GENERAL EARTHWORKS SPECIFICATION FOR RAILWAY EMBANKMENT

1.0 GENERAL REQUIREMENTS

1.1 This specification is to be read in conjunction with the conditions of contract, and all other specifications (particularly Specification for Engineered Fills) and drawings.

1.2 Where works are directed to be performed by the Contractor but are not specified in the specification, the Contractor shall carry them out with full diligence and expediency as are expected for works of this nature under the obligations of the Contractor.

2.0 SCOPE OF WORKS

2.1 The work comprises the provision of all labour, materials, tools, transportation, instrumentation, etc. necessary to construct the embankment in accordance to the Drawings and to the quality standards set in the specifications, inclusive of material and performance tests where these are specified.

3.0 STANDARDS AND CODE OF PRACTICE

3.1 Unless otherwise specified herein, the following contemporary Codes and Standards available at the date of the tender shall lay down the minimum standards required for embankment construction. Where these Codes and Standards are in conflict, or are less severe than the equivalent provisions of the Malaysian Standards, the latter standards shall take precedence:

BS 6031 Code of Practice for Earthworks

3.2 Unless otherwise permitted in the local regulations, the latest Malaysian Standards follow by British Codes and Standards pertaining to the particular type of material being used shall determine the quality of material and the method of work in the Contractor's design and construction of temporary structures.

3.3 Where the Codes or Standards do not provide adequate guidelines on any aspect of the construction operations or of temporary structures on the Contractor's design, the Contractor shall be responsible for the observance of proper safety measures and good engineering practices, including prototype testing to verify the design. If inexperienced in erecting the type of temporary structures being provided or in doubt as to the adequacy of its design, the Contractor shall engage suitably qualified competent Professional Engineers with the requisite expertise in these areas to supervise the erection or perform the design of the temporary structures.

4.0 EQUIPMENT AND LABOUR

4.1 The Contractor shall provide all equipment and labour necessary for the embankment construction.

4.2 The Contractor shall satisfy the Engineer regarding the suitability, efficiency and operational capability of his machineries. The Contractor shall be required to provide adequate numbers of operational machineries to ensure that the works are completed within the time period stipulated in the approve construction programme. The Contractor is deemed to have made provision for the availability of standby plant at all times to allow for the contingency of equipment failure. Equipment found to have a consistent record of breakdowns shall be
removed from the site.

4.3 The Engineer shall order the removal or replacement of any equipment or staff whenever he is of the opinion that such equipment or staff is not suitable for the works. The Contractor shall comply with the Engineer's instructions on these matters without extra cost or time to the contract.

5.0 CONTRACTOR'S RESPONSIBILITIES

5.1 The Contractor shall allow in his contract price for his compliance with the requirements of this section and for all other things necessary to complete the required embankment construction.

5.2 The Contractor's method of construction shall comply with the more severe of either the statutory limits imposed on construction noise, vibration and air pollution levels, or such limits necessary for the adequate protection and proper functioning of neighbouring roadways, buildings and their facilities as agreed with the Engineer. The Contractor's compliance with these limits shall not relieve him of his sole responsibility for all consequential damages to adjoining structures, roads and other properties caused by excavation work.

5.3 The Contractor shall take all necessary steps before the commencement of embankment construction to verify and supplement the soil report and any other information provided at tender, to the extent that is required in his method of construction.

5.4 The Contractor shall conduct pre-commencement site visits where necessary to establish and verify the locations and levels of all existing underground utilities within and surrounding the Site that are affected by the embankment construction, and take all necessary steps either of a temporary or a permanent nature to protect, divert or shut off the affected services to the satisfaction of the local Authority.

6.0 LOCAL REGULATIONS

6.1 The Contractor shall be responsible for executing the embankment construction strictly in accordance with the relevant local regulations and by-laws that are current at the date of the tender together with all amendments and addenda which are imposed as statutory requirements in the course of the Works.

7.0 SITE CONDITIONS AND CONSTRAINTS

7.1 Prior to the submission of the tender, the Contractor is required and deemed to have visited the Site to fully acquaint himself as to the nature, extent and practicality of the excavation, earthworks or associated temporary works (if any). The Contractor shall satisfy himself that the existing ground and formation levels as shown on the drawings are correct.

7.2 The award of the Contract shall be based on the understanding that the Contractor is familiar with the geology of the Site. He shall include in his tender for all costs arising from the nature of the ground (ground levels, water table level, rock formations, subsoil conditions etc), climatic conditions, the availability or lack of access, working space, storage, accommodation, the proximity of adjoining structures and roads, the local Regulations regarding the obstruction of public highways and any other limitations imposed by the Site and its surroundings, for the satisfactory completion of the embankment construction. He shall make due allowance for the effect of these constraints on his construction operations to ensure on-time completion of the Works. No claim by the Contractor on the grounds of lack of foresight or knowledge of the site conditions or for under-provision in connection with the Works will be considered.

7.3 The Contractor shall ensure that his method of excavation is suitable and safe for use at the
Site. The Contractor shall indemnify the Employer against any expense, liability, loss, claim or proceedings which the Employer may incur or sustain by reason of damage to any property, real or personal other than works, injury or accident to workmen or public, caused by collapse, subsidence, vibration, weakening or removal of support or lowering of ground water, arising out of or in the course of or by reason of the execution of the Works.

8.0 SITE ACCESS

8.1 The Contractor shall be responsible for obtaining all necessary statutory approvals on temporary access into the Site for the tenure of the contract period. He shall comply strictly and diligently with all conditions attached to these approvals. The access as well as the portion of public road and walkway connected with it shall be kept clean and safe at all times. Continuous and adequate security arrangements at access points into the site shall be provided for the full duration of the contract.

9.0 SUBSOIL DATA

9.1 A soil investigation report for the Site is available to the Contractor for his information. The report is intended solely as a preliminary and approximate guide to the nature of ground stratification as it is known to the Engineer. The completeness and the accuracy of the information provided is neither guaranteed nor implied. No responsibility is assumed by the Employer or the Engineer for any opinion or conclusion given in the soil investigation report.

9.2 The soil investigation report limits itself to and identifies subsurface conditions only at selected points where soil samples were taken, when they were taken. The actual conditions in areas not sampled may differ from the reported findings. Continuing adequacy of the report may be affected by time, construction operations at or adjacent to the site and by natural events such as floods and ground water fluctuations.

9.3 Given the limitations attached to the soil investigation report, the Contractor shall be obliged to place his own interpretation on the information provided and include in his tender for the cost of providing all things necessary to ensure the satisfactory completion and the safety of the earthworks, such as supplemental soil investigation and adding, upgrading, strengthening, adapting, modifying, taking down and refixing of temporary works, etc. He shall assess the limitations of the soil report and make due allowance in his construction operations to ensure the on-time completion of the Works. No extra time or payment will be considered at a later date on the grounds of under-provision in the excavation, earthworks or associated temporary works, incomplete or incorrect information contained in the soil report, or want of knowledge or foresight.

9.4 The Contractor shall make his own verification of water table at the Site. No claims will be considered for any special pumping or bailing required related to the work below the water table level. The Contractor shall allow in the tender for the cost of any extra supports to stabilise the earth required to excavate below the water table level.

9.5 Details and results of all supplemental soil investigation which the Contractor undertakes in the course of the Works shall be made available to the Engineer for his record.

10.0 PROTECTION OF PUBLIC AND PRIVATE SERVICES

10.1 The Contractor shall be responsible for detecting, protecting, upholding, upkeeping and maintaining all existing services such as railway and its services, roadside drains, mains, ducts, water supply pipes, sewers, gas conduits, electrical and telephone cables and the like over and adjacent to the Site during the tenure of the contract, regardless whether or not these services are known to exist at the time of tender. He shall take extra precautions to prevent undermining
of foundations to service lines, thereby resulting in damage and interruption of supply, and make
good any damage due to any cause within his control at his own expense and time, and pay all
consequential costs and charges in connection therewith.

10.2 In the event that damage has been done to services due to the Contractor's work or any cause
within his control, and should these repairs be carried out by the local Authority, the Contractor
shall make a direct reimbursement to the local Authority for the cost and charges for carrying out
the repairs, failing which the Employer reserves the right to pay the local Authority direct and
deduct the same from any monies due or becoming due to the Contractor.

10.3 Any information made available to the Contractor at the time of the tender is indicative and is
intended only as an approximate guide for the Contractor's own verification on Site. Immediately
after taking possession of the Site and BEFORE commencing work, the Contractor shall
establish test holes to confirm the locations and levels of all existing underground utilities within
and surrounding the Site that are affected by his excavation works. If the Engineer is of the
opinion that the site verification survey of underground services is incomplete or inadequate in
any way, he shall order additional confirmatory test holes to be carried out at the Contractor's
expense. The Contractor shall immediately notify the Engineer and the local Authority if he
should encounter services not known to have been existing at the time of tender.

10.4 If it becomes essential in the opinion of the Engineer and the local Authority to temporarily or
permanently divert any cable, pipe or other service, the Contractor shall give the necessary
notices to the local Authority and arrange for the diversion work to be carried out, regardless
whether or not the service to be diverted is known to exist at the time of tender. The cost of the
diversion will be paid for by the Employer but it shall be the Contractor's responsibility to
coordinate all service diversion works that are carried out during the tenure of the contract
period and ensure that such works do not adversely affect the on-time completion of the Works,
falling which the Contractor shall bear all consequences for any delay in completion of the
Works due to any cause within his control.

11.0 SETTING OUT

11.1 The Contractor shall provide all labour, pegs, rods, survey instruments, concrete posts etc
needed for setting out the works. The Contractor is to ensure that boundary marks defining
the limits of the Employer's property are in their correct positions and shall employ a licensed
surveyor to check the accuracy of these positions. The Contractor shall be responsible for
setting out the works from the drawings and boundary marks. The Contractor shall be
responsible for safeguarding the position and level of all reference pegs, boundary and
benchmarks used for setting out the works.

11.2 The Contractor shall obtain the Engineer's prior agreement on the locations and numbers of
reference baselines and datum levels required for setting out of embankment construction.
The Contractor shall engage a licensed surveyor to set out the extent of the embankment on
site.

11.3 The Contractor shall obtain the Engineer's prior agreement on the locations and numbers of
boundary marks. The system of boundary marks shall be employed for cross-checking.
Boundary pegs shall be maintained in good condition at all times. While such pegs may be
removed temporarily at localised zones to facilitate construction, the Contractor shall re-install
them at the earliest possible time. Boundary pegs shall not be removed without prior
consultation with the Engineer.

11.4 Checking by the Engineer does not in any way absolve or reduce the Contractor's
responsibility to ensure the accuracy of the setting out.

11.5 Earthworks shall be finished to conform within the following limits to the levels, lines, grades and
cross-sections specified or shown on the Drawings or directed by the Engineer.
11.6 Formation Width and Alignment

The widths measured on each side from the specified centreline or design line to the toes of cut batters and/or the tops of fill batters shall be not less than the widths shown on the Drawings. The alignment shall not differ from the specified lines or levels at any point by more than 10 mm.

11.7 Formation Level and Shape (Outside Subgrade Width)

Prior to topsoiling, the level at any point on the finished surface shall not differ by more than 50 mm from the specified level and the surface shall be free from depressions capable of retaining water. Unless otherwise permitted by the Engineer, no point on the surface shall lie more than 50 mm below a 3 m straightedge laid on the surface.

11.8 Batter Slope and Shape

At any cross section the batter slope shall be not steeper than the slope specified. The batter face shall be finished to reasonably uniform shape.

11.9 Batter Line

Cut batters shall be so constructed that the toe of the batter is not more than 10% of the batter height outside the calculated batter line. Notwithstanding the above, on all sections beneath bridges, and other sections where it becomes necessary to confine the lateral spread of the earthworks to closer limits due to site constraints and the Engineer directs, the tops of cut batters and the toes of fill batters shall be not more than 300 mm outside the calculated batter lines.

11.10 Drain level

Surface drain invert and side slopes shall be finished to within 50 mm of the specified level at any point and shall be free from depressions capable of retaining water.

12.0 DILAPIDATION SURVEY

Immediately after taking possession of the Site and BEFORE commencing any work on Site, the Contractor shall conduct an adequate dilapidation survey with measurements of all principal buildings and permanent facilities around the site boundaries to establish their general pre-construction condition. The survey report shall be lodged with the Employer, the Engineer, the local Authority, the adjacent Owners, and with any other party that the Employer may direct.

For each adjacent building or facility, the Contractor shall prepare a set of photographic records together with proper documentations and a schedule listing the size of the superstructure, extent of underground structure, visible defects with measurement and any other relevant details pertaining to the general condition of that building or facility.

13.0 TEMPORARY WORKS

The Contractor shall allow in the tender for the cost of providing the necessary design, statutory submission, construction, testing and monitoring of all temporary works, including the subsequent removal of all recoverable temporary structures, for the satisfactory completion of the earthworks. He shall be responsible for the overall adequacy and safety of all temporary works.

The scope of temporary construction shall include but not limited to:
(a) Life safety measures such as hoardings, barricades, nettings, signboards, etc.
(c) Ground water recharging systems, surface and groundwater drainage system using surface or subsoil drains, sumps, etc.
(d) All other measures necessary for the safe performance of the temporary works, such as maintaining, adding, upgrading, strengthening, adapting, modifying, re-positioning, taking down and refixing from time to time, etc.

The Contractor shall employ a Professional Engineer to design and supervise the construction of the temporary works. A certified copy of the design calculations and construction drawings for the temporary works shall be made available to the Engineer for the purpose of record. If the Engineer is of the opinion that the provision of temporary support for the excavation is inadequate in any way, the Engineer will order additional supports or remedial works to be provided entirely at the Contractor's own expense with no additional performance time. Such instruction will not relieve the Contractor of his sole responsibility for the sufficient support of the excavation.

The Contractor shall make all necessary statutory submissions in connection with his temporary works, and secure from the local Authority the required clearances and the statutory permit to commence work. He shall comply with the requirements of the local Regulations governing his design and construction of the temporary works, including any statutory requirements that may be imposed from time to time during the tenure of the contract.

14.0 TYPES OF TEMPORARY CONSTRUCTION

The Contractor shall be fully responsible for the type of temporary construction that he adopts to ensure the adequate support of the excavation. He shall bear all consequences in time, costs and damages arising from his failure to adhere to adequate safety procedures, sequences of work and standards of workmanship in connection therewith.

The method of construction of temporary works shall take into account the following considerations:
(a) The geology along the length and depth of the cutting
(b) The water levels, hydrogeology and strata permeabilities along the length and depth
(c) The settlements that will be expected and the anticipated effect on neighbouring structures
(d) The depth of construction required
(e) Any particular difficulties that special plant might meet with respect to access, clearances and working space
(f) Control of heave and instability of the base of excavation
(g) The adequate support of existing utilities affected by the excavation
(h) The operation of heavy equipment, the storage of bulk materials and any other form of surcharge next to excavation
(i) Control of lateral load increase and ground loss induced by water seepage through ground surface cracks behind temporary retaining structures

Due regard shall be given to the ground settlements associated with the type or method of temporary construction adopted by the Contractor:
(a) Where ground water lowering by pumping will cause soil consolidation and ground loss, the Contractor shall design and install a groundwater recharging system; the Contractor shall ensure the sediment deposits and precipitation of solutionized minerals are controlled to maintain continued efficiency of the recharge system.
(b) Timber ground supports which are non-recoverable shall be treated with approved wood preservative before use.

The minimum precautions to be taken by the Contractor for the particular temporary construction that he has adopted include but are not limited to:
14.1 **Dewatering**

Particular attention shall be given to avoid soil consolidation and ground loss next to the excavation caused by fluctuations in the water table level.

14.2 **Steel Sheet Piling**

The Contractor shall ensure that sheet piles are providing proper support to the sides of excavation under the worst combination of lateral earth pressure and groundwater pressure, including the possibility of the water level rising temporarily to the ground surface due to heavy rainfall. Particular attention shall be given to ensuring compliance with permitted noise and vibration levels during the installation and removal of sheet piles.

14.3 **Timbered Excavation**

The Contractor shall ensure that the timber is providing proper support to the sides of excavation.

In water-bearing granular soil conditions where water leakage into the excavation will cause significant groundwater drawdown leading to ground loss and/or soil consolidation, particular attention shall be given to the use of a suitable ground water cutoff system such as jet grout piling behind the timbering.

Particular attention shall be given to ensure maximum removal of timber on completion of work, but where timber is likely to be left in place, treated timber to prevent rotting is required.

14.4 **Trench Cutting**

Particular attention shall be given when using trench excavation method to control ground movement during the installation of temporary works for braced excavations in close proximity to principal adjacent structures of facilities. Trench cutting requires the sides of excavation to be cut and braced in a preselected sequence of alternate panels.

14.5 **Open Cutting**

Particular attention shall be given to the stability of side slopes and the prevention of deterioration of the sides of excavation by prolong weathering.

Abrupt changes in soil conditions, such as when a compacted soil layer is underlain by loose soil strata below, will undermine slope stability. Particular attention shall be given to safe work methods and to providing adequate support to the excavation under such conditions.

15.0 **STABILITY OF EXCAVATION AND MAINTENANCE OF EARTHWORKS**

15.1 **Surface and Percolating Water**

Surface and percolating water will undermine the stability of the excavation and nearby ground through the process of ground loss, consolidation and/or increase in lateral earth loading. The Contractor shall allow in his tender for the cost of providing adequate measures to maintain the stability of the excavation, including but not limited to:

(a) Carry out adequate slope protection.
(b) Divert surface and percolating water clear of all excavations by means of temporary drains and sumps, and provide a groundwater recharging system and etc if necessary.
(c) Fill up and seal on a daily basis all movement cracks that appear on the surface of
adjacent ground and continue until ground movement has ceased.

The Contractor shall be responsible for making good and rectifying any bank slips, erosion of slopes and other forms of ground loss, and any consequential damage to drains, culverts, pipes, utilities etc, occurring in the course of excavation and during the period when the excavation stays open, all at his own expense.

15.2 Protection of Slopes and Banks

All exposed earth slopes shall be protected with approved temporary protection not later than one day after they are cut, and IMMEDIATELY if high water table, poor soil or adverse weather conditions are encountered, prior to the application of permanent protection, ie closed turfing or hydroteeeding.

Temporary protection shall not be removed until proper and adequate slope drainage (berm drains, cascade drains and toe drains) and permanent protection (e.g. closed turfing or hydroteeeding) has been constructed as approved by Engineer.

As earthworks progress, it shall be the responsibility of the Contractor to provide slope protection in a diligent and expeditious manner on completion of each stage of excavation. The Contractor shall on no account deviate from his submitted method or sequence of slope protection unless such deviation has been approved in advance by his Professional Engineer.

15.3 Site Drainage and Dry Conditions

The excavation is at all times to be kept well drained and dry by means of temporary slopes, drains, sumps, etc and by pumping.

As earthworks progress, the Contractor shall provide and maintain temporary concrete drainage channels with cascades for the efficient drainage of the area. These drains shall be cut to a gradient not exceeding 1 in 100. The Contractor shall break up and remove temporary drains after use and make good as directed by the Engineer.

The Contractor shall install a drainage and sump system at the final excavation level. He shall maintain the drainage and sump system for the duration the excavation is kept open.

All temporary drains shall be directed to the nearest water course or to sumps which are pumped out to the roadside drain. The roadside drain shall have an adequately large section so that no mud or water will spill onto the roads or pavements. Only self priming submersible pumps of sufficient capacity such as ‘Flygt’ pumps or similar equipment are to be used. The pumps shall be of sufficient number and capacity to provide adequate pumping capability in the event of breakdown.

The effluent discharge system shall comply with the requirements of the KTM, Jabatan Kerja Raya, the Health Department and other appropriate Authorities. The Contractor shall keep the roadside drains in the vicinity of the site are free of silt due to site effluent. He shall provide a desilting basin of adequate size for this purpose and remove silt from the effluent before discharging it into the roadside drain. The Contractor shall obtain all necessary approvals and pay all costs and expenses in connection therewith.

16.0 ANTI MALARIA MEASURES

The Contractor shall take all necessary precautions to prevent the breeding of mosquitoes and pay all charges made by the local Authority for anti-malarial measures.
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