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TECHNICAL SPECIFICATION

HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

CONSTRUCTIONS OF ROADS

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0	05/04/2011	First Issue (as Spec 499/8)
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Table Of Contents

1. SCOPE

The scope of this Specification is to define minimum requirements for the design and construction of Pipeline Stations and M/R Stations access roads as well as internal roads and paving, which are required for the Natural Gas Line.

2. REFERENCES

2.1 Reference Documents

Greek Standard Technical Specifications ΠΤΠ as follows:

- X 1 : Earthworks Construction for Roads and Landscaping
- O 150 : Construction of road subbases
- O 155 : Construction of road base courses
- O 164 : Stabilization of roads with cement
- A 200 : Asphalt for roadworks
- A 201 : Asphalt solutions
- A 204 : Sampling of asphalt materials
- A 206 : Moisture Susceptibility Tests for Aggregates Used for Open or Dense Graded Bituminous Road - Mix Surface Course
- A 260 : Bituminous Base Courses
- A 265 : Bituminous Concrete Surface Courses

ΕΤΕΠ 1501-02-01-02-00 Removal of the top layer of the soil

ΕΤΕΠ 1501-02-02-01-00 General excavations for Roads and Hydraulic works

ΕΤΕΠ 1501-02-07-01-00 Construction of embankments with suitable excavation or borrow materials

ΕΤΕΠ 1501-05-03-01-00 Road pavement subgrade layer with undound material

ΕΤΕΠ 1501-05-03-03-00 Road pavement layers with unbound aggregates

ΕΤΕΠ 1501-05-03-11-01 Asphalt pre-coating

ΕΤΕΠ 1501-05-03-11-04 Hot mixed dense granded asphalt concrete layers.

ΕΤΕΠ 1501-05-03-08-00 Road shoulders with horticultural soil and aggregates mixture

ΕΤΕΠ 1501-05-02-01-00 Kerbs, gutters and roadside concrete lined drainage ditches

Road Study Instructions ΟΜΟΕ, Number 8 [Οδηγίες Μελετών Οδικών Έργων (ΟΜΟΕ) – Τεύχος 8 Αποχέτευση-Στράγγιση Υδραυλικά Έργα Οδών (κεφ. 5)]

Circular Order 41/2005, of Department of National Roads Studies (Διεύθυνση Μελετών Έργων Οδοποιίας – ΔΜΕΟ)

Circular Order 14/2007, of Department of National Roads Studies (Διεύθυνση Μελετών Έργων Οδοποιίας – ΔΜΕΟ)

Legislation of Forest Roads (Απόφαση Υπουργείου Γεωργίας 92833/4679/01.12.1997)

2.2 Reference Codes and Standards

- ΕΚΤΣ - ΦΕΚ 315Β 1997
- «Ελληνικός Κανονισμός Τεχνολογίας Σκυροδέματος»
- [Hellenic Concrete Technology Regulation]
- ΕΚΤΧ-ΦΕΚ 381Β 2000
- «Ελληνικός Κανονισμός Τεχνολογίας Χαλύβων Οπλισμού Σκυροδέματος»
- [Hellenic Reinforcement Technology Regulation]
- ΕΚΩΣ – 2000 ΦΕΚ 1329Β
- «Ελληνικός Κανονισμός Οπλισμένου Σκυροδέματος»
- [Hellenic Reinforced Concrete Code]

EN 932 Tests for general properties of aggregates

EN 933 Tests for geometrical properties of aggregates

EN 1097 Tests for mechanical and physical properties of aggregates

EN 1317 Road restraint systems

EN Test for chemical properties of aggregates

EN 10080 Steel for the reinforcement of concrete-Weldable reinforcing steel-General

EN 12591 Bitumen and bituminous binders-Preparation of test samples

EN 12697 Bituminous mixtures-Tst methods for hot mix asphalt

EN 13108 Bituminous mixtures-Material specifications

EN13179 Test for filler aggregate used in bituminous mixtures

EN 13877 Concrete pavements

EN 14188 Joint fillers and sealants

EN Hot dip galvanized coatings on fabricated iron and steel articles-Specifications and test methods

Note: For the referred Specs, Codes and Standards, the last valid version is applicable

3. ACRONYMS

HP	HIGH PRESSURE
NG	Natural Gas

4. INTERNAL ROADS

Geometrical characteristics	**Dimensions**
Width	5.00m (minimum)
Radious R of the internal edge of the road	1.3m (minimum)
Dual slope for road surface	2%
Longitudinal slope	7% (exceptional 15% for L≤25m)
Shoulder	0.60m (where required)

5. ACCESS ROADS

Access roads through public forests will be complied with the regulation of National Forest Roads. The access roads through agricultural areas will be complied with the regulation of the Greek Roads Network, as these are issued and revised by Department of National Roads Studies (Διεύθυνση Μελετών Έργων Οδοποιίας - ΔΜΕΟ) by Ministry of Infrastruction and Transportation.

6. EARTHWORKS

6.1 Clearing

Before starting, Contractor shall receive information, about the extent of the clearing, from the Owner Representative.

Trees, bushes, fences, boulders, etc. shall be removed by the Contractor and holes shall be filled with soil which shall be compacted. The rubbish material shall be driven away.

The Contractor shall ensure a careful protection of trees and bushes, which shall not be removed.

6.2 Surface Stripping

On areas to be hard-surfaced, leveled or excavated, the humus or topsoil shall be stripped. The stripped soil shall be laid out in an even layer of required thickness on areas to be sown or

planted.

6.3 Leveling

The site shall be leveled so that the area within the fence can be reinstated according to the drawings and so that the fence, under normal conditions, can be erected with a horizontal top. Furthermore, leveling shall be carried out in connection with the construction of roads.

Soft clay, turf, etc. shall not be used for filling.

Soil shall be laid in max. 0.3m thick layers and shall be well compacted.

If any soil shall be added or driven away to establish the desired level this shall be carried out by the Contractor's care and cost.

6.4 Excavation

Excavations shall be carried out according to the dimensions and elevations shown on the engineering drawings with a ±50 mm tolerance.

During excavation any unsuitable material such as humus, soft soil, bog, etc shall be driven away to an authorized place after the Supervisor's approval.

Any propping and dewatering of the trench necessary for construction purposes shall be made by the Contractor, at no extra cost to the Owner.
Any surplus material from the excavation, which shall not be used for the backfilling shall be driven away to an authorized place.

6.5 Backfilling

Backfilling shall be executed in accordance with the **Technical Standard Specification ΠΤΠ X1** Earthworks Construction for Roads and Landscaping, or any equivalent Greek Legislation.

The backfilling shall be raised in layers of 0.3m max thickness. Each layer shall be compacted effectively by at least two passes of a smooth drum vibratory roller with weight >12t. This requirement may be waived only when stable bedrock is encountered. The degree of compaction shall be specified by the acceptable settlement of the reinstated ground surface.

The backfilling material shall be free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, particles larger than 75mm and other deleterious or objectionable materials. Contaminated soil and organic soil, high plasticity soil and soil containing tree stumps, vegetation, scrap metal or organic waste shall on no account be used as fill.

No backfilling or compaction shall take place during days with rainfall. Backfilling after heavy rain shall not proceed if the surface is not inspected and approved by Owner's Representative.

6.6 Stabilization

The backfill or the subgrade shall be stabilized with lime or with cement, according to the Supervisor instructions.

Lime shall be delivered as hydrated lime or burnt lime and cement as ordinary Portland cement.

The water content of the material to be stabilized shall be regulated by watering or by aeration if required.

The material shall be pulverized by use of a rotary cultivator, whereafter the lime or cement shall be uniformly spread in the required quantity over the entire area.

Immediately after spreading of the lime or the cement mixing shall proceed and continue until a uniform color has been obtained and 80% of the mixed material can pass a 5 mm sieve.

If cement is used as stabilizing agent then the **Greek Standard Technical Specification ΠΤΠ Ο 164** shall be followed.
The stabilized soil shall be compacted as described herebelow.

6.7 Compaction Requirements

Compaction of backfill shall be uniform and fulfill the following requirements for density with standard proctor tests:

- min. 94% standard proctor for cohesive soils
- min. 97% standard proctor for frictional soils

The indicated degree of compaction shall be the average of at least 5 tests. Each individual value shall not be more than 3% below the required average.

The top layer 0.20 m thick, below the finished level in excavations or under the stripped ground, shall be compacted in accordance with the above mentioned requirements before backfilling is started.

Contractor shall submit to the OWNER Representative all field density tests for approval and acceptance of the works. Fill that does not meet the above compaction requirements shall be rejected, removed and replaced at the expense of the Contractor.

7. ROADWORKS

7.1 Roadbed

The roadbed, either bottom of excavation or bed for backfilling, shall be formed with a 40 mm tolerance which shall be for both sides.

The roadbed shall be drained.

7.2 Subbase

Subbase material and construction shall be in accordance with the **Greek Standard Technical Specification ΠΤΠ Ο 150,** or any equivalent Greek Legislation.

Crushed stone material shall be used.

The total thickness of subbase shall be 25 cm and shall be raised in two layers.

Each layer shall be laid in the whole width of the formation level in one working shift, and the layer shall be drained to ditches or drains. The formation level shall not be disturbed during laying.

Other vehicles than the ones needed for the subbase construction shall not be used on the subbase, because this may damage it. The subbase shall be leveled and compacted.

Watering may be necessary only for the compaction if this comes from the laboratory tests results.

For road construction the direction of compaction (movement of the roller) shall be parallel to the road axis.

The reinstated ground surface shall be as shown on the engineering drawings with a ±20 mm tolerance.

7.3 Base Course

The base course material and construction shall be in accordance with the **Greek Standard Technical Specification ΠΤΠ Ο 155**, or any equivalent Greek Legislation.

Aggregate shall be used.

The thickness of the base course layer shall be 15 cm and shall be raised in one layer according to the Supervisor's instructions, after compaction until the specified total thickness is achieved. Each layer shall be graded to achieve a homogeneous mixture and uniform thickness.

During detail design elaboration the Contractor may specify increased course thicknesses if required for ensuring satisfactory performance of asphalt or concrete pavements for the design traffic loads and the foundation soil conditions identified by geotechnical investigations or encountered during construction.

The materials shall be loaded, transported and unloaded in such a way that mixing with unsuitable materials or segregation shall be avoided.

The laying shall be done using methods which prevent segregation and ensure a uniform distribution of the materials. Where the gravel base layer is not supported at the sides, the layer shall be constructed with an extra width equal to the layer thickness at both sides.

The gravel base shall be leveled by hand and compacted with mechanical equipment so that the final elevation shall be according to the engineering drawings with a 10 mm tolerance.

Water shall be added to the gravel base during compaction if the water content is lower than the optimum.

7.4 Bituminous Base Course

Bituminous base course shall be made in accordance with the **Greek Standard Technical Specification ΠΤΠ Α 260**, or any equivalent Greek Legislation.

The bituminous base course shall be used as a base for the road loads distribution from the bituminous concrete surface course to the below courses. The bituminous base course shall never be used as a surface course.

The thickness of the bituminous base course layer shall be 5 cm.

If the bituminous concrete cracks it shall be removed and reconstructed.

When pavement consisting of several layers will be constructed, a bituminous prime coat type ME-0 in accordance with **the Greek Standard Technical Specification ΠΤΠ Α 201** shall be used on the cleared foundation.

Road elevation tolerance shall be 10 mm.

Any loose, overfat or unstable pavement shall be replaced, if required by the Supervisor.

Necessary longitudinal and transverse joints shall be displaced at least 0.2 m from the joints of the subjacent layer.

7.5 Bituminous Concrete Surface Course

The bituminous concrete surface course shall be constructed in accordance with the **Greek Standard Technical Specification ΠΤΠ Α 265**, or any equivalent Greek Legislation.

The thickness of the surface course shall be 5 cm.

The bituminous surface course shall be placed on the binder or on the base course layer after this has been carefully cleaned by sweeping or, if necessary, with water and bituminous prime coat has been applied on it.

For the bituminous concrete course construction course aggregates shall be used in accordance with the **Technical Standard Specification ΠΤΠ Α 265,** or any equivalent Greek Legislation. Aggregates testing shall be in accordance with the **Technical Standard Specification ΠΤΠ Α 265 paragraph 6.2,** or any equivalent Greek Legislation.

The bituminous course shall be compacted in such a way that wheel ruts are not formed later. Tolerance of the asphalt surface level shall be 10 mm.

The road surface shall be free from undulations, to such an extent that deviations from a 5 m boning rod do not exceed 8 mm and from a 3 m template do not exceed 6 mm. Short irregularities shall not occur even if they are shorter than 8 mm.

The manholes shall be constructed after the Supervisor's approval and shall be cleaned before the cover is placed. The asphalt wearing course shall be 5 mm higher than the manhole cover.

7.6 Concrete Pavement

Concrete pavement shall consist of a reinforced concrete slab 20 cm thick.

Also base course of sand will be 10cm thick (in 2 layers of 10cm each) and sub-base course of sand will be 10cm thick (in 2 layers of 10cm each).

Concrete shall be of grade C20/25 in accordance with the Greek Concrete Technology Regulation & the Greek Reinforced Concrete Regulation, reinforcement shall be steel welded mesh, S500s 6mm dia 150 x 150mm, or equivalent.

Expansion joints shall be spaced at 15 m and shall be 20 mm wide and as thick as the paving slab will be.

Adjacent slabs shall be joined with steel rods dia 25 mm, 0,75 m long, grade S500s spaced at 0,30 m. The bars shall be placed in the mid-height of the slab.

One half of the bar shall be fixed in one slab and the other half shall move free in a recess in the adjacent slab.
The side walk pavement width will be 60cm.

7.7 Curbs

Curbs shall be either precast or cast in situ.
Curbs shall be 0,15 m wide and 0,20 m high with reinforcement 2 Ø 8 straight at top and 2 Ø 8 straight at bottom, stirrups Ø 8/30.

Curbs shall be fixed on the edge of the pavement with cement mortar.

Curbs joints shall be treated with a cement mortar of 600 kg of cement per m^3.

7.8 Surfacing with Pebbles

Pebbles consist of stone material in the range 16/32 mm. The material shall not contain more than 20% limestone.
Pebbles shall be laid on a compacted layer of base course. The layer of pebbles shall be leveled and compacted slightly.

7.9 Compaction Control of Subbase and Base Materials

Compaction control shall be provided according to the Greek Technical Specification of the Ministry of Public Works: **Technical Specification ΠΤΠ Ο 150 Road Subbase Construction (Εγκύκλιος Γ9/1966 ΦΕΚ 294/66 Τεύχος Β'), Technical Specification ΠΤΠ Ο 155 Road Base Construction (Εγκύκλιος Γ10 /1966 ΦΕΚ 294/66 Τεύχος Β'),** or any equivalent Greek Legislation.

No backfilling or compaction shall take place during days with rainfall. Backfilling after heavy rain shall not proceed if the surface is not inspected and approved by the Owner representative.

7.10 Drainage

The drainage of the roads will be complied with the regulation of Road Study Instructions OMOE , Number 8.