



# NASHPA Gas Processing and LPG Recovery Plant

PROC-FC-CB/NASHPA/PROJ-1247/2015

PROJECT NO.: NASHPA 1247



DOCUMENT NO.:  
NGP-000-SCW-15.03-2002-00

SPECIFICATION

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## Specification for Road and Paving Works

### REVISION DETAILS

			<i>Yang Guohui</i>	<i>Xu Jian</i>	<i>Zhang Fu Xing</i>	<i>Qiu Rui di</i>
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## 1.0 GENERAL

### 1.1 Introduction

OIL & GAS Development Company Ltd. (OGDCL) is operating NASHPA Oil & Gas fields in Khyber Pakhtunkhwa of Islamic Republic of Pakistan. OGDCL intends to install LPG Recovery Plant, Compressors & Allied Facilities at Nashpa Oil Field, which including Wellhead facilities, Gas Gathering System and Gas Processing Plant. "NASHPA Gas Processing and LPG Recovery Plant" (the PROJECT) is Gas Processing Plant part. The objective of PROJECT is to construct a gas processing facility at NASHPA to process raw gas of NASHPA and separator gas from MELA Field. The MELA and NASHPA combined gas is the feed for NASHPA Gas Processing Plant (NGP). The NGP will produce LPG, Sales Gas and Stabilized Condensate.

### 1.2 Purpose

This specification covers the requirements for the construction of flexible roads.

All operation regarding excavation, filling, and compaction of sub-grade involved in construction of road are specified in the specification for Earth Work and Site Preparation (NGP-000-SCW-15.03-2001).

## 2.0 DEFINITIONS AND ABBREVIATIONS

### 2.1 Definitions

Throughout this Document the following definitions shall apply:

<b>Project</b>	NASHPA Gas Processing and LPG Recovery Plant PROC-FC-CB/NASHPA/PROJ-1247/2015
<b>Company/Owner</b>	Oil & Gas Development Company Ltd.(OGDCL)
<b>Consultant</b>	Zishan Engineers (Pvt.) Ltd.
<b>Contractor</b>	Hong Kong Huihua Global Technology Limited Wholly OIL HBP Science and Technology Corporation Ltd.
<b>Manufacturer/Supplier/Vendor</b>	Party(ies), which manufactures and/or supplies material, equipment and service to perform the duties as specified by CONTRACTOR in the scope of supply
<b>Shall</b>	Indicates a mandatory requirement
<b>Should</b>	Indicates a strong recommendation to comply with the requirement of this document

### 2.2 Abbreviations

The following abbreviations are used in this document:

Table 2-1 Abbreviations

COMPANY	Oil & Gas Development Company Ltd.
HBP/HH	Hong Kong Huihua Global Technology Limited



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EPCC	Engineering, Procurement, Construction and Commissioning
FEED	Front End Engineering Design
SOW	Scope of Work
AI	Asphalt Institute
ACI	American Concrete Institute
AASHTO	American Association of State Highway and Transportation Officials
BS	British Standard
IDC	Internal Discipline Check
IFR	Issued for Review
AFC	Approved for Construction
HPP	High Paving Point
FGL	Finished Grade Level

### 3.0 REFERENCES

#### 3.1 Codes and Standards

The following documents shall be considered as integral part of this specification, as well as their addenda, updating and reference documents. Specific provisions according to project geotechnical report or soil investigation for using natural site soil in the works covered by the present specification shall be followed.

Doc. No.	Description
AASHTO M 145	Classification System for Soils
AASHTO GDPS	Guide for Design of Pavement Structures
MS-4	Asphalt Handbook
SS-1	Model Construction Specifications for Asphalt Concrete and Other Plant-Mix Types
SS-2	Specifications for Pavings and Industrial Asphalt
ASTM C13	Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and impact in the Los Angeles Machine
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and impact in the Los Angeles Machine
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils



ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D1883	Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils
ASTM D2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2487	Classification of Soils for Engineering Purposes
ASTM D4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
BS 1377	Methods of test for Soils for civil engineering purposes

### 3.2 Project Specifications, Procedures and drawings

Particular reference is made to the following project specifications:

[1]	Volume I II & III of Tender Documents
[2]	Tender Documents: Specification for Road and Paving Works (165-3-SPC-013)
[3]	Design Basis for Roads and Paving (NGP-000-SCW-15.05-2001-00)
[4]	Design Basis for Civil and Steel Structures Works (NGP-000-SCW-15.05-0001-00)

## 4.0 ROADS

4.1 The width of roads will be as shown in the table or as indicated on the drawings:

Name of Roads	Nominal Width (M)	Carriage able Width (M)	Access Way Width (M)	Shoulder Width (M)
Internal Roads	6.0~8.0	6.0~8.0	4.5	1.0

4.2 Roads should cross at right angles. At the crossing the center of the road will have a radius curvature of 10.0m.

4.3 The maximum gradient (longitudinal slope) of the centerline of all roads will be maximum 6%.

4.4 The current cross-falls (transversal slope) will be 2.0% from centerline to the edge of carriage-able width.

4.5 The following structures of road for premix carpeting should be used:



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a) **Sub-grade:**

The sub-grade elevation obtained from excavation shall be perfectly horizontal and firmly compacted with vibratory roller to the required moisture content as per BS 1377, modified AASHTO, or ASTM test method.

b) **Sub-base Course:** Road sub-base course shall consist of well graded granular soil to a consolidated thickness of 175 mm after compaction, accompanied with water sprinkling and compacted with the compaction equipment i.e. 8-10 Ton Roller.

c) **Base Course:** Road base course shall consist of crushed stones (igneous or sedimentary rock) to a consolidated thickness of 20 cm after compaction. Maximum size of hard crushed stone shall be 40 mm – 50 mm down. Base course shall be sprayed with coarse sand and water on 2nd layer in the same manner as described in Item b).

d) **Premix Carpeting:** Premix Carpeting shall comprise of Bitumen Priming/Tack coat over base course, application of two layer of premix carpeting (Base Layer 50 mm, wearing course: 25 mm) over primer and tack coats, to a consolidated thickness of 75 mm after rolling, and finally application of seal coat.

e) **Shoulder:** 6" thick with 1" down rolled graded crushed stone with as per spiral road shoulder 1.0m wide along both sides of the roads. (Add spray of bitumen).

f) **Embankments:** Road embankment shall have a slope of 1:2 and are protected with brick/stone on edge with approved pattern in cement-sand mortar (1:4).

## 5.0 CURBS MATERIAL

5.1 Curbs will be either cast-in-situ or precast as stated in the specification or shown on the drawings.

5.2 The precast curbs will be of concrete type 21N/mm<sup>2</sup> and should be finished smooth and turn to line.

5.3 The precast curbs' size will be 150mm thick x 300mm width and depth as shown on drawing with one face half splayed.

## 6.0 CONSTRUCTION METHODS: SUB-BASE COURSE

Preparation of sub-grade will be carried out prior to the laying of the sub-base course, by rolling. During preparation of the sub-grade, the surface will be shaped true to cross-fall or super-elevation and will be watered and rolled as necessary until it is smooth, firm and tight. Following preparation, the sub-grade will be protected against damage until covered by the sub- base course.

Sub base course will be laid with well-graded granular soil down in one layer and compacted to 95% of the Maximum dry density as determined by AASHTO or ASTM Test Methods, using compaction equipment such as 8-10-ton roller, which is most appropriate to the material concerned.

## 7.0 CONSTRUCTION METHODS: BASE COURSE

7.1 The work will consist of a base course composed of crushed stone metal placed and compacted on a prepared and accepted sub-base in accordance with these specifications and the lines, levels, grades, dimensions and cross sections shown on the drawings and as required by the Company / Project Management Contractor.



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7.2 Aggregates for aggregate base course will consist of naturally occurring or mechanically crushed stone, free from decomposed stone, organic matter, soft particles or excess clay or any other substances which in the opinion of the Company / Project Management Contractor, may be deleterious.

7.3 The amount of crushing will be regulated so that at least 50 (fifty) percent, by weight, of the pieces retained on No.4 sieve have at least one mechanically fractured face.

7.4 The material will be crushed, washed, screened and blended as necessary to produce a grading conforming to the following table. The grading of base course will be either Class A, or Class B as directed by the Company / Project Management Contractor. The aggregate when graded will produce a smooth, evenly distributed curve within the following envelope for either Class A or Class B.

Sieve Size	% Passing by Weight	
	Class A	Class B
2" (50.8mm)	95 – 100	95 – 100
1½" (37.5mm)	85 – 95	85 – 95
1" (25.4mm)	70 – 85	70 – 85
¾" (19.1mm)	65 - 70	-
3/8" (9.52mm)	30 – 65	40 – 75
No. 4 (4.76mm)	25 – 35	30 – 60
No. 10 (2.00mm)	15 – 40	20 – 45
No. 40 (0.42mm)	8 – 20	15 – 30
No. 200 (0.75mm)	2 – 8	5 – 20

7.5 Aggregate mixtures will be so transported and handled as to avoid segregation of the material. Any segregated material in the base course will be cut out and replaced and no patching will be permitted.

#### 7.6 Compaction of Mixed Materials

After laying, the material will be uniformly compacted by rolling in a longitudinal direction from the sides to the center of roadway, over lapping on adjacent passes by at least half the width of the rear roll.

The number, type and condition of rollers will at all times be sufficient to compact the mixture to the required density while it is still in a workable condition. Rolling trials will be carried out by the Contractor until Company / Project Management Contractor is satisfied that the equipment provided and procedure adopted by the Contractor is capable of producing a base course meeting the requirements of the Contract. Such procedures will thereafter be maintained until the Company / Project Management Contractor directs otherwise. Such laid on/or compacted material as, in the opinion of the Company / Project Management Contractor, is not suitable to be incorporated in the works, will be removed and disposed of in a manner acceptable to the Company / Project Management Contractor.

The Compaction equipment weighing 10 ton roller will be provided for rolling the base course. The layer will be compacted with 95% of the maximum dry density as determined by AASHTO Test Method T.180. Rollers and other equipment not in operation won't be allowed to stand on the base course and no traffic except that unavoidably used in connection with the laying of subsequent courses will be permitted on the base course without written authorization. The base course will be sprayed with soil filler on 2nd layer to fill the aggregate





voids, and then water is sprinkled and compacted again by the roller, acceptable to the Company / Project Management Contractor.

## 8.0 PREMIX CARPETING

### 8.1 Description

The Work will consist of furnishing all labor, plants, equipment, appliances and material and performance of all operations required in the connection with the construction of Premix Carpeting on a prepared base course in accordance with these specification and to the area shown on the drawings and as directed by the Company / Project Management Contractor.

### 8.2 Material

Material such as crushed stone, sand, stone dust or filler etc. will conform to the requirement specified herein, as necessary to produce a grading conforming to the following table, and will be graded between these limits.

i) Gradation for Base layer:

Compacted Depth = 2"(50 mm) Recommended Sieve Size	Percentage Passing By Weight (No.)
$\frac{3}{4}$ "	100
$\frac{1}{2}$ "	80 – 100
$\frac{3}{8}$ "	79 – 90
No. 4	50 – 70
No. 8	35 – 50
No. 30	18 – 29
No. 50	13 – 23
No. 100	8 – 16
No. 200	4 – 10
	80 / 100 & 60 / 70 to be blended as per Mix Design (4 to 5% of total mix by weight) or as per mix design.

ii) Gradation for wearing course:

Compacted Depth = 1" (25 mm) Recommended Sieve Size	Percentage Passing By Weight (No.)
$\frac{3}{4}$ "	100
$\frac{1}{2}$ "	100
$\frac{3}{8}$ "	100
No. 4	60 – 90
No. 8	15 – 40



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No. 30	0 – 15
No. 50	0 – 5
No. 100	Bitumen
	80 / 100 & 60 / 70 to be blended as per Mix Design (4 to 5% of total mix by weight) or as per mix design.

### 8.3 Premix Carpeting

Premix Carpeting will comprise of Bitumen priming/Tack coat over base course, application of two layer of Premix carpeting (base layer 50 mm, wearing course 25 mm) to a consolidated thickness of 75 mm after rolling and final application of a seal coat.

### 8.4 Tack Coat

Prior to applying Tack coat, clean and remove foreign material carefully from the surface without disturbing the base course. A tack coat consist of Hot Bitumen grade 60/70 & 80/100 to be blended 50% each will be applied over base course at the rate of 0.575 Liters per sq.m.

### 8.5 Design Mix

The Contractor will submit the design mix for Premix Carpeting and seal coat by weight for specified material from approved laboratory confirming to the relevant international & local codes at least one week prior to the execution of the job. No extra payment will be made in this regard.

### 8.6 Mixing

Mixing will be carried out as per design mix in an approved continuous mixer. The aggregate will be dried to the optimum delivery and should be sufficient to provide an adequate supply of aggregates to the mixer. The bitumen temperature won't exceed 163°C and the mixing period to produce a uniformly consistent mix will normally be 1 minute.

### 8.7 Transporting

The transporting of Premix Carpeting material from mixing to spreading point will be carried out in approved clean Lorries. The Company / Project Management Contractor may periodically inspect this transport and reject any that is not clean, tight or mechanically unreliable.

### 8.8 Placing

The Premix Carpeting mixture will be so placed that after compaction the finished road will be smooth dense and meet the requirements of the cross-section shown on drawing, and to the entire satisfaction of Company / Project Management Contractor.

### 8.9 Density Requirement

The density achieved in the premix layer after compaction is to be at least 97% of the density achieved for the same job mix in the Marshall stability tests carried out in the laboratory. Cores are to be cut in the carpeting layer as directed by the Company / Project Management Contractor at the Contractor's expense and the cores used for density determination.



## 8.10 Compaction

After spreading, the carpeting mixture will be compacted in the following manner:

### First Stage

A three wheeled roller with a bearing pressure in the rear wheels from 1.72 - 2.40 MPa, full width of wheel will be utilized, the driven wheels leaning on the fresh mix. The change of direction in the rolling will only be carried out with the steering wheel on partly consolidated mix so that the displacement of the mix is avoided.

A check will then be made on the surface with the 3 meter straight edge, and while minor adjustments will require addition or subtraction of hot material. This will be carried out while the coat is still hot.

### Second Stage

Immediately after the initial rolling a pneumatic tyred roller will be utilized. It will be of the self-propelled type and will weigh approximately 20 tones, the tyre pressure being 2.51 - 3.32 MPa.

### Third Stage

The final finish will be given with a 10 tones tandem roller. Each stage of rolling will be carried out by passes with a half wheel width overlap and every care must be taken that the roller does not lift the mix and that its wheels are absolutely clean. Roller must not be allowed to stand on any coat, which is not completely consolidated.

## 8.11 Longitudinal Joints

While making longitudinal joints the spreader will overlap the existing strip and sufficient material must be left on the overlap to allow for adequate compaction.

Any excess material will be carefully removed so that when rolling is carried out a thoroughly workman like-joint is left.

At the end of the day, should a longitudinal joint be left open before the adjacent section is laid, the longitudinal edge will be carefully cut back to a straight line and the freshly cut face will be given a tack coat of hot bitumen.

## 8.12 Transverse Joints

The edge of the previously laid strip will be cut back to its full depth and painted with hot bitumen immediately before the hot bituminous mixture is placed against it.

Both longitudinal and transverse joints will be checked for continuity using a 3- meter straight edge immediately after rolling and any necessary correction is made at this stage.

## 8.13 Bitumen Road Thickness and Surface Tolerance

The thickness indicated for each of the various courses of bitumen road is nominal thickness. The road will be so constructed that the final compacted thickness is not less than the nominal thickness and does not exceed the nominal thickness indicated on the plans by more than 6 mm. Determination for final acceptance and payment will be made from cores of thickness and measurements taken of the completed road. The Contractor will replace the cored material in a manner satisfactory to the Company / Project Management Contractor. No



payment will be made for the extra thickness over and above the indicated tolerance. Materials being part of a trimming and leveling course will not be considered in determining the road thickness.

#### 8.14 Seal Coat

Finally, seal coat will be applied, consisting of mix of adequate quantity of chips, sand and bitumen of grade 60/70 & 80/100 to be blended 50% each, recommended by the approved laboratory, and will be spread and compacted to give the smooth leveled surface, with proper camber as per cross- section shown on the drawing and to the entire satisfaction of Company / Project Management Contractor.

#### 8.15 Testing of Samples

The following test will be carried out on all material samples proposed for use as fill/sub-base or base course material.

Atterberg limit tests.

Soil classification tests.

Compaction tests.

The tests will be done in accordance with BS1377 or equivalent ASTM standards.

Laboratory and field control tests will normally be carried out to the appropriate BS or equivalent ASTM standard for sub-grade, sub-base and base course. These tests will be as follows:

Laboratory Tests will include:

Liquid Limit Tests.

Plastic Limit Tests.

Sieve Analysis Tests.

Compaction Tests.

Laboratory CBR Tests as specified.

Density and Moisture Content.

Field Control Tests will include:

Atterberg Limit Tests.

Soil Classification Tests.

Compaction Tests.

CBR Tests.

In-Situ Dry Density Tests.

The test reports will be submitted to the Company / Project Management Contractor, and no payment will be made for the above tests, including the test reports.



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### 8.16 Opening to Traffic

No traffic will be allowed on the completed courses until the permission of the Company / Project Management Contractor has been obtained.

### 8.17 Heating of Bitumen

For security purposes heating of bitumen will not be allowed within hazardous area. However, if for genuine reason, heating is allowed inside the area, the Contractor will construct brick masonry wall or sandcrete hollow block wall 2 m high & 150 mm thick, enclosing the place where heating is allowed. No extra payment will be made to the Contractor in this regard.

## 9.0 PROTECTION OF SLOPES

Contractor will protect side slopes of road shoulders by providing standard brick / stone lining, with a 75 mm width x 150 mm depth P.C.C (1:3:6) toe wall / beam on edge as shown on drawing in order to prevent erosion from water / wind and other elements.

The thickness of protection lining won't be less than 75 mm measured normal to the surface concerned. Brick / stone laying will be carried out in such a manner that a tight and homogenous surface is achieved.