

Mr. Ian Blayney, Chairman
Parliamentary Inquiry into Economic Implications of Floating Liquefied
Natural Gas (FLNG) Operations
Economics and Industry Standing Committee
Legislative Committee Office
Level 1, 11 Harvest Terrace
West Perth, WA, 6005

Dear Ian,
RE: Submission to FLNG Parliamentary Inquiry.

This letter forms my submission to the FLNG Parliamentary Inquiry being managed by the Economics and Industry Standing Committee.

I have attached a copy of a report on the study I completed for the Cement Concrete & Aggregates Association (CC&AA) of Australia, in early October 2012, entitled "Review of the Concrete Market in the Western Australian (WA) and Northern Territory Resources and Related Infrastructure Sectors".

My report to the CC&AA alludes to several of the important technical and industry development issues regarding impacts, on the Engineering and Design, Fabrication and Manufacturing as well as Construction and Ancillary Services sectors, from using FLNG operations (related to the use of floating facilities) and conventional oil/condensate/natural gas operations, using gravity based and floating concrete support structures.

In particular, specific reference is made on page 4 of my report to the demonstration, in 1996, of the continuing potential for construction and fabrication of large foot – print and heavy concrete support structures in WA. This potential was initially realised as a result of the successful construction of the 81,000 tonne Wandoo B oil production and storage gravity based concrete structure, at the currently existing Bunbury Harbour Casting Basin.

The WA Government (in conjunction with the Bunbury Port Authority), as an incentive for Ampolex (now part of Exxon Mobil) to construct the Wandoo B support structure in WA and gain major WA industry participation, constructed the Bunbury Casting Basin at a cost, in 1995, of about \$10.00 million.

The WA Government, through the agency of the Department of State Development (DSD), undertook a further study, in 1995, to demonstrate that it could be technically and commercially viable to expand the Bunbury Casting Basin so as to allow large foot – print and heavy concrete floating production facilities support and storage structures, as well as large gravity based concrete support and storage structures, to be constructed at Bunbury.

In this regard, I understand from press and other reports in 1996, Woodside carried out major feasibility studies on the Browse Basin LNG project's off – shore and on - shore development options. At that time, one of the main Browse Basin LNG project development reference cases proved to be the utilisation of large foot – print gravity based concrete structures and platforms for supporting the offshore LNG production facilities which were to be located adjacent to Scott Reef.

Importantly, the above mentioned DSD study indicated that the Bunbury Casting Basin could be used either in its current format or as expanded to accommodate construction of large concrete support and storage structures suitable for Browse Basin LNG project developments. In addition, the WA Government's currently proposed "Pilbara Fabrication and Services Common User Facility", to be located at Port Hedland, could be designed and built to enable fabrication and construction of both large concrete gravity based and floating LNG facility support and storage structures.

In view of the current debate and major economic opportunity, for WA Local Industry to participate in the fabrication, construction and delivery of off – shore petroleum project developments, it is clearly evident that it is necessary for the WA Government to immediately undertake detailed technical and economic studies on the feasibility of utilising WA infrastructure in developing and servicing off – shore petroleum projects, such as the FLNG projects now being considered for the Browse Basin.

I would be pleased to be interviewed regarding my experience and views on this important subject which is directly related to the future direction of one of the key aspects of Local Industry Participation and economic development in WA. As mentioned in my report to the CC&AA, the recent successful utilisation of the Australian Marine Complex, for delivering the off – site fabrication and construction of 56 large pre – cast concrete and steel caissons for the Gorgon LNG project's export jetty and other key project items, has demonstrated that the WA fabrication/construction and resource sector servicing industries can effectively utilise available infrastructure to meet the needs of large offshore petroleum and mining projects.

As I will be travelling overseas from 19 August to 16 September 2013, I will be available for an interview from 17 September 2013 onwards and I look forward to your advice on the matter.

Yours sincerely,

David P Ryan.

PRINCIPAL CONSULTANT
DAVID RYAN CONSULTING

12 August, 2013

Attachment:

REVIEW OF THE CONCRETE MARKET IN THE WESTERN AUSTRALIAN AND NORTHERN TERRITORY RESOURCES AND RELATED INFRASTRUCTURE SECTORS



PREPARED BY: David P. Ryan
FOR: The Concrete Offshore Structures Industry Committee
Date: 5 October, 2012



The Concrete Offshore Structures Industry Committee (COSI) Members:

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Chair - David Meager (Evans & Peck and Concrete Institute of Australia)

David Ryan (David Ryan Consulting)

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DRC Project No. 1251.

Front Cover: At The Australian Marine Complex (AMC) – Steel Topsides being fitted to one of the 56 concrete caissons, fabricated at the AMC and weighing 3,000 tonnes each, for the Gorgon Project Export Wharf.

Disclaimer

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1.0 EXECUTIVE SUMMARY

This report provides key information to the Concrete Offshore Structures Industry Committee (COSI) regarding the current and future demand for concrete in the Resources and related Infrastructure sectors, in Western Australia (WA) and the Northern Territory (NT). An indicative outline of the current concrete market in the key WA Resources sectors, namely Oil & Gas and Infrastructure, is provided following the review of the WA and Australian concrete markets.

In particular, the review of demand for concrete, in fabrication of concrete offshore structures, prefabricated concrete items, precast concrete items and other concrete usage, has clearly shown the main reasons for the recent and potential rapid growth in concrete demand on both a national and state basis. In this regard the Concrete Industry should consider promptly undertaking a strong Australia wide promotion program in the resources and related infrastructure sectors.

The potential for a significant increase in the use of concrete in the Oil & Gas, Mining and Infrastructure sectors was identified in the earlier Concrete Offshore Structures Industry Committee (COSI Committee) study, undertaken in May 2008, which focussed on specific technical issues related to the utilisation of concrete in the construction of various marine and offshore structures, especially Concrete Gravity Structures (CGS).

This report provides relevant information on current engineering and project delivery trends, in the Oil & Gas and Infrastructure sectors, which are favouring the usage of concrete, mainly in development of several currently proposed conventional LNG projects. Off - site prefabrication, preassembly and assembly of key precast concrete items, prior to delivery to the project site, appears to have become an attractive project delivery option for major conventional LNG projects and could apply to more infrastructure project developments in the near future.

As the large conventional WA and NT LNG projects are currently providing the growth engine of Australia's Oil & Gas sector, the Chevron Australia (Chevron) – operated \$43 Billion (B) Gorgon Project has been used

in this study as the prime example to demonstrate the technical and commercial trends in concrete usage in such projects. The Gorgon Project, utilising the Greater Gorgon Area gas fields, offshore in the Carnarvon Basin, has extensively used concrete in an offsite focussed construction approach for most of the major downstream contract items, while utilising the Australian Marine Complex (AMC) common user infrastructure and associated facilities at Henderson, in WA.

Chevron has advised the Author that it expects the Gorgon Project to use approximately 390,000 cubic metres (m3) of locally supplied concrete which represents about 15.0% of the current Total WA concrete market of 2,530,000m3 and about 34.0% of the current WA Engineering Construction sector market. The Gorgon Project's locally supplied concrete usage represents about 6.0% of the current Total Australian Engineering Construction sector concrete demand and almost 2.0% of the forecast 2011/12 Total Australian annual concrete market of about 23,000,000m3.

Chevron also expects the Gorgon Project to use approximately 100,000m3 of overseas produced concrete in the form of precast primary concrete armour units and precast concrete caissons. This type of importation indicates that there may be significant import replacement opportunities for local concrete suppliers and resource project developers in the future if Marine Common User Facility (MCUF) availability is improved.

It is expected that Chevron's use of the AMC (an MCUF) for the Gorgon Project will demonstrate achievement in the optimisation of project execution and project delivery timing. In this regard, it is likely that the same or similar project delivery approach can be used by project proponents to significantly improve unit costs in the development of the large number of both currently committed and newly proposed major resources and related Infrastructure projects.

Chevron's decision to utilise the AMC facilities further emphasises the need for the Concrete Industry to promote the benefits of using the AMC facilities, as

well as other currently available and newly proposed MCUFs such as the Lumsden Point MCUF, when concrete precasting, prefabrication, assembly and load - out options are feasible.

There is also a clear case for resource project developers to consider the existing AMC and Bunbury MCUF sites as well as other potential MCUF sites in WA, such as Geraldton and Lumsden Point, for fabrication and manufacturing CGS, Floating LNG (FLNG) structures as well as other key precast concrete items for the varied types of resource and related infrastructure projects. In addition the MCUFs can also be utilised for offloading incoming materials, heavy equipment and pre – assembled units during initial construction, project expansion and operational phases of resource projects.



2.0 INTRODUCTION AND OBJECTIVES

This report is a summary of the findings of a study undertaken on behalf of the COSI Committee and provides a snap shot review of the market situation with respect to the demand for Concrete Offshore Structures, Prefabricated Concrete, and other Concrete Elements in the WA and NT Oil & Gas and related Infrastructure Sectors.

The potential for a significant increase in the use of concrete in the petroleum and mining sectors was identified in the COSI Committee study, undertaken in May 2008, entitled “Potential for Construction of Concrete Structures in WA for Offshore, Marine & Resource Infrastructure”, (K. P. Thiagarajan, 2008).

Continuing high levels of exploration activities in the many highly prospective onshore and offshore petroleum resource provinces of WA and the NT have increased significantly in recent years and this has resulted in a number of major natural gas discoveries. Major onshore minerals discoveries, especially of iron ore, have also occurred and these petroleum and minerals resource discoveries have not only prompted a number of major project development decisions for new projects but have also resulted in the commitment of several major resource project expansions.

These resource projects require significant infrastructure development and a major opportunity, for significantly increasing the use of concrete in the national and state infrastructure sectors, now exists.

The recent round of commitments for development of major petroleum resource projects, for example conventional LNG projects, has resulted in a very significant increase in concrete usage in both the WA and NT markets. Given the number of proposed and

potential LNG projects, there appears to be a very high predicated demand for concrete which is currently being shown to be suitable for off - site construction of major precast concrete items required for LNG project marine offloading, processing and product load – out facilities.

In addition, as indicated in the earlier COSI Committee study, due to the large number of potential natural gas projects there is also a predicated demand for a range of offshore support platforms, such as CGS, which are possibly more suitable technically than piled steel structures for installation in soft seabed conditions, typically found in deeper offshore sea locations.

It is also likely that there will be high demand in the near future for small FLNG facilities due to the number of potential LNG projects requiring greater flexibility in development, as well as lower costs and a broader scope of use in developing both large gas fields (>2.0 Trillion Cubic Feet (Tcf) and small gas fields (<2.0Tcf), (Andrew Williams, 2012).

With the recent increase in unit costs for conventional onshore LNG projects, FLNG offers a viable alternative development method as this gas field development option provides an early commercialisation option because it is not necessary to prove up large initial gas reserves prior to full appraisal of the gas field, whether in shallow or deep water locations, (Bernstein Research, 2012).

The existing WA MCUFs, at the Bunbury Port Authority Casting Basin and at the AMC in Henderson (see photo below), could be used to fabricate small concrete FLNG facilities (required for development of small gas fields with <2.0Tcf of gas reserves) which



AMC Facility at Henderson

could be floated out in a conventional fashion or while using air – cushions in an “Air – Lift” mode.

The potential for construction and fabrication of large foot – print and heavy concrete structures in WA, required for large oil and gas field developments, has been clearly demonstrated in the past when the concrete gravity base of the 81,000 tonnes (t) Wandoo B oil production and storage platform or SGC was constructed in the Bunbury casting basin in 1995 – 96. After using a slip – forming process, the Wandoo concrete gravity base was floated out of the Bunbury casting basin and towed to the Wandoo oil field, which is located 100km offshore in the Carnarvon Basin, in WA’s North West Shelf gas province. The CGS was completed with a float over of the steel topside after the gravity base was anchored to the sea bed.

.The Main Objectives

The main objectives of the report are as follows:

- To provide a snap shot of relevant details on the current and expected further use of concrete in construction of key items required by the WA and NT Resources and related Infrastructure sectors.

- To provide views, on trends in major resource project design, offsite prefabrication, construction and delivery methods, held by representatives from relevant Port Authorities, key major Petroleum Companies, Main Contractors, Engineering/Design Consultants as well as the AMC Management.
- To provide details on the technical and commercial issues influencing these trends.
- To identify the current and potential use of precast concrete for prefabricated concrete items and for in – situ applications related to the development of major resource projects, namely the committed Gorgon Project, the Wheatstone LNG project and the Browse (Inpex) LNG project, as well as the proposed Browse (Woodside) LNG project and other proposed projects.
- To provide information to assist the Concrete Industry in determining the extent and type of promotion needed to maintain the rate of increase in the demand for concrete in the WA & NT Resources and related Infrastructure sectors.



AMC Facility at Henderson - Gorgon Project Caisson Units



3.0 THE MARKET FOR CONCRETE OFFSHORE STRUCTURES, PREFABRICATED CONCRETE, PRECAST CONCRETE ITEMS AND OTHER CONCRETE USAGE IN THE WA AND NT OIL & GAS, RESOURCES AND RELATED INFRASTRUCTURE SECTORS

3.1 Key Factors Influencing Concrete Usage in Currently Committed and Proposed Resource Development Projects in the WA and NT Oil & Gas, Mining and Infrastructure Sectors

- The Oil & Gas Sector

As foreseen in the earlier COSI study, the AMC has recently become a fully integrated and functional MCUF for undertaking major off – site prefabrication and assembly of concrete items such as caissons, wharf modules, equipment bases and general project facilities foundation blocks. In the case of the Gorgon Project which is currently using a major proportion of the AMC fabrication facilities and area, the fabricated concrete items are subject to a variety of handling procedures prior to loading for barging to Barrow Island, which is the site of the Gorgon Project processing and load – out facilities.

Importantly, in an attempt to significantly improve the cost structure of the Gorgon Project delivery, the AMC facilities have been integrated with a large concrete batching plant located within the AMC precinct. As a result of pre - casting facilities being available at the AMC, the AMC represents one of the key components in achieving technical and commercial viability for the \$43B Gorgon Project.

As shown in the Attachment 1 Analysis table, the Gorgon Project is expected to use approximately 390,000m³ of locally supplied concrete in the construction phase, either at the AMC or for in – situ construction requirements. In addition, it is expected that Chevron's currently committed \$29B Wheatstone LNG project, utilising Wheatstone gas field offshore gas resources, in the Carnarvon Basin, will potentially use at least 220,000m³ of locally supplied concrete.

In recent years, the AMC prefabrication facilities have also been extensively used for marine pre – cast concrete and steel fabrication work for Pilbara Iron Ore projects as well as other mining sector projects. The main fabrication activities had mainly been centred on steel fabrication and pre – assembly of ore handling/ stacking and product load – out wharf decking items.

The extensive use of the AMC infrastructure by major petroleum and mineral resource companies reflects the fact that cost structures of petroleum and mining sector projects can be reduced when using offsite fabrication, preassembly, assembly and load – out methods. Importantly, the use of precast concrete in the offsite manufacture of key project items has become a technically and commercially viable option of project execution and delivery.

Bernstein Research recently estimated that the costs of conventional LNG projects (such as the Gorgon Project) have recently risen to between \$3,000 and \$4,000 per tonne of installed LNG production capacity in Australia, a four-fold increase within the last ten years. (Bernstein Research, 2012).

In addition, Shell has also recently estimated that the Prelude FLNG project will cost between \$3,000 and \$3,500 per tonne of installed LNG production capacity, with the likelihood of significant cost reductions occurring as more FLNG facilities are built to meet demand (Angela Macdonald – Smith, 2012).

The major role of concrete in reducing cost structures of major conventional LNG projects is expected to be demonstrated by the Gorgon Project which has an expected cost of about \$2,900 per tonne of the currently designated installed LNG production capacity (15.00 million tonnes per annum (Mtpa)). It is anticipated that the Gorgon Project will produce first gas in 2014. The Concrete Industry expects this major resources project to indicate that the extensive use of concrete, in delivering the project's key downstream contract items, has significantly improved project delivery in terms of environmental, scheduling and cost impacts.

- The Resources (Mining and Related Infrastructure) Sector

Despite current evidence of slowing growth in the China economy, the major market for WA iron ore, Rio Tinto, BHP Billiton and Fortescue Metals remain committed over the long term to significantly increasing production in the Pilbara, either by investing in new projects or by undertaking major project expansions.

There are also several second – tier iron ore companies that plan to increase output in the short term and so there will be a major opportunity for promoting Concrete usage in the Iron Ore mining sector, as well as the Oil & Gas and Infrastructure sectors.

It is therefore essential that, from the viewpoint of continuing growth in the Concrete Industry and continuing efforts to increase Local Industry Participation in major resource development projects, the local pre – mixed concrete, fabrication and construction industries are strongly supported by all stakeholders. This support should be consistent with ensuring that steel and concrete fabrication facilities, at the AMC and the proposed new MCUF at Port Hedland's Lumsden Point, are world class facilities. Support for these MCUFs and other possible MCUF infrastructure, for example an up – grade and/or expansion at the Port of Bunbury, should be provided by the Concrete Industry as well as the resource development companies, concrete manufacturers and by the main and sub – contractors.

3.2 The Growth Engine of Australia's Oil & Gas Sector – LNG Projects

Australia, currently the world's fourth largest LNG producer, is set to become the second largest LNG producer by 2015 and possibly the largest in the early 2020s. The Australian Oil & Gas sector is increasingly focussing on LNG projects to drive growth in the sector and so it is very likely LNG will continue to be a major growth industry and involve major capital investment and associated technical advancement, especially in pre - cast concrete and prefabricated concrete item delivery methods (John Hirjee, 2012).

In 2011, Australia again led the global LNG industry with 6 new LNG trains (totalling 24.5Mtpa of LNG capacity) committed. In view of the current outlook for world economic conditions, there is strong evidence suggesting that the 2011 level of LNG project commitment will not continue in 2012/2013 (John Hirjee, 2012). It is likely, however, that even with the continuing labour shortages, severe deficiencies in MCUF capacity or availability and significant overall project development cost inflation pressures, the expected strong growth in demand for this competitively priced and environmentally acceptable clean fuel will continue to be met for many years.

Whether the LNG projects are based on onshore or offshore gas reserves, the demand for pre - cast concrete by the petroleum industry is likely to continue its very strong current growth. At this point, 100.00Mtpa of installed LNG capacity (conventional LNG or coal seam gas and shale gas based LNG) is either in the Planning, Front End Engineering and Design (FEED) or Construction phase for Australian LNG projects.

In this regard, it should be noted that world – wide natural gas demand for power generation, alone, is projected to increase by 85% over the next three decades, from 2010 levels, and this demand will represent nearly half of the total world – wide demand for natural gas.

It is therefore likely that most Australian conventional LNG projects, currently in the planning and FEED phase, will proceed and the new WA/NT LNG project capacity in this category that will be installed over the next few years is estimated to be at least 25Mtpa of LNG.

As shown in the Attachment 1 Analysis table, assuming new conventional LNG projects use a similar construction and delivery approach to that of the Gorgon Project, there is an estimated potential new demand for concrete totalling 440,000m³ in the Browse and Scarborough LNG projects, which will result in about 23.0Mtpa of new installed LNG capacity.



3.3 Current Trends in Construction and Delivery Methods for Key Project Items of WA/NT Conventional LNG Projects – The Gorgon LNG Project’s Utilisation of the AMC Infrastructure

The Chevron - operated Gorgon Project is a natural gas project on Western Australia’s North West Shelf, involving the development of the Greater Gorgon gas fields which are located 130 kilometres (km) offshore, in a water depth of between 200 and 1300 metres. Gas production is based on subsea gas – gathering infrastructure and a conventional LNG plant on Barrow Island. The project, also including a domestic gas component, is currently under construction and will be Australia’s fourth LNG export project development. The raw gas will be transported from the offshore central gas gathering point by sub – sea pipeline to Barrow Island which is 85km north, north - west of Onslow, located on the WA North West coast.

The Greater Gorgon gas fields contain approximately 40Tcf of gas reserves which will support the project for about 60 years, while producing 15Mtpa of LNG and 300 terajoules per day of domestic natural gas.

The Gorgon Project construction and delivery method indicates that for conventional LNG projects (with gas reserves greater than approximately 5.00Tcf, in water

depths of between 200m to 1000m, with distances to shore of up to 450km and with constrained areas for materials offloading/lay – down, plant item assembly, construction and processing plant), the use of the MCUF infrastructure at the AMC, for offsite prefabrication, preassembly and assembly of large heavy concrete and composite concrete/steel items, is expected to be proven as being a technically and commercially viable project delivery option.

Several other WA/NT LNG projects, as shown in the Attachment 1 analysis table, could successfully utilise the same project construction and delivery method as being applied for the Gorgon Project. These further conventional LNG projects are, namely, Wheatstone, Ichthys, Browse LNG and Scarborough.

Chevron continues to utilise a major proportion of the AMC infrastructure for the Gorgon Project’s precasting, preassembly, assembly and load – out of the major concrete items on to barges. Chevron’s use of the AMC facilities (see photograph below of caissons) has further heightened the need for the Concrete Industry to further promote the benefits of using the AMC facilities (and other suitable currently available and newly proposed MCUF infrastructure) where precasting and prefabrication options exist. Importantly, Chevron is expected to demonstrate that the utilisation of AMC type MCUFs can significantly improve project delivery in terms of environmental,



Gorgon Project - Construction of Caisson Units

scheduling and cost impacts. This improvement will mainly result from increased productivity by avoiding extensive onsite / in – situ construction of concrete items / facilities as well as composite concrete and steel items.

The Gorgon Project Package listing on “ProjectConnect” indicates that several of the major “Gorgon – Downstream” contracts were awarded to main contractors, such as to the Saipem Leighton Consortium (SLC) (for 56 large concrete/steel Caissons, each of 3,000t and the Materials Offloading Heavy Lift Facility (MOF)), to Leighton Contractors (for the Civil and Underground Services contract) and to Boskalis Australia (for the Material Offload Facility (MOF) Concrete Wharf Modules contract).

Each of these main contractors have taken full advantage of the AMC infrastructure which provides world – class integrated precast, lay – down, preassembly, assembly and load – out facilities. The benefit to Chevron and the main contractors, from using the AMC infrastructure (Refer photo below of Units in Laydown area), has been enhanced by the employment of several carefully designed materials and key items handling techniques.

For example, the SLC has used efficient handling techniques in erecting the steel topsides onto the concrete caissons prior to being loaded onto a semi submersible barge, at one of the AMC wharves, for

transhipment to Barrow Island.

By utilising the AMC infrastructure, Chevron has in effect extensively used offsite labour and avoided transhipment of raw materials and services to the environmentally sensitive Barrow Island. This approach has allowed Chevron to comply with the Gorgon Project’s stringent quarantine provisions.

Chevron and the main contractors are investigating new packaging and handling strategies at the AMC focussed on improving safety and reducing load time of concrete onto marine vessels, before transport to Barrow Island.

In the case of the MOF and Heavy Lift Facility contract (partly for supply of precast concrete armour requiring about 90,000m3 of concrete and 155 small precast concrete caissons requiring about 10,000m3 of concrete), about 100,000m3 of concrete will be supplied from overseas. This situation eventuated before the benefits that could be obtained from timely and suitable access to a WA marine common user facility (MCUF) were fully recognised.

This type of importation indicates that there may be significant import replacement opportunities for local concrete suppliers, main contractors and resource project developers in the future, if MCUF availability is improved.



AMC Facility - Concrete Unit Lay Down Area

4.0 USAGE OF CONCRETE IN MAJOR CURRENTLY COMMITTED AND PROPOSED WA/NT OFFSHORE CONDENSATE AND NATURAL GAS PROJECTS

The results of this review of the major currently committed and proposed WA/NT Offshore natural gas are shown in the Attachment 1 analysis table.

The Gorgon Project, as highlighted above, provides clear evidence of a very significant potential demand for concrete in the WA/NT Resources and Infrastructure sectors.

In this regard, Chevron has advised that it expects that at least 390,000m³ of locally supplied precast and in – situ concrete will be used in the construction phase of the Gorgon Project. (Chevron's concrete usage numbers are based on contracts with a significant concrete content).

Based on estimates derived from the assessment of the Gorgon Project's concrete usage, it is expected that the Wheatstone LNG project, which is in the pre – construction phase, will potentially use about 220,000m³ of locally supplied concrete. The estimated Wheatstone concrete usage is based on the assumption that Chevron can effectively utilise a new MCUF and/or the common user infrastructure at the AMC, as well as facilities that may be available at the planned Ashburton North Industrial Precinct, south of Onslow.

In the case of the Ichthys LNG project in the Browse Basin, raw gas will be transported from the semi - submersible production platform, via an 850km gas pipeline to the Darwin LNG precinct which is adjacent to the Darwin Harbour. It is estimated that the Ichthys LNG project will also potentially use about 220,000m³ of locally supplied concrete.

Footnote (a) of Attachment 1 shows that, for “Currently Committed” Non FLNG projects, the usage of concrete is approximately 23,500m³ of concrete per million tonnes per annum of installed LNG production capacity and approximately 7,000m³ of concrete per \$B of LNG project investment.

Footnote (b) of Attachment 1 shows that, for “Proposed” Non FLNG projects, the use of concrete is approximately 16,000m³ of concrete per million tonnes per annum of installed LNG production capacity and approximately 5,500m³ of concrete per \$B of LNG project investment.

If the assumed value of one tonne of “supplied” pre – mixed concrete is approximately \$300.00/m³ in the Perth metropolitan area (at the AMC site), the Concrete Industry has a major potential earnings opportunity by gaining a high level of participation at least in the expected future growth of the conventional LNG sector. At this concrete supply price, the value of the Gorgon Project's locally supplied concrete, alone, would be approximately \$120M.

In addition, as mentioned above, it is likely that there will be a significant opportunity, in the short term, for the Concrete Industry to further promote construction of CGS as well as small concrete FLNG facilities at the Bunbury Casting Basin or alternatively at the AMC. It is likely, however, that with the current water depth limitations at the Bunbury Harbour and at the AMC, large concrete FLNG facilities could not be floated out, even with the assistance of technically possible “Air – Lift” methods. Current WA Government studies on new MCUF developments for WA should take in to account the potential need to accommodate construction of large concrete FLNG facilities in WA.

In the case of general utilisation of existing and/or new MCUFs by future resource projects, the extensive application of offsite precast fabrication methods will largely depend on MCUF availability. Importantly, in terms of the current need for additional MCUFs in WA, these facilities can also be extensively utilised for offloading incoming general materials, heavy equipment as well as pre – assembled concrete and steel units during initial construction, project expansion and operational phases of resource projects.

5.0 AUSTRALIAN AND WESTERN AUSTRALIAN CONCRETE MARKETS – THE SIGNIFICANCE OF CONCRETE USAGE IN THE OIL & GAS, RESOURCES AND RELATED INFRASTRUCTURE SECTORS

- The Australian Concrete Market and Engineering Construction Sector Demand

The Australian and WA concrete usage figures provided, below, are for the Engineering and Construction Sector of which the Resources Sector is an important component.

Total Australian concrete usage in 2011/12 is forecast, by the Concrete Industry, to be about 23,000,000m³. The Total Australian current usage of concrete in the Engineering Construction sector (which includes the Oil & Gas, Mining and related Infrastructure sectors) is estimated by the Concrete Industry to be 6,250,000m³ which is about 27.0% of the Total Australian Concrete market, 2011/12

- The Western Australian Concrete Market and Engineering Construction Sector Demand

The Total WA usage of concrete in 2011/12 is forecast, by the Concrete Industry, to be about 2,530,000m³. The WA usage of concrete in the WA Engineering Construction sector is estimated by the Concrete Industry to be between 40% and 50% of the Total WA concrete market. This results in the estimated 2011/12 WA Engineering Construction sector usage of concrete being about 1.14Mm³, which is about 45% of the Total WA concrete market of 2.53 Mm³.

The current WA Engineering Construction sector demand for concrete of 1,140,000m³ represents about 5.0% of the Total Australian concrete market and about 18.0% of the Total Australian Engineering Construction sector demand for concrete.

- The Significance of the Engineering Construction Sector Demand for Concrete

Chevron expects that the Gorgon Project will use about 390,000m³ of locally supplied concrete. This usage is about 15.0% of the Total WA concrete market, in 2011/12, of 2,530,000m³ and about 34.0% of the WA Engineering Construction sector concrete market of 1,140,000m³. The Gorgon Project usage of

locally supplied concrete represents about 6.0% of the Total Australian Engineering Construction sector concrete demand and almost 2.0% of the Total Australian concrete market.

- The Outlook for New Resource and Infrastructure Project Development in Australia

Although there is a strong likelihood that several major local and international Oil & Gas companies will proceed to develop a relatively large number of conventional and non – conventional world – scale LNG projects, over the next few years in Australia, it is apparent that further major growth in the resources sector demand for concrete would be greatly assisted by the Concrete Industry conducting a stronger and more targeted concrete promotion program for the Resources sector (including iron ore and other key minerals projects) and related Infrastructure sectors.

With a relatively large number of coal seam and shale gas based LNG projects also likely to proceed over the next few years, especially in the Eastern States of Australia, the Concrete Industry should now also undertake a strong Australian – wide concrete promotion program with specific targeting of the newly proposed Eastern Australian Oil & Gas projects and related Infrastructure sectors.

The current slowing in the demand for concrete in the residential and non – residential building markets also emphasises the need for a strong marketing and promotion program for concrete in the Australian resources and related infrastructure sectors.

As mentioned in section 3.3, the Gorgon Project has taken full advantage of the AMC infrastructure which provides world – class integrated precast, lay – down, preassembly, assembly and load – out facilities. The AMC and other available WA MCUFs could be utilised in future for competing with precast unit importation and the expected import replacement opportunities should be included in a marketing program.



6.0 CONCLUSIONS AND RECOMMENDATIONS

The recent round of project development commitments by several major local and international petroleum resource companies, particularly for large WA and NT conventional LNG projects, has resulted in a very significant increase in concrete demand in both the WA and NT concrete markets, in 2011/12.

The estimated Gorgon Project's locally supplied concrete usage of 390,000m³ represents about 6.0% of total Australian Engineering Construction sector concrete demand. The Gorgon Project therefore suggests that a relatively limited number of similar new LNG projects are likely to significantly improve the dynamics, trends and economic outlook of the Australian Concrete Industry.

Concrete is currently being shown to be highly suitable for offsite construction of major concrete items required for construction of LNG project marine offloading, processing and product load – out facilities. Given the impressive number of currently proposed and potential LNG projects in Australia, there is therefore a very high predicated demand for concrete in the resources and related infrastructure sectors.

Chevron, while pioneering composite concrete/steel construction and new handling techniques at the AMC (see photograph of marine caisson units below

and footing units over page) for the Gorgon Project, has set out to improve project delivery in terms of environmental, scheduling and cost impacts. It is expected that Chevron will be successful in its endeavours at the AMC and that the same or very similar project delivery approach will be used by several other Oil & Gas, Mining and Infrastructure sector project development companies in the future.

As the Oil & Gas, Mining and Infrastructure sectors present a major opportunity to achieve continuing and rapid growth in concrete demand over the next five to ten years, the Concrete Industry should immediately undertake a strong Australia wide promotion program in the resources and general infrastructure sectors. The potential threats of import replacement should be recognised.

The Chevron – operated Gorgon Project has clearly demonstrated the impressive Australian fabrication and delivery capability for large and heavy precast contracts, while employing an offsite construction approach at the AMC. Local contractors, such as the SLC, have competed with overseas precasting operations and thereby show that there are likely to be several major import replacement opportunities for precast items required by future major resource projects in Australia.



Gorgon Project - Marine Caisson Units at AMC

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Precast footing units at AMC

ATTACHMENT 1 - USAGE OF CONCRETE IN MAJOR CURRENTLY COMMITTED AND PROPOSED WA/NT OFFSHORE CONDENSATE / NATURAL GAS PROJECTS

Project Name / Major Company Interest	Investment (\$B)/ Usage of Concrete (Mm3)	Reserves - Condensate (Mbls)/Natural Gas (Tcf)/LNG Production (Mtpa), (Start – up)	Basin/Sea Depth (m) & Distance of Field to Shore (km)	Type of Offshore Production or Support Structure	Location/Type of Onshore MOF & Processing Facilities	Location/Type of Product Load – out Facilities
<i>Currently Committed ^(a)</i>						
Gorgon LNG / Chevron	43.0 / 0.39 Est.	na/40.0/15.0,(2014)	Carnarvon / 200 / 130	Sub – sea Gas Gathering Infrastructure	Barrow Island / Small Concrete Caissons & Other Pre – cast, In – situ Items	Barrow Island / Large Concrete Caissons
Wheatstone LNG / Chevron	29. 0/0.22 Est.	na/4.5/8.9,(2016)	Carnarvon / 213 / 200	Fixed Platform	Onslow / TBA	Ashburton North / TBA
Prelude FLNG / Shell	12.0/0.00 Est.	na/3.0/3.6,(2016)	Browse / 250 / 475	FLNG	na	na
Ichthys LNG / Inpex	35.0/0.22 Est.	527.0/12.8/8.0,(2017)	Browse / 250 / 200	Semi – Sub Plat.	Darwin / TBA	Darwin / TBA
Total Invest. / Usage / Prod.	119.0/0.83 Est.	35.50 LNG Prod.				
<i>Proposed ^(b)</i>						
Browse LNG (Woodside)	36.0/0.22 Est.	417.0/15.5/15.0,(2018)	Browse / 750 / 425	TLP & DTU's	James Price Point / TBA	James Price Point / TBA
Sunrise / Woodside	14.0/0.00 Est.	226.0/5.0/3.0,(2020)	Bonaparte / 600 / 500	FLNG	na	na
Scarborough / BHP & ExxonMobil	24.0/0.22 Est.	na/10.0/8.0,(2020)	Carnarvon / 900 / 280	Semi – Sub. Plat.	Ashburton North / TBA	Ashburton North / TBA
Bonaparte FLNG / GDF	6.0/0.00 Est.	na/3.5/2.00,(2016)	Bonaparte / 100 / 250	FLNG	na	na
Total Invest. / Usage / Prod.	80.0/0.44 Est.	28.00 LNG Prod.				
TOTAL INVESTMENT / USAGE & LNG PROD.	199.0/1.27 Est.	63.50 LNG Prod.				

Footnote (a). For Currently Committed Projects (Non FLNG), Usage of Concrete is approx. 23,500m3/Mtpa of Installed LNG Capacity and approx. 7,000m3 of Concrete/ \$B of Project Investment.

Footnote (b). For Proposed Projects (Non FLNG), Usage of Concrete is approx. 16,000m3/Mtpa of Installed LNG Capacity and approx. 5,500m3 of Concrete/ \$B of Project Investment.

