Abacus Primary School Energy Statement

1 Introduction

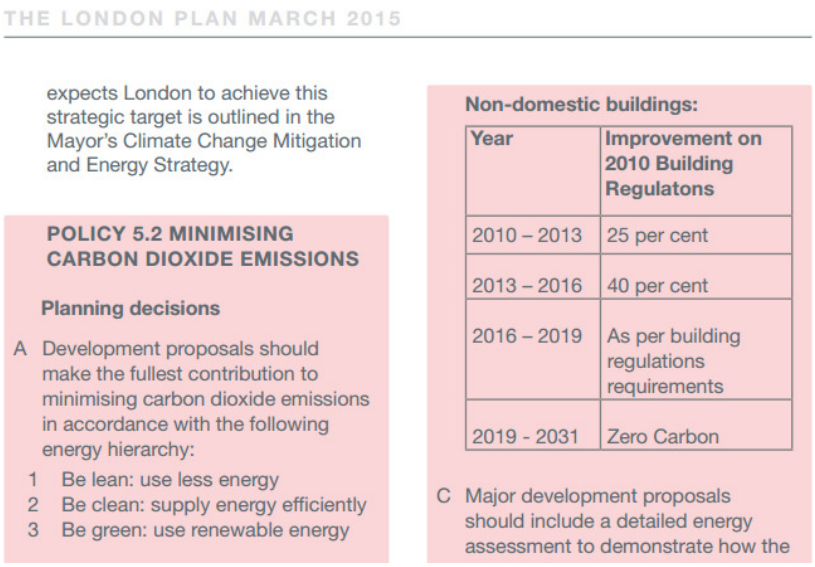
This energy strategy has been produced to show how the proposal for Abacus Belsize Primary School meets energy requirements set by London Borough of Camden Policy and the London Plan. As a Grade II Listed Building, the report considers English Heritage guidance where policies cannot be met due to the unacceptable heritage impact of alterations which would be required. Special attention is shown to proposed new build elements, which will be expected to achieve policy requirements in full.

The report refers to the predicted carbon footprint (as defined in Approved Document Part L) and considers various options for low and zero carbon (LZC) technologies.

2 Planning Policy

Aside from the EFA requirements, the Local Authority states that the scheme must comply with the London Plan:-

'*the scheme would be required to meet the London Plan Part 5.2, i.e. 40% reduction in CO2 c.f. Building Regs Part L 2010 or 35% reduction c.f. 2014 Building Regs*'



THE LONDON PLAN MARCH 2015

expects London to achieve this strategic target is outlined in the Mayor's Climate Change Mitigation and Energy Strategy.

POLICY 5.2 MINIMISING CARBON DIOXIDE EMISSIONS

Planning decisions

A Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1 Be lean: use less energy
2 Be clean: supply energy efficiently
3 Be green: use renewable energy

Non-domestic buildings:

Year	Improvement on 2010 Building Regulatons
2010 – 2013	25 per cent
2013 – 2016	40 per cent
2016 – 2019	As per building regulations requirements
2019 - 2031	Zero Carbon

C Major development proposals should include a detailed energy assessment to demonstrate how the

Fig 1** | **Extract from the London Plan

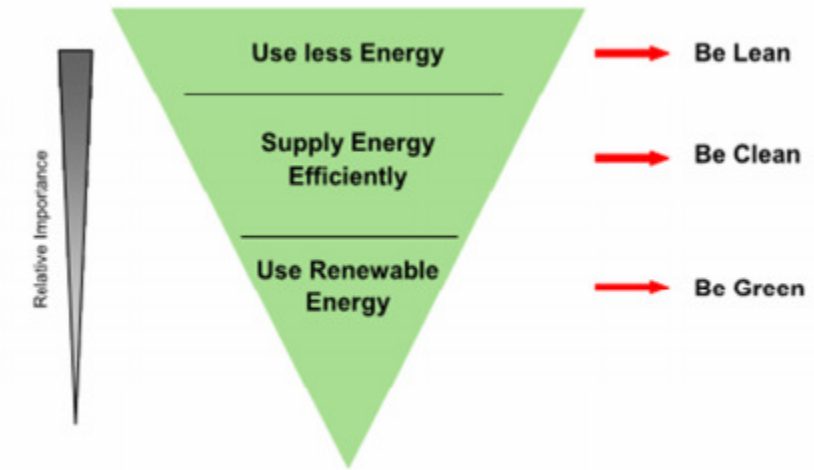


Fig 2** | **Energy hierarchy by importance

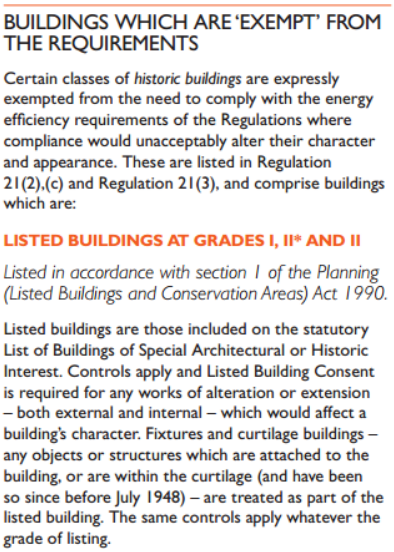
2 Planning Policy

Energy efficiency measures will be applied to the design of the new part of the scheme inline with the hierarchy shown in figure 2.

The existing part of the building, the Old Hampstead Police station, will undergo a major refurbishment.

Despite the building's refurbishment and change of use, which would normally trigger the need for compliance with the current approved document Part L 2013, its status as a listed building means it is exempt from the normal requirements (see fig 3).

In order demonstrate how the refurbished existing building compares against the London Plan's Energy hierarchy and 35% Carbon reduction requirement, its 2013 Building Emission Rate (BER) shall be compared against the existing building's BER under its former use.



BUILDINGS WHICH ARE 'EXEMPT' FROM THE REQUIREMENTS

Certain classes of *historic buildings* are expressly exempted from the need to comply with the energy efficiency requirements of the Regulations where compliance would unacceptably alter their character and appearance. These are listed in Regulation 21(2),(c) and Regulation 21(3), and comprise buildings which are:

LISTED BUILDINGS AT GRADES I, II* AND II

Listed in accordance with section 1 of the Planning (Listed Buildings and Conservation Areas) Act 1990.

Listed buildings are those included on the statutory List of Buildings of Special Architectural or Historic Interest. Controls apply and Listed Building Consent is required for any works of alteration or extension – both external and internal – which would affect a building's character. Fixtures and curtilage buildings – any objects or structures which are attached to the building, or are within the curtilage (and have been so since before July 1948) – are treated as part of the listed building. The same controls apply whatever the grade of listing.

Fig 3 | Extract from 'Energy Efficiency and Historic Buildings Application of Part L of the Building Regulations to historic and traditionally constructed buildings'

It is not economically feasible to fully model the previous building to the level of detail to which the proposed development will be simulated. Data is not easily available and it would be costly, time consuming and potentially invasive to the listed building to obtain. For these reasons the existing buildings published Energy Performance Certificate (EPC) BER (Ref No 0050-3909-0377-6990-8090) shall be used as the baseline figure.

There is sufficient capacity is the existing gas and electricity networks to supply the development.

3 Baseline Energy Demand Assessment

The London Plan uses ADL2013 to define the carbon footprint of the development. A building that is compliant with ADL2013 is taken as the baseline on which this report will discuss carbon reductions using renewable technologies. Although ADL2013 will apply to this project for building regulation compliance, the planning guidance suggests using London Plan Policy 5.2 as part of the energy strategy; The London Plan is based on a 35% improvement of ADL2013 and this is a more onerous requirement.

Baseline Energy Demand Results

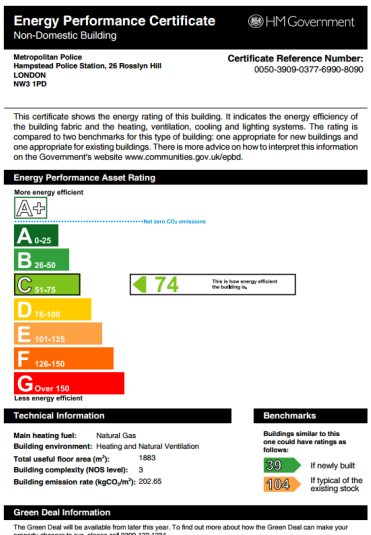
Proposed Extension TER 2013

ADL2A	CO_2 Emissions			
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
Heating	20279.39	23.05	4380	4.98
Cooling	0	0	0	0.00
Auxillary	659.85	0.75	342	0.39
Lighting	10513.61	11.95	5457	6.20
Hot Water	30388.29	34.54	6564	7.46
Equipment	Not included in assessment			

Table 1 | Baseline Energy and Carbon Emissions ADL2013

In order to satisfy the London Plan Policy 5.2 the new development would have to achieve a 35% carbon reduction over the ADL2013 Notional Building.

Existing Building BER 2013 (Previous use as police station)


Energy Performance Certificate
Non-Domestic Building
HM Government

Metropolitan Police
Hampstead Police Station, 26 Rosslyn Hill
LONDON
NW3 1PD

Certificate Reference Number:
0050-3909-0377-6990-8090

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient
A+ Net zero CO_2 emissions
A 0-25
B 26-50
C 51-75 — 74 This is how energy efficient the building is.
D 76-100
E 101-125
F 126-150
G Over 150
Less energy efficient

Technical Information

Main heating fuel: Natural Gas
Building environment: Heating and Natural Ventilation
Total useful floor area (m²): 1883
Building complexity (NOS level): 3
Building emission rate (kgCO_2/m²): 202.65

Benchmarks

Buildings similar to this one could have ratings as follows:
39 If newly built
104 If typical of the existing stock

Green Deal Information

The Green Deal will be available from later this year. To find out more about how the Green Deal can make your property cheaper to run, please call 0300 123 1234.

The existing building was previously used as a police station. GLA Energy Strategy guidance states that the baseline for any change of use should be taken at the BER of the previous building. The EPC in force for Hampstead Police Station states the Building Emission Rate (kgCO2/m2) to be **202.65**.

A simple model produced in the approved Dynamic Simulation Modelling (DSM) software based on the proposed refurbishment set as police station use confirms that the BER is broadly of the same order as the existing EPC.

Fig 3 | Existing EPC

4 Be Lean – Energy Efficient Measures

Proposed Extension

Where possible, passive design features, to provide natural ventilation and day lighting without overheating, will be utilised. The implications of different building orientations were investigated on the use of:

• Improved U-values on Building Regulations for all building elements;
• Good window design – g-values to allow maximal daylighting whilst minimising risk of overheating, location of openable windows for natural ventilation, area of glazing and the use of controlled blinds to mitigate risk of overheating of rooms:
• Optimal room proportion to allow for maximal utilisation of daylighting and effectiveness of natural ventilation;
• Corridor lightwell to maximise daylighting;
• Thermal mass – exposed concrete soffits balancing the peaks and troughs in room temperature; and,
• Night purge – automated vents to remove excess heat built up through the day.

	Part L2A (2013) Minimum Performance	Proposed Building Performance
Construction Element	U Value W/m^2 K	U Value W/m^2 K
Ground Floor	0.25	0.22
External Wall	0.35	0.26
Roof	0.25	0.18
Windows	2.20	1.48
Rooflights	2.20	1.48
	Infiltration ($m^3/hr.m^2$ at 50Pa)	Infiltration ($m^3/hr.m^2$ at 50Pa)
Air Tightness	10	3.38

Table 2 | Targeted Building Fabric Thermal Performance

The artificial lighting is a significant proportion of the overall building energy and carbon emissions. Avoiding the need to use lighting by utilising the available daylight is an important factor in reducing carbon emissions. Windows are used to provide natural daylight into the building. The following glazing parameters have been used to strike a good balance between thermal gain and light transmittance:

	Glazing Performance Criteria
Frame Factor	11%
G-Value (BSEN 410)	0.37 (South/East/West)
Visible light transmittance	0.70
Blinds	Yes

Table 3 | Targeted Glazing Performance

4 Be Lean – Energy Efficient Measures

Be Lean Energy Demand Results

Proposed New Extension BER 2013

ADL2A	CO_2 Emissions			
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
Heating	14868.62	16.9	3212	3.65
Cooling	0	0	0	0.00
Auxillary	1530.852	1.74	795	0.90
Lighting	10003.33	11.37	5192	5.90
Hot Water	34892.87	39.66	7537	8.57
Equipment	Not included in assessment			

Table 4 | Be Lean Energy and Carbon Emissions ADL2013

4 Be Lean – Energy Efficient Measures

Existing Building

It is not possible to improve the fabric energy efficiency of the listed building without dramatically affecting its heritage value, in accordance with English Heritage guidance *'Energy Efficiency and Historic Buildings Application of Part L of the Building Regulations to historic and traditionally constructed buildings'*.

Mechanical and electrical services are critical to reducing energy consumption. The following energy saving products and techniques will be integrated into the base design to achieve *reductions* in CO_2 emissions:

- Leaky sash windows will be repaired and draft proofed;
- Dimming controls linked to daylight sensors Local light switching;
- Movement and absence sensors for lighting control;
- Low energy lighting;
- Variable speed drives on air handling plant and pumps & Low specific fan power;
- Heat recovery mechanical ventilation;
- Low specific fan power;
- Metering for energy management;
- Rigorous commissioning;
- Heating controls to optimize plant efficiency; and,
- Controls set up to dynamically adjust heating, ventilation, hot water generation to reduce carbon emissions and maximise energy efficiency.

Proposed Existing Building BER 2013

ADL2A	CO_2 Emissions			
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
Heating	63635.93	72.33	13745	15.62
Cooling	175.96	0.2	91	0.10
Auxillary	941.386	1.07	489	0.56
Lighting	10487.22	11.92	5443	6.19
Hot Water	15106.17	17.17	3263	3.71
Equipment	Not included in assessment			

Table 5 | Be Lean Energy and Carbon Emissions ADL2013

In accordance with London Plan 5.4A, there is sufficient capacity is the existing gas and electricity networks to supply the development. We can confirm that no sub-station is required.

5 Be Clean – District heating and CHP

The London Plan states that developments must demonstrate how their energy systems have been design in accordance with Policy 5.6B.

Firstly;-

Connection to area wide low carbon heat distribution network

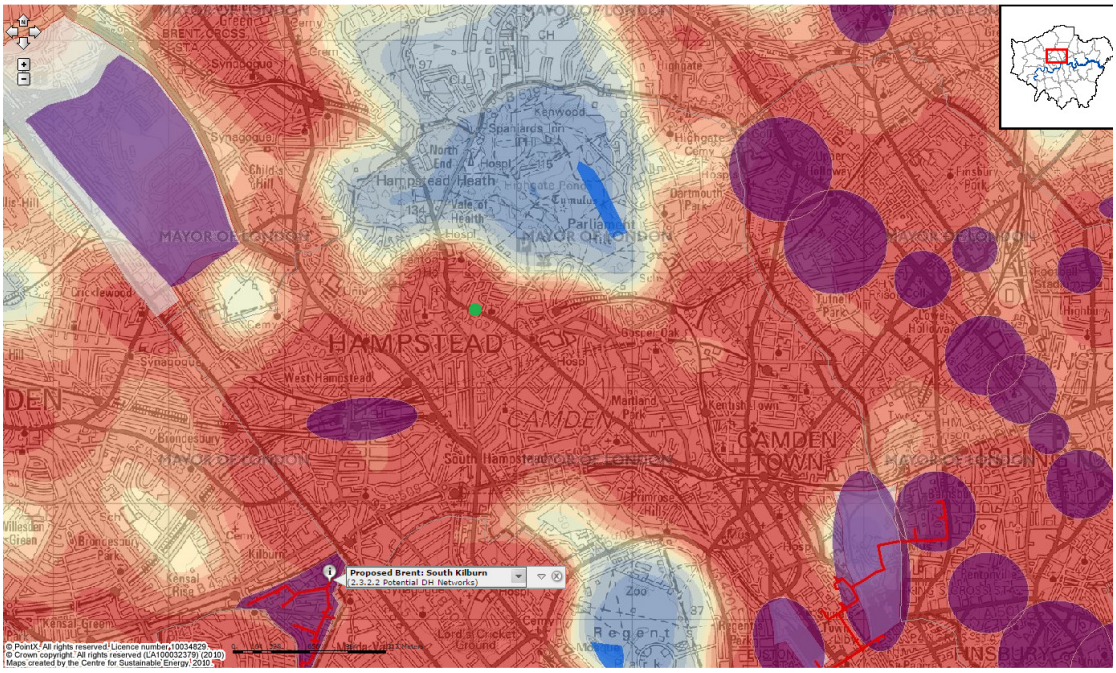


Fig 4|The London Heat Map (green dot denotes site location)

The site is a long way from the existing Euston heat network which makes connection unfeasible.

Planned networks

The site is a long way from the planned Kilburn heat network. The historic nature of the buildings in and around the school and Hampstead its self make it unlikely that any centralised heat network will come close to the proposed school at all.

Site Wide Heat Network

The school is a small development in comparison to the scale of projects suggested for heat networks in the London Plan Guidance. That said, it will feature a centralised plant room for heat generation for the whole building.

5 Be Clean – District heating and CHP

Finally;-

Combined Heat and Power

The GLA guidance document does not recommend CHP use in projects with a low simultaneous heat and power demand. The nature of a schools occupancy means that it does not have a year round baseline domestic hot water load, upon which a CHP unit would normally be sized for.

> *'Non-domestic developments with a simultaneous demand for heat and power for less than 5,000 hours per annum. Examples of such developments may include offices and schools.'*

For completeness the CO2 saving will be shown were one to be installed, however the capital cost and ongoing maintenance making it unfeasible for Abacus school.

Proposed Extension BER 2013 with CHP

ADL2A	CO_2 Emissions			
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
Heating	18176.67	20.66	3926	4.46
Cooling	0	0	0	0.00
Auxillary	1530.852	1.74	795	0.90
Lighting	10003.33	11.37	5192	5.90
Hot Water	44456.29	50.53	9603	10.91
Equipment	Not included in assessment			
CHP generator	-10689.6	-12.15	-5548	-6.31

Table 6 | Energy and Carbon Emissions ADL2013 with CHP

Existing building BER 2013 with CHP

ADL2A	CO_2 Emissions			
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
Heating	99507.36	76.81	21494	17.07
Cooling	259.1	0.2	134	0.11
Auxillary	1036.4	0.8	538	0.43
Lighting	15442.36	11.92	8015	6.36
Hot Water	20106.16	15.52	4343	3.45
Equipment	Not included in assessment			
CHP generator	-10649	-8.22	-5527	-4.39

Table 7 | Energy and Carbon Emissions ADL2013with CHP

6 Be Green – Energy Efficient Measures

Existing building and Proposed New Extension

The listed building status of the existing building and the roof play deck of the proposed new extension make the installation of installation of a photo voltaic array unfeasible.

Solar thermal energy is not compatible with the sites building services as it should be sized based on base load – this conflicts with the CHP. It would also not be feasible for the same reason as PV.

Ground source heat pumps would be technically difficult given the nature of the site, and prohibitively expensive to install given the extremely short project timeline that exists due to the completion date required by Abacus School.

Wind energy applications are generally unfeasible in an urban location at the height available to the building and certainly not in keeping with the historical character of the listed existing building.

7 Conclusions and Recommendations

The tables below summarises the findings of the energy feasibility and study:

New extension

ADL2A	CO_2 Emissions (Be Lean)		% Improvement
	kg/yr	kg/yr/m^2	
Baseline energy model ADL2A	**16743**	**18.9**	**-**
Baseline energy model ADL2A after applying energy efficient means	**16735**	**18.9**	**0.05%**

Part L 2013 (incorporating The London Plan Be Clean)		
Overall Improvement	**Kg/CO_2/m^2**	**% Overall Improvement**
ADL2A Target Emission Rate (TER) Baseline building	**18.9**	**-**
Building Emissions Rate (BER) proposed building	**15.7**	**16.58%**

Tables 8 & 9 | Summary of Energy and CO2 Emissions after Applying Energy Efficiency Technologies

The approach outlined above demonstrates the scheme adopts the London Plan Policy 5.2 energy hierarchy of "Be Lean, Be Clean, Be Green", by the Lean design of the building to incorporate passive design feature such as orientation, natural ventilation and thermal performance beyond Part L2A requirements. Furthermore the scheme is Clean by specifying efficient, lower energy usage building services.
There is insufficient suitable space, given its location in an Conservation Area, to provide solar PV equipment or other renewable energy generating equipment that would be required to meet the "Be Green" aspect of the London Plan energy hierarchy.

When the building is taken as a whole, the effect of removing an old part of the existing building, replacing with 2013 compliant block and coupling with a change of use make the overall CO2 improvement greater than the 35% requirement.

The stripping out of 1990's services and replacing modern technology has aided this saving.

7 Conclusions and Recommendations

Existing Building

ADL2A	CO_2 Emissions (Be Lean)		% Improvement
	kg/yr	kg/yr/m^2	
Baseline energy model ADL2A	**261691**	**202**	**-**
Baseline energy model ADL2A after applying energy efficient means	**33913**	**26.0**	**87.1%**

Part L 2013 (incorporating The London Plan Be Clean)		
Overall Improvement	**Kg/CO_2/m^2**	**% Overall Improvement**
ADL2A Target Emission Rate (TER) Baseline building	**202**	**-**
Building Emissions Rate (BER) proposed building	**22.2**	**89.0%**

Tables 10 & 11 | Summary of Energy and CO2 Emissions after Applying Energy Efficiency Technologies

Combined Existing Building and New Extension

Part L 2013 (incorporating area weighted TER)		
Overall Improvement	**Kg/CO_2/m^2**	**% Overall Improvement**
ADL2A Target Emission Rate (TER) Baseline building	**127.9**	**-**
Building Emissions Rate (BER) proposed building	**23.1**	**81.9%**

Tables 12 | Summary of Energy and CO2 Emissions for whole development combined

8 Further Information – Overheating

An overheating risk assessment in accordance with CIBSE TM52 of the proposed development using CIBSE AM12 compliant DSM software has shown a significant risk of overheating in the classrooms and office spaces that are located within the existing part of the building. It should be noted that the old police station had a full chilled water air conditioning system which is a clear indication that the building has suffered from overheating in the past.

The proposed development would included a modern air source heat pump air conditioning system which would use far less energy when compared with that currently installed. The new extension built to modern building regulations would not need to include an air condition system, save for the server room, and overheating will be dealt with exposed high thermal mass soffits and a low energy natural ventilation heat recovery system – complaint with the Education Funding Agency (EFA) Facilities Output Spec (FOS) and in line with other modern Priority School Building Programme schools.

The inclusion of a ventilation only system to the existing building is not proposed due to the extensive intervention it would make to the listed facades. A ducted system using only fresh air is not feasible to the limited floor space available.

Overall
Passed: 51 rooms:
Failed: 46 rooms:
Unoccupied: 9 rooms:

Data:
Days data= 153 01-May 30-Sep
Days (summer)= 153 01-May 30-Sep
Data OK? OK Full summer

Occupancy:
Note: This report assesses occupied periods only. Please be aware that TM52 should be conducted for occupied and/or "available hours".
Use of educational NCM profiles may be seen as inappropriate due to prolonged unoccupied periods during summer months.
See Section 6.1.2 (a) of TM52 for further information.

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 1 Hours (<=40hours)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Passed:	51 rooms:						
42 Year 1 Class	LW000000	48.4	3.3	25.164216	6	2	1
45 Yr 1 Class	LW00001C	48.4	2.8	21.351456	5	2	-
88 Specialist Classroom	RM00003B	48.4	0	0	0	0	-
101 Yr 6 Class	RM00003A	48.4	8.8	67.104576	19	4	1 & 2
17 Yr 3 Class	RM000013	48.4	4.2	32.027184	8	3	1 & 2
182 Reception Class 1	LW000024	48.4	28	213.51456	38	6	1 & 2 & 3
189 Yr 3 Class	18000000	48.4	37.5	285.957	50	8	1 & 2 & 3
38 Reception Class 2	LW000028	48.4	26.8	204.363936	38	6	1 & 2 & 3
58 Yr 2 Class	RM000006	48.4	10.1	77.017752	21	5	1 & 2 & 3
74 Yr 2 Class	RM000018	48.4	5.9	44.990568	12	3	1 & 2
76 Yr 5 Class	76000000	48.4	6.9	52.616088	13	3	1 & 2
81 Yr 4 Class	RM000027	48.4	10.7	81.593064	21	5	1 & 2 & 3
85 Yr 6 Class	RM00003E	48.4	8.1	61.766712	18	4	1 & 2
98 Yr 5 Class	98000001	48.4	8.6	65.579472	21	4	1 & 2
82 Yr 4 Class	RM000026	48.4	6.6	50.328432	12	3	1 & 2