BUROHAPPOLD ENGINEERING

Design Note

Project	Geville Street
Subject	Meeting the London Plan
Project no	0044143
Date	24 November 2020

Revision	Description	Issued by	Date	Approved (signature)
00	Stage 4 Planning Update	CB	24 Nov 2020	Digitally signed by David Kingstone Date: 2020.11.24 18:15:17Z00'00'

1 Executive Summary

The energy modelling for the Greville Street development has been updated based on the MEP tender documents received.

The Energy Statement submitted for planning sets out the sustainable energy strategy for the Site in line with the following planning policies:

- At least a 35% reduction in emissions compared with a baseline building in accordance with the London Plan (2015)
- 2 BREEAM Ene01 credits to support BREEAM Very Good for the offices
- 15 BREEAM Ene01 credits to support BREEAM Very Good for the shell and core A1 to A3 retail and food units

The Energy Statement for planning identified that the offices had the potential to achieve a 33% reduction whilst the shell and core areas defined as retail could achieve a 48% reduction. The overall development therefore had the potential to achieve an average 42.6% reduction in emissions over the baseline and exceed the planning target of which 15.2% was from LZC technology. However, this was based upon an assumption that the mix would be office and retail rather than office, restaurant and light industrial or a combination of these uses as approved under the planning consent.

The section 106 agreement states that on construction the development must achieve a 42.6% reduction in emissions over the baseline building emissions as well as including a 20.9% reduction in emissions associated with the provision of LZC technology (Heat pumps for heating and PV).
In order to ensure compliance for the consented mix we have adjusted the compliance model based on a mix of office, retail, restaurant and light industrial and this achieves 36.4% emissions reduction against the original target of 42.6% and the London Plan 35%, see

Table 1—1. We have reviewed the current scheme against the original model and can confirm that it would still achieve at least 42.6% for a mix comprising office and retail.

Table 1—1 London Plan emissions summary

New Build and major refurbishment	Total tCO2	tCO2 reduction	% reduction
Baseline	97.74	N/A	N/A
Be Lean	70.44	27.30	27.93%
Be Clean	70.44	0.00	0.00%
Be Green	62.20	8.24	11.70%
Total	62.20	35.54	36.36%
Target	63.53	34.21	35.00%
Shortfall	-1.33	1.33	-1.36%

The mix of shell & core usage includes:

- Retail
- Restaurant
- Light Industrial
- Offices

Full details of standards assumed in the analysis are shown in section 3.

2 Extract from the section 106 agreement

2.23	"the Energy Efficiency and Renewable Energy Plan"	a strategy setting out a package of measures to be adopted by the Owner in the management of the Development with a view to reducing carbon energy emissions through (but not be limited to) the following:- a) the incorporation of the measures set out in the submission document entitled Energy Statement for Planning for 20-23 Greville Street, London dated January 2018 by MLM Consulting Engineers Limited to achieve a 42.6% reduction in CO2 emissions beyond the Part L 2013 baseline; b) further details (including detailed drawings, any necessary surveys and system specifications) of how the Owner will reduce the Development's carbon emissions from renewable energy technologies located on the Property ensuring the Owner will target a reduction of at least 20.9% in carbon emissions in relation to the Property using a combination of complementary low and zero carbon technologies;
		f) include a pre-Implementation design-stage review by an appropriately qualified and recognised independent professional in respect of the Property including full design stage National Calculation Method (NCM) calculations certifying that the measures incorporated in the Energy Efficiency and Renewable Energy Plan are achievable in the Development and satisfy the aims and objectives of the Council's strategic policies on the reduction of carbon emissions contained within its development plan; g) measures to secure a post construction review of the Development by an appropriately qualified and recognised independent professional in respect of the Property (including but not limited to photographs, installation contracts and full As-Built NCM calculations) certifying that the measures incorporated in the Energy Efficiency and Renewable Energy Plan have been implemented in the Development and will be maintainable in the Development's future management and occupation; and

3 Part L compliance modelling assumptions

3.1 Building fabric standards

The tables below summarise the minimum building fabric standards that have resulted in a building regulations part L compliant building.

Table 3—1 Building fabric U-values

Building Fabric	Units	Proposed standard	Notes
New external wall	W/m^{2}K	0.23	Including mansard
Existing brick cavity wall		0.55 1.74	Brick cavity block, some plastered, insulated externally Brick cavity block without external insulation
Opaque curtain wall	W/m^{2}K	0.23	Opaque elements of curtain walling systems will require insulation and dry lining on inside
Ground Contact floors	W/m^{2}K	0.15	Insulated above existing floor slab
Basement walls		0.5 0.15	Existing uninsulated New insulated
Existing exposed floors		0.55	
New extension exposed floor		0.20	
New Roof	W/m^{2}K	0.23 0.13	Pitched roof with insulation over CLT Flat roof with insulation over CLT
Existing concrete roof insulated		0.13	Existing Insulated warm concrete roof
Glazing	W/m^{2}K	1.5	Office, retail, and restaurant glazing and reception rooflight
External doors	W/m^{2}K	1.6	Glazed and opaque doors

Table 3—2 Glazing properties

Glazing location	Light Transmission	G Value	Notes
Office Elevations	69%	0.40	Manually opening windows
Shell and core retail	69%	0.40	Ground floor opening doors First floor fixed windows

Table 3—3 Air permeability and thermal bridging

Air permeability and thermal bridging	Units	Good Practice building	Comments
Air permeability	m^3/hr/m^2 @ 50Pa	11.35	New build element 5.0 Existing building 15.0
Thermal Bridging		10% of the overall building fabric U-value	Default value as not specifically calculated.

3.2 Room activity definition

The Room activities have been set based on the planning class B1 Offices, applicable to the fitted out offices, A1/A2 Retail, A3/A4/A5 food unit, and B2 to B7 Light Industrial.

3.3 HVAC standards

The HVAC systems have been applied to the building and are detailed in the following tables:

Table 3—4 Heating and cooling standards

Heating and Cooling	**Units**	**Offices, Reception**	**Circulation, toilets and showers**	**Shell and Core Retail and light industrial**	**Shell and Core Food Unit**
NCM System		Split and multisplit	Radiators	Split and multi split	Split and multi split
Heating					
Fuel		Electricity			
Generator		HVRF Reverse cycle heat pump	Air source heat pump	HVRF Reverse cycle heat pump	
Emitter		HVRF fan coil units	Radiators	HVRF fan coil units	
Heating SCOP	%	351-363	354	351-363	
LTHW Pumping control		N.A.	Variable speed pumping sensor across pumps	N.A.	
Cooling					
Fuel		Electricity			
Generator		Reverse cycle heat pump	N.A.	Reverse cycle heat pump	
Emitter		HVRF fan coil units	N.A.	HVRF fan coil units	
Cooling SEER	%	623-668	N.A.	623-668	
Pumping control		N.A.			
Terminal Unit SFP	W/l/s	FCU fan energy and HBC box pump power included in SEER/SCOP			

Table 3—5 DHW system standards

DHW	Units	Office	Retail/light industrial	Food Unit
Fuel		Electricity	Electricity	Gas
Generator		Point of use storage water heater	Point of use storage water heater	Condensing direct storage water heater
Seasonal Efficiency	%	100	100	97.0
Storage Capacity	Litres	F0 – 15 Litres F2-4 30 Litres per floor F5 15 Litres F6 10 Litres	F1 Retail 30 Litres B Light Industrial 10 Litres	150
Storage loss factor	kWh/l/day	30l - 0.016 15l – 0.048 10l – 0.058	30l - 0.016 10l -0.058	0.012
Secondary circulation pipe losses	W/m			7.0
Secondary circulation pipe length	m			50
Secondary circ. Pump power	W			25
Secondary circulation operation				Timeclock control

Table 3—6 Ventilation system standards

Ventilation	**Units**	**Toilets and showers (Remote Extract)**	**Bin store (Remote Extract)**	**Offices**	**Shell & Core Retail**	**Shell & Core Food Unit**	**Shell & core kitchen (remote Extract)**
S&E SFP	W/l/s			Levels 2-4: 1.8 Levels 5&6: 1.1	*1.6*	1.2	1.0 (supply only)
Extract air volume	Varies	5.3 l/s/m2	188 l/s				1.185m3/s
Local Extract SFP	W/l/s	0.6 remote fans	0.5 remote fans				0.75
Heat Recovery Efficiency	%			Levels 2-4: 80 Levels 5&6: 82	*75*	82	
AHU air leakage standard				None specified			
Duct air leakage standard				None specified			
Ventilation control		None	None	Fan speed control based on CO_2 sensors	*Fan speed control based on CO_2 sensors*	Fan speed control based on CO_2 sensors	None

3.4 Electrical services

The following tables summarise the standards assumed for the compliance calculations in terms of electrical services:

Table 3—7 Lighting standards

Room Type	NCM Lighting lux level	Design Lighting lux level	Lighting efficacy (lm/W)	Light Output Ratio (LOR)	Lighting control	Daylight Factor Calculation	Parasitic Power (W/m^2)
Office	400	300-500 (400 modelled)	120	1.0	Presence detection / Daylight dimming Constant Illuminance control	NCM	0.1
Reception	200	300	110	1.0	Daylight dimming / Dimmed presence detection Constant Illuminance control	NCM	0.05
Reception area display lighting			110	1.0	Timeclock control of display lighting		
Circulation	150	100	120	1.0	Presence detection		0.05
Fire escape stairs	150		110	1.0			
Showers	150		120	1.0	Presence detection		0.05
WCs	200		120	1.0	Presence detection		0.05
Storage	150		110	1.0	Absence detection		0.05
M&E Plant	200		120	1.0	Manual		
Retail	600		120	1.0	Manual		
Retail display lighting			120	1.0	Timeclock control of display lighting		
Restaurant food preparation	500		120	1.0	Manual		
Restaurant eating and drinking	300		120	1.0	Manual		
Restaurant eating and drinking display lighting			120	1.0	Timeclock control of display lighting		
Light Industrial	500		120	1.0	Presence detection Constant Illuminance control		

Where rooms are specified as having daylight lighting control, all luminaires within 6m of an external window were assumed to be daylight dimmed.

3.5 Renewables and metering

Table 3—8 Renewable system standards

LZC Technology	Units	Quantity
PV collector area	m^2	45
Panel efficiency	%	20.2% Installed unshaded horizontally Inverter efficiency 95%

Table 3—9 Metering, emission factor, and power factor correction

Sub-meter	Provision	Comments
Sub-metering	Automatic monitoring and targeting software with alarms for out of range values to include a complete installation that measures, records, transmits, analyses, reports, and communicates meaningful energy management information from all building energy meters and sub-meters to enable the building operator to manage the energy the building uses.	A 5% reduction in emissions has been taken. Building Energy Monitoring and Targeting Software must be installed
Heating	Meter electrical supply to VRF system	
DHW	Meter gas feed to food unit gas fired calorifier and consider metering cold water feed to DHW supplies	
Kitchen gas	Meter gas feed to any gas catering	
HVAC	Meter all MCC Panels	
Cooling	Meter electrical supply to refrigerant based cooling units	
Lighting	Metering on a distribution board by distribution board basis	
Small Power	Metering on a distribution board by distribution board basis	
Power Factor Correction	Above 0.95	Power factor monitoring equipment must be installed. Should the stated power factor not be achieved power factor equipment must be installed.

4 As designed BRUKL output

4.1 Office BRUKL extract

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

200930_office_GREEN S4B45 — As designed

Date: Mon Nov 23 16:24:04 2020

Administrative information

Building Details

Address: Greville Street, LONDON,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: David Richard Kingstone

Telephone number: 0113 2042200

Address: 3 Wellington Place, LEEDS, LS1

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	11
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{p\text{-}Limit}$	$U_{p\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.48	1.74	L0000018:Surf[4]
Floor	0.25	0.16	1.56	L100000C:Surf[8]
Roof	0.25	0.16	0.23	L4000003:Surf[2]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	L5000004:Surf[0]
Personnel doors	2.2	1.53	1.61	L0000018:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.61	1.61	L0000013:Surf[0]

$U_{p\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{p\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	11.35

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	2447.6	2448.9
External area [m²]	2355.6	2386.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	11	3
Average conductance [W/K]	1874.79	0
Average U-value [W/m²K]	0.8	0
Alpha value* [%]	6.33	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.15	3.41
Cooling	0.79	6.67
Auxiliary	3.55	2.2
Lighting	8.81	20.13
Hot water	7.25	7.3
Equipment*	35.67	35.67
TOTAL**	**24.55**	**39.71**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	3.2	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	64.83	122.41
Primary energy* [kWh/m²]	74.61	105.03
Total emissions [kg/m²]	11	18.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

4.2 Shell BRUKL extract

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

200930_Shell S4B — As designed

Date: Mon Nov 23 16:52:17 2020

Administrative information

Building Details

Address: Greville Street, LONDON,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: David Richard Kingstone

Telephone number: 0113 2042200

Address: 3 Wellington Place, LEEDS, LS1

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	54.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	54.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	38.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{e\text{-}Limit}$	$U_{e\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.47	0.55	L0000004:Surf[0]
Floor	0.25	0.14	0.25	L0000017:Surf[5]
Roof	0.25	0.22	0.22	LB000001:Surf[5]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	L1000004:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.61	1.61	L0000011:Surf[1]

$U_{e\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{e\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	11.35

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	925.6	925.6
External area [m²]	880	925.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	11	4
Average conductance [W/K]	481.34	411.71
Average U-value [W/m²K]	0.55	0.44
Alpha value* [%]	9.65	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
34	**A1/A2 Retail/Financial and Professional services**
47	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
3	**B1 Offices and Workshop businesses**
15	**B2 to B7 General Industrial and Special Industrial Groups**
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.23	1.11
Cooling	5.78	16.67
Auxiliary	20.31	15.91
Lighting	27.15	56.57
Hot water	42	40.96
Equipment*	96.67	96.67
TOTAL**	**97.48**	**131.22**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	121.79	237.62
Primary energy* [kWh/m²]	222.98	319.97
Total emissions [kg/m²]	38.1	54.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.