

Notice of publication of Annex B, Appendix 7.7 in connection to the Final Report on Aggregates, Cement and Ready-Mix Concrete market investigation published on 14 January 2014

Following publication of the Aggregates, Cement and Ready-Mix Concrete market investigation Final Report on 14 January 2014 we are today publishing an annex to an appendix which was omitted from the published version of the Final Report in error.

Annex B to Appendix 7.7 – entitled '*Consultancy Assignment: The estimation of the cost of procuring and building a new 1 million tonnes per annum clinker plant on a Brownfield site within the UK*' is now published below. The annex had previously been published as part of our provisional decision on remedies (PDR) on 10 October 2013.

The Final Report (Appendix 7.7) refers to and summarises the below annex and it is therefore appropriate to publish the annex, as originally intended, to allow for a proper understanding of our decisions.

16 April 2014



UK Competition Commission:

Consultancy Assignment: The estimation of the cost of procuring and building a new 1 million tonnes per annum clinker plant on a Brownfield site within the UK.

23rd September 2013.



Notice

Important Notice

This Report has been prepared by Independent Cement Consultants Limited (ICC) for The UK Competition Commission (UKCC) and is an estimation of the cost of procuring and building a new 1 million tonnes per annum clinker plant on a Brownfield site within the UK.

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Contents

Section	Page
Assignment Scope	5
Executive Summary	6
Background	6
Capital Cost Estimate for a 1.2Mtpa Integrated Cement Plant	7
Infrastructure Sub Projects Cost Estimate	8
Capital Cost Estimate Breakdown 1.2Mtpa Greenfield Integrated Cement Plant	10
Cost breakdown by major cost categories	10
Cost breakdown by major unit operations	11
Capital cost reduction methods by the reuse of an existing cement plant site, for a Brownfield site with a 1.2 mtpa integrated cement plant	12
Capital cost benchmarking different integrated cement plant capacities	14
Typical Project Timescale	15
Appendix A – Capital Cost Estimate General Assumptions	16
Appendix B – Further factors affecting the Capital Cost of a new Brownfield Cement Plant	19
Increases	19
Decreases	19



List of Abbreviations

CAPEX	Capital Expenditure Cost
OPEX	Operating Expenditure Cost
SNCR	Selective Non Catalytic Reduction
TPA	Tonnes per Annum
TPD	Tonnes per Day
TPH	Tonnes per Hour
VCM	Vertical Cement Mill
VSM	Vertical Spindle Mill
AF	Alternative Fuel
RDF	Refuse Derived Fuel
MBM	Meat and Bone Meal
SRF	Solid Recovered Fuel
EPC	Engineering, Procurement and Construction
SP 5/SP 6	Number of cyclone stages in a preheater / precalciner
C/K	The Cement to Clinker ratio = tonnes cement produced per tonne clinker used.
GGBFS	Ground Granulated Blast Furnace Slag
PSP	Processed Sewage Pellets
M & E	Mechanical and Electrical Supply
WHR	Waste Heat Recovery
SNCR	Selective Non Catalytic Reduction
FLS	F.L.Smith, plant designer & equipment supplier
MSC	Multistage Combustion, a technique used in precalciner kiln processes to reduce NOx emissions.
UKCC	United Kingdom Competition Commission.
ICC	Independent Cement Consultants Ltd.
NOx	Nitrogen Oxides



Assignment Scope

The Assignment scope is to provide a range estimate of the cost a theoretical entrant into GB would have needed to incur to procure a 1 million tonnes per annum capacity clinker plant on a Brownfield site using the technology that this entrant would have purchased as at 1 January 2007.

For this theoretical plant it is to be assumed;

- That this entrant is able to find somewhere in GB with ready access to reserves of both limestone and the other raw materials required for cement making lasting 50+ years.
- The equipment would be procured from one of the major reputable European equipment suppliers such as FLS or Polysius on a turn-key basis.

A narrative explanation should set out what factors would tend towards a lower estimate and what factors would point to a higher estimate for such a plant. In addition, these range estimates should be supported by various curves, assumption explanations and expected percentage breakdown of costs for the various sub sections of an integrated cement plant

The estimated cost of the plant, which is to be calculated on a Brownfield basis should consider and comment on the costs of completing the necessary feasibility studies, etc... and the interest cost on expenditure incurred up to the point when the plant would be commissioned.

A further requirement would be to comment on typical costs of infrastructure projects to support a cement company's distribution and product strategies, such as an estimated cost for;

- Cement packing facilities
- Downstream blenders and blending of cement
- Rail links and depots
- Import facilities



Executive Summary

Background

The UKCC requested ICC to provide a range estimate of the cost a theoretical entrant into GB would have needed to incur to procure a 1 million tonnes per annum capacity clinker plant on a Brownfield site using the technology that this entrant would have purchased as at 1 January 2007.

In ICC experiences, it is quite complex to provide an estimated cost for a Brownfield site without firstly estimating the costs of a Greenfield site of a particular plant output required. Typical percentage factors can then be applied to a Greenfield cost estimate to arrive at an estimated Brownfield plant cost. This is the approach ICC has used to meet the project scope.

When providing such an estimate the following major issues need to be considered for any sensitivity analysis during UKCC financial modelling;

- There are no 2 plants exactly the same in the world. Even if the equipment design is exactly the same, the basic raw materials, the erection of equipment, operational and maintenance procedures will not be exactly the same. However, to manage these differences, industry benchmarking techniques can be utilised in order to make comparisons between different cement plants.
- When completing feasibility studies, ICC generally apply an accuracy rating of plus/minus 15% for any such estimate for a new kiln project.
- ICC believe it is prudent and good practice to allow for a contingency when estimating project costs, ICC use a figure of 10%.
- The cost of capital to fund the project will depend upon how the project is funded, E.g. via external loans or via internal resources, etc... Typical figures experienced by ICC for recent projects have been in the range of 5% to 10%. The cost of the debt incurred due to interest during the construction period has not been included in the total capital cost estimates.
- Reserves and Planning permission: Obtaining planning permission for a new kiln line at Brownfield/Greenfield sites is generally a lengthy and costly process (ICC has experience of such studies in complex cases which can amount between £15m-£30m). It is not straight forward to quantify these costs and they will vary significantly. All costs associated with obtaining planning permission, environmental permits, public consultations etc... are not included in the estimates as the variations of costs for this are significant, and strongly dependent on what was previously approved when the plant was originally built and the existing operational licenses. However, for the purposes of this estimate, ready access to reserves of both limestone and the other raw materials required for cement making lasting 50+ years is assumed.
- Exchange rates: A major part of the equipment would be paid for in Euros to the major equipment suppliers, which carries a risk in itself when paying for the equipment over a period of 4 years. E.g. The Euro is currently worth around £0.841 compared with an



average exchange rate of £0.684 in 2007. If the new line had been tendered in 2007 based upon Euros in 2007 then the project cost would be now be significantly higher in £ terms. The ICC capital cost estimate is based upon sterling estimates and the allowance of a plus/minus 15% accuracy factor for estimating capex will allow for some degree of currency exchange rate fluctuation.

- ICC used Independent Capex estimating methods to develop the Baseline Capex Model and assumed an exchange rate of 1 Euro = £0.87 and £1 = 1.61 US \$.
- Typically a major project is depreciated over 25 years for the equipment items, with civil structures depreciated over 40 years. As long as a plant has the raw material reserves, and the equipment has been responsibly operated and maintained it is not unreasonable to consider extending this life. However, the original design life of a plant needs to be considered and the margin of safety factor that is incorporated into an original design to ensure contractual performance guarantees were met. It can be seen for the existing cement plants in the UK, many plants have experienced working lives beyond their original design life. It is also known that as the plant becomes older the maintenance costs increase, which pushes up the opex, as expensive major equipment items have to be replaced requiring lengthy maintenance shutdown periods. Due to these longer maintenance periods required, the number of available operating days for producing at a plant are also reduced. Expensive major equipment items could be;
 - Kiln: section, girth gear and kiln tyre replacements
 - Cement mill: main drive gearbox internals, mill shells/mill heads or trunnions
 - Coal and Raw mill: Gearbox Internals
- It should be remembered the cement industry is a heavy industrial process industry and the quality of the raw materials in close proximity and thus reducing transportation costs to a major population centre cement demand area offers strategic advantages for a business.

Capital Cost Estimate for a 1.2Mtpa Integrated Cement Plant

The estimated capital cost as of January 2007 for a Brownfield 1.2 Mtpa cement 100% new integrated cement plant is as follows;

-Capex for a complete new integrated cement plant without contingencies = £170.58m.

-Capex for a complete new integrated cement plant with 10% contingencies = £187.64m.

(ICC assumes 10% contingencies as standard but it should be noted that this figure may vary between 5% and 15% from experience with other studies and projects).

With an estimating accuracy of capital cost estimating being plus/minus 15% the likely range of Capex required for a complete new integrated cement plant would be within the following;

No contingencies = £144.99m to £196.16m.

With 10% contingencies, (which ICC consider that it would be sensible to use) = £159.49m to £215.78m.



This estimated cost is for the maximum investment case scenario where 100% new plant is required for the new line.

From ICC experiences with benchmarking Brownfield site projects, when comparing costs and options between Greenfield and Brownfield sites, a typical Brownfield cost would be around 80% of the Greenfield/Full plant cost.

With the assumptions made as outlined within this report, using the figure of £215.78m for a Greenfield site multiplied by an 80% factor would suggest that the capex figure for a theoretical Brown field plant should be below £172.62m.

Infrastructure Sub Projects Cost Estimate

When estimating the costs of new equipment and upgrading existing facilities there are a number of infrastructure sub projects that require consideration. Within this study, no major costs for these items have been included.

Downstream blenders and blending of cement

The C/K ratio of 1.2 used for this study is lower than figures which ICC has encountered from International new plant projects where the ratio has been as high as 1.6. The C/K ratio may be increased by blending PFA or GBFS off site. Typical cement blending mixers may be incorporated in Depot/Grinding plant designs and a purpose design blending plant with silos/mixers and road loading could cost around £4m- 15m at 2007 costs. Here again, the capital cost will vary significantly depending upon the type of storage systems, number of blended cements and transportation/loading facilities required.

Rail links and depots

Rail facilities vary from zero provisions to very sophisticated provisions at the existing UK Cement plants. The capital cost may thus vary significantly from around £5m to the £25m.

It may be worthwhile noting that capex for new plants overseas with large land mass, which also lack basic infrastructure within the country have cost more than this E.g. £30m plus.

Import facilities

Cement Import facilities vary significantly in size, cost and capacity and the type of storage employed. E.g. a Dome silo or Flat cement store, shipments and hence ship unloader size, road/rail loading systems for 40,000 – 60,000 tonne cement storage. These may cost anywhere between £6m and £20m at 2007 costs. It is also worth noting that some companies adopt a strategy of installing Cement milling equipment near to an import facility.

Other

The below sub projects have not been considered for the UK estimation, however, ICC has experience of working overseas in developing countries where there are sometimes other major infrastructure issues to consider such as;

The Power supply and National Grid to ensure continuity of supply.



Water supply to ensure the continuity of supply.

Road costs to link cement works to major towns.

Housing and facilities / amenities development for small villages or camps by remote cement plant locations for workers, etc...

Fuel pipelines for gas or oil.

Summary

The estimated cost and cost range of 1.2 Mtpa per year capacity integrated cement plant (1.0 Mtpa clinker) 2007 £m, can be summarised as per the below;

Estimate	0% Contingency	10% Contingency
Greenfield site estimate (£M)	£170.58	£187.64
Minus 15% accuracy	£144.99	£159.49
Plus 15 % accuracy	£196.16	£215.78
Brownfield site estimate (£M)	£136.47	£150.12
Minus 15% accuracy	£116.00	£127.60
Plus 15 % accuracy	£156.94	£172.64

Within this estimation, whilst packing facilities have been included, a number of infrastructure items have not been included, such as;

- Downstream blending facilities (estimated as £4m to £15m per facility)
- Rail links and depots (estimated as £5m to £25m)
- Import facilities (estimated as £6m to £20m per facility depending on size, capacity and type of storage)
- Financing costs (estimated as 5-10%)
- Obtaining planning permission for new kiln line / raw reserves (estimated for complex cases as £15m to £30m)

For this UK scenario, the estimate for a Greenfield site of minus 15% on Capex is highly unlikely. Hence the costs are more likely to be £187.64 m average and £215.78m maximum with 10% contingencies or £170.58m to £196.16m without contingencies.

Similarly for the UK scenario, Brownfield Site example, the minus 15% scenario is unlikely and so the costs would be more like £150.12m average and £172.63m maximum with 10% contingencies.



Capital Cost Estimate Breakdown 1.2Mtpa Greenfield Integrated Cement Plant

Within this estimate ICC has reviewed the equipment cost for a 100% new equipment integrated cement plant where there has been a previous cement plant in operation at the considered site.

Cost breakdown by major cost categories

The typical cost breakdown by major cost categories can be summarised as follows;

Cement mtpa	1.20	1.20
Clinker mtpa	1.000	1.000
Cement to Clinker ratio(*)	1.200	1.200
Contingencies %	Zero %	10%
Capex £m	£170.58	£187.64
M+E supply plus Basic Engineering	£[X]	£[X]
Civils-concrete, steel	£[X]	£[X]
Erection	£[X]	£[X]
Project team, training, general	£[X]	£[X]
Consultancy	£[X]	£[X]
Spares	£[X]	£[X]
Total check £m	£170.58	£187.64

*N.B. ICC has assumed a prudent figure of Cement to clinker ratio of 1.2. Within the UK, the UKCC has advised that the cement companies in the UK are between 1.1 – 1.3. It is worth noting that the major international cement companies normally have policies for maximising the use of additives within cements to maximise this cement to clinker ratio. The basic concept being that clinker is more expensive to produce than some additives or extenders that can be used when making cement. This can also be dependent on the regulations and standard requirements for the grades of cement that are required in different countries.



The above estimate does not include some unpredictable costs associated with a new plant where there has been no cement plant previously at the site being considered, such as;

- Land purchase for quarry and quarry plant
- Higher costs for planning and permitting, public consultations, public enquiries/exhibitions etc...
- Higher consultancy costs for expert witnesses etc...
- Cost of access roads, rail
- Higher site preparation costs / overburden removal / quarry face development, etc...
- Securing water and power supplies
- For new developments in remote locations, where the cost of housing and other amenities may be sometimes necessary

Cost breakdown by major unit operations

The approximate cost according to the major unit operations can also be estimated as per the below;

Process Section	No Contingencies	10% Contingencies
Quarries-Crushing, conveying	£[X]	£[X]
Raw materials/additives	£[X]	£[X]
Preparation of raw meal	£[X]	£[X]
Raw meal blending	£[X]	£[X]
Preparation of clinker including fuel	£[X]	£[X]
Clinker silo	£[X]	£[X]
Preparation of cement	£[X]	£[X]
Packing and shipping	£[X]	£[X]
Utilities	£[X]	£[X]
Spares	£[X]	£[X]
Consultancy	£[X]	£[X]
Project Team/Training/General	£[X]	£[X]
Total £m	£170.58	£187.64
Maximum +15%	£196.16	£215.78
Minimum - 15%	£144.99	£159.49



(N.B. this breakdown can vary significantly between different projects and depends upon the definitions for each unit and its interfaces).

Packing facilities vary according to the plant location and the range of cements produced. Provisions for Bulk, Bag and Road and Rail despatch are assumed in the Capex estimation. A typical Bulk to Bag ratio may be around 70:30 but this is very variable as is the proportion of bulk cement despatched by rail. This area of capital cost should not be underestimated. There can be situations in the industry where a packing plant is established at one site for two cement plants located in different towns. If the cement plant without a packing plant is then sold to another owner, major investment would be required to install a packing plant in order to be able to compete in the bagged cement market. Using the above sub section costs for packing and shipping with an accuracy of plus/minus 15% would provide reasonable estimates for this type of project.

For this UK scenario, the estimate of minus 15% on Capex is highly unlikely. Hence the costs are more likely to be £187.64 m average and £215.78m maximum with 10% contingencies or £170.58m to £196.16m without contingencies. There are a number of contributing factors for the minus 15% on Capex estimate not being likely, such as;

- Would international cement plant equipment suppliers see the UK market as a booming / attractive market for equipment sales in comparison to developing countries? Probably not and thus they would predictably be less hungry to reduce their profit margins during contract negotiations. Where in developing countries, it might be considered in order to win the second and third major equipment order.
- The cement industry in the UK is very mature with some plants having over 100 year's history. The majority of UK cement plants have already gone through expansion projects to try and utilise any excess production capacity.

Capital cost reduction methods by the reuse of an existing cement plant site, for a Brownfield site with a 1.2 mtpa integrated cement plant

In this theoretical case the investment for the Brownfield site is 80% of the cost of a full Greenfield site with a new integrated cement plant, which requires 100% new equipment (i.e. where the existing facilities do not have spare capacity to support extra output).

Therefore, the percentage factor which can be applied to a complete new plant cost estimate in order to obtain a realistic Brownfield site estimate will depend upon the bottlenecks/spare capacity within the existing plant facilities. This would require lengthy and detailed study and



calculations. However, in ICC experiences this percentage factor for a Brownfield cement plant can be typically 70% to 90% of the costs of the cost of a full plant on a Brownfield site.

There are limitations to Brownfield expansions, all too often Brownfield site expansions can be used as a mechanism to obtain additional capex to meet the plant management “wish list” of improvements which are desirable for improving the existing facilities, this can inflate the true costs of the capex for an expansion project. Tight financial control as well as “value engineering” is required to ensure that all new plant costs are justifiable. Weaknesses in the project feasibility studies may also fail to identify some bottlenecks where new plant is linked in with the existing plant. This can incur additional capital expenditure at a later date as these bottlenecks are eventually eliminated.

Accurate Brownfield costs can only be estimated from knowledge of what bottlenecks exist at the site. It may be necessary to include some expenditure of refurbishing the older plant for areas such as;

- Environmental improvements to meet tighter emission standards.
- The need to integrate new and old plant centralised control rooms, air, water and drainage services, power distribution, etc...
- It may be cost effective to add in modest amounts of capital to remove some bottlenecks with the existing plant if this secures higher capacity at an attractive £/tonne investment.

Other costs not included are the demolition and restoration of land formerly used for older lines. Again, these costs are very variable but for one recent Brownfield site project, the demolition cost was in the region of £300,000. The price fluctuation and thus the value of scrap steel can influence the costs of demolition significantly.

There are numerous possible scenarios that can be considered when predicting what would or could be included within a Brownfield project and each case really is site specific. To demonstrate the technique of estimating, ICC has offered an example project. In the following theoretical estimate, it has been assumed that;

- The additional clinker and storage capacity is increased by only 50% of the normal requirement in order to minimise initial investment costs.
- The existing well sized cement mills (E.g. the plant is not already cement milling restricted for the existing plant’s clinker output) are retained with one new cement mill sized for 0.6 mtpa grinding capacity.
- Existing cement mills will be optimised to increase output and efficiency.
- The quarry crushing and conveying plant will work double shifts avoiding the need for new equipment.
- Additional conveyors and feed bins are required for the new raw mill but with no additional storage halls required.

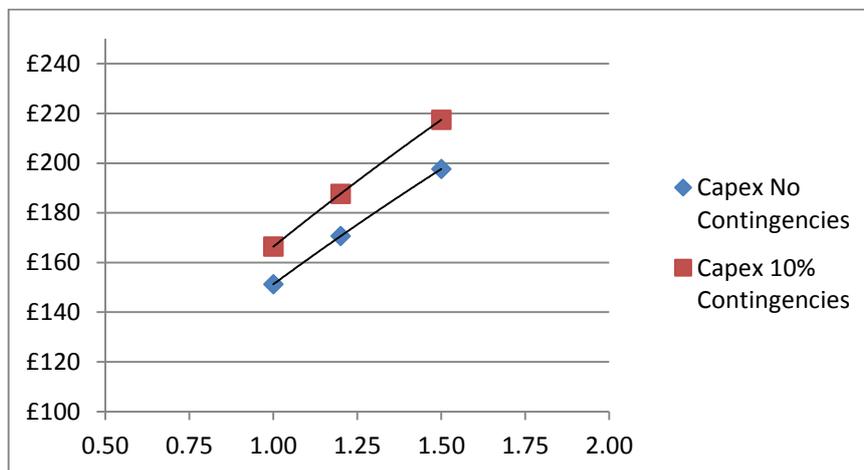
By using cost estimating techniques, it would be possible to estimate the following results;

- Capex without contingencies = £136.47m.
- Capex with 10% contingencies = £150.12m.
- Here again the estimating accuracy is no more than plus/minus 15%.

In this theoretical case the investment for the Brownfield site is assumed to be 80% of the cost of a completely new Greenfield plant installation.

Capital cost benchmarking different integrated cement plant capacities

In ICC experience over the years, a graph showing the typical cost (£m) versus capacity (cement mtpa) can be constructed based on actual costs of projects over the years. A sample of such curves is shown in the figure below;



Generally speaking the capital cost increases by a power law with higher capacity [✂].

[✂], E.g.;

- Cement 1.0 mtpa and capex £151.24 m without contingencies = £151/tonne cement.
- Cement 1.2 mtpa and capex £170.58m without contingencies = £142/tonne cement.
- Cement 1.5 mtpa and capex £197.64m without contingencies = £132/tonne cement.

Curves such as these are very helpful to identify the authenticity of any publically quoted or feasibility study estimates that are far out from the range expected.



Typical Project Timescale

The typical project implementation periods are taken as 24-28 months for a Brownfield site and 30-36 months per Greenfield site based upon the period from contract award to **completion** of commissioning. E.g. sometimes shorter periods of time are quoted in the media for producing first clinker, rather than the period required for a project to reach its full completion test certificate. This agreed achievement of the completion tests is the point in time when the EPC contractor hands over full responsibility of the plant to the new owner.

These time period estimates do not include the period for obtaining planning permission, conducting a public enquiry, etc... Shorter timescales are frequently reported for completing new projects but this may not be applicable in the UK scenario, with tighter planning and environmental controls in place in comparison to other countries.

Therefore based upon the 1.2 mtpa cement plant with 100% new plant supply, the schedule for investment has been based upon a 28 month period as follows (figures in brackets include 10% contingencies);

- Year 1= £76.76m (£84.44m).
- Year 2 = £68.23m (£75.05m).
- Year 3 (4 months) = £25.59m (£28.15m).
- **Total = £170.58m (£187.64m).**

The cost of capital to fund the project will depend upon how the project is funded, E.g. via external loans or via internal resources, etc... Typical figures experienced by ICC for recent projects have been in the range of 5% to 10%. For the UK example, it would not be unreasonable to use the 10% figure. The cost of the debt incurred due to interest during the construction period has not been included in the total capital cost estimates above but sensitivity analysis when financial modelling should indicate the significance of the interest rates applied and to what proportion of the capital cost. E.g. 30% could be from internal funds, and 70% could be from external loans. These % values can differ significantly. This example of capital cost phasing is reasonable for use by the UKCC during their financial analysis of reviewing the financing costs of such a project.



Appendix A – Capital Cost Estimate

General Assumptions

The capital costs (“capex”) for modern cement making processes vary significantly and depend upon a wide range of factors. In order to provide realistic benchmarking figures, the following assumptions have been made;

- The altitude of the plant is no more than 400 meters above the mean sea level. Plants built at high altitudes are penalised in having higher investment costs per tonne output due to factors such as the higher specific process gas volumes/lower gas density associated with their location.
- The design and supply used for the full plant is to be based upon proven, reliable and efficient European contractors. The plant must comply with the latest European environmental standards for emission limit values (ELV’s) as well as European safety standards.
- The capital cost estimates contained within this report are considered to be “budget” costs and are based upon averaging four different cost modelling techniques. The accuracy of all such “budget” estimates is not greater than plus/minus 15%. Actual costs will depend upon market conditions at the time of tendering.
- The Capital Costs are shown both with and without a standard ICC contingencies allowance of 10%.
- The costs estimates relate to costs applying in January 2007 as requested by the Competition Commission.
- Ground conditions are assumed to be good for supporting the foundations of the new plant. If ground conditions are poor, civil costs can increase significantly.
- Working capital is not included within any of the capital cost estimates.
- It is assumed that no purchase of land is required for the Brownfield plant expansion.
- Allowances are included for minimum essential working spare parts and first fill lubricants.
- The M+E supply cost includes an allowance for the plant supplier’s basic engineering.
- The overall cost includes an allowance for consultancy costs plus some of the owner’s team costs including training.
- Obtaining the raw materials reserves or completing the planning permission for a new kiln line at Brownfield/Greenfield sites is generally a lengthy and costly process. It is not straight forward to quantify these costs and they will vary significantly. All costs associated with obtaining planning permission, environmental permits, public consultations etc... are not included in the estimates as the variations of costs for this are significant, and strongly dependent on what was previously approved when the plant was originally built and the existing operational licenses. However, for the purposes of this estimate, ready access to reserves of both limestone and the other raw materials required for cement making lasting 50+ years is assumed.
- Power generation/waste heat recovery (WHR) is not included as this has not tended to be used within the new UK cement plants. With increasing energy costs and CO2 reduction considerations, the use of WHR may become more attractive in the future.
- Process Design Parameters;
 - In order to minimise capital expenditure, single units are used for raw/cement/fuel milling with a single kiln line.



- An Air Separate precalciner kiln process with 5 preheater cyclone stages (SP5) process is assumed although the actual design is site specific and depends upon factors such as the raw material moisture content.
- Minimum Clinker output around 3,040 tpd annual average with a guarantee of at least 3,200 tpd assuming 90% annual average run time. The target run time is typically 87% to 90% but 90% has been assumed in order to minimise investment costs.
- High plant reliability is a prime design requirement.
- The average raw material feed moisture is assumed to be below 5% and the raw mix is assumed to have medium grindability and average combinability characteristics.
- The baseline plant capacity is 1.0 mtpa clinker with a cement to clinker (C/K) ratio of 1.2 producing 1.2 mtpa cement per annum. Please note that alteration of the C/K ratio has a significant impact upon plant total costs as it alters the relative size and cost of the clinker making and cement milling stages.
- It is assumed that there will be typically around 5 cements different produced in both bagged and bulk form with rail loading facilities.
- A kiln bypass system (10% design with operation around 5%) is included in order to allow for the burning of alternative fuels such as RDF/SRF whilst avoid build ups due to chlorine input.
- The plant design would be sufficiently sized to allow it to burn alternative fuels (AF) such as tyres, MBM, RDF etc in order to be competitive in terms of its cost of operating costs ("opex").
- The capital costs for AF storage, handling and firing are not included initially as this would have to be justified and permitted by a stage wise approach.
- Facilities would also be provided to allow operation with up to 100% coal or petroleum coke firing.
- Cement sales – the seasonality of cement sales is assumed to be around 18% average and so it is not necessary to oversize the cement milling system for peak demand periods. Cement grindability is assumed to be average.
- Clinker storage is 14 days with 10 days cement storage.
- The pyritic sulphur content of the raw materials is sufficiently low so that an SO₂ scrubber is not required for the main exhaust gases. NO_X reduction – the use of Multistage Combustion and SNCR (Selective Non Catalytic Reduction) are allowed for.
- The plant location is close to the quarry avoiding long overland conveyors. Quarrying costs allow for the raw material crushing and conveying but not contractors mobile plant.
- Adequate road, rail and power supplies are located close to the cement plant.
- The baseline case is a Greenfield site and it is assumed that the new line requires standalone facilities i.e. the existing plant do not have surplus storage or milling capacity.
- The capital cost of many Brownfield site projects may be typically 70% to 90% of the cost of an equivalent Greenfield site and so this scenario has been shown as an example. Actual Brownfield site costs vary significantly worldwide depending upon whether or not the existing plant is retained, modified or replaced.
- VAT is not allowed for in the ICC Capital Cost estimates.
- The basis for ICC capital costs is £ Sterling but note that exchanges in the Euro/Sterling exchange rate make it difficult to estimate 2007 costs accurately. Hence ICC has assumed an estimating accuracy no greater than plus/minus 15%.
- The cost of capital is assumed to be typically 5% to 10% of the total capex.
- Depreciation of the plant would be based upon a 25 year life. Actual plant life will depend upon raw material reserves, the financial viability of future modernisation, the



design standards a plant was built to and how well the plant is operated and maintained.

- CO2 allocation – There are no allowances included for the costs associated with the right to buy CO2 emissions under the EU ETS Phase 111 scheme. The benchmark of 0.766 kg CO2 per tonne clinker would require the plant to maximise the use of bio fuels and achieve efficient operation. Hence facilities to store transport and fire bio fuels such as MBM, PSP or partial bio fuels such as RDF/SRF would need to be sought in order to reduce CO2 emissions.
(N.B. The CO2 allocation figures have changed since 2007).



Appendix B – Further factors affecting the Capital Cost of a new Brownfield Cement Plant

Increases

The following list is not an extensive list but highlight additional potential reasons for capital cost estimates for completing projects being beyond expected limits; [✂].

Decreases

The following list is not an extensive list but highlight additional potential reasons for capital cost estimates for completing projects being below expected limits; [✂].