

TALBOT MILL MANCHESTER

ENERGY STATEMENT

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SECTION 1

EXECUTIVE SUMMARY

This document has been provided in support of the refurbishment works to existing mill buildings 01, 02 and the new build apartment building which forms part of the development scheme at Ellesmere Street.

The existing mill buildings 01 and 02 are in a conservation area and as such are not bound to the building regulations in terms of energy performance, However wherever possible they have been applied with due regard to conservation area characteristics of the building.

For the new building the report considers specific guidance referring to housing standards and the associated residential development.

As a result of the abolition of 'The Code for Sustainable Homes' (CSH) there is no intention, nor is there any requirement, to achieve certification under the CSH scheme. This report is provided in support of this application which outlines what is embedded within the scheme and how it would have met criteria set out within CSH (Level 4). However it is noted that Manchester City Council can request energy standards to the equivalent of Code for Sustainable Homes Level 4.

This report seeks to fulfil this requirement with reference to the following sustainability commitments:-

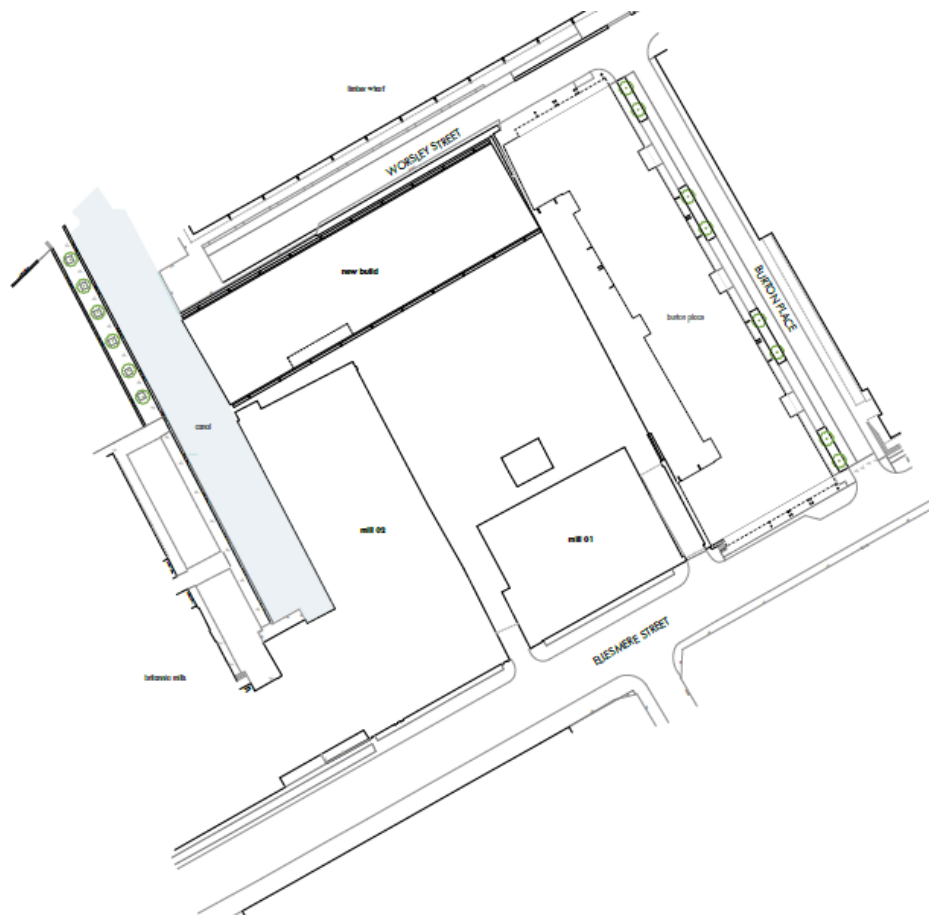
- i. Aspiring to exceed 2013 Building Regulations carbon emission toward the levels required under Level 4 of the Code for Sustainable Homes;
- ii. Use of efficient space and water heating systems allied with renewable technologies in the form of photo voltaic (PV) panels mounted at roof level;
- iii. Use of materials in the construction process which have a low environmental impact as determined by the BRE's Green Guide;
- iv. Waste minimisation principles adopted both during construction and in the lifespan of the development through promotion of recycling measures;
- v. Maximising the use of recycled and sustainably sourced building materials.

In our view the incorporation of the above, and other recommendations made within this report, will deliver a sustainable, energy efficient development.

SECTION 2

INTRODUCTION

The development at Talbot mill involves the refurbishment of existing buildings 01, 02 and the construction of a new building. A proposed plan of the site is shown in the image below.



The development is residential throughout and will provide a mix of 202 one bed and two bed apartments with unheated circulation spaces. The floor areas are as scheduled below.

Reference	No. of Apartments	No. of Floors	Gross Total Area (m2)
Building 01	41	4	3115
Building 02	73	4	6191
New Building	88	7	6678

As existing buildings 01, 02 are in a conservation area, allowances are made in Building Regulations part L1B. However with all the new building fabric elements including walls and windows the aim is to exceed Building Regulations.

The proposed new building of the development aims to exceed the requirements of Building Regulations Part L for the energy and carbon performance. This will be achieved by:-

- Improving the thermal efficiency of the walls, windows and roof by introducing high levels of insulation and improved glazing
- Reducing the air permeability to the minimum standards required to meet the SAP Assessments (used to assist energy conservation)
- Reducing the need for mechanical ventilation
- Using highly efficient sources of heating
- Designing the building fabric to reduce thermal bridging
- Utilising renewable technologies

2.1 Construction Programme

The anticipated construction programme for this project is start date in the 3rd quarter of 2018 with a circa 18/24 months construction period.

SECTION 3

M&E SERVICING STRATEGY AND DESIGN CRITERIA

The broad energy strategy for the proposed development is to design a scheme which will positively influence the overall predicted energy supply and demand.

As existing buildings 01, 02 are in a conservation area, allowances are made in Building Regulations Part L1B. Every effort will be made to ensure improvements can be made to the existing fabric where feasible with due regard to the sensitive historic and architectural characteristics of the buildings and area. All new building fabric elements will be designed to exceed building regulations.

The aim for the new Building is to create a development which uses less energy and for the energy supply to be clean and efficient and with enough generated by renewable technology to achieve the emission levels required under 2013 Building Regulations with an aspiration to deliver CO₂ reductions associated with Level 4 of the code for Sustainable Homes.

3.1 Natural Daylight

The building offers a good glazing balance with all habitable rooms having windows that create good levels of natural light. In addition to creating a pleasant living environment these characteristics help to reduce the lighting load and therefore electricity consumption.

3.2 Building Fabric

Fundamental to energy efficiency best practice is a 'fabric first' approach. This is underpinned by the notion that it is much better to ensure less energy is needed in the first place so that regardless of how energy is generated and supplied, a building requires less of it. This means that less renewable technology has to be implemented thus potentially reducing capital costs and ensuring that should future owners remove any technology e.g. if it reaches the end of its serviceable life, then the latent energy demand will be lower than otherwise.

In the new Building the glazing is to be specified with an overall U-value of 1.4 Wm²K for the frame and glass. This will provide a balance between maximising solar gain and light levels into the internal spaces whilst keeping heat loss down and with a reasonable range of product choice. The selected windows are to be 'A' rated by the BFRC.

The following tables shows the proposed U Values for the refurbishment works to the existing buildings 01 & 02 which will be applied to any new elements of the building fabric including new windows throughout.

The new windows to buildings 01 & 02 will be provided to meet the Secured By Design requirements with Aluprof SBD frames and glazing panels which are an improvement on the limiting U-Values set out in Building Regulations Part L1B as shown in the table below.

Element	Proposed U-Value (W/m ² K)	Part L1B limiting / improved U-Values (W/m ² K)
New External Walls	0.23	0.28
New Windows	1.53	1.6
Existing Ground Floor	0.25	0.25
Existing Roof	0.18	0.18

On existing building fabric elements the U Values are what can be reasonably achieved with due regard to the conservation characteristics of the existing construction.

The following table shows the U-Values that have been used in the SAP calculations for the new Building.

Element	Proposed U-Value (W/m ² K)	Part L1A limiting U-Values (W/m ² K)
External Walls	0.20	0.30
Ground Floor	0.15	0.25
Roof	0.15	0.20
Windows	1.40	2.00

All the U Values for the new building elements are an improvement on the Building Regulations.

3.3 Air Permeability

An air permeability test target of 5.0m³/m².hr has been set; 50% lower than the Building Regulations requirement but without being so low as to create unfavourable conditions with the potential for mould growth and implications for respiratory health.

3.4 Ventilation

Sufficient rapid, mechanical extract and background ventilation will be provided to ensure habitable areas meet the requirements of Part F of the Building Regulations. All apartments have been ventilated by 'whole house' mechanical extract ventilation (MEV) systems, with specific fan powers of 0.3 w/l/s.

3.5 Lighting, Appliances & Usage

The proposed development will make use of low energy lighting in line with BRE and former Code for Sustainable Homes methodology – 100% of the lighting is to be provided by energy efficient fittings. This will apply to both internal and external lighting and any security lighting will have appropriate wattage, sensors and controls to ensure efficient operation.

In line with the requirements of category ENE 5 of the Code for Sustainable Homes any fridge freezers will have an energy rating of 'A+', washing machines and dishwashers will be 'A' rated and, if fitted, tumble dryers or washer dryers will have a minimum 'B' rating.

As per the requirements of category MAN 1 of the former Code for Sustainable Homes, a Home User Guide will be supplied to all dwellings. This will detail ways residents can make best use of the features in their homes to promote energy efficiency.

The Home User Guide will also cover information on the site and local facilities to promote, amongst other things, public transport and recycling.

Further information on local transport is also provided within the Transport Statement provided as part of the planning documentation.

3.6 Heating System & Controls

Space heating is to be provided by electric panel heaters which operate at 100% efficiency. The units are fitted with programmable controls as well as room thermostats to allow efficient operation while meeting the demands of the occupants.

3.7 Hot & Cold Water Services Systems

Water heating will be provided by electric immersion heaters and hot water storage systems. The storage capacity will be sized specifically to the needs of the apartment and installed with thermostats to maximise system efficiency.

SECTION 4

RENEWABLE TECHNOLOGY CONSIDERED

4.1 Summary of the Technical Feasibility Assessment of Renewable and Low Carbon Technology Energy Options

The technical feasibility of installing each LZC technology at the Crusader Works development has been assessed in order to discount any unsuitable options at an early stage. A summary of the feasibility process is tabulated below and an overview of each technology is given in sections 4.2 to 4.9.

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
Solar Photovoltaic	Solar photovoltaic panels convert solar radiation into electrical energy. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating	Low maintenance/no moving parts. Feed in tariffs suitable for scheme. Easily integrated into building design. Excess electricity can be exposed to grid. No ongoing costs.	Any overshadowing affects panel performance Panels ideally inclined at 30° to the horizontal facing a southerly direction Conservation area designation	Yes on the new building
Solar Thermal	Solar thermal energy can be used to contribute towards space heating and hot water requirements	Low Maintenance Little/no ongoing costs Suitable for renewable heat incentive scheme	Must be sized for a proportion of the building hot water requirements Panels ideally inclined at 30° to the horizontal Conservation area designation	No
Ground Source Heat Pump (GSHP)	GSHP systems tap into the earth's considerable energy store to provide both heating and cooling to building. The design, installation and operation of GSHP is well established.	Minimal maintenance Unobtrusive technology Suitable for renewable heat incentive scheme	Large are required for horizontal pipes – space limitations on site. Boreholes required for vertical type of collectors. Full ground survey required to determine geology. More beneficial to the development if cooling is required.	No
Air Source Heat Pumps	Air source heat pumps utilise the external air temperature to provide heating and cooling to buildings. These are a common technology used in buildings.	Relatively low cost. Reliable technology minimal maintenance Cooling and heating provided	External condensers required. Refrigerant pipework required throughout the building.	No

Wind turbine (Stand-alone column mounted)	Wind generation equipment operates on the basis of wind turning a propeller, which is used to drive an alternator to generate electricity. Small scale (1kW – 15kW) wind turbines can be pole or roof mounted.	Low maintenance/ongoing costs Minimum wind speed available (www.dti.gov.uk) Excess electricity can be exported to the grid. Suitable for feed in tariff scheme.	Planning issues Aesthetic impact and background noise. Space limitations on site. Conservation area designation	No
Wind Turbine (Roof Mounted)	As above	Low maintenance/ongoing costs Minimum wind speed available (www.dti.gov.uk) Excess electricity can be exported to the grid Suitable for feed in tariff scheme	Planning issues Aesthetic impact and background noise Structural/vibration impact on building to be assessed Proximity of other buildings raises issues with downstream turbulence Conservation area designation	No
Combined Heat & Power	A combined heat & power (CHP) installation is effectively a mini on-site power plant providing both electrical power and thermal heat.	Potential high CO ₂ saving available. Efficient use of fuel Suitable for feed in tariff scheme. Excess electricity can be exported back to the grid	Maintenance incentive Sufficient base thermal and electrical demand required Some additional plant space required	No
Biomass Heating & Bio-Renewable Energy Sources (automated feed-wood-fuel boiler plant)	Modern wood fuel boilers are highly efficient, clean and almost carbon neutral (the tree growing process effectively absorbs the CO ₂ that is emitted during combustion). Automated systems require mechanical and fuel handling and a large storage silo.	Stable long term running costs Potential food CO ₂ saving Suitable for Renewable Heat Incentive Scheme .	Large area needed for fuel delivery and storage Reliable fuel supply chain required Regular maintenance required Significant plant space required Conservation area designation	No
Fuel Cells	Fuel cells convert chemical energy directly into electricity by combining hydrogen and oxygen in a controlled reaction	Virtually no pollution High electrical efficiency Suitable for feed in tariff scheme	Expensive Early stages of commercialisation High technology risk	No

Table1. Summary of Renewable and Low Carbon Technology Energy Options

4.2 Solar Photovoltaics (PV)

Photovoltaic Panels convert sunlight into electricity to run lights and appliances. They use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as Kilowatt Peak (kWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that can be used on conservatories and glass to provide shading as well as generating electricity. Solar panels are not light and the roof must be strong enough to take their weight.

PV panels take a great deal of energy to manufacture. This is known as the embodied energy. PV panels are also expensive. This can be offset to some extent with the benefit of feed in tariff payments for generating electricity and exporting some to the national grid.

The development has the available roof space on the new build to make good use of available solar energy. The hardware is relatively simple in set up with no significant moving parts and very little maintenance. The proposed development size and site characteristics would provide high level areas with good solar exposure and relatively little over-shading for most of the year. This would allow the PV array to operate at good efficiencies. The system could be sized to allow sufficient power generation in an angled plane, in conjunction with other energy efficiency measures, to reduce CO₂ emissions below those required by current Building Regulations. This technology is therefore considered the most appropriate for this development.

In the new development building an installation of a roof mounted PV array to be provided 48KWP (circa 350m²) will ensure that both the requirements of Building Regulations are exceeded and that the development energy requirements will be reduced in the order of 10%.

4.3 Solar Thermal Hot Water Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tube collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage, the less pipe work is required. Annual maintenance checks are recommended.

The solar collectors are typically connected to a condensing boiler via a Hot Water HW cylinder with twin coil.

Notable plus points for the technology includes:

- Reliability of system;
- Low maintenance and operation;
- Effective, proven design methodologies;
- Simple technology which requires little/no user interface

A typical installation in the UK has a panel size of 3 - 4.2m² which is used in conjunction with a HW storage tank of 180 – 300 litres, of which a minimum of 90 - 150 litres is dedicated solar hot water storage.

There is a system available which can work with a combination boiler but this system does still require a storage vessel. Solar thermal hot water panels are a viable technology in this case however there are space limitations at roof level which may restrict options for the installation of an appropriately sized system.

Due to the visual impact and space limitations this is not viable.

4.4 Ground Source Heat Pumps

GSHP's have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP can be sized to cater for the heating and domestic hot water requirements. Typically each heat pump would be connected to its own single ground loop which will be installed in a pre-drilled bore hole external to the block to a depth of 50 to 100 metres depending on the ground conditions. GSHPs extract heat from the earth using heat exchangers.

The efficiency of ground source heat pumps is measured by Coefficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2 - 4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2 - 4 units of heat are produced, making it an efficient way of heating a building.

GSH is dependent on an electrical supply and is generally considered as most cost-effective in areas where mains gas is not available. If a heat pump is used in place of a modern gas-condensing boiler, the carbon savings may be less clear-cut. Electrical energy from the National Grid is carbon inefficient when the low thermal efficiency of power stations is taken into consideration, along with distribution losses over the grid. Also there is not enough external space for the ground collector loops. Therefore GSH is not deemed a viable technology in this case.

4.5 Air Source Heat Pumps

Air source heat pumps are a common method of providing heating and cooling to a building and utilise the external ambient air to provide a heat sink for the refrigeration cycle.

In heating mode the heat within the external air is used on the refrigeration cycle, the refrigerant gas absorbs the heat and through the cycle increases the temperature to discharge heat into the space through the efficient heat pumps. In cooling mode the internal heat within the building is absorbed by the refrigerant gas and is discharged to atmosphere through the refrigeration cycle.

The ratio of heating or cooling performance against the power input is the Coefficient of Performance and measures the efficiency of the heat pumps, typically for these type of heat pumps COP's of 3.0 to 3.5 can be expected.

With this type of system it uses internal cassette or fan coil units and external condensers mounted in an area where a free flow of air can be provided. Alternatively the heat pump can serve the heating system direct using a heat exchanger, this however requires a discharge temperature of 60°C which reduces the COP to approximately 2.0.

Due to the substantial capital cost, the plant space requirements and the ongoing maintenance, air source heat pumps will not be viable for this development as the simple payback will be in excess of the plants expected service life.

4.6 Wind Turbines

Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of houses or apartment blocks;
- Mast mounted – Which are free standing.

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings;
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical;
- The local annual average wind speed is 6 m/s or more;
- There are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence.

Wind power is one of the cleanest and safest methods of generating electricity. Although in a relatively low-rise area, local features such as trees and buildings would still potentially create turbulence at mast levels meaning that wind speed is likely to be less than 6 m/s. Widely reported experience of micro wind power has largely discredited its performance potentials.

Also with regards to the visual impact of wind turbines and the sensitive historic and architectural characteristics of this development this technology is not deemed viable in this case.

4.7 Combined Heat & Power (CHP)

A CHP installation is effectively an on-site mini power plant providing both electrical power and thermal heat. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating engine or turbine, which in turn drives an alternator to generate electrical power. The heat emitted by the engine and exhaust gases is recovered and used to heat the building or to provide hot water.

The most economic selection of a CHP plant is described in CIBSE document AM12 'Small Scale Combined Heat and Power for Buildings', this states that the unit should be sized on a base heat load so that it operates for a minimum of 4000 hours per year, or about 11 hours / day. This document also tables suitable buildings for a CHP installation of which a residential blocks is listed as one of these.

The noise levels associated with a CHP installation should not be overlooked. Typically, acoustic enclosures and upgraded low noise attenuators are employed to ensure noise levels don't exceed 65dBA when 1m from the unit. On confined sites, the plantroom structure can be enhanced and attenuators fitted to the mechanical ventilation to prevent any noise issues.

As CHP only caters for the base heating load, the system would have to be primarily centralised gas fired heating boilers with an estimated heating load of circa 700 kW to cater for the heating and hot water loads.

On this development plant space is at a premium and as such a gas fired heating system of this size supplemented with CHP will be difficult to implement. Also the visual impact of large flues on the development may compromise the sensitive historic and architectural characteristics of the development. For these reasons this technology is deemed viable in this case.

4.8 Biomass Heating

Bio-renewable energy sources are considered to be those which are grown, harvested and replaced by new stock. Modern wood-fuel boilers are highly efficient, clean and smokeless. Wood-fuel is almost carbon neutral as an energy source (the tree growing process effectively absorbs the CO₂ that is emitted during combustion).

In theory, this makes wood fuel boilers an attractive option. However, in practice, bulk fuel storage is required on site to avoid constant deliveries and mechanical handling systems between storage silo and boiler plant are recommended.

With larger boilers, these requirements create the need for substantial amount of external plant space. A large area would have to be sacrificed to accommodate the wood-fuel facilities. Furthermore, the logistics of fuel deliveries and ongoing maintenance costs would be a potential issue.

A chimney would also need to be constructed of a sufficient height and distance away to not cause a nuisance to residents. This would also have a visual impact which would not be complimentary to the historic and architectural characteristics of the development.

With the above factors in mind this technology is not considered feasible for this development.

4.9 Fuel Cells

Fuel cells convert chemical energy directly into electricity by combining hydrogen and oxygen in a controlled reaction. They emit virtually no pollution as the products of this reaction are electricity, heat and water vapour.

There are a number of fuel cell types of which the PEM (Proton exchange membrane) fuel cell is widely regarded as the most practical technology for many applications.

Fuel cells are very expensive compared with many other technologies due primarily to the cost of the component pieces. Potential use of hydrogen fuel cell technology is to generate on-site power. But systems are on the early stages of commercialisation and so projects have substantial technology risk. For this reason, fuel cells have not been considered for use on this project.

SECTION 5

CONCLUSIONS

Sample SAP 2012 calculations have been undertaken for the New Building development (see Appendix A for summary of results). SAP 2012 is the method of determining compliance with current (2013) Building Regulations with regard to fabric energy efficiency and CO₂ emissions.

The design principles for the development may be stated as being that of a “fabric first” approach, with the intention of limiting energy demand and CO₂ emissions at source and provide a development which reduces consumption of energy resources over the long term.

Facilities to be included comprise:-

- Construction of the thermal envelope (walls, roofs, floors, windows and doors) which meet or exceed the requirements of current Building Regulations;
- A design air permeability of 5.0m³/m².hr; 50% lower than current Building Regulations requirements;
- Installation of highly efficient space and water heating systems with user controls that further improve efficiency;
- Installation of a roof mounted PV array and 100% low energy lighting throughout the development;
- Renewable technologies in the form of photo voltaic panels (approx. 48KWP (circa 350m²);

These factors will allow the proposed development to exceed the CO₂ targets of 2013 Building Regulations as well as reducing the energy usage of the new build apartment block in the order of 10%.

In our view the incorporation of the above, and other recommendations made within this report accord with best practice and present the most viable, sustainable option for the proposed development.

APPENDIX A

Dwelling	Ref	Address	Floor Area (m ²)	CO2 Emissions (KgCO ₂ /m ² .yr)			Kg CO ₂ /yr	Energy Use (Kwh/yr)		
				DER	TER	% Reduction		Total Energy	PV Energy	% Reduction
Type 04 ground floor Sth	1 Bed - T04GF	Talbot Mill	40.3	25.14	26.34	4.56	871.16	5153.1	431.8	8.4
Type 04 mid floor Sth	1 Bed - T04MF	Talbot Mill	40.3	20.78	23.48	11.5	737.46	4362.3	431.8	9.9
Type 02 mid floor Nth (Mid)	2 Bed - T02MF_END	Talbot Mill	62.8	23.96	23.13	-3.59	1232.46	7290.2	647.7	8.9
Type 02 mid floor Sth (End)	2 Bed - T02MF_END	Talbot Mill	62.8	19.38	20.22	4.15	1032.39	6106.8	647.7	10.6
Type 02 mid floor Nth (End)	2 Bed - T02MF_MID	Talbot Mill	62.8	21.97	21.84	-0.6	1122.51	6639.9	647.7	9.8
Type 03 mid floor West	2 Bed - T03MF_END	Talbot Mill	37.1	25.07	28.24	11.23	803.27	4751.5	647.7	13.6
Type 05 top floor	2 Bed 2 storey duplex - T05TF	Talbot Mill	75.4	26.64	23.66	-12.6	1747.98	10339.7	647.7	6.3

Sample SAP 2012 Calculation Results Sheet (New building)