ExxonMobil

Point Thomson
Gas Cycling Project

Infield Road System Needs and Alternatives

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Introduction

This document provides a summary of an evaluation of the needs for infield (gravel) roads and alternatives means of access and transportation to the East and West well pads that may meet those needs. This evaluation has been developed for the agency EIS team to assist in their development and analysis of alternatives.

This evaluation of the need for infield roads should be considered in the context of alternatives considered and rejected by ExxonMobil during conceptual engineering. ExxonMobil rejected an offshore development option utilizing drill sites in the lagoon recognizing environmental concerns although the drilling program would have been less costly and complex. Another option not progressed was construction of a road to Badami. Consequently, the base case project has evolved to an onshore coastal development without access to other infrastructure and with reliance on infield roads as a critical project component. This paper focuses on the transportation needs and alternatives related to access to the East and West Pads during construction, drilling and operations. Information about projected traffic on the infield road system is provided in a separate paper entitled *Point Thomson Gas Cycling Project Transportation and Logistics Report Revision 0* submitted on February 24, 2003.

Basis of Development

An infield road system is an integral part of the development scheme for the Point Thomson Gas Cycling Project. Gravel roads linking the Central Facilities Pad and Central Well Pad with the East and West Well Pads are essential to provide year round access to those pads for transportation of construction materials, drill rigs, work over rigs, drilling supplies (tubulars, mud, cement, chemicals etc.), personnel and for emergency response. The East and West pads are essentially satellite drilling and production facilities which, as such, are not designed as stand alone self supporting units; they lack life support infrastructure such as camps, and other infrastructure that would allow for independent operation and control of their production functions.

All North Slope oil and gas development projects, including those that lack road access to the Prudhoe Bay infrastructure such as Alpine and Badami, have infield road systems linking drilling/production pads to centralized processing facilities. This development scheme has proven the most efficient and safe development scheme for Arctic oil and gas development.

Without gravel access roads the overall development strategy (and project schedule) would have to be re-evaluated. Whatever the transportation alternatives adopted, the centralized facility concept would likely be changed to make the East and West Pads more self-sufficient perhaps with their own construction and drilling camps, and additional storage space for drilling, waste management and other supplies. The project schedule may have to be extended due to the limited windows for movement of heavy equipment, drill rigs and bulk supplies.

Needs for Access to East and West Pads

Emergency Response

Reliable year-round access to the East and West Pads is required to provide emergency response to these facilities. Emergency response needs may include:

- Evacuation of personnel for medical or safety reasons
- Urgent repairs to facilities required which left undone could pose an imminent safety or environmental hazard

Spill Response

Although some spill response equipment will be maintained on site at the East and West Pads a spill incident may require additional equipment as well as personnel that are based on the Central Facilities Pad. As with emergency response, time is of the essence in mounting a successful response so reliable year round access to transport equipment and personnel is essential. A quick initial response can dramatically reduce spill impacts. Also bringing in personnel and equipment after the initial response is more effective with reliable access.

Waste Handling

The principal component of the waste management strategy for Point Thomson is a Class I (Industrial) disposal well located on the Central Well Pad (adjacent to the Central Facilities Pad) which will be used for the disposal of drilling wastes, camp wastes, produced water and other non-hazardous wastes. The largest volumes of wastes during the construction/drilling phase of the project are drilling wastes (muds, cuttings and other drilling fluids). While some of the drilling wastes generated at the East and West Pads will be disposed of on-site by annular injection, drilling plans included truck haulage of wastes to the centrally located Class I well on the Central Well Pad. Some temporary storage of drilling wastes in lined containment structures is planned at the East and West Pads but storage is limited and not planned for the long term since larger pads would be required.

Winter Pad Construction

The construction plan for Point Thomson includes gravel works involving road and pad construction during winter season, which is the common practice on the North Slope. Upon initial completion of the gravel access roads, construction equipment will haul and place gravel at the East and West Pads. Construction during the first winter is scheduled to allow drilling of the production wells as soon as possible after the drill rigs are mobilized and set upfollowing the first summer sealift.

Summer Pad Construction

The gravel laid at the East and West Pads during the winter is "green gravel" which requires further working to dry out the gravel during the following summer using heavy construction equipment mobilized to the site over the gravel access roads. This work may include additional gravel placement (due to settlement), capping with finer material, compaction, shaping and grading. This work has to be complete in time for drill rig movement to the pads in early fall of the first construction year (2005).

Drilling Production Wells

The Point Thomson drilling schedule, which involves a two rig program, calls for drilling to start as soon as possible after rig mobilization in the summer sealift. This requires gravel access roads since ice roads would not be available until the following January. The drilling program requires the movement of rigs between the three pads (East, Central and West) in a reasonable time frame to provide an optimal completion of sufficient production and gas injection wells that allow the most efficient ramp up to full production. Drilling with one of the rigs commences on the Central Pad (disposal well and gas injection wells) which then moves to the West Pad after completing those wells. The second rig commences drilling on the East Pad and then moves to the Central Pad to drill the remaining gas injection wells. Thus, year-round access to the East and West pads is essential to meet the first production target of 4Q 2006 or 1Q 2007.

Facilities Construction

In addition to the production wells, permanent facilities that will be constructed on the East and West Pads include production manifolds, well metering and control facilities, an electrical building, methanol tank and injection system, and a gathering-line pig launcher. This construction will be conducted concurrent with the drilling activities.

Facilities Operations

The on-going operations on the East and West Pads will be supported by road from the CPF including routine maintenance and repair activities and inspections. Year-round access will also be required for both routine and unplanned maintenance and repair.

Well Servicing

Following the drilling phase, well servicing will be required during the life of the project including the use of coil tubing units, slickline units, wireline units, frac units and hot oil units. Table 1 summarizes the preliminary estimates which are based on long-term historical information that indicates during the life of the field such operations will be conducted.

Table 1. Estimated Point Thomson Well Servicing

Equipment	Year 1-5	Years 6-10	Years 11-15	Years 16-30
	# of Days Per Year	# of Days Per Year	# of Days Per Year	# of Days Per Year
Coil Unit	0	6	0	3
Slickline	8	16	16	8
Wireline	8	4	4	4
Frac Unit	6	0	0	0
Hot Oil	12	8	8	6

These well servicing activities will likely be conducted using equipment mobilized from Prudhoe Bay via barge or ice road. To the extent possible well work over activities will involve a scheduled program due to the expense of mobilizing such equipment. However, unplanned work may be required to ensure safety and maintain production. As such gravel roads afford access to the East and West Pads year-round once the equipment has been delivered to Point Thomson. Having equipment staged long term at each pad is not cost effective.

Pipeline Inspection and Repair

Routine visual pipeline surveillance of the gathering lines and a portion of the export pipeline will be conducted year-round from the infield roads. Repair activities will be conducted from the road in those areas where the pipelines are close to the road. Other repair activities will likely involve construction of short access snow/ice roads from the main gravel roads to minimize the need for ice road/pad construction and related water haulage, or may require tundra travel from the gravel road.

People Movement

Construction and drilling operations will be conducted by personnel housed at the Central Facilities Pad either at the temporary construction camp or permanent camp. At the peak, the construction and drilling work force is estimated at over 500 people. Workers will travel to the East and West Pads on buses, trucks and similar vehicles using the gravel road system. Each drilling rig employs about 50 people per shift who have to be transported between the camps on the Central Facilities Pad and the East and West Pads. If reliable year-round access is not available, separate camp facilities and related support infrastructure (water, power, waste treatment etc.) would likely have to be provided for the workers. This would necessitate larger pad sizes and significantly increase construction costs.

Feasibility of Access Alternatives to Infield Gravel Roads

Table 2 provides a feasibility assessment of various transportation alternatives to infield gravel roads for a number of transportation options according to the access needs summarized in the previous section. The selected transportation modes are technically feasible for some access needs but may not be cost effective, environmentally sensitive or practical. The table provides an indication of seasonal feasibility - winter and summer - for each of the transportation modes. In this regard the table does not indicate that winter and summer feasibility for ice roads and boats is, respectively, limited to the short ice road season (typically from January through mid-April) and open water season (typically mid-late July through September. Thus for these alternatives, other modes of transportation are required for the Spring break up and Fall freeze up periods. It should be noted that none of the alternatives alone satisfies all access needs.

Ice Roads

Ice roads are a technically feasible alternative to gravel roads for most access needs during the winter season only (i.e. January through April). They can support the transport of drilling rigs, small modules and most standard construction equipment (bulldozers, front-end loaders, gravel trucks, cranes etc.) as well as personnel. However, ice roads are expensive ($40,000-50,000/mile) and require significant volumes of water and are not available for about eight months of the year.

If ice roads were to be utilized as the only means of pad access the following impacts or problems would be generated for the Point Thomson Project:

- Equipment for summer gravel works would have to be stored on the East and West Pads
- The drilling schedule would be inflexible and likely be extended. Production as a result may be delayed or the ramp up to peak may be delayed due these schedule problems.
- Drilling consumables would have to be stockpiled on the pad sufficient for eight months of drilling as would drilling wastes (unless each pad had its own disposal well). Each pad would need an individual mud plant.
- Emergency and spill response would be delayed if an ice road had to be constructed to the pad (if not already in place) and would therefore be only useful for sustained incidents.
- Housing and related infrastructure would have to be provided for construction and drilling workers thus duplicating facilities on the Central Facilities Pad.
- Additional warehousing would have to be provided.
- Maintenance gravel would have to be stockpiled on the pad for summer use.
- Most of the above constraints would necessitate construction of a much larger pad to provide space for additional facilities and storage.

These project impacts are only partially mitigated by the summer transportation alternatives as explained below.

Rolligons

Rolligons are tundra approved low ground pressure vehicles with inflatable/deflatable bags (wheels) that come in a variety of sizes and load capacities. The 35-foot articulated model, for example, can carry up to 40 ton parts of drill rigs. However, there are only two drill rigs on the North Slope that are suitable to be broken down and hauled by Rolligons. Rolligons are used on the North Slope to haul camps, fuel and other supplies as well as personnel. They are used to pioneer and construct ice roads.

Rolligons can be used year-round although the tundra is typically closed to all off road vehicles including rolligons during the break up period when the tundra is particularly susceptible to damage.

While technically feasible rolligons are expensive to operate and their limited capacity would require numerous trips to sustain construction, drilling and operations at the East and West Pads.

Helicopters

Even heavy lift helicopters such as the "sky crane" are impractical to support a major construction and drilling operation such as Point Thomson. Numerous trips

would be required to fly construction equipment, drilling rig parts, supplies etc. from the Central Facilities Pad to the East and West Pad. Operational costs are very high.

Smaller helicopters such as the Bell 412 the Chinook are suitable for transport of personnel. However, the number of personnel to be moved between the pads during construction and drilling phases (likely over 100 per day at peak) would necessitate numerous trips and numerous helicopters. The coastal location of the Point Thomson facilities makes fog a significant problem for reliable daily transportation between the pads.

Boats

For the purposes of this analysis it is assumed that provision of two additional docks at the East and West Pads to provide large boat and barge access with similar capabilities to the proposed Point Thomson dock (access to minimum of 6 feet of water) is not environmentally acceptable. Therefore, marine access to these pads would be provided by small boats and landing craft that would run up on the beach. A gravel ramp and short access road to each pad would be constructed. Such vessels would be capable of transporting some construction equipment and supplies to the pads but would not be capable of moving large loads such as drill rigs, work over rigs and modules to the work site. Some support of the summer construction phase such as completing the gravel works could be provided by marine access. However, most construction and drilling operations would require alternative access such as ice roads for transport of large equipment and bulk materials to the site. Likewise movement of people to and from the work sites would be more efficiently conducted by helicopter due to the transit time from the Central Facilities Pad.

The major disadvantage of relying on marine access to the sites is the short open water season window, which lasts about two to three months (early-mid July through September).

Hovercraft

Hovercraft could provide year-round access to the East and West Pads. Small hovercraft for transportation of personnel and small cargo have been tested on the North Slope and, elsewhere in the World, large hovercraft capable of hauling heavy equipment and vehicles (e.g. the cross-channel ferry hovercraft in the UK) are in use. However, capital and operational costs are very high (on a per ton basis) compared with conventional land and marine transport. Noise is a particular concern such that extensive use of hovercraft (of any size) in the summer may be infeasible. In summary, as shown on Table 1, hovercraft, are indicated to be technically feasible for satisfying most transportation needs but are not regarded as a reliable and cost-effective system for such a broad scope of requirements.

Conclusions

1. None of the alternatives alone satisfies all of the pad access needs which gravel roads provide.

2. Ice roads are the most versatile alternative which fulfill most needs (except summer construction and year-round facilities operations) and would need to be augmented with break up, freeze up and summer transportation alternatives. Irrespective, the East and West Pads would have to be substantially larger to provide additional space for drilling supplies, a construction/drilling camp, and other storage due to the limitations of the various summer alternatives to satisfy transportation needs.

3. A common problem of the summer alternatives (Rolligon, helicopter, boat and hovercraft) is related to size and load limitations, which can only be partially overcome by increasing the trip frequency of the transportation mode.

Table 2. Feasibility of Access Alternatives to Infield Roads

	SW Gravel Roads	W Ice Roads	SW Rollagon	SW Helicopter	S Boats	SW Hovercraft
Emergency Response	✓	✓	✓	✓	X	✓
Spill Response	✓	✓	✓	✓	✓	✓
Waste Handling	✓	✓	X	X	X	✓
Winter Pads Construction	✓	✓	X	X	X	X
Summer Pads Construction	✓	X	X	X	✓	✓
Drilling New Wells	✓	✓	X	X	X	X
Facilities Construction	✓	✓	✓	X	X	✓
Facilities Operations	✓	X	X	✓	X	✓
Drilling Well Servicing	✓	✓	✓	X	X	✓
Pipeline Inspection/Repair	✓	✓	✓	✓	X	✓
People Movement	✓	✓	X	✓	X	✓

Key
SW = Summer and Winter
W = Winter Only
S = Summer Only
X = Technically Infeasible
✓ = Technically Feasible