Brownfield land redevelopment

Recently brownfield sites have become popular due to the serious deficiency in the number of greenfield spaces on hand for development. This is more prominent in the built up areas where the demand for residential and commercial property is elevated.

In 2008 the UK set a target for brownfield developments. 60% of all new houses were to be built on brownfield sites. Records show that we have already exceeded that target and with the rate that we are reclaiming brownfield sites at present we should significantly raise that percentage over the coming decade.

The uses for brownfield sites are not restricted to residential and commercial buildings. They are often considered for redevelopment into open spaces for recreation, woodland and various other community related areas.

Reclaiming brownfield sites is at the heart of the UK Sustainable Development Strategy. This “ Development Strategy” incorporates an extensive collection of economic, social and environmental objectives. Brownfield redevelopment cleans up environmental health hazards and eyesores and in doing so it promotes community growth and regeneration.

Managed effectively as a sustainable redevelopment scheme, Brownfield sites provide affordable housing, encourage economic growth through locally sourced materials nurturing local business’ and trades, protect local wildlife and provide environmentally safe areas for families to enjoy.

Furthermore, redevelopment of brownfield sites can give an area a make-over and can help send a message to the locality indicating the importance of preservation and recycling.

2. 0 Brownfield Land Redevelopment Steps

Now that the land has been chosen for the proposed development, a large sports centre within a small town in Scotland, it is important to establish whether or not the Brownfield site in question is suitable for such a development.

The proposed site will involve the demolition of an existing building. Therefore all planning laws must be adhered to and the local planning authorities must be notified in writing outlining the intentions for the proposed site. This is important as special licences are required to reclaim Brownfield sites.

There are a number of tests and studies that must be carried out in order to obtain the required information to determine the extent of the decontamination measures required to prepare the site.

2. 1 Demolition and Recycling Existing Building On-Site

In order to maximise the sustainability of the development it is important to identify, separate and eliminate all hazardous materials from the demolished waste. Furthermore any recyclables such as masonry rubble and other materials should be extracted from the demolition waste and can be used in the concrete / asphalt or paved areas around the site. This promotes sustainable development by contributing to the government sustainability objectives of prudent use of natural resources and protection of the

environment. Using low embodied building materials reduces the CO2 emissions during the construction process and also has a positive effect on the cost of the entire project as less waste is sent to expensive landfill.

There are a number of companies within the UK that specialise in construction and demolition waste recycling and disposal. These companies work closely with " Site Waste Management Plans" ensuring that only hazardous materials are disposed of and everything recyclable is reused.

2. 2 Identification of Hazardous Materials

A large number of materials are involved in any build, therefore, when a building is being demolished it is important to identify these hazardous materials and dispose of them safely so that they do not become a danger to anybody else in the future.

The building on the proposed site is a 150 year old derelict masonry building. The existing building is to be demolished and any suitable recyclables are to be used in constructing the new sports centre and any concrete / asphalt or paved areas around the site. In order to identify the various materials it is important to put a sorting plan in place. This will ensure only recyclable materials get reused and all hazardous materials are disposed of appropriately.

The history of the building plays a key part in the types of hazardous materials that can be expected to be found within the building. From the period the building was built a suitably qualified professional can conclude that the building shell itself will contribute various hazardous materials to the list for safe disposal. These are likely to include asbestos, insulation

materials, foams containing CFC’s (Chlorofluorocarbons) that are harmful to the O-Zone layer, roofing felts and bitumen.

An engineer will also look into the space within the building to determine what hazardous materials may have been associated with the various uses of the building. The derelict building in question was originally used as a textile factory and later a furniture factory. This would indicate that hazardous materials such as varnishes, glues, sealants, resin-based floorings and wood treated with chemicals or preservatives may be present from that period of the buildings lifetime. In recent decades the building was used as a truck repair shop. This might suggest that there may be some contamination from oil or lubricants, petroleum and any spillage from car / truck batteries.

It is very important to test for the presence of these substances and more as identifying the presence of hazardous material is the first step to decontaminating the site.

2. 3 Further Investigation

Following investigation into the building to be demolished, tests must be carried out on the condition of the soil around the site. It is important to note that all Brownfield site redevelopments come hand in hand with strict environmental issues. As a result it is recommended that an appropriately experienced environmental consultant is used. The environmental consultant will have background knowledge of Brownfield developments and will adequately investigate any environmental risks.

Firstly they will undertake a desk top review of the proposed site by gathering all historical information available. This may relate to former

quarrying or landfill in the area. Secondly they will prepare an environmental assessment report. Contained within this report will be the results from extensive testing for hazardous compounds within the soil, ground water and surface water.

If the findings of the report are positive and support redevelopment on the site, the next step is remediation and elimination of hazardous materials.

2. 4 Remediation / Elimination of Hazardous Materials

Now that the various hazardous materials have been identified, it is time to categorize and divide them so that they can be safely disposed of. This is what's known as remediation.

The demolition of the building itself should be the final step when clearing the site. Initially the building should be stripped down with careful consideration given to how each material is classed and whether it can be recycled or disposed of. This includes all loose material, fixtures, fittings, windows, doors, heating and electrical systems and roofing. Once this has been categorized and divided all that should be left is the building skeleton and foundations for safe demolition

Up until a few years ago remediation of Brownfield sites was an expensive process. However, recent new remediation technologies have emerged and are cheaper than the more traditional methods. They include:

- Bioremediation – This utilises the natural processes of indigenous bacteria, microorganisms, plants, enzymes and fungi to destroy or neutralise toxins and contaminants.

- Phytoremediation – This process uses plants. The can store contaminants in their leaves and stems (bioaccumulation). Some contaminants such as heavy metals can be harvested and mined for reuse (phytomining).
- In-Situ Chemical Oxidation – This process injects oxygen or chemical oxidants into the contaminated soil or water to destroy harmful compounds.

2. 5 Recycling Masonry Rubble

With a project like this there is serious demand for concrete / asphalt and pavements around the development. Fortunately with the demolition of the existing derelict masonry building, a lot of the requirements can be met using recycled masonry rubble from the existing building.

When using recycled masonry rubble from demolitions such as this it is important to ensure that the rubble is free from contaminants. Once this is done, the rubble is then graded into aggregates. This is a simple process that involves sieve like machines that vibrate, separating the various sized aggregates and compiling them with aggregate material of similar sizes. The aggregates can then be used in various locations around the site depending on their size and classification.

It is important to note that the quality of recycled masonry rubble meets the requirement for use in constructing roads. Strenuous testing and categorizing is required on the aggregates that are intended for concrete use within the building in order to ensure the consistency is sufficient. Lightweight aggregate does not meet requirements for use as a secondary

concrete aggregate as the majority of masonry materials are too soft and will adversely affect the strength of concrete products.

2. 6 Access Roads and Pavements

The existing building will have a number of access roads already in place. These roads will have to be excavated and in keeping with the sustainable design of the proposed building and use of recycle materials in the new build it is only fitting that the excavated asphalt should also be recycled and form part of the new access roads and pavements around the site. The manufacture of asphalt it a very energy expensive process as the materials involved must be heated to very high temperatures in order to mix together. Therefore, the use of recycled asphalt for road toppings around the site will have a cost benefit to the project as well as a positive impact on the environment.

3. 0 Proposed Sports Centre Complex

The proposed sports centre will be built using low embodied, recycled materials where possible paying particular attention to the energy performance of the building. The building design will take passive solar heating into consideration with cleverly positioned windows and landscaping throughout the site providing adequate shelter from the elements during the winter months.

Sourcing materials locally cuts down on transport costs over large distances. This automatically reduces carbon emissions and also supports the local industry ensuring jobs and community growth. This will be a key component in the sustainable building of the proposed sports centre.

3. 1 Foundations

The best foundation for the proposed sports centre is a raft foundation. Due to the size and scale of the proposed build a raft foundation will allow the weight of the building to be transferred to the ground over a greater area and also provide a level surface for which to build upon. It is important that there is adequate steel reinforcement in the concrete to combat ground movement.

When the recycled masonry rubble is graded into aggregates, some of these aggregates will be suitable for use in the concrete raft foundation. Recycled concrete aggregates can replace up to 20% of virgin aggregate in concrete within the provisions set out in BS 8500-2.

3. 2 Structural Framing / Building Skeleton

The most efficient way to build the proposed sports centre building is using a steel framed construction. The steel structure would meet the spatial requirements of the main sports hall, high ceilings with long spans and column free space to accommodate an indoor football pitch or basketball court. Recycled steel would be appropriate here as steel can be used countless times with no negative affects to its strength or performance.

3. 3 Wall Build-Up

Once the foundations and steel structure are in place it is time to think about the external wall build up. Given the intended use of the sports hall it is important to use a material that will not only be sustainable in its construction and hard wearing but also have an acoustic quality as the noise generated within the sports hall when it’s occupied will be of an elevated nature and could disrupt the surrounding public.

There is a wide array of products available such as concrete blocks with 50% coarse aggregates replaced with plastic while still providing adequate strenght but all things considered, I would suggest an aerated concrete block. These are among the most environmentally friendly building products available. They are formed from recycled materials. One of which is Pulverised Fuel Ash (PFA), this is an unavoidable by-product of the coal-fired power generation process which is normally stockpiled in huge unsightly mounds or is dumped at sea. Further enhancing the sustainability of this product is the fact that no material goes to waste, anything left over when a batch is made automatically goes into the next mix. Also due to the lightweight of the material, more can be loaded onto a single lorry reducing the CO2 emissions produced in transport and speeding up construction.

The cavity should be 100mm partially filled with natural wool insulation or a similar approved natural insulation or recycled insulation system. The external face of the building should be clad with recycled bricks tied back to the internal leaf with acoustically approved wall ties.

3. 4 Floor Build-Up

Each area of the sports centre will require a different finish depending on the proposed use. The reception for instance will need to provide a warm and welcoming atmosphere, this can be achieved using carpet. Recycled carpet is available, this is formed from recycled material such as plastic, wool, cotton or nylon and laid on a recycled rubber underlay. The rubber could be derived from any scrap tyres remaining on the site from the truck repair shop.

The changing rooms will require a hard floor which is impervious to water. Many green options are available such as recycled ceramic floor tiles and eco-friendly rubber floor tiles. A study should be undertaken of the business' in the area in order to decide which material is easiest to obtain with the pursuit of sustainability in mind.

If there is a quarry nearby it might be an idea to investigate stone as a possible material for the flooring in hard wearing areas. Stone has a natural, timeless beauty and a feeling of solid quality which is hard to match with any other type of material. Unfortunately due to the costs associated with stone it may not be a plausible material as it is by no means the cheapest type of flooring to install or maintain.

The flooring in the sports hall is a specific type of flooring material. It has a number of functional requirements associated with it. It must be durable, smooth and slightly soft to prevent serious injury. An ideal surface therefore, would be a rubber based surface which can be formed from any scrap tyres found on the site. This is a cost beneficial process as it is a sustainable use for the waste rubber meaning it is not necessary to pay for the safe disposal of the unused tyres. The recycled rubber surface should then sit on some rigid insulation such as woodwool, mineral./rock wool or expanded or extruded polystyrene to increase the thermal performance.

3. 5 Roof Construction

For the proposed sport centre i would suggest a green roof. A ' Green Roof' is a roof that has a vegetated covering planted over a waterproofing

membrane. The roof consists of various layers, each with its own function. The various layers cater for drainage, moisture, root protection and filtering.

Green roofs have many benefits over traditional or conventional roofs. They offer a longer roof life span, increased acoustic performance, improved thermal performance in the winter and heat shielding in the summer and as they are living organisms they retain and store 90% of rain and storm water and return it to the atmosphere by means of evaporation.

3. 6 Energy Performance of the Building

A key feature of this building is the excessive use of recycled and sustainable materials in the construction. This has a positive effect on the environment ensuring minimal CO2 emissions are generated in the manufacture of the materials. This is an admirable practice and it sends a clear message to developers that the use of recyclables can have beneficial implementations for both the project budget and also the environment.

It is important to maintain this objective throughout the buildings lifetime. This can be done by implementing micro renewable technologies during the construction process. A building of this scale is often associated with large energy bills. With the prices of oil escalating and the UK’s dependency on fossil fuels at a peak, it is vital that this building incorporates as many micro renewable technologies as possible in order to drive the running costs down to a manageable level.

I would strongly suggest the use of solar photovoltaic cells (PV) and wind turbines to generate electricity along with wood fuelled boilers (biomass)

connected to a central heating system as the most relevant micro generation technologies that a building of this nature could benefit from.

4. 0 Sustainable Urban Drainage Systems

4. 1 Introduction to SUDS

Sustainable urban drainage systems are a new environmentally friendly way of dealing with surface water run-off. Traditional drainage schemes lead to flooding, cause pollution and are generally more expensive to install. Surface water no longer has the opportunity to soak into the ground, instead it is collected in a network of pipes along with any contaminants such as oil, solid matter or toxic metals it may pick up along the way and it is discharged into the nearest rivers or streams.

Sustainable urban drainage systems replicate natural drainage methods. Water run-off is collected and stored to allow natural cleaning to occur prior to infiltration or controlled release to watercourses. As a result they prevent pollution, control flooding, recharge ground water in the natural water table and enhance the environment.

There are for main design options. These are:

- Filter Strips and Swales
- Filter Drains and Permeable Surfaces
- Infiltration Devices
- Basins and Ponds

It is important to note that depending on the required performance of the sustainable urban drainage system, a combination of two or more design

options may need to be incorporated in order to achieve a suitable drainage solution.

4. 2 Filter Strips and Swales

Filter strips and swales are vegetated surface features that drain water evenly off impermeable areas. Swales are long shallow channels whilst filter strips are gently sloping areas of ground.

4. 3 Filter Drains and Permeable Surfaces

Filter drains and permeable surfaces are devices that have a volume of permeable material below ground to store surface water. Water run-off flows to a storage area via a permeable surface such as gravelled paving areas or solid paving blocks with gaps between the individual units. When the water falls it passes through the surface to the permeable fill in the filter drain. This then allows the storage, treatment, transport and infiltration of the water resulting in clean uncontaminated water being returned to ground.

4. 4 Infiltration Devices

Infiltration devices drain water directly into the ground. They may be used either at source or alternatively the runoff can be conveyed in a pipe or swale to the infiltration area. They include soakaways, infiltration trenches and infiltration basins as well as swales, filter drains and ponds. Infiltration devices can be integrated into and form part of the landscaped areas.

4. 5 Basins and Ponds

Basins and ponds store water at the ground surface, either as temporary flooding of dry basins and flood plains, or permanent ponds. These structures can be designed to manage water quantity and quality.

4. 6 Benefits of Sustainable Urban Drainage Systems

There are a number of benefits to installing a sustainable drainage system as opposed to a traditional / conventional system. For example the cost of connecting to storm sewers and public drains is avoided and maintenance is simple and cheap. Maintenance can be carried out by landscaping contractors without the need of skilled engineers and heavy machinery. When clean filtrated water is distributed back to the site it gives the natural vegetation a chance to thrive and can create a very pleasant environment for everyone to enjoy.

4. 7 Proposed Sustainable Urban Drainage System

A sports centre will require a number of hard surfaces to cater for car parking. I would suggest using solid paving blocks for the surface in the car parking areas. A gap must be left between each block allowing water to filter through to an under the surface storage drain which runs to a designated area such as a vegetated or green area. This rainfall run-off precaution must be implemented in the initial design stage.

I would also suggest soak holes / soakaways around the site to filter any water collected in downpipes around the building. With the current climate that we live in it has to be expected that substantial rain will fall each year. As such, a well designed sustainable drainage system can minimise flooding and any inconvenience that may be caused during times of high rain fall.

5. 0 Conclusion

The aim of the brief for this report was to critically analyze and evaluate the possibilities of redevelopment on a brownfield site with the demolition of an existing derelict masonry industrial building and the construction of a new

sports centre utilising as many of the recycled materials from the demolition as possible.

I approached this project somewhat blind with my basic knowledge of brownfield redevelopment. After researching the topic further I discovered all the environmental benefits surrounding brownfield redevelopment. With the declining availability of greenfield sites and the growing need for housing and community growth, brownfield redevelopment has got to be at the top of the list where possible in order to preserve what natural areas are left. Furthermore building on brownfield sites removes unsightly and often dangerous derelict buildings and gives local areas a chance to regenerate and create a new image.

Decontaminating brownfield sites in a specialised task but the removal of hazardous materials makes it a safer environment for all concerned. Luckily new techniques for remediation of contaminated sites have made it cheaper. This can be appetising for potential developers looking to expand their property portfolio and as a result it can have a knock on effect within a community generating jobs and business for local trade.

The brief stated that materials from the demolition of the existing masonry industrial building must be recycled and used in the construction of the new sport centre. When the list of materials that could be recycled in the existing building was broken down, it was found that almost everything could contribute in some way to the new build. This impacts on the budget for the project and in keeping with the UK’s carbon emission reduction targets

subsequently cuts down on any CO2 emissions that would have been produced in the manufacture of virgin material.

The use of micro-technologies would fit in well with the overall idea of a sports centre as in my opinion a sports centre implies health and wellbeing which can be related back to the terms “ clean” and “ green energy” associated with these methods and the environment.

The implementation of Sustainable Urban Drainage Systems permits the safe return of clean irrigated water back to the soil. The benefits of cost and minimal maintenance alone speak for themselves. With four main design options available I feel it is important to include at least one system as a drainage solution on sites such as this within small towns in order to preserve the local wildlife and allow vegetation to thrive free from water pollution.

All in all i feel that this project were it to be undertake would be very feasible. Most of the costs for would come from decontaminating the site. The build itself would prove to be cheaper with recycled materials already available on-site and given the nature of the proposed sports centre I would not foresee any issues with the local community as it will provide a safe location for children and adults alike to hang out. The sustainable nature of the proposed build also indicates that this building is embracing plans to move forward into a greener future and it may set a precedent for future green development within the area.

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