



**GOVERNMENT OF PAKISTAN
MINISTRY OF COMMUNICATIONS
NATIONAL HIGHWAY AUTHORITY**

**Construction of
Peshawar Northern Bypass (Package-2)
(Km 7+600 to Km 19+500)**

**BIDDING DOCUMENTS
VOLUME-III**

- PARTICULAR SPECIFICATIONS
- SPECIAL PROVISIONS

AUGUST 2010

NATIONAL HIGHWAY AUTHORITY	
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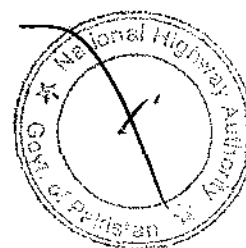
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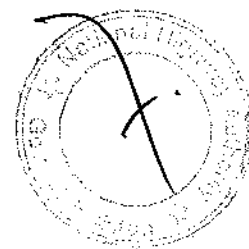
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FOREWORD



FOREWORD

SPECIAL PROVISIONS

The following Special Provisions are amendments, corrigenda, deletions and additions to the General Specifications, issued by the National Highway Authority in December 1998, laid down in Volume II. Items of Particular Specifications are represented by the corresponding item number of the General Specifications to which an amendment, a corrigendum, a deletion or an addition relates. When a new item has been considered for the Project, it is preceded by the letters SP (Special Provision) followed by a three digit number which corresponds to the number next to the last attributed number in the class of work series.

Whenever a reference is made in the Special Provision in regard to any manual or a test designation either of the American Society for Testing and Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), Asphalt Institution, Federal Highway Specifications or any other recognized national organization and the number on other identification representing the year of adoption or latest revision is omitted, it shall mean the Specifications, manual or test designation in effect on the day the Notice to Proceed with the Works is issued to the Contractor.

No separate items are provided for haul or transportation and these are deemed to be part of the relevant pay item of the Contract Bill of Quantities.



GENERAL



GENERAL

1. INTRODUCTION

Insert before para 1.1 the following:-

a) DESCRIPTION OF THE WORKS

The proposed Peshawar Northern Bypass, a four lane dual carriageway, takes off from Peshawar toll plaza of M-1 and ends near Jamrud on N-5 passing through North of Peshawar City. It will provide connection with Motorway network, reduce traffic congestion in the city and also facilitate the through traffic of Afghanistan. Length of proposed Peshawar Northern Bypass is about 32 kms. There are three contract packages of the project.

Package No.1 consists of construction of 7.6 km four lane dual carriageway and all allied structures i.e. two (2) bridges and eight (8) drainage culverts, and Package – 2 consists of construction of 11.6 Km.

The work shall include Granular Material Platform, Earthwork for the embankment, Granular Subbase, Aggregate Base Course, Asphaltic Base Course and Asphaltic Wearing Course. The construction of Bridges, Drainage Structures, Retaining Structures, Drains, Ditches and Protection Works are also included in the Scope of Works. All construction material, labour, equipment and accessories shall be provided by the Contractor.

The Contractor is to provide facilities for his workforce. The Contractor will also provide facilities for the Engineer's Representative. Basic services for these facilities are to be provided as well as furniture and equipment according to lists in the Contract.

b) GENERAL DESCRIPTION OF THE AREA

Peshawar Northern Bypass (Package-2) starts from Charsadda Road and Ends near Warsak Road.



c) MATERIALS SOURCES

Fill material and aggregates for use in the work shall be provided by the Contractor, where not available from excavation within the work, from sources to be identified and established by the Contractor who will be responsible for surveying and testing to prove the extent and suitability of materials, for land and royalty/malkana costs, for access roads, site facilities, stripping overburden, separation of materials, processing and transport of materials, reinstatement, insurance and all other costs. All costs shall be considered as included within the rates inserted for the items included in the Bill of Quantities.

Test results on materials, obtained by the Engineer during preparation of the Contract, are available for inspection, on application to the Employer's Representative.

1.1 Testing

In para 4, at end of first sentence in line 3, add the following:

", except as provided in Item 1.21, Certificate of Compliance."

1.2 Trial Section

At the end, add new items as below:

1.3 Certificate of Compliance

A Certificate of Compliance shall be furnished prior to the use of any material where these Specifications warrant such certificate to be furnished. In addition, where permissible under these Specifications, the Engineer may permit the use of certain materials or assemblies prior to sampling and testing, if accompanied by a Certificate of Compliance. The Certificate of



Compliance shall be furnished with each lot, clearly identified in the certificate.

All material used on the basis of Certificate of Compliance may be sampled and tested at any time. A Certificate of Compliance however shall not relieve the Contractor of his other obligations under the Contract for incorporating materials in the Work. Such materials shall conform to the requirements of the relevant Contract Drawings and Specifications.

The Employer reserves the right to refuse the permission for the use of materials on the basis of a Certificate of Compliance.

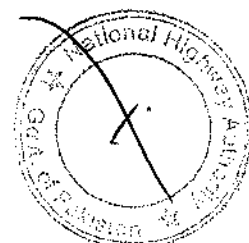
The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

1.4 **Irrigation Canals, Channels, Water-courses, Drains and Sewers etc.**

The Contractor shall conduct his operations so as to offer the least possible obstruction for maintaining flow in irrigation canals, channels, watercourses, drains and sewers. The Contractor shall observe all rules and regulations of appropriate authorities regarding the interruption and maintenance of flow in irrigation canals, channels, watercourses, drains and sewers and shall save harmless and indemnify the Employer in respect of all claims, demands, proceedings, damages, costs and expenses whatsoever arising out of or in relation to any such construction, operations or interferences with irrigation flows.

The Contractor shall maintain alternate channels wherever temporary relocation of irrigation channels, water-courses, drains and sewers, is required or where his operations disrupt the irrigation flow, without any compensation from the Employer.

1.5 **Access and Canal Roads**



If the Contractor finds it necessary or selects to use existing canal roads, the Contractor shall make all necessary arrangements and obtain all permits from the provincial Irrigation Department for the use of such canal roads. The Contractor shall observe all rules and regulations of the Irrigation Department regarding the use of said canal roads. The cost of maintaining all necessary safety measures and temporary structures and making any necessary repairs, replacements or similar operations and all or any other costs required by reason of his use of such canal roads shall be borne by the Contractor and he shall save harmless and indemnify the Employer in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever arising out or in relation to any such operation or interference.

The Contractor shall submit a plan for approval of the Engineer, indicating the road network to be used for haulage and other works.

1.6 Making Good Damage to Services, Earthworks etc.

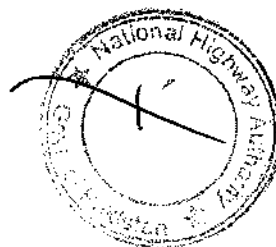
The Contractor shall make good, at his own cost, all damages to telephone, and electric cables including underground installations or wires, sewers, water, or other pipes except where Authority, Employer or Private Party owning or responsible for the same elects to make good such damages.

All injury to the surface of the land, to the beds of water-courses, protection banks, river beds, etc. where disturbed by the works (other than where specifically ordered by the Employer) shall be repaired by the Contractor or the Authorities concerned at the Contractor's expense. All such making good shall be as approved by the Employer.



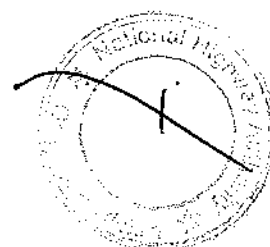
1.7 **Safety Precautions**

The Contractor shall adequately provide safety, healthcare and welfare to his persons and prevent the damage to works, material and equipment for the purpose of or in connection with the Contract.



SECTION 100

EARTHWORK AND ALLIED ACTIVITIES



EARTHWORK AND ALLIED ACTIVITIES

SECTION 100 GENERAL

100.1 DESCRIPTION

In line 2, delete "earth" and insert "soil".

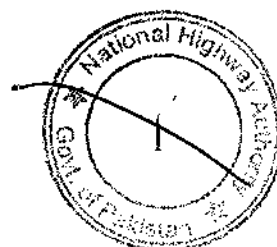
100.2 SOIL INFORMATION

In para 2, line 2, delete "earth" and insert "soil".

In para 2, line 3, after "requirements", add "in particular the borrow pits".

100.4 REMOVAL OF EXISTING OBSTRUCTIONS

- i) In line 5, after "bridges", add "walls, buildings and roads".
- ii) In line 7, after "item", delete "exists" and add "appears in the Bill of Quantities".



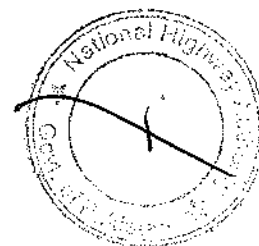
ITEM 101 CLEARING AND GRUBBING

101.3.1 Measurement

Delete para 2.

101.3.2 Payment

In line 4, after "original" insert "level and".



ITEM 104 COMPACTION OF NATURAL GROUND

104.1 DESCRIPTION

Delete complete paragraph and replace with following:

Prior to the natural/original ground, the cleared and grubbed surface (i.e. the surface after clearing and grubbing), stripped surface after stripping and the excavated surface after excavation shall be compacted. Prior to commencement of embankment construction in accordance with these Specifications, as shown on the Drawings or as directed by the Engineer's Representative. The compaction shall be carried out through a written order of the Engineer's Representative.

104.2 CONSTRUCTION REQUIREMENTS

Delete top paragraph and replace with:

The natural ground/cleared and grubbed, stripped and excavated surfaces shall be broken up, ploughed, scarified, all sods and vegetable matters removed and compacted to a depth of 200 mm and to the specified density as given below:

104.2.1 COMPACTION OF ORIGINAL GROUND SURFACE IN AREAS OF HIGH WATER LEVELS AND SALINITY

Delete complete paragraph and replace with:

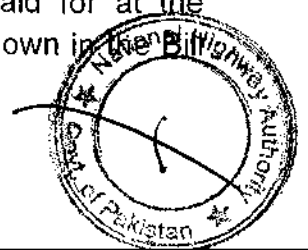
"Refer to Special Provision SP 116 for material and construction requirements under these conditions".

104.3.1 MEASUREMENT & PAYMENT

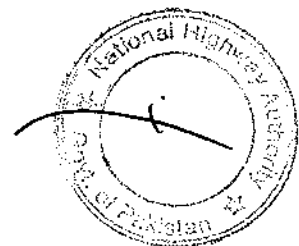
Delete complete paragraph and replace with:

The quantity to be paid for shall be the number of square meters directed to be compacted and accepted by the Engineer's Representative for payment. The restoration of original ground levels with fill material after execution of Item 104 shall not be paid separately and shall be deemed to be included in this pay item.

The area determined as provided above shall be paid for at the Contract unit price for the pay item listed below and shown in the Bill of Materials.



of Quantities which price and payment shall constitute full compensation for all the costs necessary for the proper completion of the work prescribed in this Section.



ITEM 105 ROADWAY AND BORROW EXCAVATION FOR EMBANKMENT

105.1 DESCRIPTION

In line 4, after "all excavation" add "after stripping of top soil (if required)".

In line 8, add at the end:

"It shall include the only suitable material for fill in the embankment or backfilling of Structure All unsuitable or surplus material is provided for in item 106. Excavation for structures is covered under item 107. Excavation for diversion / widening of water-courses is included."

105.2.1 Road Way Excavation

i) Delete "Road Way" from the title and insert "Roadway."

ii) Delete para 2 and replace with:

"Roadway Excavation shall further be classified as "Common Excavation" and "Rock Excavation" The classification shall include all the materials of whatever nature encountered except where these are unsuitable or surplus to requirements as in item 106".

iii) **a) Common Excavation**

In line 7, insert "silts" before "sands."

105.2.2 Borrow Excavation

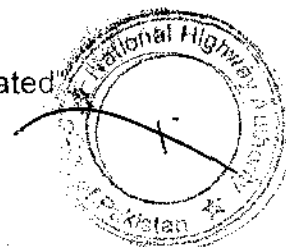
In para 3, line 4, add at the end:

"In particular they will be left in a safe, free draining condition. In all areas any topsoil previously removed shall be reinstated unless otherwise instructed by the Engineer's Representative".

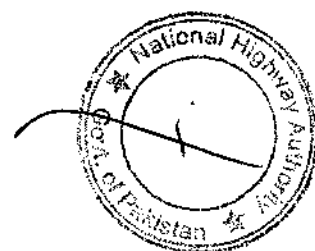
105.3 CONSTRUCTION REQUIREMENTS

i) In para 4, add at the end:

"Where appropriate drainage shall be reinstated"



- ii) In para 8, delete first sentence and insert "borrow material shall not be taken within two (2) kilometers, reach from downstream of any hydraulic structure."
- iii) After last para insert the following:
 - a) The excavated material approved for fill under any item of the Bill of Quantities shall be used in the manner as described under the item of work.
 - b) If it is unsuitable material, it shall be disposed of at the designated location in the manner as directed by the Engineer's Representative.
 - c) If the material is surplus to the fill requirements of the Project, it shall be disposed of at the location in a manner approved by the Engineer's Representative.
 - d) In rock excavation any area over-excavated in the subgrade shall be reinstated as directed by the Engineer's Representative at the cost of the Contractor. For disposal of excavated rock material same procedure shall be followed as described above for "Common Excavation".



ITEM 106 EXCAVATION OF UNSUITABLE OR SURPLUS MATERIAL

106.1 DESCRIPTION

At the end, add following para:

This also includes the material of existing structures and obstructions which are required to be removed as shown on Drawings or as directed by the Engineer's Representative.

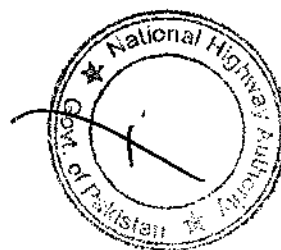
106.3.1 Measurement

In para 3, line 1, delete "Nos. 106a, 106b, 106c and 106d".

106.3.2 Payment

Delete table of pay items and replace with:

Pay Item No.	Description	Unit of Measurement
106	Excavate Unsuitable or Surplus Material	CM



ITEM 107 STRUCTURAL EXCAVATIONS AND BACKFILL

107.1 DESCRIPTION

In line 12, add at the end:

Excavation below original ground and filling with granular fill shall be paid under this item. Common filling and backfilling shall be paid under item 108 for all common filling and backfilling above the level of the original ground line".

107.2.3 Common Backfill

In line 2, between "allowed" and "subject" insert "on condition that the material requirements in item 108.2 are followed and".

107.3.1 Preparation of Foundations of Footings

- ii) In para (ii), line 2, delete "special, care" and replace with ", special care".

At the end of add para (iii) as follows:

Foundation material on which structure is to be placed shall be compacted to 95% modified AASHTO T-180, unless otherwise directed by the Engineer's Representative. In case unsuitable material is encountered at foundation level, it shall be removed to the depth and extent as directed and replaced with suitable material of the type as determined by the Engineer's Representative.

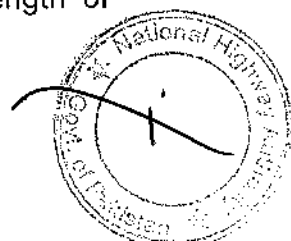
107.3.2 Excavation in Embankments

In para 3, line 2, after "payment", add "except where granular backfill is specified by the Engineer's Representative".

107.3.3 Backfill

- i) Delete para (h) and substitute as under :

"No backfill shall be placed against any concrete or masonry structure until permission is obtained from the Engineer's Representative and preferably until the concrete or masonry structure has been in place fourteen (14) days, or until test cylinders show the strength to be 80% of the 28 days cylinder strength of



concrete as per table 401-1. The backfilling shall be carried out on both sides of the structure simultaneously. All buried concrete surfaces shall be bitumen coated Cost of which shall be included in backfilling".

ii) At the end, add Para (i) as follows:

(iii) Any temporary backfill or platform constructed by the Contractor for piling purposes or for any other work item shall be subsequently removed by the Contractor without any payment as directed by the Engineer's Representative.

107.4.1 Measurement

a) Structural Excavation

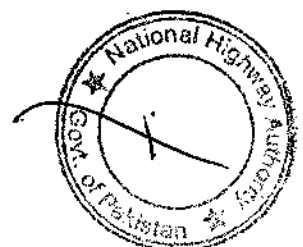
i) In line 2, between "position" and "computed" insert "below top soil".

ii) In sub-para (1), line 4, add the at the end:

"Neat lines of footings or foundations shall mean the outer faces of footings or foundations excluding lean concrete."

iii) At the end, add the following para:

No separate payment shall be made for compaction of excavated foundation under structures.



ITEM 108 FORMATION OF EMBANKMENT

108.1 DESCRIPTION

In line 6, add at the end "The work shall also include the compaction, trimming and shaping of the side slopes as shown on the plans and removal of any excess fill as directed by the Engineer's Representative, prior to placement of top soil on slopes of the embankment where required".

108.2 MATERIAL REQUIREMENTS

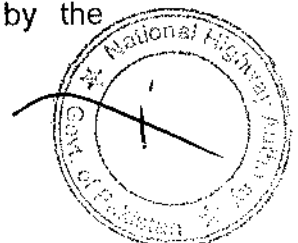
Delete this entire item and replace with:

Material for embankment shall consist of suitable material excavated under the foregoing Items 105 and 107 and approved by the Engineer's Representative's. Borrow material however, shall only be used when there is no suitable material available from the roadway or structural excavation.

Wet excavated material which will be suitable when dry and if approved by the Engineer's Representative shall first be allowed to dry before being placed in the embankment.

The material under this section shall conform to the following Specifications:

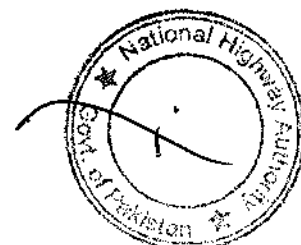
- a) The Contractor shall use AASHTO Class A-1, A-2, A-3, A-4, soil as specified in AASHTO M-145 or other material approved by the Engineer's Representative.
- b) The material for embankment, except the top 30cm, shall have a minimum soaked C.B.R. value of 5.0 per cent unless otherwise stated on the Drawings. The C.B.R. shall be determined in accordance with AASHTO T-193 at a max. dry density, AASHTO T - 180 corresponding to the required compaction zone of the embankment. For top 30cm, however, the CBR shall not be less than 8.0 per cent determined as above at 95 per cent laboratory max. Dry density.
- c) In case sandy material (P.I. < 4) is used for embankment formation, it shall be properly confined with a material having plasticity index value from 4 to 10 as approved by the Engineer's Representative.



- d) In areas subject to flood and prolonged inundation of the embankment, such as at bridge sites, the material used in embankment, unless rock, shall be AASHTO Class A1 (a), A1(b) and A-2-4 soils. Other soils may be used with the written consent of the Engineer's Representative and provision of suitable protection to the embankment slopes as directed by the Engineer's Representative.
- e) For the purpose of embankment and subgrade construction the following type of soil shall be considered as unsuitable materials:
 - 1) Material from soil AASHTO classification group of A6 and A7.
 - 2) Material from swamps, marshes and bogs;
 - 3) Peat, logs, stumps and perishable materials;
 - 4) Material susceptible to spontaneous combustion;
 - 5) Materials having a moisture content greater than the maximum permitted for such materials in the contract or as directed by the Engineer's Representative;
 - 6) Organic Soils.
- f) The moisture content of the soil at the time of compaction shall be uniform and shall be such that the soil can be compacted to the specified density and approved by the Engineer's Representative. The moisture content shall be as directed by the Engineer's Representative, as determined from a test section and moisture density test (AASHTO T-180 Method D) done on each type of soil to be used in the construction of the work to determine the maximum density, the optimum moisture content and the moisture range required for the soil to achieve the desired compaction and approved by the Engineer's Representative. The soil shall be compacted at optimum content with $\pm 1\%$ tolerance.

108.3.1 Formation of Embankment with Borrow Common Material

- i) In para 1, last line, after "approved" add "for each material source or borrow area."
- ii) Delete para 5 "The compaction of the embankment equipment" and replace with :



"The compaction of the embankment shall be carried out at the designated optimum moisture content with $\pm 1\%$ tolerance consistent with the available compacting equipment. In forming the embankment, the Contractor shall take steps to ensure that the work can be drained free of rain water, and he shall make due allowance in the height and width of the work for swelling or shrinkage."

iii) In para 6, line 6, after the word "disking" add "and scarifying".

iv) In last para, add at the end:

"In order to prevent erosion of the slopes the Contractor shall compact the trimmed slopes to the required density prior to laying top soil or as directed by the Engineer's Representative."

108.3.2 Formation of Embankment with Rock Material

i) In para 1, line 4, delete "than".

ii) In para 2, line 2, delete "clean small spells,"

108.3.3 Formation of Embankment on Steep Slopes

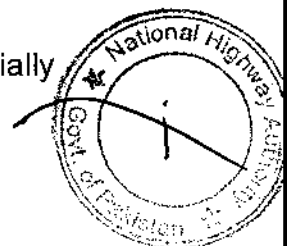
Delete 1st para and replace with:

"Where an embankment is to be constructed against an existing slope of 1 vertical to 5 horizontal or steeper, hill sides, existing shoulders or where new fill is to be placed and compacted against existing pavement or where embankment is to be built along one half the width at a time, the existing slope shall be benched. The horizontal dimension of benches shall be greater than half the width of the compacting equipment in use except where this would result in a vertical dimension at the back of the bench of more than 60 cms in which case the horizontal dimension may be reduced."

The compaction of benches shall be as per Clause 108.3.1 of the General Specifications.

No measurement shall be made of the material cut from the existing slope, re-compacted at the same place or reused elsewhere for benching purpose. Filling against the slope will be calculated on the volume of fill placed against the original slope.

Existing slope in the context of this clause includes a partially



constructed embankment but does not include the side of trench excavation.

108.3.4 Formation of Embankments on Existing Roads

Delete line 6 after the "Engineer" and replaced with:

"The material declared suitable will be measured under relevant item and that declared unsuitable, will be measured under item 106, unless a separate pay item appears in Bill of Quantities.

108.3.5 Formation of Embankments in Water Logged Areas

Delete entire para and replace with:

This work shall be performed as stipulated in SP 117.

108.3.6 General Requirement

Delete entire 2nd Para and replace with: -

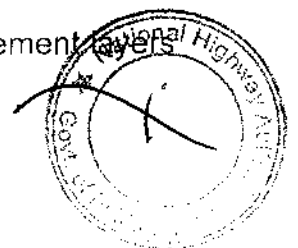
i) As a result of settlement, if an embankment requires the additional material upto 30cm thickness to bring it up to the required grade level, the top of the embankment shall be prepared as per requirement of Sub-Grade preparation as stated in item No. 109. No separate payment shall be made to the Contractor for the scarification, removal and replacing or reworking of existing material to a depth as directed by the Engineer's Representative, unless a separate pay item appears in the Bill of Quantities.

ii) After the last paragraph, add the following:

Embankment filling shall be brought up and compacted over the full width of the embankment of one carriageway in one operation in layers parallel with the sub-grade level. At no time shall any part of the embankment width under one carriageway be left more than one layer lower than any other part of the embankment width.

Shoulder construction shall be brought up simultaneously with the pavement construction.

In order to prevent water penetration into the pavement layers



during construction, shoulders and median construction shall be brought up simultaneously with the pavement construction whenever the transverse slope of the subgrade slopes downwards towards the median. The fill behind abutments and wing walls of all bridges, pipes slab and box culverts shall be deposited in well-compacted, horizontal layers not exceeding twenty (20) cm in thickness to the density 100 percent of max. Dry density as per AASHTO T180 (D).

- iii) After item 108.3.6, add item 108.3.7 "Trial Section" as follows:

108.3.7 Trial Section

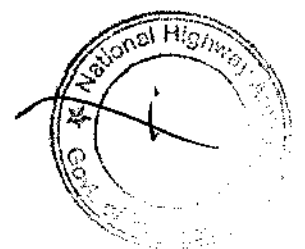
Before starting the filling of the embankment the Contractor shall construct trial sections of 500 m or as directed by the Engineer's Representative in 2 layers depth for each soil type/source proposed for use as fill material. The soils used in the trials shall be the same as those intended to be used for the formation of embankment and the compacting equipment shall be same that the Contractor will use for the main work.

The construction of embankment with any type of soil/material source shall be subject to written approval of the Engineer's Representative after the trial section made for that particular type of soil/material source.

The object of these trials shall be to determine the optimum moisture content and the relationship between the number of passes of compacting equipment and density obtained for the soil types under trial and for the verification of the soil type itself. No separate payment will be made for this work, which shall be required as a subsidiary obligation of the Contractor under Pay item Nos. 108a, 108b or 108c, as the case may be.

108.4.2 Payment

- i) In Sub-Clause c, Formation of Embankment from Roadway Excavation, line 2, delete "form" and replace with "from".
- ii) In table of pay items, description of pay item 108a, line 2, delete "form" and replace with "from".



116.1 DESCRIPTION

This work shall consist of the formation of embankment in areas of soft / weak foundations; compaction of natural ground shall not be possible as specified in item 104 and also in areas of high water table. This also include the wet areas which cannot be dried by scarifying or other measures and exhibit moderate to severe heaving of surface during proof-rolling.

The embankment shall consist of a working platform of the granular material followed by the embankment fill material and earthen dowels provided at toe of the embankment, all constructed in accordance with these specifications and the specifications for other work items involved and in conformity with the lines, grades, sections and dimensions shown on the drawings or as directed by the Engineer's Representative.

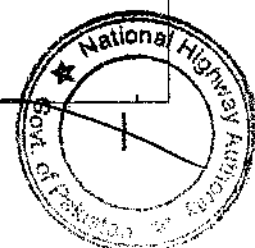
116.2 MATERIAL REQUIREMENTS**116.2.1 Subgrade/Embankment**

The subgrade/embankment material shall be as per Clause 108.2 of General Specifications.

116.2.2 Granular Material Platform

The material for the working platform shall consist of normal or processed granular fill material obtained from borrow excavation or quarry waste. This material shall conform to the following Specifications:

Mesh Sieve Size (AAS II 707-27)	%age of weight Passing
37.5 mm	100
10 mm	75 - 100
# 4	60 - 80
# 10	45 - 65
# 40	25 - 40
# 100	0 - 15
# 200	0 - 5



The selected material shall be of such grading so that intrusion into the working platform material of subgrade or natural ground surface material is not allowed.

For following the above, this condition to be met it will be required that the following ratio is to be checked and followed:

$$\frac{\text{D15 - (Granular Fill Material)}}{\text{D85 - (Natural Ground Material)}} < 5$$

D85 and D15 mean the practical diameters corresponding to 85% and 15% respectively, passing (by weight) in a grain size analysis.

116.2.3 Earthen Dowels

The material for earthen dowels shall be any soil obtained from borrow excavation or any other source as approved by the Engineer's Representative having a plasticity index of more than 6. It should be free of organic and other deleterious substances.

116.3 CONSTRUCTION REQUIREMENTS

116.3.1 Subgrade/Embankment

The subgrade/embankment above the granular material platform shall be compacted to 95% AASHTO T-180 D regardless of zone of embankment within which falls.

116.3.2 Granular Material Platform

Prior to laying of granular material platform, the pond/water logged area upon which embankment are to be placed, shall have been dried and drained or kept drained of all surface water prior to commencing of fill and all clearing and grubbing shall have been performed, manually if necessary in accordance with the relevant specifications.

Construction of the granular fill layer shall proceed from one end of the soft area by using the granular fill as a ramp for further granular fill transport. The thickness of the granular fill working platform prescribed shall be as shown on the Project drawings or as directed



by the Engineer's Representative and the width shall be that of the embankment or part as directed by the Engineer's Representative. The placement and compaction of the working platform including boxing material shall be carried out by the use of appropriate light equipment, in layers, if necessary. The placement, spreading and compaction of the Granular Material Platform shall be carried out by using light equipment. The top 15 cm of the platform shall be compacted to at least 90% AASHTO T - 180 density.

In those areas of high water levels and salinity with soft subsoils and where embankments are high such as approach fills to structures, special provisions shall be made to measure and determine likely fill settlements which may occur. These preconditions are necessary in order to specify particular construction procedures which may be necessary and to establish the time at which the pavement structure can be placed to avoid cracks & subsidence of these layers.

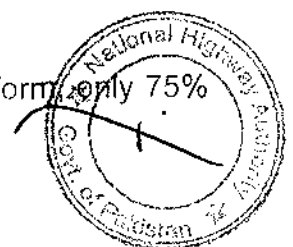
In particular, additional compaction of the fill material and its adequate protection shall be required to prevent underscore and the risk of "collapse" settlement.

At locations where granular material platform is used as detour road, Contractor shall maintain its line and grade. This maintenance may require replenishing of granular material for remedying the sinking of granular material platform or loss of material due to traffic. No extra payment, under this item, shall be made to the Contractor for re-working, re-instatement, replacement of granular material which has become slushy or replenishing of granular material for whatsoever reason.

116.4 MEASUREMENT AND PAYMENT

The quantities measured against this item as shown on the drawings with respect to line and grades shall be paid for at the contract unit price for the pay items listed below and shown in the Bill of Quantities. These prices and payments shall constitute full payment and compensation for providing including hauling, processing, placing at site and compacting as specified, replenishing granular material for remedying loss of material due to traffic and sinking of granular material platform during construction or during use as detour road, labour and other costs related to the completion of works in all respects.

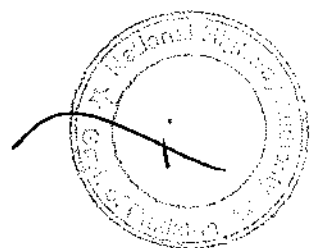
On completion and approval of granular material platform, only 75%



payment for pay item SP 116a shall be made to the Contractor. Balance 25% payment for pay item SP 116a shall be made to the Contractor only when the granular material platform is no more required to serve as detour road and it has been re-worked, re-instated or replaced as directed by the Engineer's Representative and is re-approved and ready to receive oncoming layer of embankment.

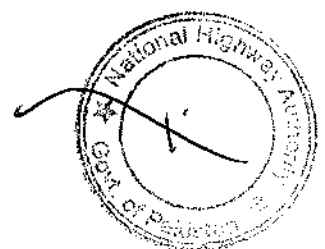
Pay Item No.	Description	Unit of Measurement
SP 116a	Formation of Granular Material Platform	CM
SP 116b	Formation of Earthen Dowels	CM

The payment for formation of embankment other than item SP 116 shall be paid under item 108 of Bill of Quantities.



SECTION – 200

SUBBASE AND BASE



SUBBASE AND BASE

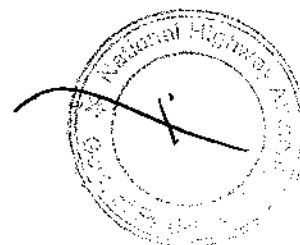
SECTION 200 GENERAL

200.1 DESCRIPTION

In para 1, line 2, delete ", base," and insert ", crushed aggregate base course,"

200.2.1 Sampling and Testing

In para 3, line 5, after "..... Testing and Material (ASTM)", insert the word "or" for particular materials or procedures, the British Standards Institution,"



ITEM 201 GRANULAR SUBBASE

201.2 Material Requirements

In para (a):

- i) In second line, delete "A, B and C" and replace with "B".
- ii) In the table of Grading Requirements for Subbase Material, delete "grading A".



ITEM 202 AGGREGATE BASE COURSE

202.1 DESCRIPTION

Add at the end:

The word "Aggregate Base" wherever appearing in Item 202 should be read as "Crushed Aggregate Base Course".

202.2 Material Requirements

i) In para (a):

(1) In line 2, delete " or B".

(2) In the table of Grading Requirements for Aggregate Base Material, delete "grading B".

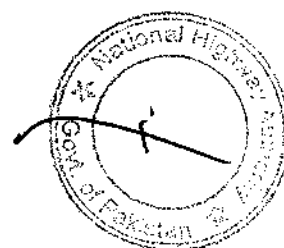
ii) In para (e), line 2, delete "the material shallas determined by AASHTO T-89 & 90." and replace by the following:

"the portion of filler, including any blended material, passing No. 40 mesh sieve shall have a liquid limit not more than 25 and a plasticity index not more than 4 when tested in accordance with AASHTO T-89 & T-90. "

202.4.2 Payment

Replace the pay item table as follows:-

Pay Item No.	Description	Unit of Measurement
202	Crushed Aggregate Base Course	CM



ITEM 203 ASPHALTIC BASE COURSE PLANT MIX

203.2.2 Asphaltic Material

In line 2, delete "40-50,60-70 or 80-100" and replace with "60-70".

203.2.3 Asphalt Concrete Base Course Mixture

- i) In line 2, delete "Class A and/or".
- ii) In the table of Combined Aggregate Grading Requirements (Table 203-1), delete "grading for Class A".

203.2.4 Job Mix Formula

After para 3, add the following:

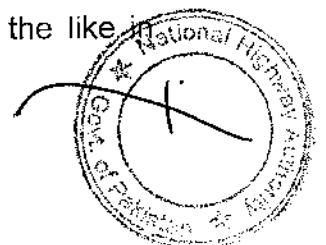
The combined gradation should produce a smooth curve approximately paralleling grading band limits for designated mix. The job-mix formula with allowable tolerances for a single test then becomes the job control grading band. If application of job-mix tolerances results in a job control grading band outside the master grading band, the full tolerances shall still apply.

Prior to final approval, the proposed job mix, with a bitumen content at the permissible upper percentage limit determined in JMF, shall be compacted to refusal (750 to 900 blows) and the resulting air voids in the mix shall not be less than 3%.

203.3.7 Spreading and Finishing

Delete para 2 and replace with the following:

Care shall be taken to ensure that material is properly compacted up to joint positions. If this is not done or results in misshapen surface on a layer, the Engineer may instruct unacceptable material to be cut back before laying the adjacent material. Joints in superimposed layer of asphaltic material must be offset longitudinally by at least 2m and transversely by at least 30 cm. Longitudinal joints in wearing course shall, after cutting back, be of good alignment and preferably coincident with the position of carriageway markings. Except where laying in echelon, joints in wearing course shall be cut back to a vertical face and Tack coated. Kerb faces, ironwork and the like in



contact with wearing course shall be tack coated prior to laying wearing course.

The outer edges of wearing course shall be cut back to a good alignment, parallel with the road alignment. This will require a small additional width of wearing course to be laid.

The Contractor should allow, within his bid rates, for this additional width and for all cutting back of wearing course which will not be measured for payment. Tack coating of vertical faces will not be measured for payment.

203.3.10 Surface Tolerances

At the end, add the following:

The surface irregularities will also be tested by a rolling straight edge of the type designed by Transport Research Laboratory of UK, along any line or lines parallel to the edge of pavement on sections of 300m selected by the Engineer, whether or not it is constructed in shorter lengths. Sections shorter than 300m forming part of a longer pavement shall be assessed using the number of irregularities for a 300m length prorata to the nearest whole number. Where the total length of pavement is less than 300m, the measurements shall be taken on 75m length. No irregularity exceeding 10mm shall be permitted.

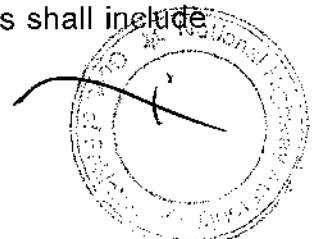
Maximum Permitted Number of Surface Irregularities using a Rolling Straight Edge

Surface under test	Irregularity			
	4 mm		7 mm	
Length	300m	75m	300m	75m
Asphaltic Base course	40	18	4	2

203.4.2 Payment

Delete the Item and replace with:

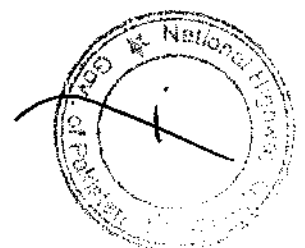
The quantities of asphaltic leveling/base course will be measured by volume in Cu.m compacted in place. Measurements shall be based on the dimension as shown on plans or as otherwise directed or authorized by the Engineer. No measurement shall be made of unauthorized areas or for extra thickness. These items shall include



the furnishing of all materials including asphalt additive or anti-stripping agent, if allowed by the Engineer to meet requirements of JMF; the drying and screening of aggregates; the mixing of bituminous material with the aggregates and the placing, furnishing and compaction of the mixed material.

Quantities of asphalt concrete mixed, wasted or disposed of in a manner not called for under the Specifications or remaining on hand after completion of the work will not be paid for. The quantities determined as measured above shall be paid or at the Contract unit price for the particular pay items listed below and shown in the Bill of Quantities, which prices and payment shall constitute full compensation for all costs necessary for proper completion of the work prescribed in the item:

Pay Item No.	Description	Unit of Measurement
203 a	Asphaltic Base Course Plant Mix (Class B)	CM
203 b	Asphaltic Levelling Course Plant Mix (Class B)	CM



**ITEM 209 SCARIFICATION OF EXISTING ROAD/BREAKING OF ROAD
PAVEMENT STRUCTURE**

209.1 DESCRIPTION

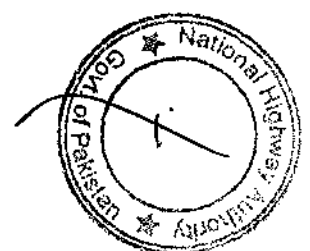
- i) In line 4, delete "aggregate base" and replace with "pavement structure".
- ii) In line 4, delete "base material" and replace with "embankment/ pavement structure".
- iii) In line 6, delete "crushed stone base aggregate" and replace with "embankment/pavement structure".

209.2 CONSTRUCTION REQUIREMENTS

In para 2, line 2, delete "off" and replace with "of".

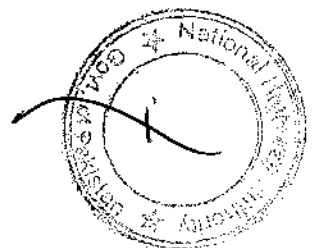
209.3.2 Payment

In line 4, after "equipment," add "disposal as directed by the Engineer,"



SECTION 300

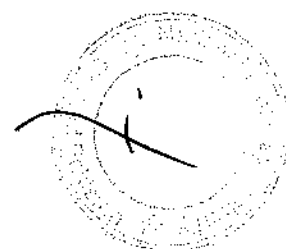
SURFACE COURSES AND PAVEMENT



SURFACE COURSES AND PAVEMENT

SECTION 300 GENERAL

In para 1, line 5, after "..... Testing and Material (ASTM)", insert the words "or, for particular materials or procedures, the British Standards Institution,".



ITEM 302 BITUMINOUS PRIME COAT

302.3 CONSTRUCTION REQUIREMENTS

In para 1, delete sentences 1 to 3 and replace with:

Prior to the application of prime coat, loose material shall be removed from the surface and cleaned by mechanical blowers and hand brooms. The application is prohibited when the weather is foggy or rainy or when the atmospheric temperature is below fifteen (15) degree C unless otherwise directed by the Engineer. On a soil surface or granular sub-base or crashed aggregates base course, the cleaned surface shall be given a light application of water and allowed to dry to a surface-dry condition before prime coat is applied.



ITEM 305 ASPHALT CONCRETE WEARING COURSE-PLANT MIX

305.2.2 Asphaltic Material

Delete entire para and replace with:

"Asphalt binder to be mixed with the aggregate to produce asphalt concrete wearing course shall be asphalt cement of penetration grade 60-70 or a grade approved by the Engineer's Representative. Generally it will meet the requirements of AASHTO M-20".

305.2.3 Asphalt Concrete Wearing Course Mixture

- i) In line 2, delete " and/or Class B".
- ii) In the table of Asphalt Concrete Wearing Course Requirements (Table 305-1), delete "grading of Class B".
- iii) In Marshal Test Criteria" Percent air voids in mix, delete "4 - 7" and replace with "3.5 - 5.5".

305.2.4 Job-Mix Formula

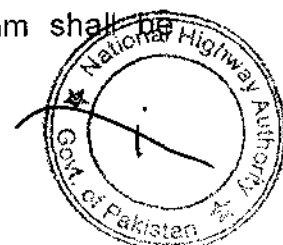
After para 4, add the following para:

Prior to final approval, the proposed job mix, with a bitumen content at the permissible upper percentage limit determined in JMF, shall be compacted to refusal (400 to 600 blows) and the resulting air voids in the mix shall not be less than 2%.

305.3.2 Pavement Thickness and Tolerances

At the end, add the following:

The surface irregularities will also be tested by a rolling straight edge of the type designed by Transport Research Laboratory of UK, along any line or lines parallel to the edge of pavement on sections of 300m selected by the Engineer, whether or not it is constructed in shorter lengths. Sections shorter than 300m forming part of a longer pavement shall be assessed using the number of irregularities for a 300m length prorata to the nearest whole number. Where the total length of pavement is less than 300m the measurements shall be taken on 75m length. No irregularity exceeding 10mm shall be permitted.



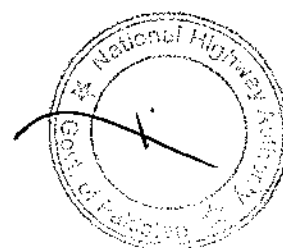
**Maximum Permitted Number of Surface Irregularities
using a Rolling Straight Edge**

Surface under Test	Irregularity			
	4 mm		7 mm	
Length	300m	75m	300m	75m
Wearing course	20	9	2	1

305.4.2 Payment

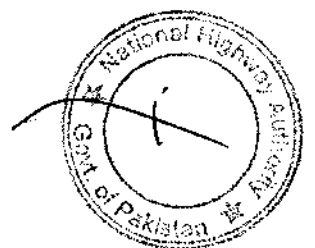
Para 2 of Price Adjustment

Delete 3rd line from "or the Contractor may opt to place an additional layer of wearing course asphalt, grading with a minimum thickness of 35mm".



SECTION 400

STRUCTURES



STRUCTURES

SECTION 400 CONCRETE

401.1 DESCRIPTION

Paragraph 1, line 3 between "aggregates" and "all in accordance", add "and chemical admixtures as may be required".

Add the following to 401.1 at the end of paragraph 1.

A Tolerances on dimensions and setting out

Concrete structures in their final state must present the same dimensions as shown on Drawings and comply with the following tolerances:

A.1 Tolerances (TL) on every dimension (d), (length, width, diagonal or thickness) will be given by the formula:

$TL = 0.25 (d)^{1/2}$ where TL and d are given in mm
The tolerances (TL) will have to be within:

- a minimum of 10mm
- and a maximum of 70 mm

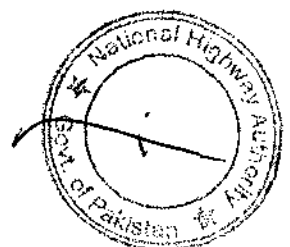
A.2 Tolerances of plumb (TA) for a height h is given by the following formula: $TA = 0.5 (h)^{1/2}$ where TA and h are given in mm

A.3 Tolerances of flatness

A.3.1 Ordinary surface form finish

- Unit flatness built up by a 2 m ruler should allow space less than 15mm between the concrete and the ruler.
- Local flatness build up by a ruler of 0.20m should allow a space less than 6mm between the concrete and the ruler.

A.3.2 Class 1: Surface form finish



- Unit flatness built up by a 2m ruler will allow a space less than 7mm between the concrete and the ruler.
- Local flatness built up by a ruler of 0.20m will allow a space less than 2mm between the concrete and the ruler.

A.4 Setting out and leveling tolerances

All tolerances for topography will be controlled by external control point.

A.4.1 In plan, at the edges, the tolerances are:

- 30 mm for footings
- 30 mm for piers
- 20 mm for decks

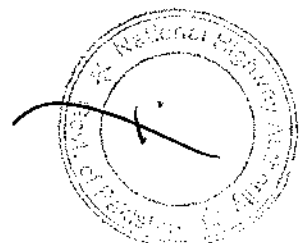
A.4.2 In elevation, the tolerances are:

- 30 mm for footings
- 20 mm for the top of a pier
- 3 mm for the top of a bearing pad
- 25 mm for a slab intrados
- 25 mm for a slab extrados

The Contractor will take all the provisional measures to achieve these values; for instance:

- Camber for false work due to its settlement and deformation, taking into account the schedule of concreting/prestressing.
- Stiffeners on formworks.

In case of dimensions exceeding the tolerances, the Contractor will make a proposal for corrections to the Engineer's Representative. If accepted by the Engineer's Representative, repairs will be made as soon as possible. If not accepted, the Engineer Representative can require partial or total demolition of unsatisfactory structures, and reconstruction will have to take place without any extra payment.



B

Cracking

Reinforced concrete structures must not show cracks larger than 0.3 mm. Therefore, cracks of width larger than 0.3 mm will be filled by injecting a suitable epoxy - resin in a way as approved by the Engineer Representative.

If cracks are due to improper materials, workmanship etc., the Engineer Representative can stop the concreting until investigations and testing have been completed at the cost of the Contractor.

If necessary, the Engineer's Representative can demand demolition and reconstruction of the structure, without any extra payment.

401.1.1

Classes of Concrete

Paragraph 1, line 2, delete "A, B, C, D1, D2, D3, Y" and insert" A1, A2, A3, D1"

- Lean Concrete. (The mix by weight shall be 1:4:8 (Cement, sand, coarse aggregates):)

Table 401.1 Portland cement Concrete Requirements.

Delete Table and insert table below:

**TABLE 401.1
PORTLAND CEMENT CONCRETE REQUIREMENTS**

Class of Concrete	Min. Cement Kg/Cubic Meter	Max. Size of Coarse Aggregate (mm)	28 days Compressive Strength (Min) (Cylinder) (Kg/Sq.cm)	Consistency (Range in Slump) Vibrated (mm)	Maximum Permissible Water - Cement Ratio
A1	300	20	210	25 - 75	0.58
A2	380	20	280	75-100	0.54
A3	400	20	280	100- 150	0.58
D1	450	25	350	50-100	0.40
Lean Concrete	175	51	100	-	-

Add the following to 401.2.2 as 2nd paragraph.

401.2.2 Fine Aggregate

All concrete surfaces shall be considered as exposed to humid conditions. So, fine aggregates to be used in the preparation of concrete shall be tested for alkali – aggregate reaction, by ASTM-C-289.

Add the following to 401.2.3 to line 6 in paragraph 1.

401.2.3 Coarse Aggregate

All concrete surfaces shall be considered as exposed to humid conditions. Therefore, coarse aggregate to be used in the preparation of the concrete shall be tested as per ASTM-C-289.

Add the following to 401.3.5a after 5th paragraph.

401.3.5 Handling and Placing Concrete

a) General

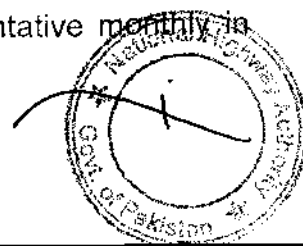
"Before concreting in any section, reinforcement shall have to be completely cleaned and free from all contaminations, including concrete which may have been deposited on it from previous operations. Concreting shall take place only after the Engineer's Representative inspection and approval of the placing of reinforcement.

The Contractor shall allow the Engineer's Representative to conduct the inspection for 8 hours after the reinforcement is in placed to conduct the inspection.

The Engineer's Representative shall check the records of concrete being placing at site in a manner as stated below:

Contractor shall keep the records, in order as agreed by the Engineer's Representative, containing all details of every pour of concrete placed. These records shall include class of concrete, location of pour, weather conditions, date of pour, ambient temperature and concrete temperature at time of placing, moisture content of aggregates, details of mixes, batch numbers, results of all tests undertaken, location of test cylinder sample points and details of any cores taken.

The Contractor shall supply two copies of these records each week to the Engineer's Representative covering work carried out the preceding week. In addition, he shall supply to the Engineer's Representative monthly in



histograms of all 28 days cylinder strengths, together with accumulative and monthly standard deviations and any other information which the Engineer's Representative may require concerning the concrete placement in the Works".

Add the following to 401.3.6e as 4th paragraph.

401.3.6 Casting Sections and Construction Joints

e) Construction Joints

"The Contractor may require the construction joints at different locations which are not shown on the drawings. If so, the Contractor shall submit his proposal for approval of the Engineer's Representative. If the stresses distributions in the structure are changed by the new construction joints, new calculations can be asked from the Contractor for checking the reinforcement. If the quantities of steel and formwork are increased, no extra payments shall be made. Elsewhere, on visible faces, aesthetical treatment of construction joint will be provided without any extra payment.

Modify 401.3.7 as follows:

401.3.7 Concrete Surface Finishing/Rendering

Delete and substitute 401.3.7d with:

d) Ordinary Surface Form Finish

"Ordinary surface form finish will follow AASHTO-SS-8.12.2. Non-shrinkable mortar will be used.

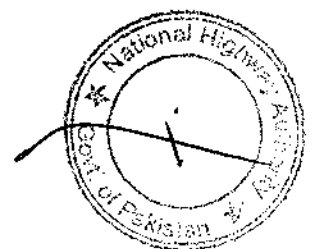
Ordinary surface form finish shall be applied to all concrete surfaces, except those of Class 1 form finish which are defined hereafter".

Delete and substitute 401.3.7e with the following:

e) Class 1 Surface Form Finish

"Class 1 surface form finish will follow the AASHTO-SS-8.12.3.

Metal, fiber or plywood forms in good conditions will be used exclusively.



"Class 1 surface finish shall systematically be required to be applied as the final finish for the following surfaces, unless otherwise directed by the Engineer's Representative.

- i) All form finish surfaces of bridge super-structures, except the under surfaces between girders.
- ii) All surfaces of bridge piers, columns and abutments, and retaining walls above finished ground and to at least three tenth (0.3) meter below finished ground.
- iii) All surfaces of barriers".

Add the following to 401.3.10 as last paragraph.

401.3.10

Testing of Compressive Strength

"Equipment used for trial batches will have to be the one that would be used on that specific job".

Modify 401.4 as follows

401.4

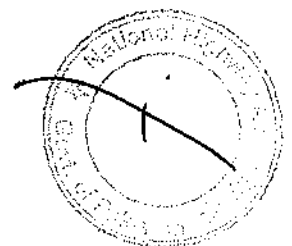
MEASUREMENT AND PAYMENT

Add "all the material" to line 4 of section 401.4.2 paragraph 1.

between "also for" and "such work", add "all materials and"

Add the following to 401.4.2 as 2nd paragraph.

In case the pier piles are extended unto the transom of the longitudinal beams by a pier of the same diameter, the limit of measurement for piles and therefore for the grade of concrete shall be unto the natural ground level or waterway bed. The extended part unto the transom shall be treated as column of the structure and its payment should be made according to relevant pay items of the specifications.



ITEM 404 STEEL REINFORCEMENT

Modify 404.3.1 as follows:

404.3.1 Fabrication of Bent Bars

Add the following to 404.3.1a as 2nd paragraph:

a) Order tests

Project shop drawings for bar lists and bending diagrams will be provided to the Engineer's Representative for approval, according to AASHTO-SS Section II -9.3. These documents shall be given to the Engineer's Representative at least one month before placing the steel.

c) Fabrication

For deformed bars grade 60, bending will be made only mechanically".

Delete in 404.3.1.c from the word: "Stirrups" to the end, and substitute with:

- "- Stirrups and column tie bars: $D = 4d$ for $d \leq 16\text{mm}$
- Other bars having $d \leq 32\text{ mm}$
- Grade 60: $D = 8 \times d$
- Grade 40: $D = 5 \times d$

Add the following to 404.3.1 as 4th heading.

d) Shipping

All grade 60 bars will be shipped to the site in straight bars.

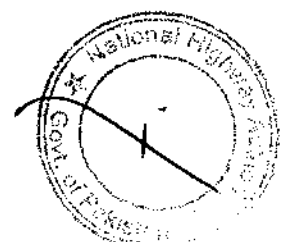
Modify 404.3.2 as follows:

404.3.2 Placing and Fastening

Add the following to 404.3.2b as 4th paragraph.

b) Placing and Fastening

- Tolerances



Tolerances on bars placing will be $\pm 20\text{mm}$ in any direction parallel to a concrete face, and $\pm 10\text{mm}$ at right angle to a face.

- Control of formwork before placing the steel:

No reinforcement shall be placed before the Engineer's Representative has inspected the formwork and given his approval. The Contractor shall allow the Engineer's Representative at least four (4) working hours after the form is finished to conduct the inspection".

Delete in 404.3.2.e from the words "Top of slab" to the end and replace it by:

e) Covering

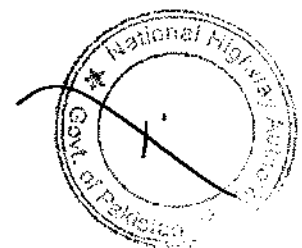
- For DIA $\leq 20\text{mm}$

The minimum cover will be:

30mm except for the faces in contact with soil where a minimum cover of 40mm is required.

- For DIA $> 20\text{mm}$

The minimum cover will be 40mm everywhere except for the faces in contact with soil where a minimum cover of 50mm is required.



ITEM 405: PRESTRESSED CONCRETE STRUCTURES

405.3 CONSTRUCTION REQUIREMENTS

Add the following to 405.3.1 as 3rd last paragraph.

405.3.1 Prestressing Method

In his submittal, the Contractor will also describe techniques he intends to use for:

- Placing ducts and stands.
- Marking ducts completely tight against accidental entrance of laitance during concreting.
- Prestressing operations and measurement of elongation.
- Injection.
- Cutting of tendons surplus, and filling anchorage recesses.

He will also ensure that all provisions will be taken for the protection of prestressing steel, ducts, anchorages, jacking and grouting equipments and all miscellaneous items. Protection will be on storage areas, and also at every stage of construction until injection by grouting and concreting of anchorages recesses.

All type of protections will be described in details (methodology and materials) by the Contractor in his submittal. As for the "storage of materials on site" he will follow AASHTO-SS Division II 10.3.1.6.

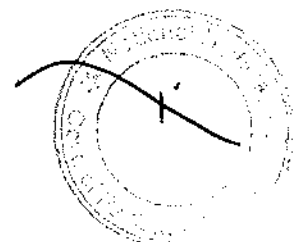
It is assumed that all these provisions will be sufficient to ensure that the friction coefficient of strands/ducts will be included between 0.20 and 0.24 and no oxidation on steel (ducts and strands) will occur.

Add the following to 405.3.2 as last paragraph.

405.3.3 Prestressing Equipment

At least three (3) jacks will be provided on the job in good conditions, accompanied by certified calibration curve.

Add the following to 405.3.4 as 2nd paragraph.



405.3.4 Placing Steel

Density of supports, their stiffness and accuracy of position are parameters that affect the loss of tension in cables due to wobbling. The Contractor will take all suitable provisions to reduce this "wobbling effect".

In particular, the space between two supports will be less than 1mm.

Add the following to 405.3.7 as last paragraph.

405.3.7 Post Tensioning

-A record shall be kept of the jacking forces and elongations at every stage, in a form that will be submitted by the Contractor and accepted by the Engineer's Representative.

-After cutting surplus length of cables, recess will be filled by concrete type Y.

Delete 405.3.8 and substitute by:

405.3.8 Grouting of Bonded Steel

All ducts used for post-tensioning will be filled by injection of grout.

a) Grout

It shall be a mixture of cement, water and, eventually, admixtures. Composition shall be submitted to the Engineer's Representative for approval, along with the following information:

- The nature, quality and origin of the constituents.
- Measure by weight of each constituent,
- Sequence of Mixing

The cement shall be Portland cement that does not exhibit phenomenon of "false setting" (Test of TUSCHENBROOK), without any sulphur ions S^{2-} , with a chloride ions Cl^- less than 0.05%, and without any element susceptible to induce corrosion of steel.

- The water shall not contain chloride ions Cl^- more than 500 mg/l, sulphate ions SO more than 400 mg/l, and no detergent
- Type of admixtures.



The submittal shall include the chemical composition of the grout and results of laboratory tests for the following features:

- Sweating
- Fluidity
- Mechanical Strength

Sweating

The quantity of water due to sweating at the surface of grout maintained at rest during three (3) hours must be less than 2% of the volume of the grout; this water must be totally re-absorbed twenty-four (24) hours after the mixing.

Fluidity

The flow-out time through the MARSH cone with a 10 mm hole diameter, will be included between 13 and 25 seconds during the time foreseen for the grouting, and at least for 1 hour, at a temperature of 32°C.

Mechanical Strength

At 28 days, cylinder strength shall be more than 300 kg/Sq cm.

- (b) Grouting Operation
AASHTO – Division II – 10.6 will be followed.

Note that mixing water shall have to be cooled in summer when temperature of concrete will be above 32°C.

- (c) Quality Control:

C.1 Laboratory tests

They will be made to verify the suitability of the grout composition to the intended basic features here above specified.

C.2 Checking tests on site

Checking for sweating and fluidity shall be made 24 hours before beginning of the injections at the conditions that will actually prevail at the injection time; same materials and equipments will be used for the purpose.

Results of test will be transmitted to the Engineer's Representative.

C.3 Tests during grouting operations

For each operation, three series of fluidity tests will be made. Each series consist of one test on the grout at the entry vent and one test on the grout at



the exit vent. Results of test will be transmitted to the Engineer's Representative as well as quantities of grout actually consumed for each duct.

Delete and substitute 405.3.9 by:

405.3.9 Handling – Launching – Placing:

Working Shop Drawings of handling and all operations to the final positioning of girders will be submitted to the Engineer's Representative.

If permanent displacements of the piers/abutments or of the neoprene bearings are induced as a result of the Contractor's methodology, these displacements will be calculated by the Contractor and provisions, like jacking, will be provided by him at his own cost to relieve the structure of these displacements.

Calculations notes showing that stability of beams, inclusive lateral buckling, are ensured at every stage until transverse prestressing will be provided. This submittal does not relieve the Contractor of his full responsibility during handling, transport, placing, and attached operations like jacking or slimmings.

Delete 405.4 and substitute by:

405.4 MEASUREMENT AND PAYMENT

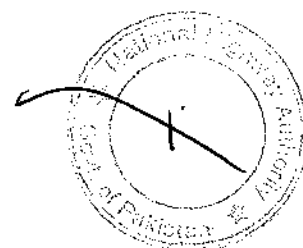
405.4.1 Measurement

Measurement for the prestressed concert girder (complete in all respects) shall be made for number of girders of various types actually installed at site.

405.4.2 Payment

405.4.2.1 Delete entirely after paragraph 1 and insert the following:-

<u>Pay Item No</u>	<u>Description</u>	<u>Unit of Measurement</u>
405a	Prestressing wire strands, ½ " dia, including sheaths, male/female cones and Anchors	Ton
405b	Launching of Girders	Ton



414.1 SCOPE OF WORK

The Contractor shall carry out confirmatory boring at bridge sites at locations marked on the drawings or as divided by the Engineer's Representative.

The purpose of the work specified herein is to determine the type, nature, arrangement, thickness and texture of the various subsurface strata, the conditions and the Engineering characteristics of the subsurface materials as they exist to the depth and at the specified locations. This is to be accomplished by means of drilling, in-situ testing, collection of disturbed and undisturbed soil samples and water samples and laboratory testing.

The Contractor shall carry out the specified works under the supervision of the Engineer's Representative.

414.1.1 Plant and Equipment

The Contractor shall keep at least one rotary drill machine on the site and one percussion winch on the site along with accessories to meet the requirements of the work. The plant and equipment shall be in good operating condition and capable of efficiently performing the Work as set forth.

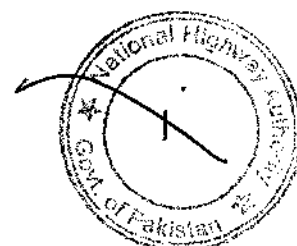
414.1.2 Drillers and Supervisory Staff

The Contractor shall always have on the site, at all times, qualified, experienced and competent persons including geotechnical engineers or engineering geologists who shall conduct and supervise drilling, sampling, logging and in-situ testing. The Contractor shall remove any of his employees from the site that in the opinion of the Engineer's Representative does not meet these requirements.

The Contractor shall make his own arrangements for housing of his personnel, security and storage of the equipment and supplies at the site.

414.1.3 Setting up at each Hole

The Contractor shall make all the necessary arrangements for setting-up at each location, everything necessary for carrying out the work specified and for the preparation and reinstatement of the work areas, improvement to access routes and all other temporary works.

414.1.4 Measurement of Quantities

The quantities shown in the Bill of Quantities are only approximate. The payment shall be made on the basis of actual work performed in accordance with the Specifications.

414.1.5 Submission of Field and Laboratory Data

The Contractor shall supply complete field and laboratory investigation data to the Engineer's Representative within the time set-forth for completion of works. This data shall include copies of all the approved logs and test records provided during the course of the Contract including any alterations or amendments required by the Engineer's Representative.

414.1.6 Location point of Investigation Points

- a) The locations of the points to be investigated are shown on drawings. However, the actual locations of shall be establish the actual location in the field the Contractor on the basis of the drawings. Locating the boreholes accurately in the field shall be sole responsibility of the Contractor.
- b) It is to be understood that further drawings may be issued by the Engineer's Representative showing the revised locations of investigation points.
- c) All the investigation points shall be located by field survey to an accuracy of 1 m in plan and 0.05 m in ground elevation by the Contractor.

414.2 METHODS OF WORKING

414.2.1 Areas to be Investigated

The locations of boreholes are shown marked on the drawings. However, The Engineer's Representative will specify from time to time during the Contract Period the exact location and reference number of all holes. To locate the holes accurately in the field it shall be the Contractor's responsibility.

414.2.2 Casing

A hole shall be cased in any stratum which is friable or not sufficiently strong to stand unsupported, or when directed by the Engineer's Representative.

The Contractor shall ensure that casings are of a suitable size and are inserted in such a manner as to render them recoverable. The Contract Rates for drilling shall be deemed to include the supply, insertion and recovery of casing and any damage, loss or delay caused by difficulty or failure in recovering casing.

414.2.3 Removal of Casing



Casing shall not be removed from any hole nor any filling introduced into a hole until permission is given by the Engineer's Representative. This permission will normally be given as soon as work in the hole is completed and the groundwater level has been measured.

As far as possible the Contractor shall avoid leaving a hole overnight after he has begun to withdraw the casing and before he has finished.

414.2.4 Supplementary Holes

Holes that are abandoned shall be supplemented by the other holes adjacent to the original location. Also holes from which unsatisfactory samples have been obtained and/or in which unsatisfactory field tests have been performed due to the negligence of the Contractor shall be supplemented by other holes adjacent to the original location. The exact location of such supplementary holes shall be specified by the Engineer's Representative in the field.

Penetration to the depth where the unacceptable holes were abandoned or to the depths where unsatisfactory samples were obtained or unsatisfactory field testing was performed may be made by any method selected by the Contractor that in the opinion of the Engineer's Representative will permit satisfactory field testing and sampling below those depths at which original hole was abandoned shall be carried out using only the specified method of advancing the hole.

No payment will be made for that portion of the supplementary hole above the depth paid for in the unacceptable hole.

414.2.5 Groundwater Level

The groundwater level in holes shall be determined, after completion of the hole or when required by the Engineer's Representative, as follows.

Clear water shall be added or the hole shall be bailed-out as necessary to bring the water level to the expected groundwater level as directed by the Engineer's Representative and the water level shall be measured and recorded at intervals of 6 hours for a period of 24 hours thereafter.

414.2.6 Backfilling Holes

Boreholes shall be backfilled with grout as directed by the Engineer's Representative.

Grouting for backfilling holes shall consist of a mud formed by mixing one part by weight of bentonite with 10 parts of water, to which shall be added two parts by weight of cement after the bentonite and water have been thoroughly mixed. Alternatively, holes may be backfilled with purpose-made pellets of bentonite or bentonite/cement, provided they are of a size which, in the opinion of the Engineer is compatible with the size of hole. If there is no standing water in the hole, grout may be poured from the



top. If there is standing water in the hole, the grout shall be fed into the bottom of the hole by a tremie pipe, the end of which shall always be below the groundwater junction while grouting is being carried out.

Grout backfill shall be taken up to 30 cm below the original ground level. Any apparent loss of grout due to leakage or consolidation within one week shall be made-up with fresh grout and then the remaining depth of the hole shall be filled with concrete.

414.2.7 Logs

Logs of boreholes shall be provided on an approved specimen. These shall include descriptions of all strata including details of the soil macrofabric (such as frequency, orientation and nature of fissures) and details of samples taken, and an account of all observations and field tests. Logs of boreholes shall include notes on the nature, quantity and colour of the drilling fluid returns. All logs shall be subject to the approval of the Engineer's Representative and two draft copies shall be submitted to the Engineer's Representative, not more than two days after the hole is backfilled. Soil descriptions shall conform to ASTM designation D 2488 and classified according to ASTM designation D 2487. All depths and thicknesses of topsoil and strata shall be recorded in meters and all reduced levels shall be recorded in meters with reference to Survey of Pakistan datum. Accurate determination of ground levels at all the hole points is the Contractor's responsibility for which no extra payment shall be made.

414.2.8 Contractor's Responsibility for Records

The presence of the Engineer's Representative or any of his staff and their keeping separate drilling records shall not relieve the Contractor of any of his responsibilities for keeping records.

414.2.9 Order of Work

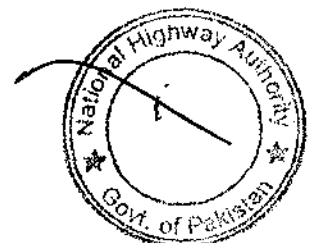
The sequence of the work activities shall be determined and approved in the field by the Engineer's Representative.

414.3 DRILLING

414.3.1 Depth of Drilling

Drilling would generally be required unto a minimum of 30 meters depth or at least 3m below the pile tip level, as shown on the Drawings or as directed by the Engineer's Representative which ever is more with a minimum hole size of NX as directed by the Engineer's Representative.

414.3.2 Accuracy of Alignment of Holes



Boreholes will be within 2 degrees of the vertical unless the Engineer's Representative has ordered the drilling of an angled hole in which case the hole angle shall be within 5 degrees of the angle specified.

414.3.3 Drilling Plant

The drilling plant and ancillary equipment to be mobilized at the site should be adequate to advance the boreholes in an efficient manner, to the required depths.

Rotary drilling rigs shall be of the hydraulic feed type equipped with side discharge type fish tail and tricone bits for drilling. Bits and casing shall conform to B.S. 4019; Part I; 1974 or an approved equivalent.

Drilling bits shall be of side discharge type designed to prevent unnecessary disturbance of soil at bottom of the hole by flow of drilling fluid, unless the Engineer's Representative directs otherwise.

414.3.4 Drilling Procedure

The method of drilling shall be of any approved standard and accepted method by means of which a hole of specified diameter is extended to the desired depth. The normal method of drilling shall be rotary unless gravelly strata are encountered where percussion may be used.

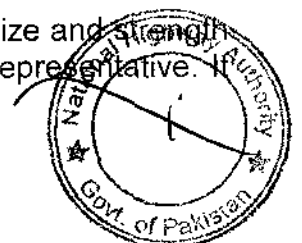
During drilling the Contractor shall regulate the drilling operation which ensures minimum disturbance in the underlying material in which the in-situ testing and sampling is to be carried out.

In rock, core drilling shall be carried out in such a manner and using such sizes of bits, that the maximum core is recovered. This requires close surveillance of the flushing media, drilling pressures, lengths of runs, use of appropriate core barrels and other factors relevant to the nature of the material drilled. The drill bit shall be withdrawn and core removed as often as may be necessary to secure the maximum possible amount of core. In soft or friable formation, dry drilling techniques may be required using single tube core barrel with tungsten carbide bits as directed by the Engineer's Representative. The cores would be placed in core boxes in a proper manner.

414.3.5 Stabilizing of Holes

Drilling mud of suitable consistency shall be used during rotary cum wash boring to stabilize the walls of boreholes by preventing caving-in and to avoid disturbance of the sampling horizons. The drilling mud shall be a mixture of bentonite and water with approved chemical additives being used, if required, to assist in modifying its density and viscosity. The density and viscosity shall be selected considering such factors as hole stability, cutting operation and undisturbed samples recovery.

Where drilling mud is not effective, casing of appropriate size and strength may be used subject to the approval of the Engineer's Representative.



will be responsibility of the Contractor to use appropriate means to stabilize the walls of the boreholes.

It shall be ensured that there is no jetting action of the drilling fluid. The minimum amount of drilling fluid necessary to carry away the cuttings shall be used. During drilling the Contractor shall regulate the pressure of the drilling fluid to ensure minimum disturbance to the underlying material in which the in-situ testing and sampling is to be carried out.

414.4 SAMPLING

414.4.1 General

The Contractor shall take disturbed or undisturbed samples from any borehole when ordered to do so by the Engineer's Representative. This shall include the provision of all necessary sampling equipment, tubes and containers, crates and boxes, as well as handling and transportation to the approved laboratory or store at site.

414.4.2 Approval of Equipment

No equipment or containers shall be used unless and until approved by the Engineer's Representative.

414.4.3 Care of Samples

The Contractor shall be responsible for the safe keeping of samples of all kinds until these have been handed over to the designated laboratory or disposed-off on the Engineer's Representative's instruction as the case may be. Any sample lost, damaged or showing signs of deterioration while in the Contractor's care shall be replaced by the Contractor at no expense.

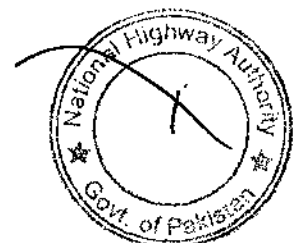
414.4.4 Labeling Samples

All disturbed and undisturbed soil samples and water samples taken from holes shall be clearly labeled. Each label shall include the following information:

- a) Name of Contract
- b) Reference number of the holes
- c) Reference number of sample
- d) Date of sampling
- e) Brief description of the sample (e.g. stiff brown silty clay)
- f) Depth of the top and bottom of the sample below ground level
- g) Number of the sampler tube

Tubes and crates for undisturbed samples shall be labeled "Do not jar or vibrate" and Haul and transport in a horizontal position.

414.4.5 Disturbed Samples



In all the boreholes, small disturbed samples shall be taken at the top of each stratum, and at intervals as directed by the Engineer's Representative. Material from the cutting shoes of open drive undisturbed samples, and from the split spoon sampler used for Standard Penetration Tests shall also be taken as disturbed samples.

414.4.6 Undisturbed Sampling

Undisturbed sampling from boreholes shall be done by Shelby tube or Pitcher/Denison sampler or as directed by the Engineer's Representative. The undisturbed samples should be properly sealed and preserved as directed by the Engineer's Representative.

414.4.7 Cores

The cores obtained from boreholes shall be carefully removed from the core barrel and placed in the boxes in the correct sequence, with increasing depth from left to right and top to bottom in the box. Coloured photographs of cores should be taken at site.

Where the core is contained in an expandable triple tube liner, the ends of the tube shall be sealed and waxed as directed by the Engineer's Representative.

Each core run shall be segregated by labeled wooden blocks 25 mm thick and the depth of the bottom of each run shall be marked on the partitions in the core box with paint.

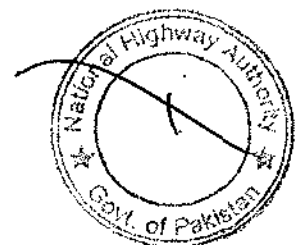
No box shall contain more than 3 meters of core.

414.4.8 Core Samples

Selected cores, preferably not less than 30 cm in length, shall be preserved as core samples. The preservation would consist of clearance of any loose sludge, waxing of cores, packing in wooden boxes using sawdust and labeling before transportation to the testing laboratory.

414.4.9 Water Samples

The Contractor shall take water samples from holes when directed by the Engineer's Representative before the addition of water to the hole unless it is unavoidable. If necessary, the hole shall be bailed-out before taking the sample to ensure that any potential contaminant is removed. No fuel or other potential contaminant shall be allowed to enter the hole. The method of sampling shall be as approved by the Engineer's Representative. Samples shall only be stored in approved air tight and scrupulously clean containers, and shall not be less than 1 litre in volume.



414.4.10 Transportation of Samples

All samples shall be shifted to the store at the site, the day they are collected. Samples in tubes shall be kept and transported with the tubes in a horizontal position.

The samples shall be continuously transported to the testing laboratory on conclusion of every borehole and on the instructions of the Engineer's Representative. The laboratory for testing shall be approved by the Engineer.

414.5 IN-SITU TESTS

414.5.1 Standard Penetration Tests (SPTs)

When directed by the Engineer's Representative the Contractor shall carry out Standard Penetration Tests (SPTs) in boreholes. The penetration resistance 'N' shall be expressed as the number of blows of a 63.5 kg hammer freely dropping 76.2 cm required to force the standard split tube sampler 30.5 cm into the soil.

Standard Penetration Test (SPTs) shall be conducted in the boreholes in accordance with ASTM 1586 generally at 1 meter depth interval or as directed by the Engineer's Representative at the site.

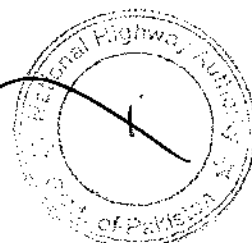
414.6 LABORATORY TESTING

414.6.1 General

The samples are to be tested in a laboratory approved by the Engineer's Representative. The Engineer's Representative shall have access to the laboratories to supervise and check the laboratory testing of the samples. The testing shall be carried out in accordance with ASTM, BSS or AASHTO Standards or as directed by the Engineer's Representative. The Contractor shall arrange to carry out the following laboratory tests on the specified samples of the subsoil materials. The samples to be tested and the tests to be carried out for each sample shall be specified by the Engineer's Representative.

414.6.2 Type of Tests

<u>Sr. No.</u>	<u>Name Of Test</u>	<u>Standard</u>
i.	Grain size analysis	ASTM D 422
ii.	Liquid limit, plastic limit	ASTM D 4318
iii.	Specific gravity	ASTM D 854
iv.	Unit Weight of Soil	
v.	Unconfined compression (soil)	ASTM D 2166
vi.	Unconfined Compression (rock)	ASTM D 2938
vii.	Natural Moisture Content	ASTM D 2216



viii.	Consolidation	ASTM D 2435
ix.	Direct Shear	ASTM D 3080
x.	Triaxial Compression Test	ASTM D 4767
xi.	Sulphate content of Soil	BS 1377
xii.	Organic matter content of soil	BS 1377
xiii.	Total dissolved salts of soil	BS 1377
xiv.	Chloride content of soil	BS 1377
xv.	Chemical Analysis of Water BS 1377	
	i) Sulphate content of water	
	ii) Total dissolved salts of water	
	iii) Chloride content of water	
	iv) pH of water	

414.7 RECORDS AND REPORTS

414.7.1 Records

- a) The Contractor shall keep accurate logs and records of all work accomplished under this item. All such records shall be preserved in good condition and order by the Contractor until these are delivered and accepted by the Engineer's Representative. The Engineer's Representative shall have the right to examine such records at any time prior to their delivery to him. Separate logs shall be made for each borehole. The following information shall be included on the logs or in the records for boreholes.
 - i. Borehole number or designation and elevation of top of borehole.
 - ii. Method of drilling holes.
 - iii. Dates and time by depths when hole was performed.
 - iv. Type of drilling fluid used.
 - v. Depths at which samples were recovered or attempts made to collect samples along with designation, thickness and type.
 - vi. Record of SPT on borehole log.
 - vii. The classification or description by depth of the materials samples including a description of condition of compactness or stiffness of soil materials encountered and moisture conditions.
 - viii. Depth of groundwater level if encountered.
 - ix. Depth of bottom of borehole.
- b) The Contractor shall furnish the Engineer's Representative with the record as specified above in duplicate, not later than 48 hours after completion of each borehole.
- c) The presence of Engineer's Representative or the keeping of separate records by the Engineer's Representative shall not relieve the Contractor of the responsibility for the work specified in this Section. Payment shall not be made for any work for which the records have not been furnished by the Contractor.




414.7.2 Reports

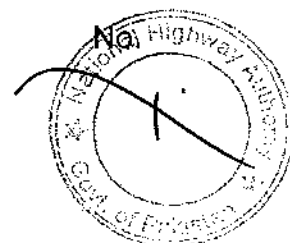
- a) The results of each borehole, and the field tests carried out shall be communicated to Engineer's Representative as follows:
 - i. Oral reports as the work proceeds
 - ii. Three sets of complete data of the work within two (2) days of the date of completion of borehole.
- b) The data shall comprise:
 - i. A site plan showing the position of the boreholes and giving their map reference
 - ii. The borehole logs
 - iii. Complete results of field tests
 - iv. Comments on any point which the Engineer's Representative has put to the Contractor for inquiry and investigation during the works.
- c) Complete results of laboratory tests shall be communicated to the Engineer's Representative within seven (07) days of the data of completion of borehole.

414.8 MEASUREMENT AND PAYMENT

The measurement and payment for the work specified in the Contract for drilling of bore holes, collection of disturbed, undisturbed and rock core samples, performing the standard penetration tests, laboratory testing and compilation and submission of results shall be done and paid as per the pay item given in the BOQ, which payment shall be full compensation for furnishing all labour, material, tools, equipment and incidentals and for performing all the work involved in this item as mentioned above in this specification.



<u>Items</u>	<u>Description</u>	<u>Unit</u>
SP- 414(a)	6" 4" dia drilling rotary wash boring including back filling of holes from NSL unto 35m depth or as directed by the Engineer's Representative.	L.M.
SP- 414(b)	Performance of SPT I/C collection, preservation & Transportation of disturbed samples to an approved Laboratory.	No.
SP- 414(c)	Collection of undisturbed soil samples from boreholes using Shelby Pitcher/denison sampler I/ preservation and transportation of samples to an approved Laboratory.	No.
SP- 414(d)	Performance of FDT in test pits through sand replacement method I/C moisture content	No.



determination.

SP-414(e)	Excavation of test pits unto 1.0m depth.	M
SP-414(f)	Collection of undisturbed block samples from test pits at appropriate location decided by the Engineer's Representative.	No.
SP-414(g)	Collection & Preservation of water samples from bore holes & transportation to an approved Laboratory.	No.
SP-414(h)	Laboratory Testing	
i.	Grain size analysis	No.
ii.	Hydro meter analysis.	No.
iii.	Atterberg limits	No.
iv.	Specific gravity	No.
v.	Natural moisture contents	No.
vi.	Bulk density	No.
vii.	Direct shear test	No.
viii.	Consolidation test	No.
ix.	Unconfined compression test	No.
x.	Chemical analysis of soil.	No.
xi.	Chemical analysis of water.	No.
xii.	Submission of investigation report (Triplicate)	No.



415.1 GENERAL

Expansion joints will follow Specifications of AASHTO-SS-Division II-section 19 "Bridge deck joints seals"

The Contractor shall submit to the Engineer's Representative, complete documentations about the Expansion joints he intends to use for the movements shown on the Drawings, including references of the last 10 years, material Specifications for metal, rubber and bonding between them, fixations, and test certificates from authorized laboratories showing that the proposed joints meet the specifications.

Elsewhere the submittal will be accompanied by samples of at least 0.50m, with its fixations.

The expansion joints shall satisfy the following functional requirements:

1. It shall withstand traffic loads of the highway, and accommodate movements between the deck and abutment or the adjacent deck.
2. It shall have good riding quality and shall not cause any inconvenience to road user.
3. It shall not cause skidding hazard.
4. It shall not generate excessive noise or vibration during the passage of vehicles.
5. Parts liable to wear out shall be easily replaceable.
6. It shall be watertight and will have provision for carrying away water and silt.
7. It shall be easy to inspect and maintain.
8. It shall be resistant in hot and very sunny climate.

415.2 CONSTRUCTION REQUIREMENTS

The methodology of placing the expansion joint will be clearly described by the Contractor with a complete set of drawings.

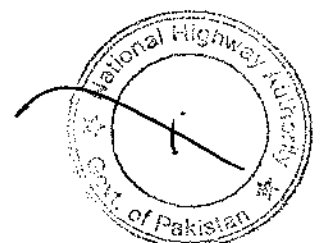
Connection or overlapping between roadway and walkway expansion joints will be clearly shown.

Connection with water proofing of the deck will be detailed.

All necessary provisions in deck reinforcement will be indicated.

Initial gap at the time of placing will be clearly indicated and justified.

The second stage reinforced concrete for fixations, if any, will be Class Y concrete and will be included in pay items SP a to d.



415.3 MEASUREMENT AND PAYMENT

415.3.1 Measurement

The length of computed joints for roadway is measured in linear metre between the faces of the kerbs, plus 150 mm height on each bridge railing.

415.3.2 Payment

The accepted quantity measured as provided above shall be paid for at the contract unit price respectively for the pay items listed below and shown in the Bill of Quantities which price and payment shall be full compensation for furnishing all materials, labour, equipment, tools and incidentals and any work pertaining to expansion joints and which is not paid for separately, necessary to complete the item.

Payment Item No.	Description	Unit of Measurement
SP 415	Manufactured trade mark expansion Joints for roadway, for 25 mm movement	M

