yes
L10 S3 Office	13.1	52.9	1991	3157	-37%	0.38	Yes
L10 W1 Office	13.4	69.5	2093	3220	-35%	0.38	Yes
L10 W2 Office	13.9	85.8	2232	3338	-33%	0.38	Yes

6.0 APPENDIX A

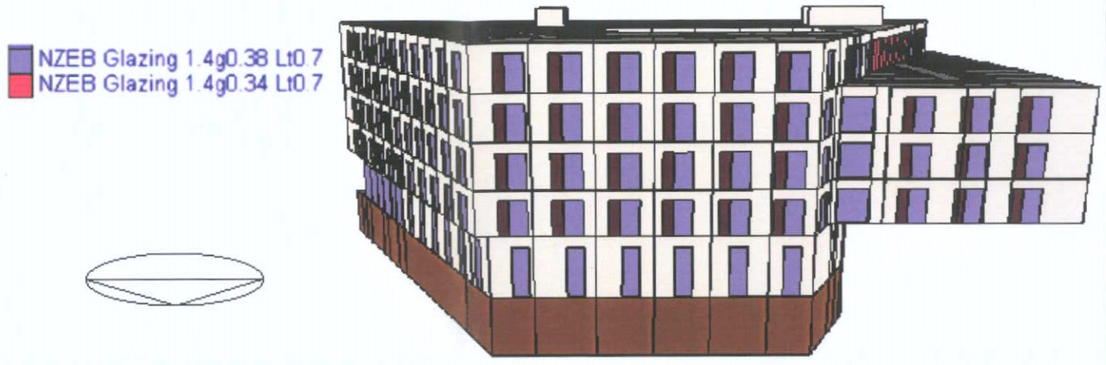
Table A2 – SOLAR GAIN RESULTS – Office (Cont'd)

Zone Name (Office)	Facade Length (m)	Floor Area (m^2)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	g-Value Required	Compliant
L11 E1 Office	16.9	98.3	3923	4068	-4%	**0.26**	Yes
L11 E2 Office	9.0	61.3	2068	2165	-4%	**0.23**	Yes
L11 E3 Office	15.1	68.8	3499	3625	-3%	**0.30**	Yes
L11 N1 Office	6.3	36.4	1497	1513	-1%	**0.31**	Yes
L11 N2 Office	9.4	48.2	2192	2268	-3%	**0.32**	Yes
L11 NW1 Office	6.3	41.3	1463	1513	-3%	**0.26**	Yes
L11 NW2 Office	9.4	53.8	2199	2268	-3%	**0.30**	Yes
L11 S1 Office	12.0	65.3	2836	2885	-2%	**0.25**	Yes
L11 S2 Office	12.0	78.7	2800	2884	-3%	**0.26**	Yes
L11 S3 Office	10.4	53.7	2465	2490	-1%	**0.28**	Yes
L11 W1 Office	15.3	78.9	3618	3677	-2%	**0.26**	Yes
L11 W2 Office	15.6	95.4	3677	3756	-2%	**0.26**	Yes

7.0 APPENDIX B –

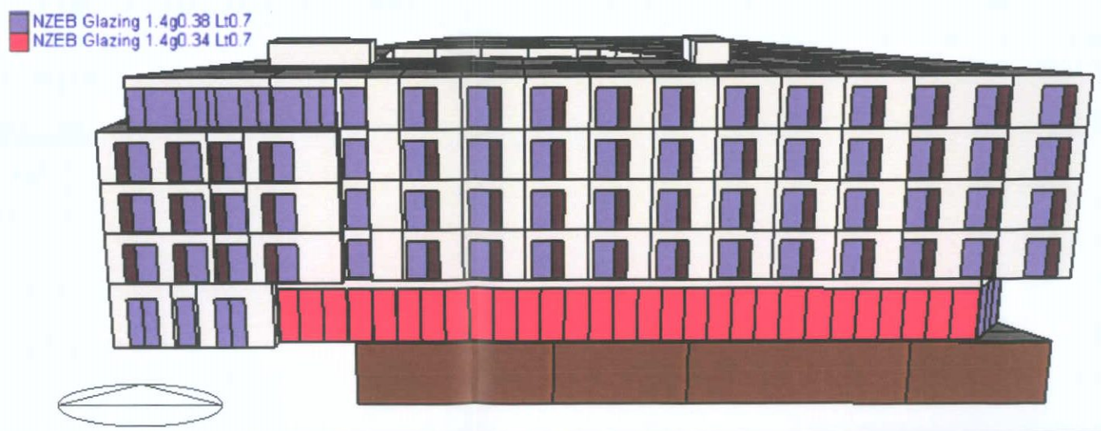
Table B1 - PROPOSED HOTEL Solar Gain Requirements

Hotel Building - Glazing Solar Control Requirements



North Elevation

East Elevation



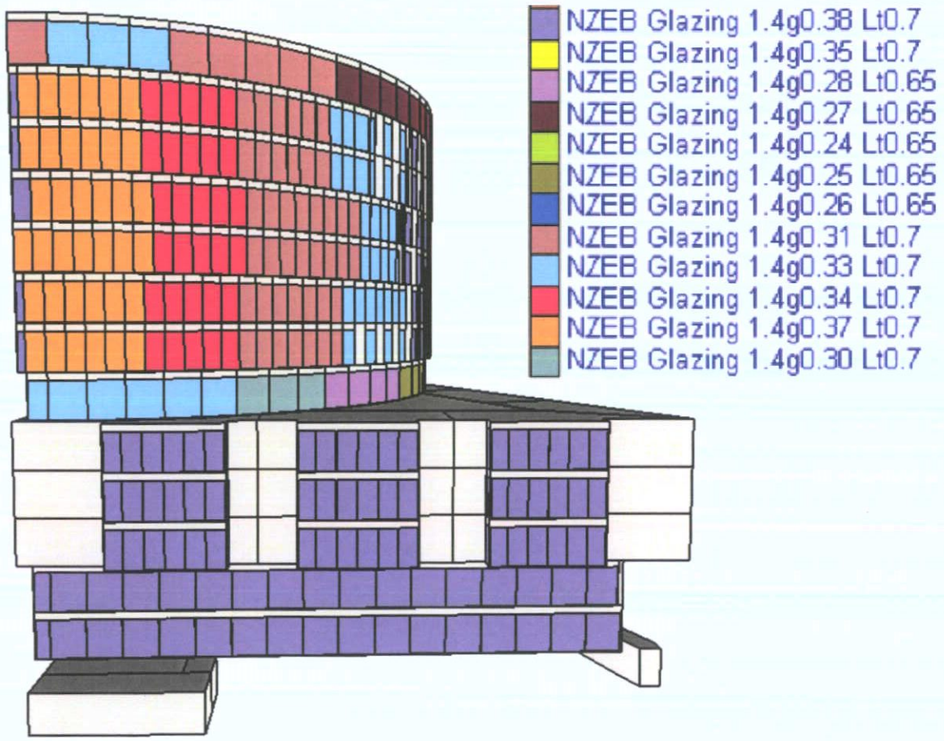
South Elevation

West Elevation

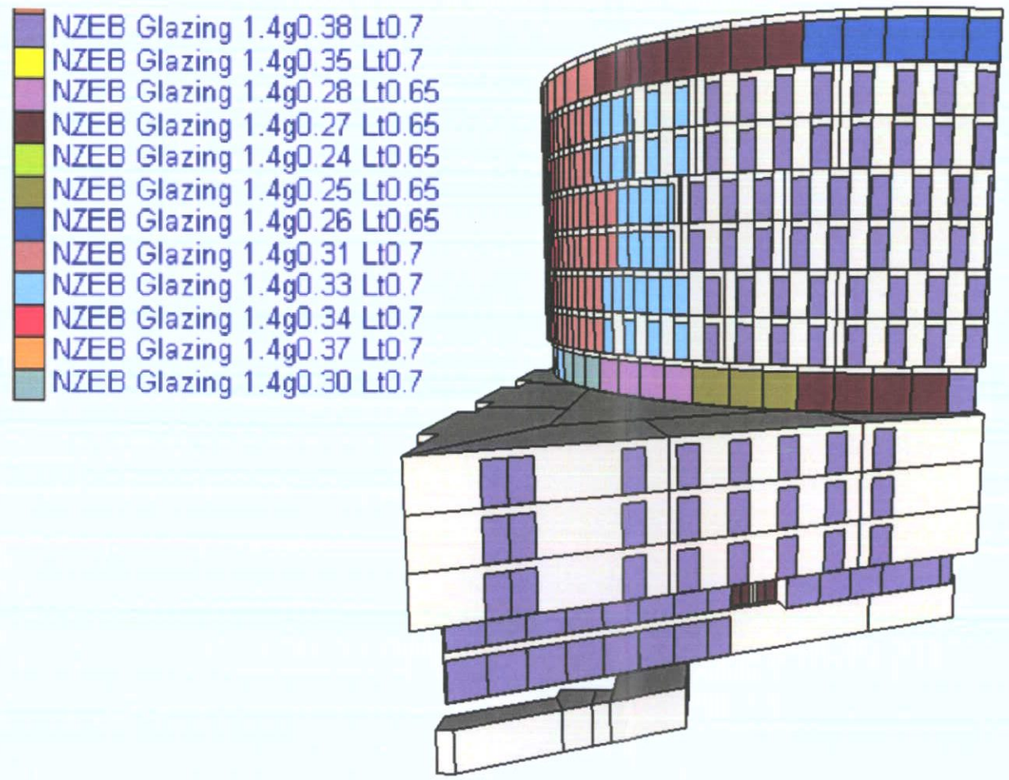
7.0 APPENDIX B –

Table B2 - PROPOSED OFFICE Solar Gain Requirements

Office Building - Glazing Solar Control Requirements



North Elevation

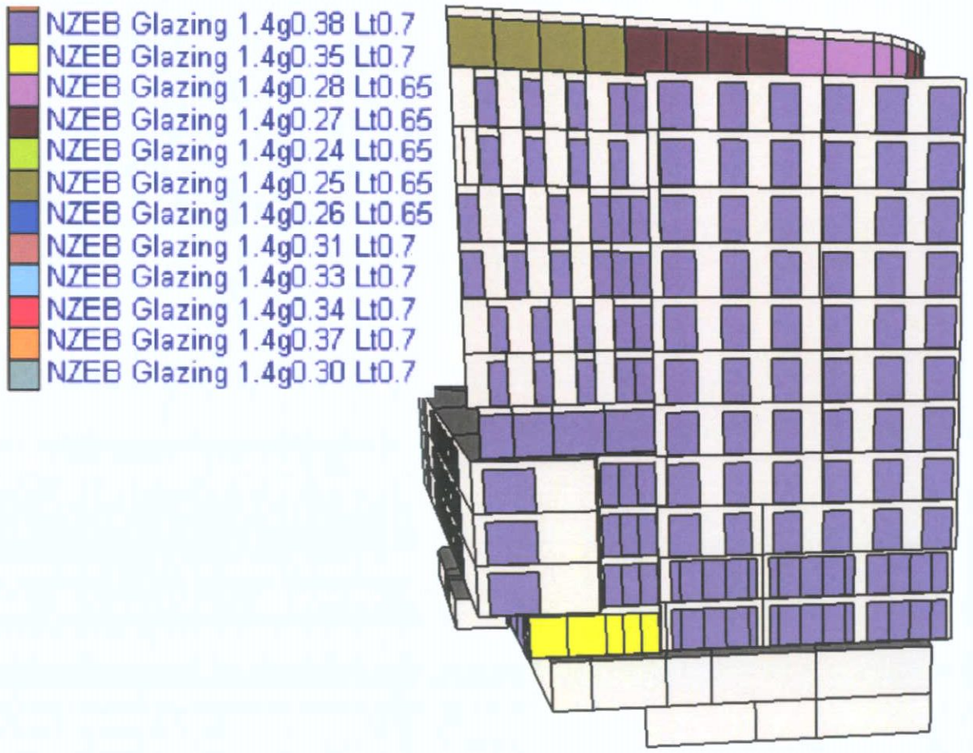


East Elevation

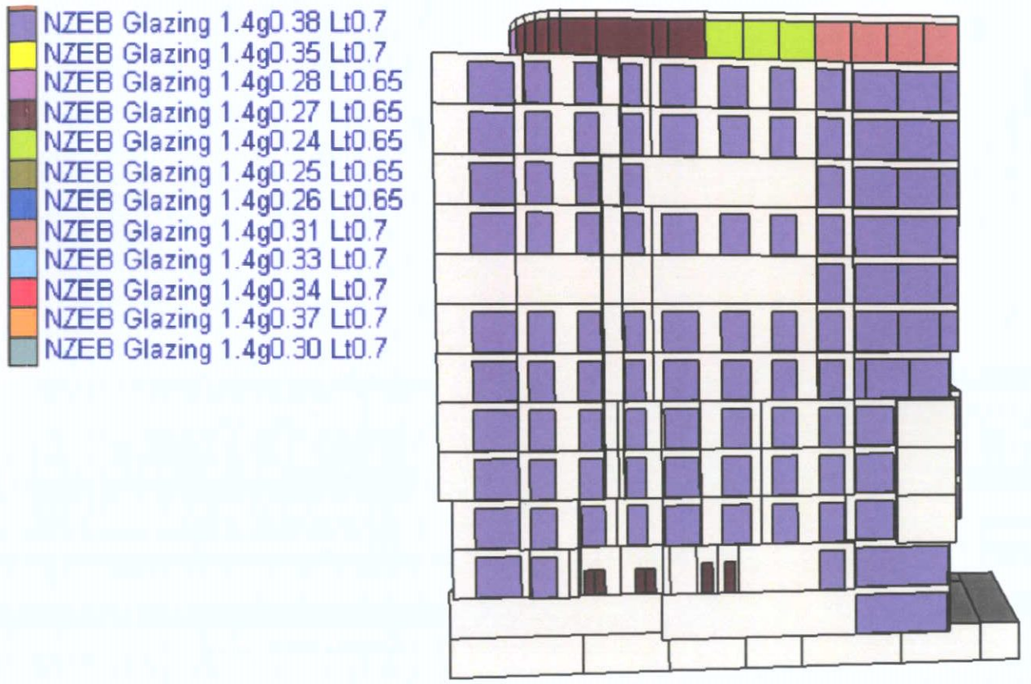
7.0 APPENDIX B –

Table B2 - PROPOSED OFFICE Solar Gain Requirements (Cont'd)

Office Building - Glazing Solar Control Requirements



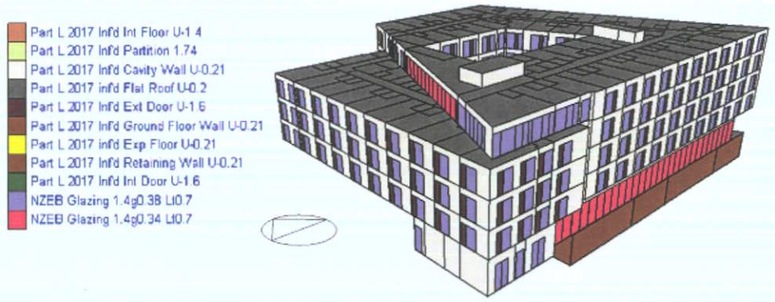
South Elevation



West Elevation

8.0 APPENDIX C

Table C1 - PROPOSED HOTEL BUILDING FABRIC & HVAC ASSUMPTIONS



Building Fabric -			
Element	U-Value W/m²K	General Fabric Details	
External Walls	0.21	Glazing Performance	
Roof	0.20	Glazing Light Transmittance	70% to 65%
Ground Floor	0.21	Glazing g-Value	0.34 to 0.38
Exposed Floor	0.15		
		Air Permeability	m³/hr.m²@50Pa
Glazing (Centrepane)	1.4	New Building	3.0

Thermal Bridges			
Junction	Ψ Value W/m K	Junction	Ψ Value W/m K
Roof to Wall	0.180	Lintel above Window or Door	0.450
Wall – Ground Floor	0.240	Sill below Window	0.080
Wall – Wall (Corner)	0.140	Jamb at Window or Door	0.090
Wall – Floor (int not ground floor)	0.110		

Heating System -			
Heating- ASHP Space Heating to all areas			
Fuel Type	Grid Electricity	ASHP Seasonal Efficiency EER/SEER	3.03/5.03
Heating Water Pumps	Variable Speed	Distribution System Efficiency	95%

Hot Water System -			
HWS – ASHP Heating to all areas			
Fuel Type	Grid Electricity	ASHP Seasonal Efficiency SEER	2.90
Heating Water Pumps	Variable Speed	Distribution System Efficiency	95%

Cooling - To Ensuite bedrooms, Bars, Dining areas, Offices, Reception and Fitness Suite			
Fuel Type	Grid Electricity	ASHP Seasonal Efficiency EER/SEER	5.00
Chilled Water Pumps	NA	Distribution System Efficiency	NA

HVAC System - Natural Ventilation - Circulation and Back of House Areas		
Natural Ventilation		
Local Mechanical Ventilation with heat recovery - Ensuite Bedrooms, Reception Areas		
Mechanical Ventilation (VRF MVHR)	System Fans Specific Fan Power (W/l.s)	1.8
	Demand Control Bases on Gas Sensors	Yes
	Speed Control Regulation	Yes
	Plate Heat Exchanger	Yes
	Heat Recovery Efficiency	70%
Centralised Mechanical Ventilation with Heat Recovery - to Reception, Bars, Dining area & Fitness Suite		
Mechanical Ventilation (Centralised AHU - MVHR)	System Fans Specific Fan Power (W/l.s)	2.1
	Demand Control Bases on Gas Sensors	Yes
	Speed Control Regulation	Yes
	Plate Heat Exchanger	Yes
	Heat Recovery Efficiency	70%
Mechanical Ventilation to Kitchens		
Mechanical Ventilation (MV)	Supply and Extract Fan Specific Fan Power (W/l. s)	1.1
Extract Only - WCs & Stores		
Extract Ventilation (Ex)	Extract Fan Specific Fan Power (W/l. s)	0.5

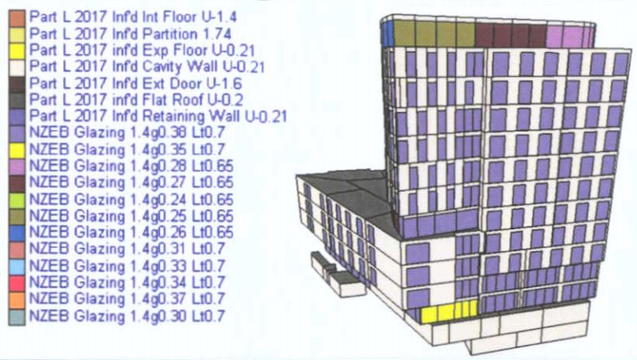
Lighting - Proposed					
Space Type	Presence Detection Switching	Daylight Control	Lighting Control Parasitic Power (W/m²)	Lamp and ballast Efficacy (lumens/W)	Light Output Ratio
Ensuite Bedrooms	Local Manual	Local Manual		85	1.0
Reception	Local Manual	Na		85	1.0
Bars	Local Manual	Na		85	1.0
Dining areas	Local Manual	Na		85	1.0
Fitness Suite	Local Manual	Na		85	1.0
Circulation	Local Manual	Na		85	1.0
Staff Areas	Auto On/Off	Na	0.1	85	1.0
Toilets	Auto On/Off	Na	0.1	85	1.0
Storage	Local Manual	Local Manual		85	1.0
Comms	Local Manual	Local Manual		85	1.0
Display Lighting					
Time Control of Display Lighting		Yes	Lamp and Ballast Efficacy		65 lumens/W

Controls - Proposed	
Automatic monitoring and targeting with alarms for out-of-range values	Yes
Power factor correction to achieve a whole building power factor of at least	>95%
Time Control on Secondary Circulation	Yes

Renewables
Renewable Energy Contribution is provided by the Air Source Heat Pumps from the Heating systems

8.0 APPENDIX C

Table C2 - PROPOSED OFFICE BUILDING FABRIC & HVAC ASSUMPTIONS



Building Fabric -			
Element	U-Value W/m²K	General Fabric Details	
External Walls	0.21	Glazing Performance	
Roof	0.20	Glazing Light Transmittance	70% to 65%
Ground Floor	0.21	Glazing g-Value	0.24 to 0.38
Exposed Floor	0.21		
		Air Permeability	m³/hr.m²@50Pa
Glazing (Centrepane)	1.4	New Building	3.0

Thermal Bridges			
Junction	Ψ Value W/m K	Junction	Ψ Value W/m K
Roof to Wall	0.180	Lintel above Window or Door	0.450
Wall – Ground Floor	0.240	Sill below Window	0.080
Wall – Wall (Corner)	0.140	Jamb at Window or Door	0.090
Wall – Floor (int not ground floor)	0.110		

Heating System - Heating- ASHP Space Heating to all areas			
Fuel Type	Grid Electricity	ASHP Seasonal Efficiency EER/SEER	3.03/5.03
Heating Water Pumps	Variable Speed	Distribution System Efficiency	95%

Hot Water System - HWS – ASHP Heating to all areas			
Fuel Type	Grid Electricity	ASHP Seasonal Efficiency SEER	3.50
Heating Water Pumps	Variable Speed	Distribution System Efficiency	95%

Cooling - To Office Spaces			
Fuel Type	Grid Electricity	ASHP Seasonal Efficiency EER/SEER	5.00
Chilled Water Pumps	NA	Distribution System Efficiency	NA

HVAC System - Natural Ventilation - Core Areas					
Natural Ventilation					
Fan Coil Unit Mechanical Ventilation with heat recovery - Office and Reception Areas					
Mechanical Ventilation (FCU MVHR)	System Fans Specific Fan Power (W/l.s)				2.1
	Thermal Unit Fan Specific Fan Power (W/l.s)				0.3
	Ductwork Leakage Tested		Yes	Cen Classification	Class D
	Air Handling Unit Leakage Tested		Yes	Cen Classification	Class L1
	Plate Heat Exchanger	Yes	Heat Recovery Efficiency		70%
	CO2 Sensor				NA
Extract Only - Changing, WCs & Stores					
Extract Ventilation (Ex)	Extract Fan Specific Fan Power (W/l. s)				0.5

Lighting - Proposed					
Space Type	Presence Detection Switching	Daylight Control	Lighting Control Parasitic Power (W/m²)	Lamp and ballast Efficacy (lumens/W)	Light Output Ratio
Office	N/A	Photocell / Dimming	0.1	110	1.0
Reception	N/A	Photocell / Dimming	0.1	110	1.0
Circulation	Auto On/ Off	N/A	0.1	110	1.0
Changing	Auto On/ Off	N/A	0.1	110	1.0
Toilets	Auto On/ Off	N/A	0.1	110	1.0
Storage	Auto On/ Off	N/A	0.1	110	1.0
Comms	Auto On/ Off	N/A	0.1	110	1.0

Controls - Proposed	
Automatic monitoring and targeting with alarms for out-of-range values	Yes
Power factor correction to achieve a whole building power factor of at least	>95%
Time Control on Secondary Circulation	Yes

Renewables			
System	Annual Yield MWh	No. of Panels	Area of Panels m²
Photovoltaic Panels (PV)	90.96	379	606.4

9.0 APPENDIX D – Provisional Building Energy Rating

Fig 9.1 – Provisional Building Energy Rating for the Hotel

Fig 9.2 – Provisional Building Energy Rating for the Office

IN2™

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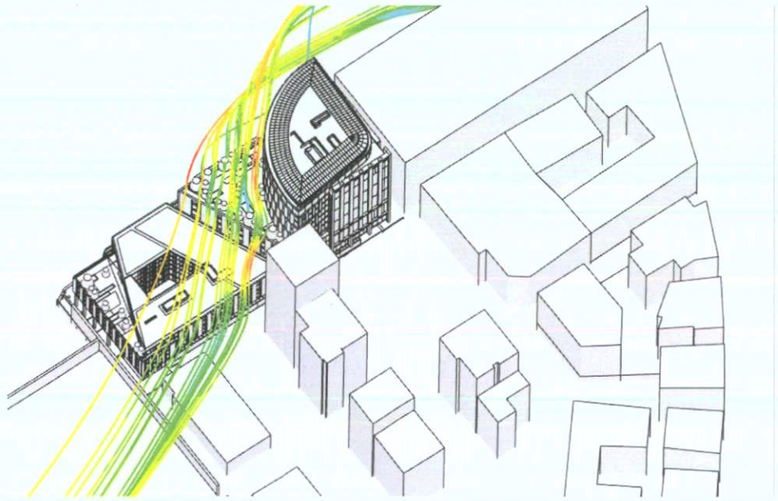
APPENDIX 9B

MICROCLIMATE WIND ANALYSIS REPORT

Heuston South Quarter
Commercial Development

St John's Road West
Dublin 8



Microclimate Wind Analysis

IN2 Project No. D2026
20/07/2022
REV05

Revision History

Date	Revision	Description
17/02/2022	00	Issue for client review
28/02/2022	01	Revised to reflect comments
03/03/2022	02	Additional commentary included in Section 4.7
14/03/2022	03	Revised Development Description
04/05/2022	04	Revised to reflect granted adjacent SHD Development
20/07/2022	05	Revised to reflect design change for hotel

Table of Contents

1.0 Executive Summary

This report summarises the Microclimate Wind Analysis undertaken for the proposed commercial development at Heuston South Quarter, St John's Road West, Dublin 8.

The analysis utilises Computational Fluid Dynamics (CFD) modelling software to simulate the wind profiles for each of the twelve cardinal wind directions for the proposed development.

The results of the modelling are evaluated using the Lawson Criteria, a best practice methodology for assessing acceptable wind velocities and microclimate effects.

It should be noted that the analysis has been undertaken with and without the proposed SHD Residential scheme (ABP Ref: TA29S.311591) included. The ground level results of each scenario are outlined in Sections 4.1 and 4.2. Roof terrace level results are compared across Sections 4.6 and 4.7. The results determined that the massing of the proposed SHD scheme slightly reduces wind speeds at the pedestrian walkways between the proposed hotel and office buildings, and proposed and existing office buildings. With the SHD scheme in its granted form, these walkways are predicted to be generally suitable for "Pedestrian Sitting". Excluding the permitted massing of the SHD residential development would result in an increase in the area of these walkways deemed more suited to "Pedestrian Standing". These wind conditions would still be permissible for the intended use of the spaces as transient walkways.

The proposed seating area to the south of the hotel building is predicted to experience slightly improved levels of pedestrian comfort, from suitable for "Pedestrian Sitting", to "Outdoor Dining/ Pedestrian Sitting" without the proposed SHD scheme in place.

Similarly, comparison of roof terrace levels with and without the proposed SHD Residential scheme indicates a minor alteration in pedestrian comfort conditions in these areas. However, each of the roof terraces would still be determined to be well sheltered and suitable for amenity use, with or without the proposed SHD scheme in place.

The results of the Heuston South Quarter commercial development analysis indicate no undesirable wind effects. At ground level, the conditions have been determined to be predominantly suitable for "Outdoor Dining" and "Pedestrian Sitting" in accordance with the Lawson Criteria methodology utilised.

Hotel roof terrace at level 4 and office roof terraces at levels 4 and 11 were analysed. The addition of landscaping effects to the West Side of the roof terraces is predicted to be effective in mitigating against wind effects. Both the hotel and office roof terraces are determined to be predominantly suited to "Outdoor Dining/ Pedestrian Sitting" and are therefore suitable for use as amenity spaces in accordance with the Lawson Criteria methodology utilised.

The analysis undertaken identified that the proposed development was determined to not unduly impact on the local wind micro-climate, with no adverse wind effects predicted to be introduced to the receiving environment.

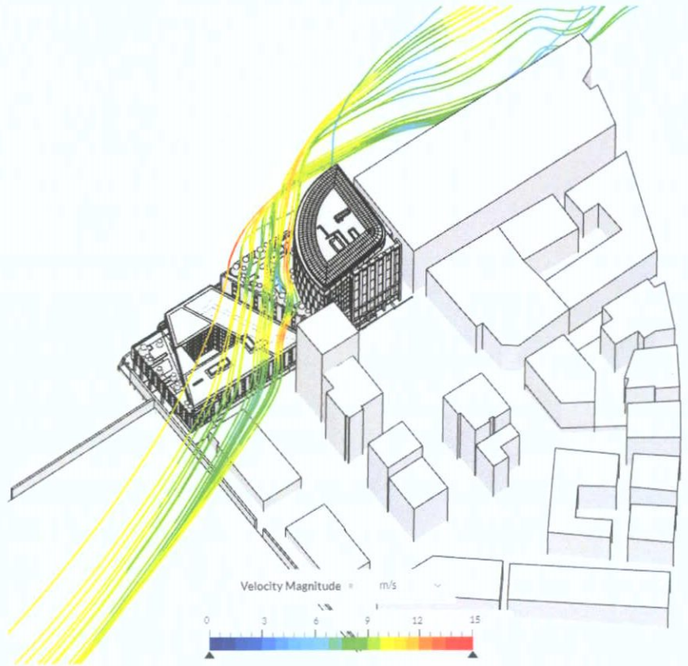


Fig 1.0 – CFD Model of Proposed HSQ Commercial Development

2.0 Development Description

HPREF HSQ Investments Ltd intends to apply for planning permission for a commercial development at a site at Heuston South Quarter St. John's Road West (to the north), Military Road (to the east), Royal Hospital Kilmainham (Protected Structure) (to the south and west), Kilmainham, Dublin 8.

The proposed development will provide a mixed use commercial development comprising of a hotel (241 no. bedrooms) and an office block delivering a cumulative Gross Floor Area (GFA) of 32,602, inclusive of basement area. The proposed development consists of:

- Site clearance and localised demolitions to remove part of the podium and Basement Level -1 reinforced concrete slabs at the interface of the proposed hotel and office blocks, together with the incorporation of part of the existing basement level structure extending to approximately 4,228 sq.m (GFA).

- The proposed basement will be integrated within the existing basement levels serving the wider HSQ development and will be accessed from the existing vehicular ramped accesses/egresses onto/off St. John's Road West and Military Road to the north and east, respectively. The proposed basement area is split into two areas to provide a dedicated Hotel Basement area of approximately 2,132 sq.m (GFA) and an Office basement area of 2,096 sq.m (GFA).

- The construction of a 5-storey hotel (over lower ground and basement levels) to provide 238 no. bedrooms. At basement level provision is made for 24 no. car parking spaces; 2 no. motorcycle spaces together with plant and storage rooms. A waste storage area with dedicated loading bay / staging area is provided along with dedicated set-down area for deliveries. A dual-purpose service bay is also provided at basement level with modifications to existing line markings to the basement parking area to accommodate the development. At Lower Ground floor level provision is made for 14 no. Bedrooms; Conference Room; Kitchen and Staff facilities and Changing Rooms / WCs plus ancillary Gym. This floor is arranged around an internal courtyard space. Provision is made at Podium level for 19 no. Bedrooms; Dining Area and Foyer with entrance at the South-Eastern corner of the building onto a new laneway separating the proposed hotel and office building. Provision is made at the south-western corner at podium level for an ESB sub-station / switch room and 15 no Sheffield type bicycle stands are provided for the hotel and the retail / café unit, providing storage space for 30 no. bicycles. A total of 205 no. bedrooms are provided at the upper levels (above podium level). The top floor of the hotel (4th floor) has a splayed setback to provide a west facing roof terrace. An ancillary hotel bar (118 sq.m) opens onto this roof terrace.

- The construction of a 12-storey (over lower ground and basement levels) office building to the east of the proposed hotel building to provide 19,474 sq.m of office floorspace (GFA) from lower ground floor level and above. Provision is made at basement level for 30 no. car parking spaces; 2 motorcycle spaces and 120 no. bicycle storage spaces together with plant and storage rooms. Provision is made for a further 196 no. bicycle storage spaces at Lower Ground floor level plus changing rooms (including showers). At podium level 2 no. ESB sub-stations and switch rooms are proposed. The foyer and entrance is provided at the southern end of the building at Podium level along with a Retail/Café unit of 208 sq.m at the South-Western corner of the building. The building is setback at 4th floor level to provide a west facing roof terrace. Splayed setbacks to the southern and eastern elevations at the 11th floor level forms a roof terrace that wraps around the South-Eastern corner of the building. Plant is provided at rooftop level that is enclosed by curved louvred screens and PV panels.

- Works proposed along the St John's Road West frontage include the omission of the existing left-turn filter lane to the vehicular ramped access to the HSQ development and re-configuration of the pedestrian crossings at the existing junction together with the re-configuration of the existing pedestrian crossing over the westbound lanes of St. John's Road West leading to an existing pedestrian refuge island and re-alignment of the existing footpath along the site frontage onto St John's Road West to tie into the reconfigured junction arrangement.

- Drainage works proposed include the provision of 2 no. below basement surface water attenuation tanks with duty/stand-by arrangement pump sumps and associated valve chambers, and 2 no. below basement foul pump sumps with duty/stand-by arrangement and 24hr emergency storage and associated valve chambers. New foul drainage and stormwater drainage connections are proposed to existing foul and storm sewers in St. John's Road West with associated site works.

- Hard and soft landscaping works are proposed at lower ground level along St John's Road West and at podium level to provide for the extension and completion of the public plaza to the south of the proposed Office Block and the provision of a new pedestrian laneway connecting St John's Road West with the public plaza at podium level.

The application is accompanied by an Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS).

3.0 Methodology

3.1 Wind Analysis

The predicted wind patterns around the proposed development were determined using Computational Fluid Dynamics (CFD) software (SimScale). This enabled an assessment of the site wind conditions highlighting zones of high pressure, negative pressure, and air movement for varying wind conditions.

An initial 3D representational model of the existing buildings and their immediate surroundings was created, and simulations undertaken for 12 cardinal wind directions.

Wind Climate Data was taken from the Global Wind Atlas. This utilises a microscale modelling system, enabling localised wind data to be obtained for high resolution (250m grid) topography, such as hills, ridges, and land use, including urban environments.

Fig 3.1.1 illustrates Global Wind Atlas data for the general Dublin area, indicating average wind speed at 10m height. The relative sheltering of the Urban area can be seen, in contrast to Dublin Airport to the North, and Dublin/ Wicklow mountains to the South, and exposed coastal locations.

Recorded wind speeds for Dublin Airport are relatively high- in what is one of Europe's windier meteorological weather station locations. However, the particular site location at HSQ2 identified in Fig 3.1.1, is an area relatively sheltered on a macro level, within the Dublin City area.

The CFD simulations utilised wind profiles accounting for terrain effects. Allowing for the nature of the site and location, a surface roughness layer profile representative of "Urban Terrain" (z0=0.4m height)" was utilised, derived from GIS survey analysis1[1].

Figures 3.1.2 and 3.1.3 indicates the long-term annual "Wind Rose" obtained from the Global Wind Atlas for the site at Heuston South Quarter, Dublin 8. The rose diagrams illustrate the frequency that wind will be from a certain direction and at what speed. It can be seen how the prevailing Westerly/ South Westerly winds entirely predominate due to the Atlantic gulf stream, with only lower occurrence from other directions.

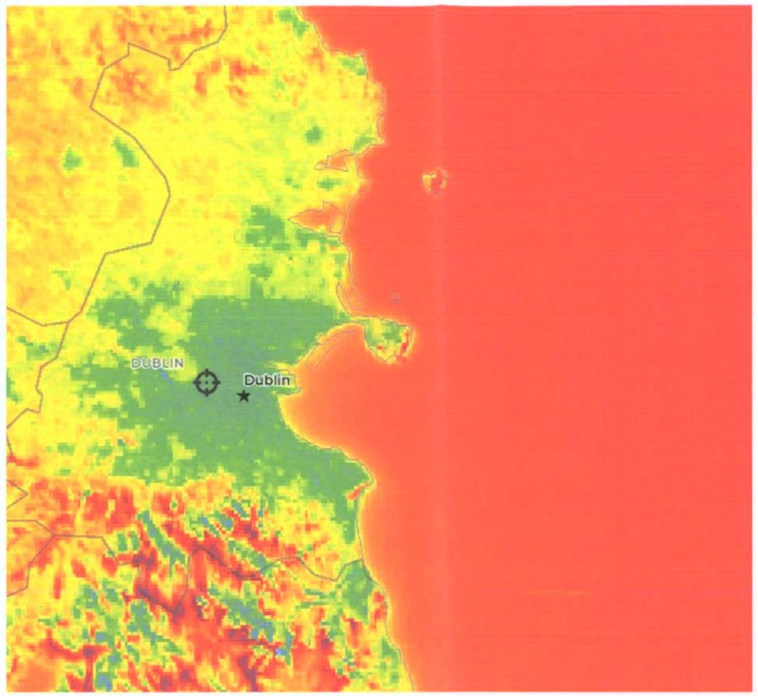


Fig 3.1.1 – Mean Wind Speeds across Dublin – Global Wind Atlas

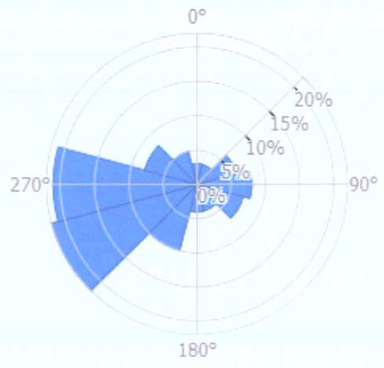


Fig 3.1.2 – Wind Frequency Rose for HSQ – Global Wind Atlas

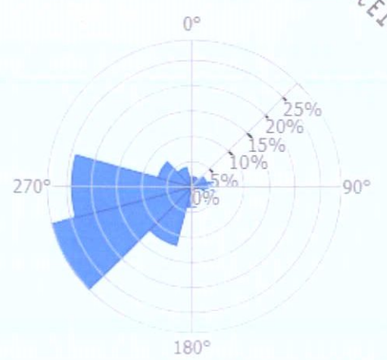


Fig 3.1.3 – Wind Speed Rose for HSQ – Global Wind Atlas

[1] European Space Agency's Climate Change Initiative Land Cover (CCI-LC) dataset v2.0.7.

Fig 3.1.4 outlines the 3D representational model of the proposed development and its surroundings that was created based on current architectural modelling information, and simulations were undertaken for 12 cardinal wind directions.

Fig 3.1.5 illustrates Velocity streamlines across the proposed development and surroundings under prevailing SW (240°) wind conditions. These CFD simulation results form the basis of the Pedestrian Wind Comfort Analysis undertaken, which is described in detail in Section 3.2 below.

The methodology calculates predicted airflow patterns around buildings for all wind orientations and calculates average velocity applying weighting based on probability of occurrence throughout the year. It should be noted that wind effects around buildings for prevailing SW wind conditions are deemed to have more of a potential impact to pedestrian discomfort, as these will occur on a more regular occurrence.

However, it should be noted that the methodology assesses averaged (hourly) wind conditions for the purposes of general pedestrian comfort and does not intend to predict gusting, abnormal nor potential future climate change conditions.

Nevertheless, the Lawson Criteria methodology basis, as described in detail below, has been proven to be a robust means of analysing Pedestrian Comfort and its basis has been successfully adapted and implemented in both National Standards (Netherlands NEN.8100) and Design Guidelines (City of London – Wind Microclimate Guidelines (2019)).

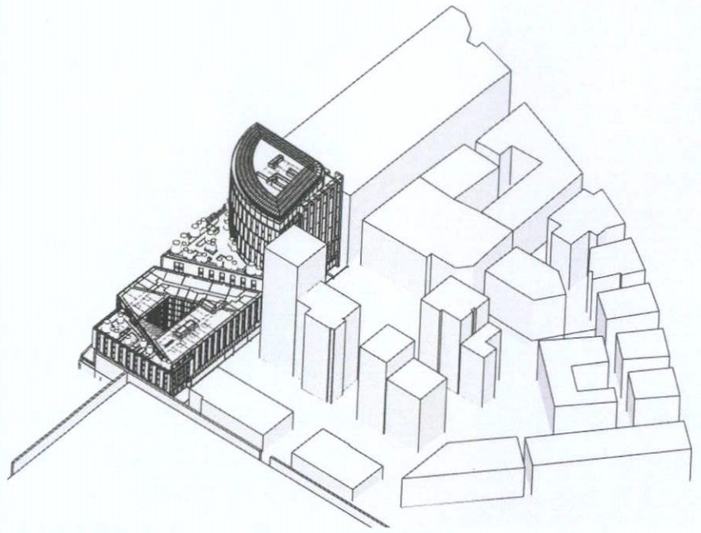


Fig 3.1.4 – 3D Representational Model of Proposed HSQ2 Commercial Development and Surroundings

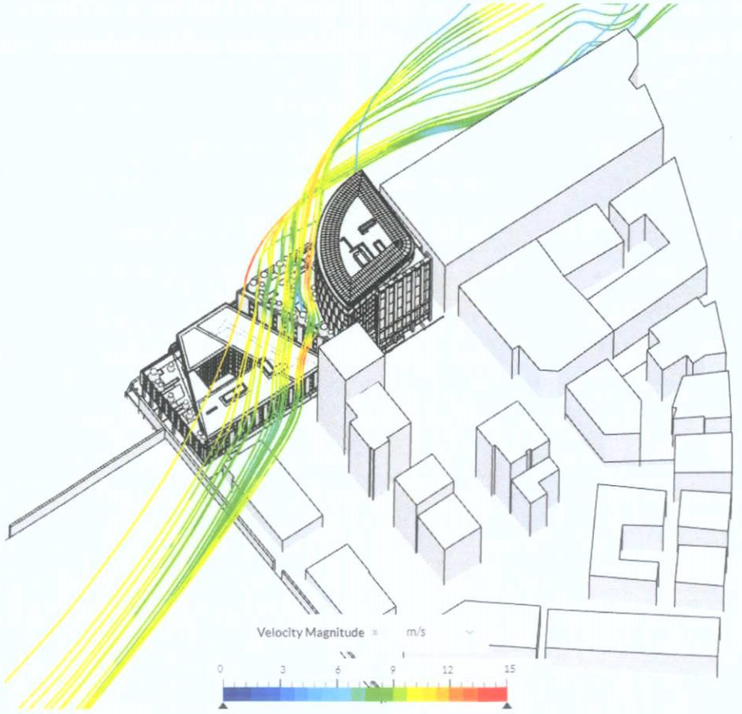


Fig 3.1.5 – Velocity Streamlines across Proposed Development and Surroundings under Prevailing SW (240°) Wind Conditions

3.2 Pedestrian Comfort

Pedestrian Wind Comfort was assessed utilising the "Lawson Criteria" scale, which has been developed as a means of assessing the long term suitability of urban areas for walking or sitting, accounting for both microclimatic wind effects (i.e. site location and prevailing winds) and microclimatic air movement associated with wind forces influenced by the localised built environment forms and landscaping effects.

The original Lawson Criteria (as described in Building Aerodynamics, Tom Lawson, Imperial College Press, 2001) assesses probability of wind discomfort based on the Beaufort Scale as referenced in Figure 3.2.1.

Figure 3.2.2 illustrates the Lawson Criteria scale, as utilised and assessed within the report, which ranges from areas deemed suitable for long term sitting through to regions uncomfortable for pedestrian comfort. "Pedestrian Walking" areas, for example, are defined as areas that would not experience wind velocities in excess of 8m/s for more than 5% of the year, whereas uncomfortable areas would experience averaged wind velocities greater than 10m/s for more than 5% of the year.

The assessment identifies area where potential wind occurrence, based on probability of wind direction and speed, would either be mitigated (Outdoor Dining/ Pedestrian Sitting and Standing) or exacerbated (Business Walking/ Uncomfortable) due to proposed massing from potential developments.

However, it should be noted that in terms of pedestrian comfort, the Lawson Criteria assesses solely for wind/associated air velocity effects. Therefore, other environmental aspects that may influence a space's microclimate, such as exposure to sunlight and envisaged temperature variation throughout the year are not accounted for within this methodology.

Beaufort Force	Hourly-Average Windspeed m/s	Description of Wind	Noticable Effect of Wind
0	<0.45	Calm	Smoke rises vertically
1	0.45 - 1.55	Light	Direction shown by Smoke drift but not by vanes
2	1.55 - 3.35	Light	Wind felt on faces: leaves rustle: wind vane moves
3	3.35 - 5.60	Light	Leaves and twigs in motion: wind extends a flag
4	5.60 - 8.25	Moderate	Raises dust and loose paper: small branches move
5	8.25 - 10.95	Fresh	Small trees in leaf sway
6	10.95 - 14.10	Strong	Large branches begin to move: telephone wires whistle
7	14.10 - 17.20	Strong	Whole trees in motion

Fig 3.2.1 Beaufort Scale

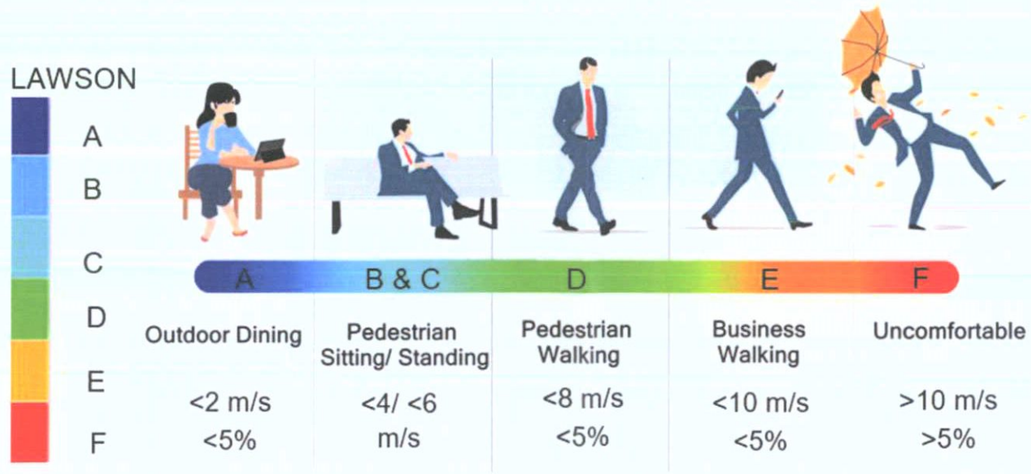


Fig 3.2.2 Lawson Scale

4.0 Lawson Criteria Results

Figure 4.1.1 outlines the Lawson Criteria Scale utilised to assess Pedestrian Comfort across the proposed Heuston South Quarter Commercial development. Blue contours illustrate the most sheltered regions, areas deemed "Suitable for Outdoor Dining". Light Blue/Cyan contours indicate regions "Suitable for Pedestrian Sitting" and "Pedestrian Standing" respectively. Green contours indicate areas "Suitable for Pedestrian Walking", with orange illustrative of being "Suitable for Business Walking". Red areas highlight zones as "Uncomfortable".

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.1.1 – Lawson Criteria Scale

4.1 Ground Level Results

Fig 4.1.2 illustrates the Pedestrian Comfort results for 1.5m above the ground level of the development. The conditions have been determined to be predominantly suitable for "Outdoor Dining" and "Pedestrian Sitting", as illustrated by dark/light blue contours.

Fig 4.1.3 indicates the proposed locations for seating areas around the proposed hotel and office buildings. This image demonstrates that all proposed seating areas are in sheltered locations, determined to be suitable for "Outdoor Dining/ Pedestrian Sitting".

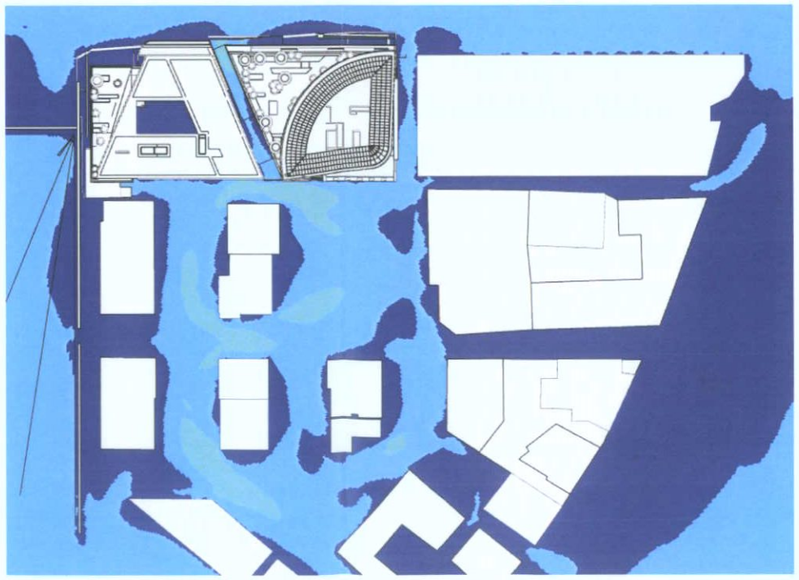


Fig 4.1.2 – Lawson Criteria Results at 1.5m above Ground Level across Proposed HSQ2 Commercial Development and Surroundings

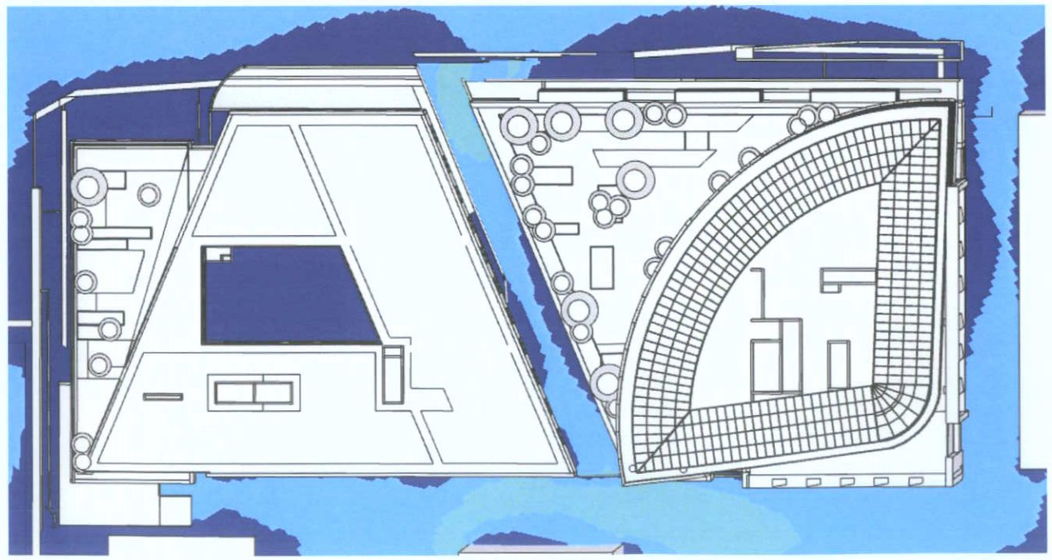


Fig 4.1.3 – Lawson Criteria Results at 1.5m above Ground Level Around Proposed Development

4.2 Ground Level Results – Without SHD Residential Scheme

It should be noted that the above analysis has been undertaken with the granted SHD Residential scheme (ABP Ref: TA29S.311591) included. The ground level results for the proposed Commercial scheme without the Residential scheme are illustrated in Fig. 4.2.2.

The results determined that the massing of the proposed SHD scheme slightly reduces wind speeds at the pedestrian walkways between the proposed hotel and office buildings, and the walkway between the proposed and existing office buildings. With the SHD scheme in its proposed form, these walkways are predicted to be predominantly suitable for "Pedestrian Standing". With the SHD scheme in its granted form, these walkways are predicted to be generally suitable for "Pedestrian Sitting". Excluding the permitted massing of the SHD residential development would result in an increase in the area of these walkways deemed more suited to "Pedestrian Standing". These wind conditions would still be permissible for the intended use of the spaces as transient walkways.

The proposed seating area to the south of the hotel building is predicted to experience slightly improved levels of pedestrian comfort, from suitable for "Pedestrian Sitting", to "Outdoor Dining/ Pedestrian Sitting" without the proposed SHD scheme. With the SHD scheme in place, a proportion of westerly winds were predicted to be funnelled and minorly accelerated between the proposed hotel building and adjacent residential buildings, and across the proposed seating area. Without the SHD scheme, no compression and acceleration of these winds is predicted to occur, resulting in improved wind conditions.

Similarly, the exclusion of the proposed SHD scheme is predicted to minorly alter, but not unduly impact, wind conditions at roof levels, as described in Section 4.7.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.2.1 – Lawson Criteria Scale

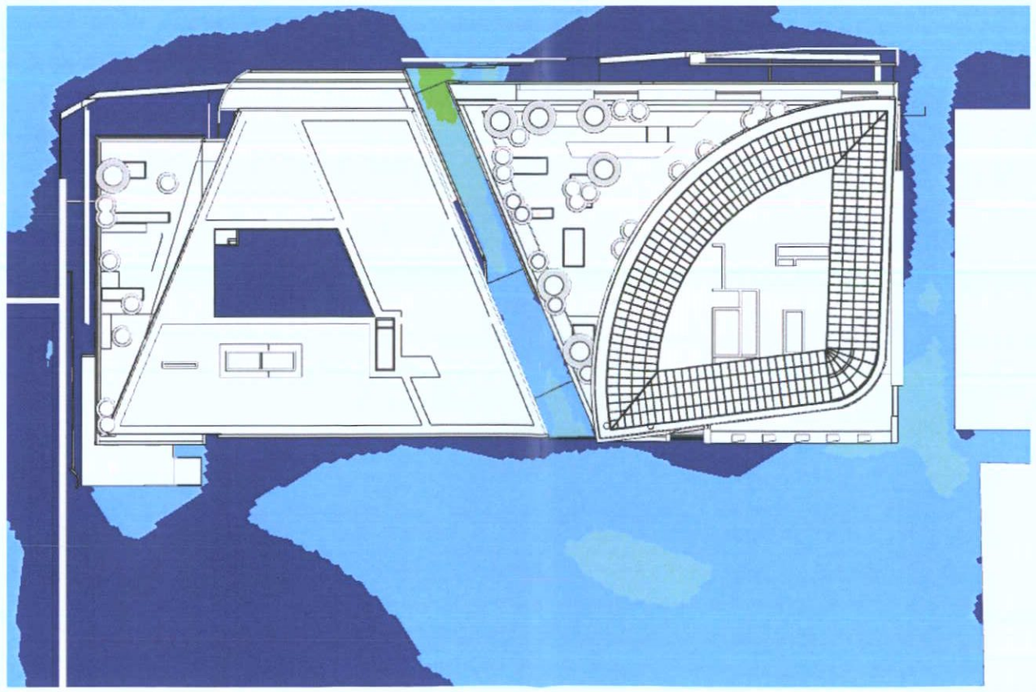


Fig 4.2.2 – Lawson Criteria Results at 1.5m above Ground Level across Proposed HSQ2 Commercial Development, without SHD Scheme to the South

4.3 Hotel Courtyard

The proposed hotel courtyard space is predicted to be particularly well sheltered from wind effects.

This is predominantly due to the enclosed courtyard arrangement, and relatively low height of the hotel building surrounding it.

The entire space is determined to be suitable for “Outdoor Dining” in accordance with the Lawson Criteria methodology utilised.

As a result of the wind analysis undertaken, placement of long-term outdoor seating has been focused towards this area to maximise pedestrian comfort.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.3.1 – Lawson Criteria Scale

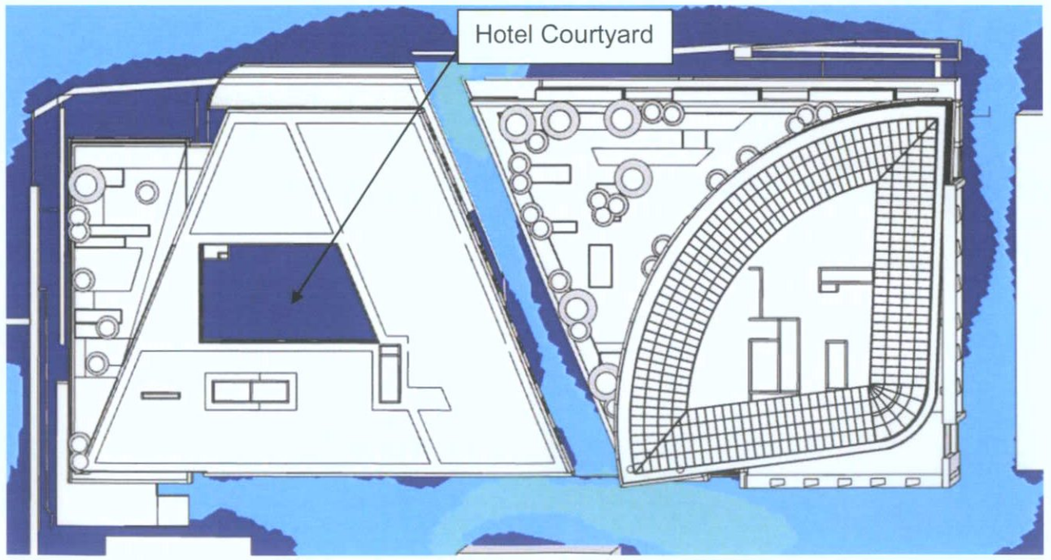


Fig 4.3.1 – Lawson Criteria Results at 1.5m above Ground Level with Hotel Courtyard Identified

d

4.4 Roof Terraces

Figure 4.4.2 illustrates results of pedestrian comfort results at roof terrace level of the proposed hotel and office developments. Hotel roof terrace at level 4 and office roof terraces at levels 4 and 11 were analysed. These are the results of initial analysis of the space, without landscaping effects.

The level 4 office roof terrace in this configuration is predicted to be subject to excessive wind speeds from the prevailing SW winds, and conditions determined to be suited to “Pedestrian Walking”. Only a minor area of this terrace is deemed suitable for “Pedestrian Sitting”. Therefore these Pedestrian Comfort conditions would be unsuitable for use as an amenity space. Additionaly, doorways from the office building to the roof terraces are predicted to be subjected to accelerated winds, which is undesirable.

Fig 4.4.3 presents streamlines which indicate the flow of air at level 4 around the proposed office building.

The addition of landscaping effects (trees, planting) is predicted to improve wind conditions at hotel and office roof terraces, as described in Section 4.5 overleaf.

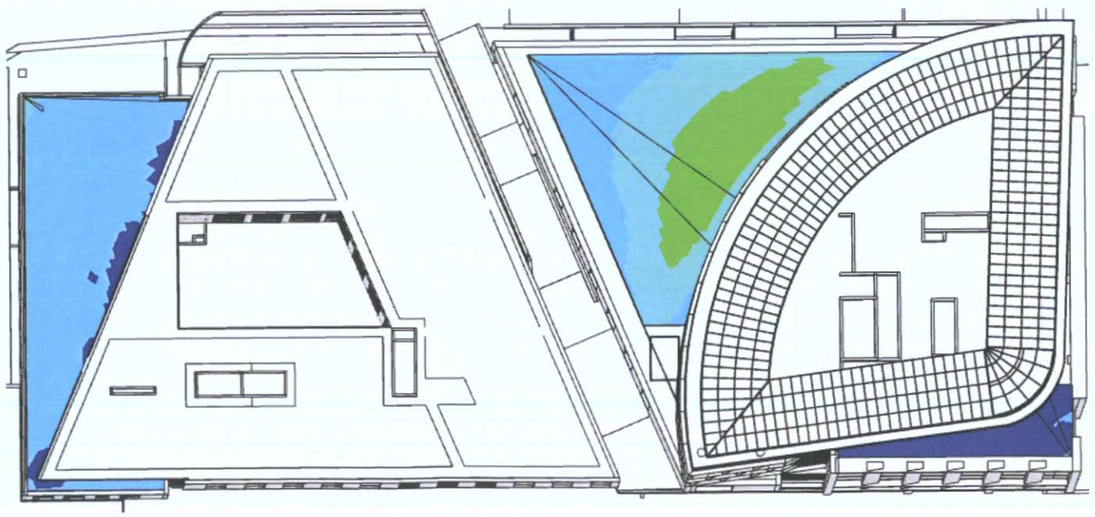


Fig 4.4.2 – Lawson Criteria Results at Hotel (Level 4) and Office (Levels 4 and 11) Roof Terraces

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.4.1 – Lawson Criteria Scale

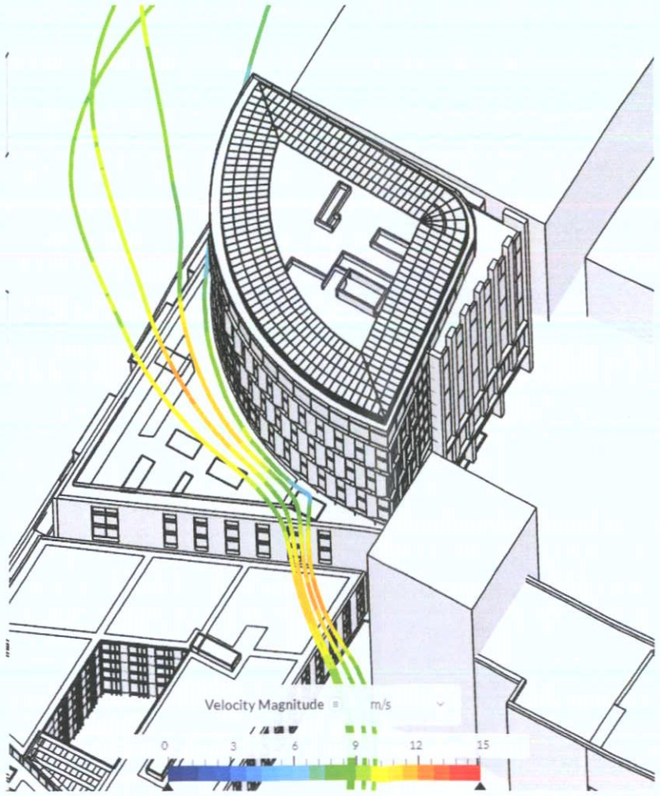


Fig 4.4.3 – Wind Velocity Streamlines under Prevailing SW (240°) Wind Conditions

4.5 Level 11 Roof Terrace

The top floor (11th floor) roof terrace at south-east corner of the proposed Office building is predicted to be well sheltered from winds. The space is predicted to be suitable for "Outdoor Dining" in accordance with the Lawson Criteria methodology utilised.

This is due to the design of the building massing. The majority of wind flow is deflected around the curved face of the building. Therefore, minimal airflow is predicted across the 11th floor roof terrace. Additionally, the tall fins that protrude along the south and east edges of the roof terrace aid in sheltering the roof terrace from winds.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.4.1 – Lawson Criteria Scale

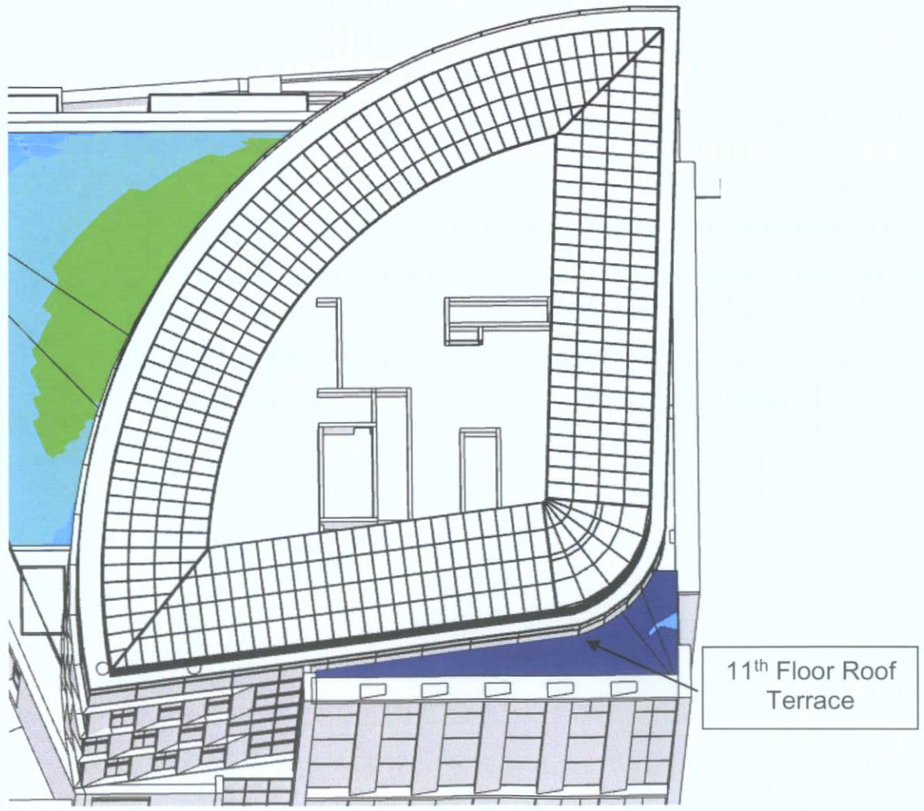


Fig 4.5.1 – Lawson Criteria Results at Office Level 11 Roof Terrace

4.6 Roof Terraces – Mitigation Measures

It is proposed that landscaping effects in the form of trees and planting be added at roof terrace level to mitigate against potential adverse wind conditions.

Detailed Landscape plans for the proposed development have been included in the planning pack by Doyle + O'Troithigh Landscape Architecture.

Planting is predominantly located towards the West of the proposed roof terraces, which has been determined to be effective in reducing wind speeds across these spaces. Fig 4.6.2 indicates Pedestrian Comfort results are much improved by the proposed landscaping design. The image shows the Lawson Criteria results contours overlaid onto Landscape plans. It can be seen that all proposed seating areas are located towards regions most sheltered from winds. Planting boxes located at doorways provide screening from winds.

Both the hotel and office roof terraces are now determined to be predominantly suited to "Outdoor Dining/ Pedestrian Sitting" and are therefore suitable for use as amenity spaces in accordance with the Lawson Criteria methodology utilised.

Fig 4.6.3 illustrates that wind velocities under prevailing SW wind conditions are predicted to be reduced by the proposed landscaping, when compared to results shown in Fig 4.5.1 above.

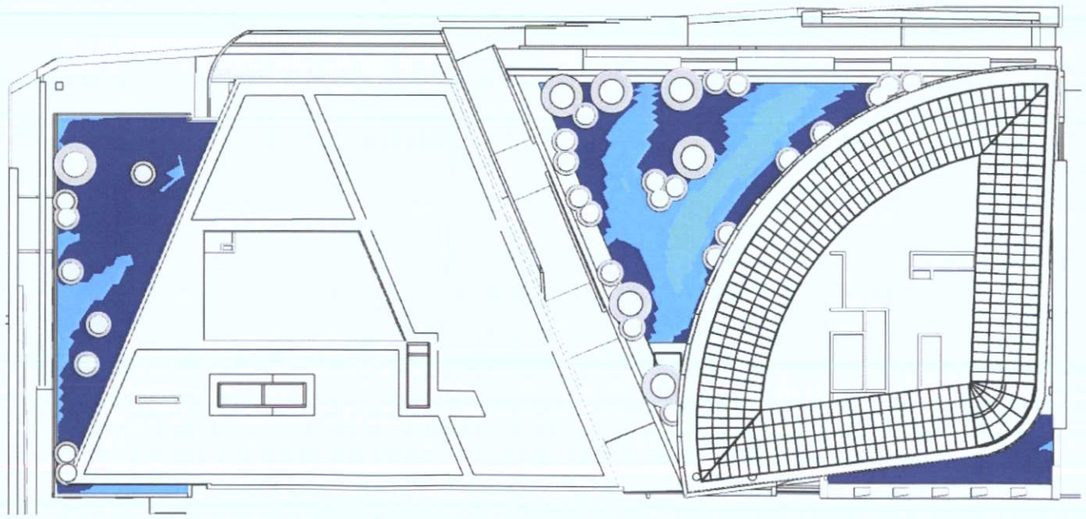


Fig 4.6.2 – Lawson Criteria Results at Hotel (Level 4) and Office (Levels 4 and 11) Roof Terraces

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.6.1 – Lawson Criteria Scale

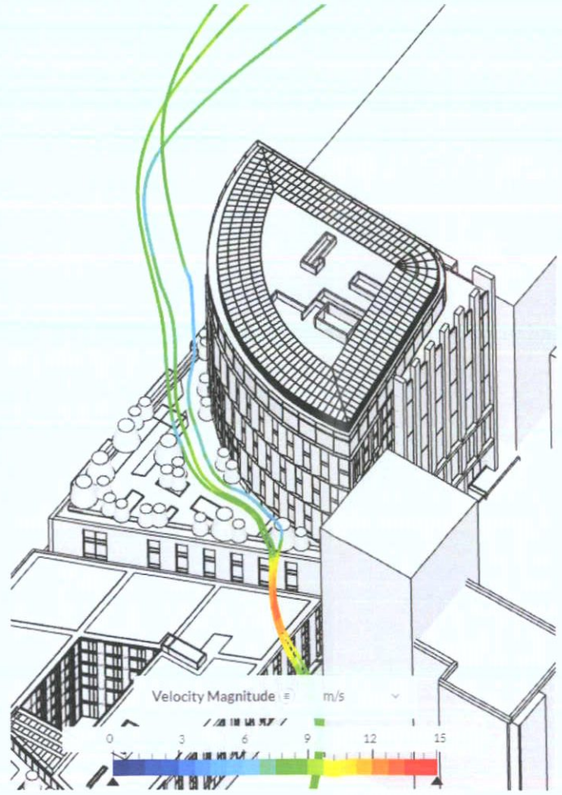


Fig 4.6.3 – Wind Velocity Streamlines under Prevailing SW (240°) Wind Conditions

4.7 Roof Terraces – Without SHD Residential Scheme

It should be noted that the above analysis has been undertaken with the proposed SHD Residential scheme (ABP Ref: TA29S.311591) included. The roof terrace level results for the proposed Commercial scheme without the Residential scheme are illustrated in Fig. 4.7.2. These results were compared against those in Fig 4.6.2.

The results determined that the massing of the proposed SHD scheme slightly reduces wind speeds at all roof terrace levels. Without the SHD scheme in place, some of the area to the north of the Level 4 office terrace is determined to be more suited to "Pedestrian Sitting". With the SHD in place, this area would be "Suitable for Outdoor Dining", and therefore more comfortable for amenity use.

A slight increase in wind speeds across the outer corner of the Level 11 office roof terrace without the SHD development. In this scenario, the Level 11 terrace is entirely open to winds from the S/ SW, without significant sheltering from neighbouring buildings.

Pedestrian comfort conditions at the Level 4 hotel roof terrace are predicted to be the same in both scenarios analysed. Its exposure to prevailing SW winds is not particularly impacted by the proposed SHD scheme.

Therefore, it is evident that the massing of the proposed residential buildings aid in sheltering the proposed hotel and office roof terraces from prevailing SW winds. However, each of the roof terraces would still be determined to be well sheltered and suitable for amenity use, with or without the proposed SHD scheme in place.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig 4.7.1 – Lawson Criteria Scale

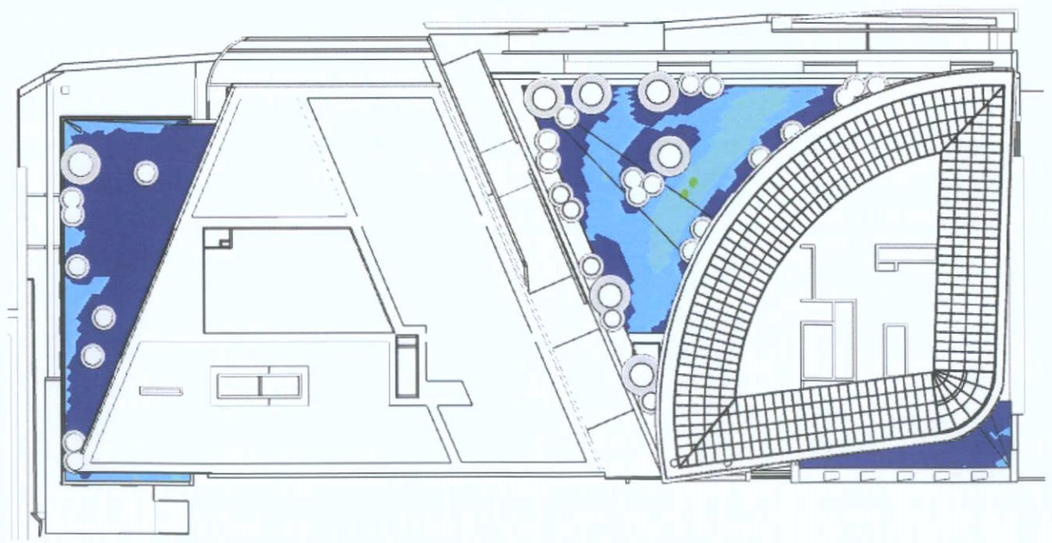


Fig 4.7.2 – Lawson Criteria Results at Hotel (Level 4) and Office (Levels 5 and 11) Roof Terraces without SHD Scheme

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APPENDIX 10A

NOISE MONITORING SURVEY REPORTS.

RESIDENTIAL SITE

tms environment ltd

Specialists in laboratory analysis, monitoring and environmental consultancy

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Fax: +353-1-4626714
Web: www.tmsenv.ie

NOISE MONITORING SURVEY

AT

RESIDENTIAL DEVELOPMENT SITE AT HEUSTON SOUTH QUARTER, MILITARY ROAD, KILMAINHAM

Report Ref.: 28172 - 2
Issued: 28 January 2021

Prepared by: Fergal Mulligan
Environmental Scientist

Approved by: Imelda Shanahan Date: 28 January 2021

Dr Imelda Shanahan
Technical Manager

CONTENTS PAGE

1.0 Scope

This report deals with completion of a baseline noise survey for a proposed residential development at Heuston South Quarter. The survey was carried out to assess the existing noise climate in the area. This report presents the results of the environmental day time noise survey carried out on the 26th of January 2021 at four locations (N1, N2, N3 and N6).

2.0 Regional environmental setting

The proposed residential site has an L shape. It is bordered to the north by the proposed commercial site. To the south and to the east is existing HSQ commercial and residential property. To the west are the gardens of the Royal Hospital, Kilmainham.

3.0 Monitoring Locations

Noise measurements were completed at 4 noise monitoring locations. These locations are shown on a map presented in Appendix I. A description of the monitoring locations is presented in Table 1 below.

Table 1 Monitoring locations for noise survey at HSQ

Monitoring Location	Description
N1	SE corner of proposal residential site. Coordinates: 53°20'39.7"N 6°17'51.9"W
N2	SW corner of proposal residential site. Coordinates: 53°20'39.2"N 6°17'56.3"W
N3	NW corner of residential site / SW corner of commercial site Coordinates: 53°20'41.4"N 6°17'56.9"W
N6	NE corner of residential site / SE corner of commercial site Coordinates: 53°20'42.1"N 6°17'52.7"W

4.0 Survey Protocol

4.1 Monitoring Locations

The noise monitoring locations chosen for this survey were selected to assess the existing noise climate at the proposed site. Noise measurements were made to determine the existing noise climate at noise locations.

The noise monitoring locations were chosen per the guidelines in *ISO 1996 Acoustics - Description and Measurement of Environmental Noise* and in addition, with reference to the 2016 EPA publication, *"Guidance Note for Noise: Licence Applications in Relation to Scheduled Activities (NG4)"*. In all cases the sound level meter was located 1.5m above ground and at least 3.5m away from any sound reflecting objects. A foam windshield was placed on the microphone to reduce any wind interference during measurements. A description of the monitoring points is presented in Table 1.

4.2 Instrumentation and methodology

Noise measurements were made according to the requirements of *ISO 1996: Acoustics - Description and Measurement of Environmental Noise* and in addition, with reference to the 2016 EPA publication, *"Guidance Note for Noise: Licence Applications in Relation to Scheduled Activities (NG4)"*. The measurements were made using a Bruel & Kjaer 2250 Light integrating sound level meter fitted with 1:1 and 1:3 Octave Band Filter. The instrument was calibrated *in situ* at 94 dB prior to and after use. The sound level meter was orientated towards the propose site and mounted on a tripod at 1.5m above ground level. This instrument is a Type 1 instrument in accordance with IEC 651 regulations. The Time Weighting used was fast and the Frequency Weighting was A-weighted as per IEC 651.

4.3 Glossary of terms used

L_{Aeq} : The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over a given period.

L_{A90}: The sound pressure level in dB(A) which is exceeded for 90% of the time.

L_{A10}: The sound pressure level in dB(A) which is exceeded for 10% of the time.

L_{ArT}: the sound pressure level in dB(A) with penalty adjustments added following the detection of tonal and/or impulsive noise.

$^1/_3$ Octave Band Analysis: Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one-third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit. (The unit of frequency is the Hertz, Hz).

4.4 Survey implementation

TMS Environment Ltd. personnel conducted the day time baseline noise survey on the 26th of January 2021. The day time noise survey was carried out between 09:18 – 18:57. All noise monitoring was attended by TMS Environment personnel. The measurement parameters included meteorological observations of prevailing conditions at the time of the survey. The main measurement parameter was the equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$. In accordance with

the requirements set out in the EPA Environmental Noise Survey Guidance document day time noise monitoring was carried out between the hours of 07:00 – 19:00. Monitoring periods for the day time monitoring were 30 minutes at each location. A $^1/_3$ Octave Frequency assessment was carried out as required during all monitoring surveys.

5.0 Weather conditions

The weather conditions at the time of the daytime survey on the 26th of January 2021 were cold and cloudy with an occasional slight south-westerly breeze. The wind speed recorded during the monitoring events ranged from 2 to 8 km/hr.

6.0 Survey results

The environmental noise measurement results are reported in Table 2 to Table 5. The $^1/_3$-octave band frequency analysis results are presented in Appendix II.

Table 2 Results for Monitoring Location N1 – 26 January 2021

Monitoring Location:	N1 – 26 January 2021					
Period	Date/Time	Measured Noise Levels dB(A)				
		L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{ArT}
Daytime 07:00-19:00	26 Jan 2021 09:21 – 09:51	51	48	53	72	51
	26 Jan 2021 09:52 – 10:22	52	48	54	69	52
	26 Jan 2021 10:23 – 10:53	53	48	55	72	53
	Average	**53**	**48**	**54**	**71**	-
	Daytime Criterion					-

Daytime comments:
Predominant noise was from distant traffic on the R148, birdsong, passing traffic and some light construction work. A loud vehicle that pulled industrial waste bins was present during this time.

Table 3 Results for Monitoring Location N2 – 26 January 2021

Monitoring Location:	N2 – 26 January 2021					
Period	Date/Time	Measured Noise Levels dB(A)				
		L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{ArT}
Daytime 07:00-19:00	26 Jan 2021 10:55 – 11:25	55	48	55	74	55
	26 Jan 2021 11:26 – 11:56	52	48	54	62	52
	26 Jan 2021 11:57 – 12:27	53	49	56	68	53
	Average	**53**	**48**	**54**	**68**	-
	Daytime Criterion					-

Daytime comments:
Predominant noise was from distant traffic on the R148, birdsong and local traffic. A loud vehicle that pulled industrial waste bins was present during this time.