List of Method Statements of Road Works

List of Method Statements of Road works is define general idea of works, how to carry out. When it is preparing for the certain project it has to be considered that Standard Specification for that particular project or work.

1. Method Statement for Survey Work
2. Method Statement for Borrow Excavation
3. Method Statement for Sub Grade Preparation
4. Method Statement for Channel Excavation
5. Method Statement for Clearing And Grubbing
6. Method Statement for Culvert Construction
7. Method Statement for Bituminous Surfacing
8. Method Statement for Embankment Construction
9. Method Statement for Line/Side Drains
10. Method Statement for Construction of Sub-Base
11. Method Statement for Quarry Operation Procedures
12. Method Statement for Shoulder Construction
13. Method Statement for Crusher Plant
14. Method Statement for Prime Coat & Tack Coat
15. Method Statement for Random Rubble Masonry Retaining Wall
16. Method Statement for Concrete Retaining Walls

Introduction

Generally the entire construction project involves surveying, the following steps are

proceed in road construction projects to covers the Traverse Survey, Temporary Bench Mark Survey, and Center Line Setting out, Center Line marking, Cross Section Survey and Submittable of Drawings.

Abbreviations

TBM – Temporary Bench Mark

GA – Government Body

Traffic Safety Management & Control

Safety Awareness Meeting

Safety awareness meeting has to be conducted every working day morning/every other day to brief the work force in the safety prevention measures. Traffic Safety will be discussed as a topic. Each survey group should be well awarded to follow specified instructions such as "Barricading Boards" and signalmen will be deployed to control the traffic flow during working time. The survey team should have practical knowledge to adjust following specified instructions that will not meet.

Operating Procedure

Site investigation has to be carried out for safety precautions prior to commencement of the work, in order to display relevant sign boards.

- Men at work 75m-100m ahead" sign boards would be placed on both left hand side of the road.
- 25 m away from men at work sign Narrow Road/one lane traffic sign would be placed in order to notify the drivers with regard to road situation.
- Working area will be corded off with traffic cones to indicate setting out survey for the oncoming traffic to see on both sides.
- "One way traffic ahead" sign boards would be placed 90m ahead of working area in order to notify oncoming drivers.
- Traffic controllers would be deployed on both sides in order to control "one way traffic".
- Photographs would be taken to disseminate and maintain traffic safety records.
- Radio communication system would be used where normal communication is impossible.
- After completion of the work, safety cones and barricade boars has to be removed accordingly.

General Traffic Arrangement will illustrate

In addition to following safety precaution has to be adopting to minimize accidents that can be happened.

- Safety helmets, traffic safety vests, boots, dust mask & gloves will be provided.
- Warning sign boards would be displayed through out the site.
- Monthly safety awareness program & training program would be conducted.
- First aid facilities would be provided.
- Safety officer has to visit the sites twice a day and required safety measures will be adopted at site. In addition, work discrepancies will be discussed in the following day morning at the safety meeting

Resourses

Man Power

2 Site Engineers

2 Nos. Total Station

1 Safety Officer

4 Nos. Survey Staff

4 Surveyors

2 Nos. Level Instrument
22 Skill Laborers

Equipment & Hand Tools

8 Flagmen
3 Nos. Tape (30m)
6 Nos. Tape (5m)
24 Nos. Traffic Cone
1 No. Rope (30m Length)
6 Nos. Safety Sign Board
4 Nos. Walkies Talkie
1 Narrow Road Traffic Safety Sign Board

Material

Road Marking
Concrete Nails

Borrow Excavation

October 27, 2010

Introduction

The borrow excavation shall consists the operations such as site clearing, stripping of the overburden and stockpiling. Excavation would only be proceeded where those sites have been approved as borrow sites to be used in the construction work.

Abreviation

QAE - Quality Assurance Engineer

SE - Site Engineer
TO - Technical Officer
QAS - Quality Assurance System
ME - Materials Engineer (Contractor)
TS - Technical Specification

Resource Allocation

Man power

- 1 No Supervisor.
- Un skilled labors
- Operators

Equipments

- Track Back-hoe loaders
- Dump trucks

Quality Control Procedures

Sampling and testing

Samples of soil would be taken from the borrow location and those samples would be placed in a polythene bag providing identification tag. All required tests would be carried out in the materials testing laboratory to confirm that those materials are in which category. After testing and with the satisfying results, excavation would be preceded and those materials would be stock piled at the site.

Even the materials are properly stock piled at the site the materials in the stock pile would be tested before issuing for the construction purpose. No materials would be allowed to execute in the construction work until the required tests are completed and satisfied.

Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by the person in charge for the borrow excavation in case of preconstruction, during construction. The inspection check list shall include the specific requirements, safety and environmental measures. See Inspection Check List

Dimension control

In case of the excavation of borrow materials, it is essential to have the designated limits of the borrow site to maximize the quality of the borrow materials. When the excavation is beyond the designated limit, it tends to mix with unsuitable materials.

Methodology

Clearing of the borrow site

1 The location and dimensions of the borrow pits would be identified as instructed by the Engineer.

2 All ordinary jungles, stumps and roots would be removed by a manual mean or using any other suitable equipment within the approved borrow area.

3 All removed matters would be collected to a place and then they would be disposed to a suitable disposal location or burned at the site with the judgment of the Engineer.

Stripping of the overburden

1 The overburden would be removed up to the required depth by using suitable

mechanical devise and those materials would not be allowed to mix with other materials classified as suitable for filling.
2 The all unsuitable materials would be disposed to a suitable disposal location by means of tipper trucks.
See Flow Chart of Borrow Excavation

Excavation

1 Borrow excavation would be carried out using a Back-hoe loader and would be properly stock piled with well-drain facilities. The material from the borrow pits would be blasted, ripped and excavated in a manner that will ensure the effective breaking down of the material in the borrow pit before it is loaded.
2 Rippable material which tends to break into large blocks would be cross ripped.
Borrow materials would be confirmed to the requirement before the application.
Dump trucks would be applied for the transportation of borrow material.

Subgrade Preparation

October 29, 2010

1.0 Introduction

Sub grade preparation shall be carried out using selected materials where the exposed surface is not suitable for the sub grade.

2.0 Abbreviation

QAE - Quality Assurance Engineer

SE - Site Engineer

TO - Technical Officer

QAS - Quality Assurance System

ME - Materials Engineer (Contractor)

TS - Technical Specification

3.0 Resourse Allocation

Man Power	**Equipments & Tools**	**Material**
Site Engineer	Back-hoe loader	Selected sub grade material which meets the engineering properties, approved by the Engineer
Technical Officer	Water pump	
Single Supervisor	Dump trucks	
Double Flagmen (minimum)	Level Instrument	
Unskilled labors	Camber board/ Straight edges	
Operators	Mortar pans	
	Mamoties	
	Pick axes	
	Crow-bars	
	Wheel barrows	
	Shovels	
	Buckets	

3.0 Quality Control Procedures

1. Sampling and testing

Suitable materials would be employed in the preparation of sub grade as those materials have been classified to use as sub grade materials by the all preliminary tests done on it. Sampling of these materials would be made in a manner to identify easily their status of test and all the necessary details would be entered to the sample register. In case of placing these materials, the specified layer thickness and degree of compaction for each layer would be achieved. Field density test would be carried out in case of checking the degree of compaction according to the method stipulated in the relevant BS codes. See Inspection Test Plan.

2. Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by the person in charge for this work in case of pre-construction, during construction. The inspection check list shall include the specific requirements, safety and environmental measures.

3. Dimension Control

Preparation of sub grade would be carried out according to the designed cross sections. The required depth and length of the excavation would be properly maintained during construction and those requirements would be checked with the inspection check list.

4.0 Methodology

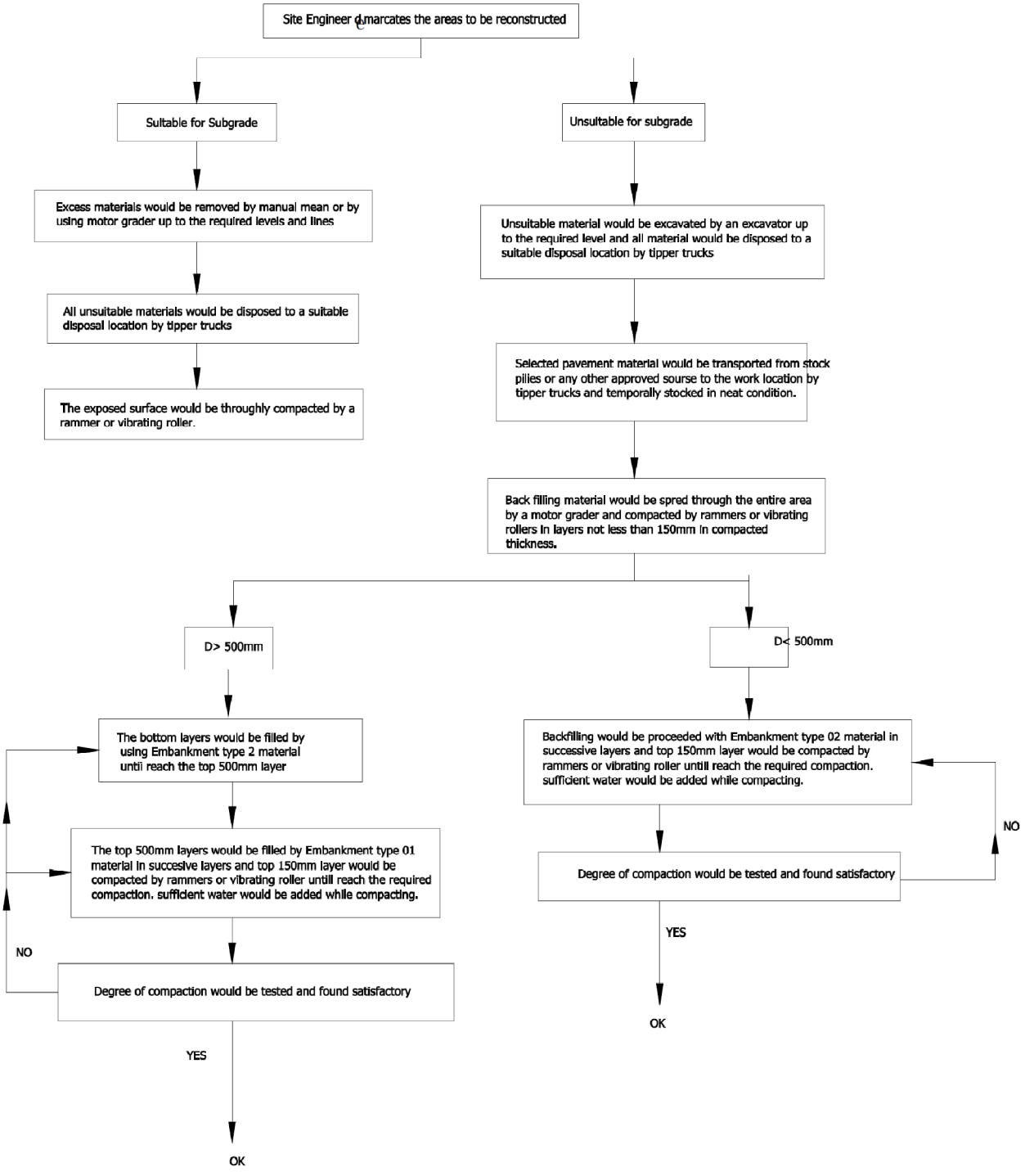
• If the exposed layer of soil unsuitable for sub grade, these layers would be excavated up to the required depth by using a back-hoe loader and the required levels of the excavation would be controlled by the surveyor.

• Selected suitable material would be placed and compacted in successive layers by using rammers or vibrating rollers to a minimum depth of 150 mm.

• If the exposed layer of soil suitable for the sub grade, the layer would be thoroughly compacted by using vibrator rollers or rammers until reach the required compaction.

• The top 150mm sub grade layer in cut areas would be compacted to not less than 95% of the maximum dry density of the material at moisture content within 2% of the optimum moisture content as determined by AASHTO T-180. Water would be sprayed while compacting for achieving a better compaction.
• The surface of the finished sub grade would be neat and workmanlike and would have the form, super elevation, levels, grades and cross section as shown on the drawings.See methodology flow Chart

SUBGRADE PREPARATION



Flow Chart - Methodology of Preparation Subgrade

Channel Excavation

October 30, 2010

How to do a channel, Side Drain, Side Ditches etc..

1.0 Introduction

This works consist of excavation for all channels, drains, ditches where in side and out side of the right of way showing on the Drawing or as instructed by the Engineer. The proper drainage shall be provided by constructing, shaping, finishing or backfilling where necessary involved in conformity with the required alignment, levels, grades and cross sections.

2.0 Abbreviation

QAE - Quality Assurance Engineer
QAI - Quality Assurance Inspector
QCI - Quality Control Inspector
SE - Site Engineer
SEO - Safety and Environmental Officer
TO - Technical Officer
QAS - Quality Assurance System
ME - Materials Engineer (Contractor)

3.0 Resource Allocation

3.1 Man power

QAI
QCI
Site Engineer -01
Supervisor-01
Flagmen (If necessary)-02
Surveyor-01
Surveyor helpers-05
SK/USK labours-08
Operators- As required

3.2 Equipment & Tools

Back-hoe loader
Wheel Loader(If necessary)
Dump trucks(15 tons)
Rammers
Tractor Trailer
Compacting rollers
Level instrument
Mortar pans
Mamoties
Pick axes
Crow-bars
Wheel barrows
Shovels

Safety Inventory

01. 10 No of barrels
02. 02 No of signal Men
03. 10No Traffic Jackets with Retro reflective patches/stripes
04. Sufficient barricade tapes.
05. 05 No barricade boards with Retro reflective stripes

06. 02 No Stop and Go signs
07. 03 No Road works ahead
08. 01 No Road Works ahead, End
09. 05 No of traffic cones
10. 04 No. of Blinking Lights

4.0 Quality Control Procedures

4.1 Sampling and testing

Embankment Filling Material:

Samples would be collected from the work execution areas and would be placed in a polythene bag providing identification tag. All required tests would be carried out in the materials testing laboratory for identification suitability of the Excavation Materials. The areas where backfilling is required for the conformity of the design levels, the works would be carried out with approved filling materials in layer by layer as described in technical specifications. Required test would be carried out after placing and compacting to check the degree of compaction.

4.2 Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by the person in charge for the Channel excavation in case of covering pre construction, during construction. The inspection check list shall include the specific requirements, safety and environmental measures.

4.3 Dimension Control

Channel excavation would be carried out according to the designed cross sections conformity with typical section issued for construction. The required shape, depth and offset of the excavation would be properly maintained during construction and those requirements would be checked with the inspection check list.

5.0 Methodology

5.1 Setting Out

• The setting out would be carried out in the area where the Engineer's approval is given for channel excavation.
• Levels of excavation would be marked by the surveyor using pegs.
• The line of the Excavation would be marked with lime powder or any other proper manner

5.2 Excavation and Shaping

• The set out area would be subjected for the excavation with machinery or in manual manner conformity with designed line and levels
• The shape of the drain would be maintained to satisfy the typical sections issued for the construction.
• All materials suitable for embankment Construction removed from excavations would be used in Embankment construction or any other filling specified to fill with Embankment Materials.
• Materials deemed not suitable for embankment filling would be disposed of to approved disposal locations
• Any area backfilling have to be done to form earth drains, filling would be done using approved filling material instructed by the Engineer

Clearing & Grubbing

October 31, 2010

1.0 Introduction

This Method Statement provides the details of materials, the equipment, the procedure and relevant documents related to the clearing and grubbing activities, including the quality control verifications, the measurement verifications, and also the traffic management plan, disposing of valuable trees, disposing of branches at disposal sites, disposing of logs and uprooting of roots to be implemented.

2.0 Location of Works

The location of the clearing and grubbing works will be limited to selected areas bound within the Right of Way (ROW) as instructed by the Engineer. These works may applicable alternatively, as required to locations outside the ROW (i.e. borrow pits, disposal areas etc.)

3.0 Abbreviation

SE – Site Engineer

ROW – Right of Way

SO – Safety Officer

Man Power	**Equipments & Tools**	
Site Engineer 01 Nos	JCB, and/or Backhoes, and/or Dozer, and/or Motor Grader	Mammoties,Chain Saw
Supervisor 01 Nos	Dump Trucks/ Tractors	Mortar Pans,Rope
Unskilled Laborers 20Nos	Chainsaws and axes	Crowbars ,Hand Axe
Flagmen 02 Nos	Traffic Control Equipment as required and other minor materials	Shovels,Axe,Safety belts
Operators 02 Nos		Knifes,Sharpner
*** Note : The major equipment used in for the clearing and grubbing works include, but are not limited to the above.**		Pick axes,Flat end steel bar

5.0 Safety Management Action Plan

In order to minimize the occurrence of site accident, the provision of a safe working environment for workers to work is essential. In addition to the above, the following safety precaution must also be implemented in achieving the minimization of site accidents.

5.1 Site Staff and Labor

• Safety Induction Training would be conducted to all new employees by the Safety Officer prior to start any work.

• Regular safety induction courses and toolbox talks would be arranged on site for operative and supervisory staffs and in particular for those new workers.

• Personal Protective Equipment (PPE) such as safety boots and helmets would be provided with workers. In addition, adequate PPE (e.g. ear and eye protectors) should also be available for construction works as required.

• Barricades with warning signs would be established all around the excavated area.

• All tools, plant, equipment and temporary facilities and all other items use to carry out the work should be in a safe, sound and good condition.

• Alcoholic drinks and other substances, which may impair judgment, would be prohibited from the Site.

• Snake Bite: When clearing shrubs and trees special attention would be made to protect workers from snake bite, and therefore, make sure all workers in this area would wear boots up to knees

• Working Radius: Mammoties and jungle clearing knife should have working space to move freely without hurting other employees.
• Fall Prevention Measures –Investigation would be take place to identify abandon wells and drainage systems in order to prevent from falling into abandon wells and drainage systems.
• Workers would not be allowed to work in the stream water unless provide with a safety belt with a long lanyard in order to rescue them in case of drowning. In addition, workers would be provided with life jackets.
• A notice would be erected to prevent outsiders entering into our work sites, "No Entry for Outsiders".
• Signalmen would be deployed if the work spaces disturb traffic flow in the main road. A traffic supervisor would also be deployed to take responsibility over the traffic control.
• First Aide Facilities- First aid facilities such as a first aide box would be made available for in case of minor injury treatment.

5.2 Traffic Safety

• All traffic safety arrangements would be implemented as specified in the Manual on Traffic Control Devices – Part II Traffic Control Devices for Road Works published by the National Safety Secretariat – Ministry of Highways.
• One way traffic would be arranged placing two barricade boards on either sides, sufficient traffic cones would be placed as required by the road bend and space, two signalmen would be deployed on either sides and two barrels would be placed in order to provide safety guard to the signalmen from oncoming vehicles, and barricade tapes would be tie up additional protection during cutting branches and truck of the tree.

Culvert Construction

November 1, 2010

1.0 Introduction

Culvert Construction Procedure

2.0 Abbreviation

SE – Site Engineer

TO – Technical Officer

PPE – Personal Protective Equipment

QAE – Quality Assurance Engineer

ME – Materials Engineer

TS – Technical Specification

3.0 Resources

Man Power	Equipment/ Tools	Materials
SE	1 No. Back Hoe Loader (if necessary)	15 mm thick Plywood Sheets
TO	1 No Excavator	50 x 50mm and 50 x 25mm timber Reefers
Surveyor1 No. Water Tanker		
Survey helpers	Concrete Mixer	Grade 15 & 25 Concrete
Supervisor	Dump Truck	Reinforcement Steel [Y10mm,Y12mm,Y16mm, Y25mm, 6mm]
Skilled & Unskilled laborers	Rammer Compactor	Binding wire
	Leveling Instrument	Polythene film
	Water Pump	Mould Oil
	2 Nos. Poker vibrators(1 is standby)	Gunny Bags
	Wheel Barrows	Backfill Material
	Mortar Pans	Water
	Timber Planks/ Steel Plates	Cover Blocks
	Hand Tools	6”×4” Rubble
	Hydraulic Breaker (if necessary)	PVC Pipe(Type 600)
		Geo textile
		Metal for stone packing
		Cement
		Fine Aggregates
		Coarse Aggregates

4.0 Quality Control Procedure

4.1 Material sampling and testing.

The materials Engineer would take the samples from required materials such as concrete and soil according to the specified frequency and locations.

Concrete: in concrete, one set of cubes would be made per 10 cu.m of concrete. At least one sample would be taken on each day that a particular grade is used. Crushing strength of the concrete cubes would be tested for the samples at ages of 7 and 28 days. Each sample would be identified by identification No and it is displayed on the test cubes and a same identification No would be included in the sample register. The identification tag includes, the date of cast, age of test and date of test to be performed.

4.2 Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by the person in charge for the reconstruction of Culvert in case of Pre-construction, during construction and post construction. The inspection check list shall include the specific requirements, safety and environmental measures. Inspection checklist for culvert construction

4.3 Dimension Control

All specified lengths, widths and heights would be properly maintained during construction and all these dimensions would be checked with the inspection check list. In case of identifying the undesirable changes in specified dimensions and even beyond the specified tolerances, the particular work would be reworked before the subsequent work.

5.0 Methodology of Work

Methodology flow chart and the work would be carried out for only half of the culvert first and second part would follow the finish of the first part.

5.1 Removal of Existing Structures

Existing structures would be removed with prior approval of the Engineer and as per the Technical Specification.

5.2 Excavation

1. This work consists of the necessary excavation for foundation of culverts, head walls, wing walls and other structures.
2. Necessary diverting of streams, construction and subsequent removal of necessary
coffer dams,sheet pile driving, shoring, dewatering, pumping and removal of any obstructions for placing the foundation, backfilling, clearing the site of debris and the disposal of excess excavated materials would be also included in this work schedule.
3. Prior to commencement of excavation, the limit of excavation would be set out as shown in the drawings and directed by the Engineer.
4. All excess soil and other material from the excavation including logs, boulders etc would be removed from the site and disposed to the locations approved by the Engineer.

5.3 Structural & Masonry Work

1. Prior to commencement structural and masonry work, the excavated areas would be compacted to the required level given by the Engineer if necessary.
2. Concrete trial mixing, sampling and testing would be carried out as mentioned in Technical Specification and accordance with the BS 1881 standard and subsequently all the test results would be submitted to the Engineer for approval.
3. Subsequently form work of base and re-bar would be carried out according to the construction drawings and the base would be made with a grade as instructed by the Engineer and concrete would be thoroughly compacted by vibration.
4. Concrete would be placed in such a manner as to avoid segregation by means of chutes and the displacement of reinforcing bars and would be spread in horizontal layers where practicable.
5. All concrete surfaces would be kept wet for 7 days after placing concrete.
6. Abutment and wing wall would be constructed by using random rubble or concrete up to the level of capping beam with providing weep holes as per the

details given by the Engineer.
7. All the exposed surfaces of RRM would be plastered with cement mortar.
8. As done in the base all the procedures would be carried out for constructing the capping beam as per the construction drawings.
9. Having completed all the necessary work in placing reinforcing bars and form work, the deck would be concreted with a grade as instructed by the Engineer.
10. The surface of the deck would be kept wet for at least 7 days after placing concrete.
11. No temporary loads would be placed on the deck. Deck slab would be opened to traffic after the Engineer's direction and not sooner than 28 days after the placing of the concrete has been completed.

Bituminous Surface Treatment

November 2, 2010

1.0 Introduction

This method statement covers all the procedures to be adopted for asphalt concrete surfacing work consisting of furnishing materials, mixing at a central plant, and spreading and compacting asphalt concrete wearing, binder and regulating course on an approved base course.

2.0 Abbreviation

CM – Construction Manager
SE - Site Engineer
SEO – Safety & Environmental Officer
ME – Material Engineer
PPE – Personal Protective Equipment

Man Power

CM
SE
ME
SEO
Lab Technicians & Helpers
Surveyor
Survey Helpers
Supervisor/Foreman
Operator (A/P Finisher)
Operator (Tandem Roller)
Operators (Tire Rollers)
Driver – Distributor
Driver - Dump Truck
Skilled & Unskilled laborers

Equipment

Asphalt Plant (2 nos)
Water Bowser
Tandem Roller
Dump Trucks
Asphalt Paver
Air Compressor
Tire Roller
Asphalt Distributor

Material

1. The material would be composed basically of graded crushed coarse aggregate, fine aggregate, filler, asphalt material, tack coat (CRS-1) and prime coat (MC-30).
2. The several mineral constituents would be sized, uniformly graded and combined in such proportions that the resulting blend meets the grading requirements for the specific type under the contract.
3. Temperature, Delivery of Mixture : 105º C ~160º C
4. Compaction Temperature: 105º C ~ 135º C

4.0 Methodology

4.1 General

1. Before construction of asphalt pavement for the section concerned would be completed so that the section DGAB already constructed would be protected against erosion.
2. DGAB should be done on a prepared and accepted sub-base course or other roadbed in accordance with the specification and specific requirements of the contract in conformity with the required lines, levels, grades, dimensions and cross sections.
3. Quality of the work would be secured through the careful control for the materials.
4. Adequate safety control measures would be provided to prevent from any damage or danger to the public and the personnel involved in the work.

4.2 Preparation of Existing Surface

1. Prior to application of prime coat the base would be brushed to remove all dust, loose particles and other extraneous material and the surface would be moistened with water just before priming.
2. Where local irregularities in the existing surface, the surface would be brought to uniform contour by patching with an asphalt mixture to be approved by the Engineer.
3. Where the mix is laid over cement concrete pavements, joints and cracks would be cleaned and filled with bituminous material as approved, and any unevenness of the surface would be corrected as required. A tack coat would then be applied to the surface.

4.3 Weather Limitations

1. Asphaltic mixtures would be placed only when the surface is dry, when the weather is not rainy or will not soon be rainy and prepared road bed is in a satisfactory condition.
2. For use in an emergency such as rain, chilling wind or unavoidable delay enough tarpaulin covers would be used for the purpose of covering or protecting any material that may have been dumped and not spread.

4.4 Limitations due to Equipment

1. No work would be carried out when there is insufficient equipment for hauling, spreading, compaction and finishing or insufficient labour to ensure progress at a rate compatible with the output of the mixing plant to ensure a continuous paving operation.
2. Trucks for hauling asphalt mixtures would be tight, clean, and smooth metal beds that have been sprayed with soapy water, thinned fuel oil, paraffin oil, or lime solution to prevent the mixture from adhering to the bed and the amount of sprayed fluid would be kept to the practical minimum.
3. Each load would be covered with a canvas or other suitable material of such size as to protect the mixture from the weather.
4. Any truck causing excessive segregation of material by its spring suspension or that causes undue delays shall, upon direction of the Engineer, be removed from the work until such conditions are corrected.
5. When necessary, in order that the mixture would be delivered to the site within the specified temperature range, a properly fastened insulating cover would be used.
6. Loading and transporting would be such that spreading, compacting and finishing would all be carried out during daylight hours unless satisfactory illumination is provided.

7. The equipment for spreading and finishing would be approved mechanical, self powered pavers, capable of spreading and furnishing the mixture to the lines, grades, levels, dimensions and cross sections.
8. The mixture after spreading and initial tamping by the Paver, would have a smooth surface free of distortions caused by dragging, tearing or gouging.
9. Any defects in the finished surface would immediately be rectified before any rolling takes place and there would be no unnecessary scattering back by hand of material on paver laid work.
10. For keeping all small tools clean and free of accumulation of asphaltic material, suitable means would be provided.

Embankment Construction

November 3, 2010

1.0 Introduction

The construction of embankments shall be subjected to the areas where the road center line considerably deviates from the existing road center line and this work shall consist of top soiling, placing of embankment materials and compaction. Embankment construction under special conditions would be carried out as specified in the technical specification.

2.0 Abbreviation

QAE - Quality Assurance Engineer.
SE - Site Engineer
TO - Technical Officer.
QAS - Quality Assurance System.
ME - Materials Engineer (Contractor).
TS - Technical Specification

3.0 Resources Allocation

3.1 Man power

- Site Engineer-01
- Technical Officer-01
- Supervisor-01
- Flagmen -02
- Skilled labors-04
- Unskilled labors-06
- Operators-As required

3.2 Equipment & Tools

- Back-hoe loader-01
- Motor Grader-01
- Vibrating roller-01
- Water bowser -01
- Water pump
- Dump trucks
- Level instrument
- Mortar pans
- Mamoties
- Pick axes
- Crow-bars
- Wheel barrows
- Shovels
- Buckets
- Water barrels
- Safety boots
- Safety Helmets
- Safety Gloves
- Traffic signs
- Blinking Lights
- Barricade boards
- Traffic cones
- Direction boards

3.3 Materials

- Embankment material-type I
- Embankment material-type II

4.0 Quality Control Procedures

4.1 Sampling and testing

The materials Engineer would take the samples from the excavated materials to check weather those materials are suitable or unsuitable for backfilling and the results of the test would be forwarded to the Engineer for approval.

Excavated Soil:

Samples of soil would be taken from the locations where the embankment construction is carried out and those samples would be placed in a polythene bag providing identification tag. All required tests would be carried out in the materials testing laboratory according to the frequencies specified in the technical specification to confirm wether the material is suitable for back filling or not.

Filling Material:

Filling materials as embankment type 1 and type 2 would be found from the borrow pits or from any other excavation. Those materials would be tested as specified in the technical specification prior to the application by taking samples according to the required frequency.

Each layer of those materials would be tested for the required degree of compaction by the method stipulated in the BS 1377. The minimum degree of compaction to be achieved is 95 % of the MDD for the top 150 mm layer and 93% for the remainder of the embankment.

4.2 Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by QAE or the respective QA inspectors in case of preconstruction, during construction. The inspection check list shall include the specific requirements, safety and environmental measures.

4.3 Dimension Control

Embankment construction would be carried out according to the designed cross sections. The required slope and length of the excavation would be properly maintained during construction and those requirements would be checked with the inspection check list.

5.0 Methodology

5.1 Preparation of the existing surface for embankment construction.

- Limits of the embankment construction would be identified form the approved drawings given by the Engineer.
- The Surveyor would set out the lines of embankment fill and reference levels would be marked on pegs as directed by the SE and would be notified to the Engineer for approval. The center line would be referenced before commencement of the work.
- All top soil would be removed by using a manual mean or a suitable mechanical devise to an average depth of 150mm and would be disposed to a suitable disposal location by using dump trucks.
- The existing surface would be compacted using a 5-10 ton roller with 4-6 passes or 3 ton roller with 12-20 passes depending on the width of the area.

Methodology Flow Chart

5.2 Embankment filling.

• Embankment filling would be commenced after approval of the borrow pits and the material by the Engineer.

• The borrow materials would be transported to the site by the Dump trucks and stock piled in separate lots as Type I and Type II. If the requirement of embankment material is in small quantities, it will be supplied to the site directly. If it is in larger quantities it will be stock piled at a well-drained area and it will be kept covered to prevent it getting wet. Inspections would be carried out irrespective of quantity.

• Filling embankment would be carried out in bench style. Benching of sloping surfaces would be carried out manually to 150mm height or as directed by the Engineer in each step, before starting to fill the material.

Channel Excavation

October 30, 2010

How to do a channel, Side Drain, Side Ditches etc..

1.0 Introduction

This works consist of excavation for all channels, drains, ditches where in side and out side of the right of way showing on the Drawing or as instructed by the Engineer. The proper drainage shall be provided by constructing, shaping, finishing or backfilling where necessary involved in conformity with the required alignment, levels, grades and cross sections.

2.0 Abbreviation

QAE - Quality Assurance Engineer
QAI - Quality Assurance Inspector
QCI - Quality Control Inspector
SE - Site Engineer
SEO - Safety and Environmental Officer
TO - Technical Officer
QAS - Quality Assurance System
ME - Materials Engineer (Contractor)

3.0 Resource Allocation

3.1 Man power

QAI
QCI
Site Engineer -01
Supervisor-01
Flagmen (If necessary)-02
Surveyor-01
Surveyor helpers-05
SK/USK labours-08
Operators- As required

3.2 Equipment & Tools

Back-hoe loader
Wheel Loader(If necessary)
Dump trucks(15 tons)
Rammers
Tractor Trailer
Compacting rollers
Level instrument
Mortar pans
Mamoties
Pick axes
Crow-bars
Wheel barrows
Shovels

Safety Inventory

01. 10 No of barrels
02. 02 No of signal Men
03. 10No Traffic Jackets with Retro reflective patches/stripes
04. Sufficient barricade tapes.

05. 05 No barricade boards with Retro reflective stripes
06. 02 No Stop and Go signs
07. 03 No Road works ahead
08. 01 No Road Works ahead, End
09. 05 No of traffic cones
10. 04 No. of Blinking Lights

4.0 Quality Control Procedures

4.1 Sampling and testing

Embankment Filling Material:

Samples would be collected from the work execution areas and would be placed in a polythene bag providing identification tag. All required tests would be carried out in the materials testing laboratory for identification suitability of the Excavation Materials. The areas where backfilling is required for the conformity of the design levels, the works would be carried out with approved filling materials in layer by layer as described in technical specifications. Required test would be carried out after placing and compacting to check the degree of compaction.

4.2 Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by the person in charge for the Channel excavation in case of covering pre construction, during construction. The inspection check list shall include the specific requirements, safety and environmental measures.

4.3 Dimension Control

Channel excavation would be carried out according to the designed cross sections conformity with typical section issued for construction. The required shape, depth and offset of the excavation would be properly maintained during construction and those requirements would be checked with the inspection check list.

5.0 Methodology

5.1 Setting Out

• The setting out would be carried out in the area where the Engineer's approval is given for channel excavation.
• Levels of excavation would be marked by the surveyor using pegs.
• The line of the Excavation would be marked with lime powder or any other proper manner

5.2 Excavation and Shaping

• The set out area would be subjected for the excavation with machinery or in manual manner conformity with designed line and levels
• The shape of the drain would be maintained to satisfy the typical sections issued for the construction.
• All materials suitable for embankment Construction removed from excavations would be used in Embankment construction or any other filling specified to fill with Embankment Materials.
• Materials deemed not suitable for embankment filling would be disposed of to approved disposal locations
• Any area backfilling have to be done to form earth drains, filling would be done using approved filling material instructed by the Engineer

Sub Base Construction

November 4, 2010

1.0 Introduction

This would consist of placing and compacting of sub-base material in layers on an existing pavement or prepared sub-grade in accordance with lines, levels, grades, dimensions and cross sections.

2.0 Abbreviations

SE – Site Engineer
SEO – Safety & Environmental Officer
ME – Material Engineer
PPE – Personal Protective Equipment
MDD – Maximum Dry Density
OMC – Optimum Moisture Content

3.0 Resources

Man power

- SE
- ME
- SEO
- Lab Technicians & Helpers
- Supervisor/Foreman
- Skilled & Unskilled laborers

Equipment/ Tools

- Pick-axes
- Crow bars
- Mammoties
- Back-hoe loader
- Motor grader
- Vibrating tamper/rammers/ plate compactor
- Walk-behind double drum roller
- Vibrating roller
- Field density test kit (Sand replace type)

Material

1. The material would be obtained from approved source in borrow cut and natural soil or material obtained by blending two or more soils or by blending soil and sand.
2. The completed sub-base would contain no aggregate having a maximum dimension exceeding two thirds of the compacted layer thickness.

4.0 Methodology

4.1 Procedures

1. Sub-base construction would be carried out after checking the underlying layer conforms to the specified requirements.
2. The sub-base material would be placed, spread, broken down, watered and compacted in accordance with the requirements of the specification.
3. All materials deposited in place prior to compaction would be evenly spread over the whole of the designated area for the layer concern.
4. Thickness of any layer, when measure after compaction would comply with requirements specified.
5. Water required before material is compacted would be added to the material in

successive applications by means of water bowsers fitted with sprinklers.
6. The water would be thoroughly mixed with the sub-base material to be compacted by means of a motor grader.

7. Mixing would be continued until the required amount of water is added and a uniform homogeneous mixture is obtained.
8. The field moisture content would be within 2% of the predetermined optimum moisture content at the time of compaction.
9. If the material is too wet, it would be dried by aeration and if it is too dry the material would be sufficiently watered prior to compaction.
10. Where an existing sub-base layer is to be improved by addition of a layer of material less than 100mm thick the existing surface would be scarified to a depth instructed by the Engineer, mixed with the imported material to form a homogeneous layer of minimum depth of 100mm, recompacted to the dry density specified for the layer and formed to the lines and levels.

Quarry Operation

November 6, 2010

1.0 Introduction

This covers all the operations under the development of proposed mechanized quarry site with the details of equipments, machinery and procedures related to the quarry operation including quality control verifications, safety, health and environmental measures.

2.0 Abbreviations

QM – Quarry Manager
ME – Mining Engineer
SO – Safety Officer
CEA – Central Environmental Authority
GSMB – Geological Survey & Mines Bureau
IML – Industrial Mining License
EPL – Environmental Protection License
IEER – Initial Environmental Examination Report
NBRO – National Building Research Organization

3.0 Resources

Man Power	**Equipments**	**Materials**
Quarry Manager	03 Nos. Air Compressors	Dynamite
Mining Engineer	1 No. Track Drill	Ammonium Nitrate
Safety Officer	3 Nos. Hand Held Rock Drills	Detonators
Blasting Foreman	3 Nos. Excavators	Electric Cord
Blasting Headman	2 Nos. Crushing Plants	Quarry Dust
Powder men	1 No. Rock Breaker	Diesel
Drillers & Helpers	1 No. Front End Loader	
Heavy Equipment Operators	5 Nos. Dump Trucks	
Mechanics	3 Nos. Wheel Loaders	
Electricians	1 No. Vibratory Roller	
Welders	3 No. Tandem Rollers	
Security Staff	3 No. Bulldozers	
Drivers	6 Nos. Generators	
Laborers	1 No. Fork Lift	
	1 No. Motor Grader	
	1 No. Water Pump	
	Circuit Tester	
	Siren	
	Blasting Machine	
	Hand Speaker	

4.0 Methodology

Methodology Flow Chart Download Here

Inspection Check List

4.1 Removal of Overburden & Top Soil

1.This area contains a soil profile which is strewn with boulders and generally 0-2m deep and overburden would be removed with excavator.

4.2 Drilling Pattern and Particulars

1. Drilling at top of the rock would be carried out up to depth of 6m with 64mm drill bit with compressed air driven track drill machine to a total of 10 holes.

2. Hand held rock drill would be used in making and leveling the berm or access road,
if any occurrence of humps which would obstruct the haulage machinery to operate.

4.3 Charging of Bore Holes

1. Charging of bore holes with explosive materials would be done under strict supervision of Mining Engineer.
2. Electric short delay detonators one and/or two in each delay would be used in drilled holes per one blast.
3. A total of maximum 10 holes with 6m depth would be used for a single blast with a maximum of 5.6 kg of dynamite and not exceeding 75kg of ANFO as main blasting agent.
4. Charging would be done with more than 2.8m stemming height.
5. For stemming material, quarry dust would be used.
6. If the bore holes are in wet condition, explosive materials covered by polythene cover would be inserted to the bore hole.

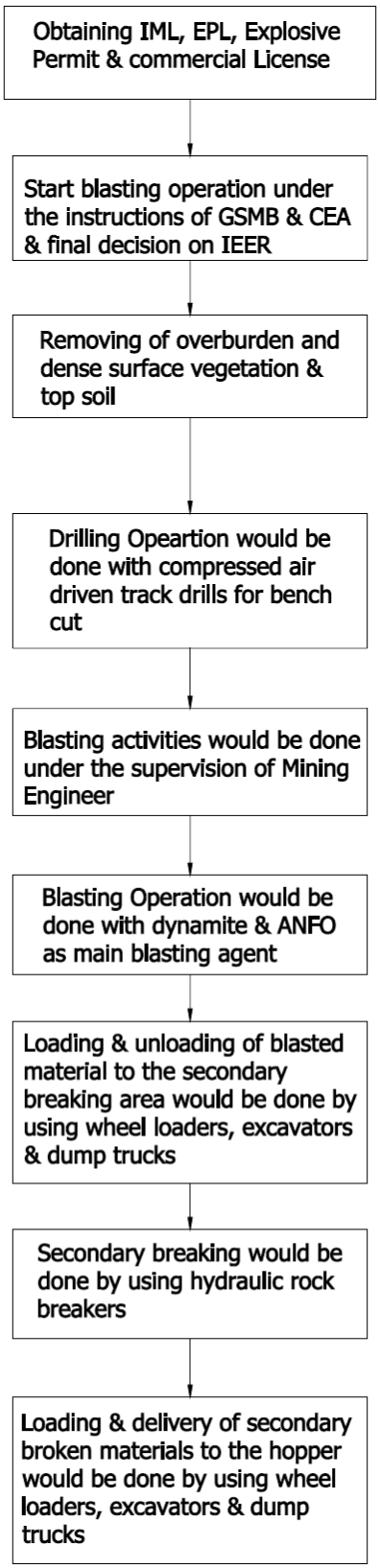
Inspection Check List

4.4 Firing of Explosives Before and After

1. Blasting activities would be carried out in few blasting faces and the blasting face would be developed according to bench system in order to avoid unsuitable working conditions.
2. Only industrial explosives, blasting agents and accessories manufactured to international standards would be used for blasting.
3. The standard explosives storing and handling methods would be strictly followed during the storing, transporting, mixing charging and testing to avoid any misfires.
4. Explosives would be stored in a specially constructed container by covering the container wall with light weight wood so as to keep air gap to reduce the heat effect and providing ventilation holes.
5. For security reasons, the storage container would be placed at the nearest police station.
6. Explosive mixing, charging and firing would not be done under adverse weather conditions.
7. Before once the detonators is joined together in the method of series circuit pattern, the firing cable is laid out in the opposite direction of blasting face.
8. Maximum 12 blasts per week (Maximum 3 blasts per blasting day & maximum 4 blasting days per week) would be carried out.
9. In blasting operation, the air blast over pressure level would not be exceeded 105dB.
10. Time of blasting would be 9.00h – 17.00h on week days except public holidays.
11. 30 minutes before the firing, people in surrounding area would be alerted to move away from the blasting perimeter and into the designated safe area. This would be done using a hand speaker.
12. Sentries would be posted with red flags, to safe designated area where people will be gathered. Strict instructions would be adhered and no one would be allowed to enter the area until the all clear signal are sounded.

13. After the blasting, quarry face would be checked up for misfired.
14. The houses in the vicinity would be checked up for any mishaps, damages or injuries to persons or property.

METHODOLOGY FLOW CHART FOR QUARRY OPERATIONS



Shoulder Preparation

November 6, 2010

1.0 Introduction

Shoulder construction would be carried out according to the designed cross sections and this work shall consist of excavation, backfilling and the provision of shoulder filter drain.

2.0 Abbreviation

QAE - Quality Assurance Engineer
SE - Site Engineer
TO - Technical Officer
QAS - Quality Assurance System
ME - Materials Engineer (Contractor)

3.0 Resource Allocation

3.1 Man Power

- Site Engineer-01
- Supervisor-01
- Flagmen (If necessary)-02
- Surveyor-01
- Surveyor helpers-05
- SK/USK labours-08
- Operators- As required

3.2 Equipment & Tools

- Back-hoe loader
- Wheel Loader(If necessary)
- Dump trucks(15 tons)
- Rammers
- Compacting rollers
- Level instrument
- Mortar pans
- Mamoties
- Pick axes
- Crow-bars
- Wheel barrows
- Shovels

4.0 Quality Control Procedures

4.1 Sampling and testing

Shoulder material:

Samples of soil would be taken from the locations approved by the Engineer and those samples would be placed in a polythene bag providing identification tag. All required tests would be carried out in the materials testing laboratory according to the frequencies specified in the technical specification to confirm whether the material is suitable to be used as shoulder materials. Required test would be carried out after placing and compacting to check the degree of compaction.

4.2 Inspection Check list

To ensure that the all activities being performed with the expected quality, an

inspection check list would be filled by the person in charge for the shoulder construction in case of preconstruction, during construction. The inspection check list shall include the specific requirements, safety and environmental measures.

4.3 Dimension Control

Shoulder construction would be carried out according to the designed cross sections. The required slope, depth and length of the excavation would be properly maintained during construction and those requirements would be checked with the inspection check list.

5.0 Methodology

5.1 Excavation for the Existing shoulder

• Necessary excavation would be done using back hoe loaders or manual means up to the required level.

• Levels of excavation would be marked by the surveyor using pegs.

• All the unsuitable materials would be disposed to approved location or as directed by the Engineer.

Methodology Flow Chart

5.2 Placing & Compaction of Shoulder materials

• The exposed surface would be trimmed by using suitable mechanical devise to eliminate the unevenness of the surface for proper compaction.

• The exposed surface would be compacted by using mechanical tampers or using vibrator rollers and the compaction would be done in series of over lapping for both directions.

• The shoulder materials would be made to have an effective breaking down before it is placed on the prepared surface to facilitate the compaction.

• The shoulder materials would be placed on top of the prepared surface in layers not exceeding 225mm for compaction.

• Compaction would be preceded using 5-10 tons smooth wheeled rollers or any other roller of comparable compactive effort.

• Before laying shoulder materials, required amount of water would be added to achieve the optimum moisture content.

Quarry Operations

November 6, 2010

4.5 Loading, Unloading & Secondary Breaking

Machinery

1. Hydraulic Rock Breakers
2. Dump Trucks
3. Wheel Loaders
4. Excavators

1. Operative time would be 6.00h to 18.00h.
2. Secondary blasting would be carried out with blasting mat, sand bag, used tires, steel plate to prevent fly rocks.

Rock Blasting, Rock Blasting Arrangement

5.0 Social & Environmental Control

A suitable and qualified Environmental officer would be appointed for the project and he will the primary point of contact for assistance with all environmental issues with in the project. A complaint register would be maintained to enter all public complaints and matters related to environmental and social aspects with suitable method of receiving complaints.

5.1 Disposal of Debris and Spoil

(a) All debris and residual spoil material would be disposed only at locations

(b) The debris and spoil would be disposed in such a manner that waterways and drainage paths are not blocked.

(c) Any approval on this manner if necessary would be obtained from the relevant local authorities.

5.2 Protection of Ground Cover & Vegetation

(a) Construction vehicles, machines and equipments would be used and stationed in the areas of work.

(b) Necessary instructions would be provided to all drivers and operators not to destroy ground vegetation cover unnecessarily.

5.3 Soil Failures & Prevention of Soil Erosion

(a) All necessary steps would be taken to ensure the stability of slopes.

(b) Slopes of cuts which are unduly exposed to erosive forces would be graded and covered with suitable material.

(c) During the rainy season, the works that lead to heavy erosion would be avoided.

5.4 Contamination of Soil by Fuel & Lubricants

(a) Vehicles, machinery and equipments maintenance would be carried out in designated locations approved by the Engineer.

(b) Adequate measures such as not discharging on the ground and accordance with the CEA guidelines would be taken against pollution of soil by spillage of petroleum products, waste oil, untreated waste water etc.

5.5 Disposal of Harmful Construction Wastes

(a) A list of harmful, hazardous and risky chemicals or material if any and the places where such chemicals or materials are dumped would be provided.

(b) Any area including water bodies contaminated would be cleaned up as per the Engineer.

5.6 Protection of Water Sources & Quality

(a) Adequate precautions would be taken to protect all the sources of water such as wells, springs etc.

(b) Existing canals and streams would not be blocked temporally and permanently. If diversion or closure or blocking of canals and streams is required for the execution of work, approval would be first obtained from the Engineer by writing.

5.7 Siltation of Water Bodies

(a) Embankment slopes, slopes of cuts would not be exposed to erosive forces and they should be covered with suitable covering material such as grass etc.

(b) Typical measures such as use of proper berms, dikes, slope drains at appropriate locations would be provided to prevent siltation of water bodies.

(c) Construction materials containing fine particles would be placed not subjected to flooding.

5.8 Contamination of Water from Construction Waste

(a) Measures would be taken to prevent the waste water from entering directly into streams, water bodies etc.

(b) Oil, grease and other contaminants would be removed from the waste water from vehicle and plant maintenance.

(c) Wastage of water would be also minimized.

(d) Adequate and appropriate facilities for disposal of sewerage and soil waste would be provided.

(e) All waste arising from the work would be disposed in a manner that is acceptable to the Engineer and as per the guidelines of the CEA.

5.9 Flood Prevention

(a) All measures would be taken to keep all drainage paths and drains clear of blockage at all time.

(b) All preventive measures would be taken to avoid any aggravate floods.

Prime Coat and Tack Coat

November 7, 2010

1.0 Introduction

Prime Coat

Prime coat would act as a protective measure for the Aggregate Base, prior to laying surface courses. It enhances the bond between two layers.

Tack Coat

Tack Coat would be applied over existing pavement so that to provide bond between two layers.

2.0 Abbreviations

CM – Construction Manager
SE – Site Engineer
SEO – Safety & Environmental Officer
ME – Material Engineer
QAE – Quality Assurance Engineer
QAS – Quality Assurance System
PPE – Personal Protective Equipment

3.0 Resources

3.1 Man Power	**3.2 Equipments & Tools**
CM	Water Bowser
SE	Brooms/ Brushes
ME	Air Compressor
SEO	Distributor
QAE	Level Instruments
Lab Technicians & Helpers	Safety Inventory
Surveyor	Blinkers
Survey Helpers	Barrels
Supervisor/Foreman	Signal torches
Operator (Water Bowser)	Traffic Jackets with Retro reflective patches/stripes
Operator (Sprayer Bowser)	Sufficient barricade tapes.
Operator (Broomer)	Barricade boards with Retro reflective stripes
Operator (Air Compressor)	Stop and Go signs
Skilled & Unskilled laborers	Road works ahead boards
	Traffic cones
	End sign (road works end)

3.3 Material

Prime Coat

1. The prime coat shall consist of medium curing cutback bitumen (25 – 45 percent) or MC30.
2. The Blotting material shall be crushed rock or river sand having grading limit of specified in contract specification.

Tack Coat

3. The Tack coat shall consist of medium curing cutback bitumen (10- 20 present) or CRS 1h.

4.0 Methodology

4.1 Prime Coat

4.1.1 General

1. The prime coat would be applied over the prepared approved aggregate base cause which laid in accordance to the designed cross sections levels, given by the surveyor.
2. Dense graded aggregate base should be done on a prepared and accepted sub-base course or other roadbed in accordance with the specification and specific requirements of the contract in conformity with the required lines, levels, grades, dimensions and cross sections.
3. Quality of the work would be secured through the careful control of the materials as same as the workmanship.
4. Adequate safety control measures would be provided to prevent from any damage or danger to the public and the personnel involved in the work.

4.1.2 Preparation of Surface

1. Prior to application of prime coat the base would be brushed to remove all dust, loose particles and other extraneous material and the surface would be moistened with water just before priming.
2. Where local irregularities in the existing surface, the surface would be brought to uniform contour by patching with fine particles of aggregate base course or an asphalt mixture to be approved by the Engineer.
3. Where the mix is laid over cement concrete pavements, joints and cracks would be cleaned and filled with bituminous material as approved, and any unevenness of the surface would be corrected as required. A tack coat would then be applied to the surface.

Random Rubble Retaining Wall

November 7, 2010

1.0 Introduction

Retaining walls to be constructed at the places where identified by the Engineer and this work shall consist of RR masonry retaining walls including all necessary components.

2.0 Abbreviation

SE - Site Engineer
TO - Technical Officer.
QAS - Quality Assurance System.
ME - Materials Engineer (Contractor).
TS - Technical Specification.

3.0 Resource Allocation

Man Power	Equipment & Tools	Material
Site Engineer-01	Track Back-hoe loader-01	Cement
Surveyor-01	Wheel Loader(If necessary)	Fine Aggregates
Survey helpers-04	Water pump(If necessary)	Coarse Aggregates
Forman-01	Dump trucks(15 tons)-02	Steel
2 Nos- Flagmen (minimum)	Mamoties	Random Rubble
Skilled labours-06	Crow bars	Plywood sheets
Unskilled labours-05	Shovels	
Operators-As required	Level instrument	
	Porker vibrator	
	Safety boots	
	Safety Helmets	
	Safety Gloves	
	Traffic signs	
	Blinking Lights	
	Barricade boards	
	Traffic cones	
	Direction boards	

4.0 Quality Control Procedures

4.1 Material sampling and testing

The materials Engineer would take the samples from required materials such as concrete and soil according to the specified frequency and locations.
Concrete: in concrete, one set of cubes would be made per 10 cu.m of concrete. At least one sample would be taken on each day that a particular grade is used. Crushing strength of the concrete cubes would be tested for the samples at ages of 7 and 28 days. Each sample would be identified by identification No and it is displayed on the test cubes and a same identification No would be included in the sample register. The identification tag includes, the date of cast, age of test and date of test to be performed.

4.2 Inspection Check list

To ensure that the all activities being performed with the expected quality, an inspection check list would be filled by QAE or the respective QA inspectors in case of pre construction, during construction and post construction. The inspection check list shall include the specific requirements, safety and environmental measures.

4.3 Dimension Control

All specified lengths, widths and heights would be properly maintained during construction and all these dimensions would be checked with the inspection check list. In case of identifying the undesirable changes in specified dimensions and even beyond the specified tolerances, the particular work would be reworked before the subsequent work.

5.0 Methodology

Excavation

• Limits of the Excavation would be identified from the drawings and required levels and lines would be set out by the surveyor using pegs.

• Excavation would be carried out by wheel back-hoe loaders or any other suitable equipment up to the required levels and lines.

• The Engineer would be informed for inspection of foundation before preceding the subsequent work.

• All suitable material would be properly stock piled and other unsuitable material would be disposed to a suitable disposal location by tipper trucks.

• If the exposed surface is unsuitable for the construction of foundation, necessary excavation would be done for back filling with suitable material.

Concrete Retaining Wall

November 8, 2010

Reinforcement:

- Reinforcement arrangement in the wall section would be provided as shown in the drawing by lapping with previous bar arrangement. If the wall height is more than the single bar length, lapping would be provided at 1/3 of the wall height from its bottom or top.
- PVC pipes would be placed inside the reinforcement arrangement in a spacing as directed by the Engineer in both ways to the required slope and the length for the purpose of providing weep holes.

Concreting Work:

- The concreting area of the wall would also be cleaned to remove all the unsuitable matters before start the concreting by a manual mean or using compressed air.
- 12mm thick regiform sheet would be placed vertically in each 5m intervals for the purpose of Expansion joints (length of the interval can be change due to the length of the retaining wall)
- Slump of the mix would be tested at the site by the standard slump measuring methods and the result shall confirm to the specified workability of the concrete mix.
- Concrete would be placed in successive layers and porker vibrator would be applied while concreting. Shutter vibrators would also be applied while concreting where the volume of concreting is too large.
- Curing would be done for base concreting using wet gunny bags after 24 hrs from concreting and it would be preceded up to 7 days.
- Inlet of the weep hole would be enclosed by a suitable geotextile and stone packing would be made around the geotextile.

Backfilling

- Back filling behind the structure would be done using suitable filling materials
- Lower layers would be filled using embankment type 02 materials
- Top 500 mm would be filled using embankment type 01 material
- Compaction would be preceded in successive layers with the application of vibrator roller or rammers.

6.0. Safety Plan

6.1 Safety Management Action Plan

In order to minimize the occurrence of site accident, the provision of a safe working environment for workers to work is essential. Our company endeavors to make a zero accident record in each site. In addition to the above, the following safety precaution must also be implemented in achieving the minimization of site accidents.

6.1.1 Site Staff and Labor

- Safety Induction Training would be conducted to all new employees by the Safety Officer prior to start any work.
- Regular safety induction courses and toolbox talks would be arranged on site for operative and supervisory staffs and in particular for those new workers.
- Personal Protective Equipment (PPE) such as safety boots and helmets would be

provided with workers. In addition, adequate PPE (e.g. ear and eye protectors) should also be available for construction works as required.

- Barricades with warning signs would be established all around the excavated area, "Retaining wall under Construction" the wording would be given in all three languages.
- All tools, plant, equipment and temporary facilities and all other items use to carry out the work should be in a safe, sound and good condition.
- Alcoholic drinks and other substances, which may impair judgment, would be prohibited from the Site.
- Working Radius: Mamoties and jungle clearing knife should have working space to move freely without hurting other employees.
- Fall Prevention Measures: Investigation would be take place to identify falling hazards and preventive measures would be taken immediately.
- Workers would not be allowed to work in the stream water unless provide with a safety belt with a long lanyard in order to rescue them in case of drowning. In addition, workers would be provided with life jackets.
- A notice would be erected to prevent outsiders entering to our work sites, "No Entry for Outsiders".
- Signalmen would be deployed if the work spaces disturb traffic flow in the main road. A traffic supervisor would also be deployed to take responsibility over the traffic control.
- First Aid Facilities: First aid facilities such as a first aid box would be made available for in case of minor injury treatment.