Code of Practice for works on public streets

Land Transport Authority
## Revision History

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<tr>
<td>8 January 2009</td>
<td>R1</td>
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<td>10 March 2009</td>
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Preface

The Code of Practice for Works on Public Streets was prepared by the Road-Opening Section, and acted upon by the Deputy Director, Road Infrastructure Management Division. It comes into effect in March 2008 and supersedes the Code of Practice for Road-Opening Works.

This Code aims to ensure that all works are carried out safely with minimal inconvenience to road-users. It shall apply to all works as defined in the Street Works (Works on Public Streets) Regulation within the public streets: laying and maintaining of utility apparatus, lane closure on carriageway and engineering works.

The Code sets out the procedures and requirements for obtaining approval for permit to carry out work on public streets. It also sets out the technical requirements for the various types of utility services, engineering works and related reinstatement works. General amendments and revision to the procedures, requirements and standards may be made from time to time as the Authority deems fit.

Compliance with this Code of Practice does not by itself confer immunity from Legal obligations.

This Code of Practice for Works on Public Streets is issued by the Land Transport Authority under Regulation 12 of the Street Works (Works on Public Streets) Regulations.

LAND TRANSPORT AUTHORITY
PART I – INTRODUCTION

SECTION 1
GENERAL

1.1 SCOPE

1.1.1 This Code is issued under Regulation 12 of the Street Works (Works on Public Streets) Regulations. It sets out the procedure to obtain permission to carry out works affecting public streets. It also stipulates the technical requirements, sets standards of materials and workmanship when carrying out utility services laying work, engineering works and any other works that affect the integrity of any public infrastructure. In the absence of any other technical/engineering requirements, the latest edition of the Authority’s Material and Workmanship Specifications shall prevail.

1.1.2 Nothing in this Code shall derogate or prejudice the Authority’s powers, rights and remedies under the Street Works Act and the Street Works (Works on Public Streets) Regulations, as amended from time to time.

1.2 USEFUL REFERENCES

1.2.1 Street Works Act

1.2.2 Street Works (Works on Public Streets) Regulations

1.2.3 Code of Practice for Traffic Control at Work Zone

1.2.3.1 This Code provides a useful guide on the posting and arrangement of temporary signs. It also contains illustrations on typical signing arrangement.

1.2.4 LTA’s Standard Details of Road Elements

1.3 CONSULTATION

1.3.1 The applicant is advised to consult the Authority on any requirements relating to works on public streets before making any formal application for approval.

1.3.2 Any preliminary consultation with the Authority or submission of plans shall not be taken as approval or disapproval of the proposed works or be construed as having the agreement of the Authority.
1.3.3 Unless otherwise stated, all conditions and comments as stipulated during the consultation process shall form part of the conditions for permit to carry out works affecting public streets.

1.3.4 The applicant shall re-submit the proposal for the comments of the Authority if the proposed works do not commence within 2 years from the date of comments given for the previous consultation.

1.4 APPLICATION

1.4.1 All applications are to be submitted electronically through the “Permit for Road Occupation Management Portal (LTA.PROMPT)” at the following URL - https://prompt.lta.gov.sg.

1.5 DEFINITIONS

For the purpose of this Code, the following definitions shall apply:

“applicant” means any person who makes or has made an application under Regulation 5 of the Regulations and includes a person whose application has been granted by the Authority;

“ASTM” means the American Society for Testing and Materials;

“Authority” means the Land Transport Authority of Singapore established under the Land Transport Authority of Singapore Act;

“BCA” means the Building and Construction Authority of Singapore;

“BS” means the current British Standards;

“Code of Practice” means the Code of Practice issued by the Authority under Regulation 12 of the Regulations and includes any amendment, which may be made to the Code of Practice from time to time;
“contractor” means a contractor who is registered with LTA under the LTA.PROMPT;

“DIN” means the Deustches Institut fur Normung Standard

“emergency works” means works which must be carried out immediately in order to put end to or prevent the occurrence of any circumstances (whether existing or imminent or which the person requiring the works to be carried out believes on reasonable grounds to be existing or imminent) which are likely to cause serious danger to any person or property;

“LTA.PROMPT” means the Permit for Road Occupation Management Portal;

“major roads” means all roads other than minor roads;

“minor roads” means local access roads of carriageway width 7.4m or less;

“MPC” means the Master Plan Committee;

“no-opening period” means period during which no excavations are allowed on the road concerned. The no-opening period is determined as follows:

<table>
<thead>
<tr>
<th>Type of Roads</th>
<th>Length of no-opening period</th>
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<tbody>
<tr>
<td>Newly resurfaced road</td>
<td>One (1) year from completion date of resurfacing work</td>
</tr>
<tr>
<td>Newly constructed or upgraded road</td>
<td>Two (2) years from the completion date of the project</td>
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</table>

“professional engineer” means a person who is registered as a civil or structural engineer under the Professional Engineers’ Act and who possesses a valid practising certificate issued under that Act;
“road lines” means any lines or other markings which are required by the Authority to be drawn on the surface of a public street for the guidance or direction of motorists or pedestrians using the public street; “Regulations” means the Street Works (Works on Public Streets) Regulations as amended from time to time; “site supervisor” means a person who possesses a Certificate in Pavement Construction and Maintenance Course or holds a degree in civil engineering or holds a recognized diploma in civil engineering with at least 5 years experience in road-related works; “SS” means the current Singapore Standards; and “works” includes:

(a) any construction work on a public street that is likely to affect the structural integrity and safe operation of any public street or road structure;

(b) utility works within the meaning of Section 2 of the Street Works Act;

(c) street works within the meaning of Section 2 of the Street Works Act;

(d) any works for the purpose of construction or repairs of a building that require occupation of a public street or that affect the flow of traffic;

(e) any works which are preparatory or incidental to any works referred to in paragraphs (a) to (d), such as the temporary storage or depositing of any building materials or debris or the placing of any equipment or the erection of any temporary structure, on the public street on which the works are to be or are being carried out.
PART I – INTRODUCTION

SECTION 2
STRUCTURE OF CODE

2.1 CODE STRUCTURE
2.1.1 This Code is divided into five main parts as follows:

(a) Part I - Introduction
(b) Part II - Submission Procedure & Requirements
(c) Part III - Technical Requirements
   - Utility Works
   - Engineering Works
   - General Reinstatement
(e) Part IV - Demerit Points System

2.1.2 Unless otherwise stated, references to a Regulation number (example, Regulation 12) in this Code are references to the regulations numbered in the Street Works (Works on Public Streets) Regulations, as amended from time to time.

2.2 SUBMISSION PROCEDURE AND REQUIREMENTS
2.2.1 The submission procedures and requirements for obtaining approval for permit to carry out works affecting public streets are stipulated in Part II of this Code.

2.3 TECHNICAL REQUIREMENTS
2.3.1 The technical requirements for the various types of utility services laying, engineering works and related reinstatement works are set out in Part III of this Code.

2.4 DEMERIT POINTS SYSTEM
2.4.1 Part IV of this Code stipulates the circumstances under which a contractor will be issued with demerit points and/or fined. It also sets out the criteria by which a contractor can be suspended.
PART II - SUBMISSION PROCEDURE AND REQUIREMENTS

SECTION 3
WORKS PROPOSAL ON PUBLIC STREETS

3.1 GENERAL

3.1.1 This section stipulates the procedures and requirements for obtaining in-principle pre-consultation approval for work proposals that affect public streets and/or road infrastructure before submission of application for permit to commence work.

3.1.2 Eight sets of plans for the following work proposals shall be submitted to the Authority for in-principle pre-consultation approval:

(a) Work proposal that requires Master Plan Committee (MPC) adoption;

(b) Any improvement or upgrading schemes for utility services;

(c) Any excavation works of 4m depth or deeper; and

(d) Tunnelling works and engineering works.

3.1.3 The submission should include but not be limited to the following:

(a) Proposed extent of works including route alignment and excavation area in relation to public streets;

(b) Preliminary impact analysis of the works on public streets or road infrastructure/s;

(c) Proposed feasible method of work execution i.e. open-cut, pipe-jacking, etc.; and

(d) Letters of clearance from other relevant authorities.
PART II - SUBMISSION PROCEDURE AND REQUIREMENTS

SECTION 4
APPLICATION FOR APPROVAL TO COMMENCE WORKS ON PUBLIC STREETS

4.1 GENERAL

4.1.1 This section stipulates the procedures and requirements for obtaining approval for permit to commence and carry out works that affects the public streets and/or road infrastructure. (Please see Appendix B for the submission process).

4.1.2 Applications for permit to commence and carry out works must be submitted electronically through the “Permit for Road Occupation Management Portal (LTA.PROMPT)” at this URL- https://prompt.lta.gov.sg.

4.1.3 Applicants, who meet the criteria under Regulation 5 of the Regulations, must register online as an applicant with the LTA.PROMPT before they are allowed to make any submissions for permission to carry out works.

4.2 WORKS PERMIT

An application has to be submitted to the Authority for permission to carry out works on public streets after the necessary pre-consultation approvals have been obtained from the relevant authorities or agencies. The types of works shall be as defined in Section 1.5 (Definitions) of this Code. Examples of these works shall include but not be limited to the following:

(a) excavation to lay or repair utility services;

(b) soil investigation works;

(c) parking of a vehicular crane on the road for the purpose of construction or repairs of a building;

(d) external works of developments.
4.3 DOCUMENTS REQUIRED

4.3.1 The electronic application shall be accompanied by the soft copy of the following items:

(a) Location and site plans of the proposed works to be carried out on the public streets;

(b) Photographs of the existing roads and ground condition;

(c) Method statement of works to be carried out;

(d) Photographs and schematic diagrams of the extent of the existing road markings where applicable;

(e) Notification of emergency openings, where applicable;

(f) Engineering evaluation report accompanied by plan for engineering works, where applicable;

(g) Certified topographic survey plans that indicate the scale, boundary lines, lot numbers and existing surrounding roads and road structures, etc (only applicable for critical engineering works involving tunnelling, piled foundation, basement construction, etc that are likely to affect the structural integrity of the public streets); and

(h) A copy of the Public Liability Policy Schedule/Endorsement(s) for a limit of not less than S$1million (any one accident and unlimited during any one period) and Workmen's Compensation Policy Schedule/Endorsement(s). Both policies shall provide for the Authority's interests to be noted as "Principal". The Public Liability policy shall also include a "cross liability" clause. The policies shall indemnify the Authority against any liability, in respect of personal injury/injuries or damage to property/properties and existing services, caused as a result of the execution of the works. The period shall cover the works duration and defects liability period. All documents, including all endorsements shall be officially signed and stamped by the insurance company.

(i) Letters of development / planning clearances, where applicable.

4.3.2 The Authority may also require a Banker’s Guarantee, of an appropriate amount to be determined by the Authority, to be submitted if it deems fit. (Please see sample formats as shown in Appendix C & D).
4.3.3  Applicants are advised to visit the LTA.PROMPT website for more information on the electronic application and the recommended formats of the attachments.

4.4  DUTIES OF APPLICANT

4.4.1  When a permit is issued for an application, the applicant must submit the actual commencement date of their works through LTA.PROMPT at least 3 days in advance. Hence, the actual commencement date must be a future date, as backdating of actual commencement date is not allowed.

4.4.2  The permit will be revoked if no works are commenced within 28 days (herein referred to as the “validity period”) from the date approved by the Authority for the commencement of the works.

4.4.3  Upon completion of the works, the applicant must notify the Authority of the actual completion date through LTA.PROMPT within 7 days. The applicant shall also submit in the same notification a post condition photographic survey report of reinstated works and the surrounding roads as well as ground conditions.

4.4.4  If the works cannot be completed by the estimated completion date, the applicant must submit a request for extension of time through LTA.PROMPT before the estimated completion date. Otherwise, any works beyond the estimated completion date will be considered as unauthorized works.

4.4.5  The applicant shall then submit the reinstatement test report where excavation and/or engineering work are involved, through the LTA.PROMPT to the Authority. The Defects Liability Period or DLP to be imposed will be determined by the Authority depending on the type of works and depth of excavation. There will be no DLP imposed for works that involve lane closure only e.g. parking of mobile crane to carry out hoisting work, etc. The applicant shall submit declaration that the reinstatement works are in satisfactory condition 3 months after the start of the DLP through the LTA.PROMPT.

4.4.6  Upon expiry of the DLP, the applicant shall apply for the handing-over of the reinstatement works to the Authority through the LTA.PROMPT.
4.4.7 The applicant shall ensure the works, for which a permit has been granted by the Authority are according to the statutory and technical requirements, guidelines and Codes of Practice for all relevant authorities and agencies and any other conditions as specified by the Authority.

4.4.8 The applicant shall also ensure that appropriate traffic control plans, according to the Code of Practice for Traffic Control, are implemented on site. He shall also ensure that appropriate information signs informing road users of impending works are posted strategically on site at least 1 week in advance of the commencement of works. The signs shall contain information such as the type of works, agency responsible for the works, the start and end dates of the works and the contact numbers for enquiries.

4.4.9 Applicant has to notify the Authority if there is a change in applicant, contractor and/or supervisor.

4.5 EMERGENCY WORKS

4.5.1 In the event of an emergency works, the applicant must inform the Authority immediately through telephone to LTA CALL CENTRE (1800-CALL-LTA) and follow up with official notification via email or facsimile within 3 working days of the emergency opening duly endorsed by an authorized officer. The application must be submitted through the LTA.PROMPT Portal within 7 working days.

4.6 CO-ORDINATION WITH OTHER GOVERNMENT AGENCIES AND PARTIES OF INTEREST

4.6.1 Barring the Authority’s approval, the applicant shall fulfil the statutory requirements of other relevant authorities before commencement of works on public streets. The applicant shall also liaise and co-ordinate with all other relevant agencies or persons whose operations or utilities may be affected by the carrying out of the works.

4.6.2 Where the works are carried out for a building development, the applicant shall liaise closely with the Qualified Person of the development to ensure that all works on public streets including utility services connections are arranged such that they can be completed with minimum inconvenience to the public. The permanent reinstatement works shall be carried out after all the necessary works and utility services connections are completed or deem necessary by the Authority.
Where scheduled bus routes are affected by the works, the applicant shall liaise with the relevant bus operators to ensure minimum disruption to the bus services.

4.7  
**AVAILABILITY OF APPLICANT**

4.7.1 The applicant shall make himself/herself readily contactable at the contact information given in the application, any time of the day during the duration of the actual work.

4.8  
**DUTIES OF SITE SUPERVISOR**

4.8.1 In accordance with Regulation 14, the person for whom the works to be carried out shall appoint a suitably qualified site supervisor to supervise the carrying out of works.

4.8.2 He shall be responsible for the overall site safety and site management and provide full-time supervision on site to supervise the works and receive directions from the Authority where necessary.

4.8.3 The site supervisor shall also ensure that the appropriate traffic control plan is being implemented on site.

4.9  
**DUTIES OF CONTRACTOR**

4.9.1 Without prejudice to Regulations 14, 15 and 18, the contractor shall be responsible for the safe execution of the works in strict compliance with the requirements as stipulated in this Code and the permit issued by the Authority.

4.9.2 The contractor shall ensure that appropriate traffic control plans are implemented on site.

4.9.3 The contractor appointed by the applicant to carry out any works on any public street shall be registered with the Building and Construction Authority. Please refer to Appendix F on the approved categories of registered contractors for works on public streets.

The Authority may consider other categories of registered contractors to perform works on public streets that do not involve opening up of the public streets. Examples of such works are lane closure for lifting, hoisting activities and maintenance of building facade (i.e. painting or washing).
4.10 **DEFECTS LIABILITY PERIOD**

4.10.1 The Defects Liability Period (DLP) is a warranty period that starts after the completion of a satisfactory permanent reinstatement. The applicant shall ensure that the reinstatement work is maintained in a defect-free condition during the DLP. The applicant shall monitor the condition of the reinstatement work and any defect which appears during the DLP shall be promptly rectified.

4.10.2 The DLP shall only begin when the Authority is satisfied with the permanent reinstatement. The DLP shall run for:

(a) 1 year for works where the depth of excavation is 1.5m or less; and
(b) 2 years for works where the depth of excavation is more than 1.5m.
PART II - SUBMISSION PROCEDURE AND REQUIREMENTS

SECTION 5
ENGINEERING WORKS PROPOSAL ON PUBLIC STREETS

5.1 GENERAL

5.1.1 This section stipulates the additional procedures and requirements for obtaining in-principle planning approval to commence engineering works within the public streets.

5.1.2 Engineering works refer to any construction work that is likely to affect the structural integrity and safe operation of any public streets or road structure.

5.1.3 The applicant or the appointed professional engineer is encouraged to initiate a consultation meeting with the Authority to discuss his proposal before submitting the engineering work proposal to the Authority.

5.1.4 Upon clearance of engineering work proposal, the applicant or the appointed professional engineer shall submit an application for permit to carry out the engineering works through the “Permit for Road Occupation Management Portal (LTA.PROMPT).

5.1.5 The requirements given in the written directions of the engineering works proposal shall form part of the conditions for the permit to carry out the engineering works.

5.1.6 No engineering work shall commence on site without the approval by the Authority issued through the LTA.PROMPT.

5.1.7 The Authority may impose any other requirements deemed necessary for safeguarding of the public streets and road structures.
5.2 APPLICATION FOR ENGINEERING WORKS PROPOSAL

5.2.1 An application for engineering works proposal shall be submitted by the applicant or the appointed professional engineer and accompanied by the following items:

(a) Plan for engineering works;

(b) Engineering evaluation report;

(c) Instrumentation proposal;

(d) Method statement of work;

(e) Contingency plans & Emergency procedure;

(f) Pre-condition survey report;

(g) Construction schedule;

(h) Traffic control plan, where applicable; and

(i) Relevant documents indicating planning approval from the competent authority.

5.2.2 The requirements for the above items are given in Clause 5.3 to Clause 5.11 of this section for compliance.

5.3 PLAN FOR ENGINEERING WORKS

5.3.1 Plan for engineering works shall be prepared and endorsed by a professional engineer.

5.3.2 Layout plans and cross sectional details shall indicate the following items:

(a) Scale of the plans;

(b) Location plan of proposed engineering works; and

(c) Vertical and horizontal distances of the engineering works (site preparation, substructures and building construction works, etc.) in relation to the existing road reserve line and/or road structure, where applicable.
5.4 **ENGINEERING EVALUATION REPORT**

5.4.1 Engineering evaluation report shall be prepared and endorsed by the appointed professional engineer. The engineering report shall also be accompanied by the checklist for temporary earth retaining structure (Please see sample format of the checklist as shown in Appendix E).

5.4.2 The above report shall address the following items:

(a) Predicted movements of the existing road and/or road structures due to the proposed engineering works at various stages of construction and at completion of the works. The evaluation shall include the following items:

(i) Detailed examination of the ground conditions at site;

(ii) Calculations for the derivations of the predicted movements; and

(iii) Appropriate sensitivity analysis to check that the assessment would not be affected by any variation in input parameters and conditions that may occur during all stages of the construction work.

(b) Assessment of the likely effects of movement on the existing road structure, where applicable.

(c) Proposal for any special measures or advance works needed to minimise the susceptibility of the existing road and/or road structure to damage and to ensure the safe operation of the public street.

5.4.3 The Authority may specify any other requirement on the engineering evaluation report which are deemed necessary for the safeguarding of the public streets and road structures.

5.5 **INSTRUMENTATION PROPOSAL**

5.5.1 Instrumentation proposal shall be prepared and endorsed by the appointed professional engineer.

5.5.2 The proposal shall include the following items:

(a) Comprehensive monitoring system to monitor the movement of the existing road and/or road structure and the ground adjacent to it;
(b) Layout plans and relevant cross-sections indicating the locations of proposed instruments relative to the road and/or road structures;

(c) Details of the instruments or equipment, including the types, function of instruments, depth of installation, etc.;

(d) Frequency of monitoring;

(e) Review levels, i.e. trigger, design and allowable for all instruments; and

(f) Valid calibration certificates for the instruments proposed, where applicable.

5.5.3 A copy of the initial readings endorsed by the appointed professional engineer shall be submitted to the Authority before the commencement of works.

5.6 METHOD STATEMENT OF WORK

5.6.1 Method statement for carrying out any engineering works shall be prepared and endorsed by the appointed professional engineer.

5.6.2 The proposal shall be accompanied by the following items:

(a) Location plan showing the boundary line of the engineering works relative to the road and/or road structures;

(b) Site layout plan showing the site set-out, movement of machineries and storage of plant & equipment;

(c) Write-up and/or plans indicating step-by-step sequence of carrying out each phase of works or activities; and

(d) Construction risk analysis to identify potential risk of construction activities on road users and public streets. Both the general construction hazards and geotechnical risks shall be presented with the corresponding risks assessed and precautionary measures to mitigate these risks.
5.7 CONTINGENCY PLAN & EMERGENCY PROCEDURE

5.7.1 A contingency plan and emergency procedure prepared using the guidelines given in Section 5.8 below shall be endorsed and submitted by the appointed professional engineer.

5.7.2 The contingency plan shall include immediate rectification, temporary traffic diversion/ control plans in the event that roads and/ or road structures are affected due to excessive ground movements.

5.7.3 The emergency procedure shall include the project organisation chart and a list of emergency contact numbers. The reporting procedure for incident and roles of key personnel must be clearly defined.

5.8 PREPARATION OF CONTINGENCY PLAN AND EMERGENCY PROCEDURE

5.8.1 This section serves as a guide to the preparation of a contingency plan and emergency procedure. It aims to ensure that a set of the contingency plan and emergency procedure is in place for immediate implementation should the need arise at site.

5.8.2 IDENTIFICATION OF EMERGENCY SITUATIONS

5.8.2.1 An emergency situation may arise due to various incidents at site, such as:

(a) Monitoring results exceed the alert levels / work suspension levels specified by the qualified person;

(b) Accidents such as construction material falling onto the public street, crane toppling onto the road structure; and

(c) Failure/ collapse of temporary earth retaining structure that affects the structural integrity and/ or safe operation of the public street, etc.

5.8.2.2 The appointed professional engineer shall prepare an emergency plan stating the immediate actions to be taken in the event of an emergency in order to safeguard the integrity of the public street. In addition, the follow-up actions to be taken after the implementation of control measures at site should also be provided.
5.8.2.3 The appointed professional engineer shall also identify all possible hazardous situations that may arise due to the proposed works and prepare a contingency plan.

5.8.3 EMERGENCY PROCEDURE REPORT

5.8.3.1 An emergency procedure report shall include the following items:

(a) Descriptions of the project and proposed works or activities to be carried out;

(b) List of possible hazard/emergency situations that may arise due to the proposed works or activities;

(c) Governing criteria for initiating an emergency procedure;

(d) Step-by-step procedure or flow chart showing the actions to be taken by the appointed professional engineer and the project team should an emergency happen. Where applicable, the procedure shall incorporate the steps to review the monitoring results obtained, the re-examination of the method of work, the revision to the predictions, the review of instrumentation provisions, the contingency measures to be implemented, etc.; and

(e) Call-up list stating the names and contact numbers of all key personnel including the qualified person, the project manager, the site supervisors, and the instrumentation specialist. A flow chart for the emergency reporting shall also be included.

5.9 PRE-CONDITION SURVEY REPORT

5.9.1 Condition surveys to be undertaken by a professional engineer or building surveyor shall include physical surveys of road and road structures that comprise existing footpath and drains within the influence zone of engineering works to be carried out.

5.9.2 A topographical survey for road reduced levels, at 3m grid spacing along each traffic lane shall be conducted and certified by licensed land surveyor.
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<th>Section</th>
<th>Description</th>
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<tr>
<td>5.9.3</td>
<td>A pre-condition survey report that comprises of both condition and topographical survey of engineering works shall be prepared and endorsed by an independent person who has the appropriate qualifications, for example, professional engineer or building surveyor.</td>
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<tr>
<td>5.9.4</td>
<td>A copy of the endorsed condition survey report shall be submitted to the Authority before commencement of work.</td>
</tr>
<tr>
<td>5.10</td>
<td><strong>CONSTRUCTION SCHEDULE</strong></td>
</tr>
<tr>
<td>5.10.1</td>
<td>A comprehensive work programme/schedule shall be submitted. The programme may be in the form of bar/ Gantt charts that indicate the sequence of works and the duration required.</td>
</tr>
<tr>
<td>5.11</td>
<td><strong>TRAFFIC CONTROL PLAN</strong></td>
</tr>
<tr>
<td>5.11.1</td>
<td>For all works within the public streets, the requirements, specifications and arrangements of the traffic control plans (TCP) shall be in accordance with the LTA’s Code of Practice for Traffic Control at Work Zone.</td>
</tr>
<tr>
<td>5.12</td>
<td><strong>FULL-TIME SUPERVISION</strong></td>
</tr>
<tr>
<td>5.12.1</td>
<td>The applicant shall inform the Authority in writing of the appointed professional engineer or the professional engineer’s assignee to provide full-time supervision on site for the engineering works.</td>
</tr>
<tr>
<td>5.12.2</td>
<td>The applicant shall notify the Authority in writing whenever there is a change in the professional engineer / professional engineer’s assignee appointed for supervision.</td>
</tr>
<tr>
<td>5.13</td>
<td><strong>COMMENCEMENT OF WORK</strong></td>
</tr>
<tr>
<td>5.13.1</td>
<td>The Authority will issue a letter of clearance in writing to the applicant upon approving the relevant engineering work proposal.</td>
</tr>
<tr>
<td>5.13.2</td>
<td>Once the letter of clearance is obtained, the applicant shall submit an application through the “Permit for Road Occupation Management Portal (LTA.PROMPT)” for the permit to commence and carry out works on public streets.</td>
</tr>
</tbody>
</table>
5.14 DEPARTURE OR DEVIATION FROM APPROVED PLAN

5.14.1 In accordance with Regulation 21, amendment plan shall be submitted to the Authority for approval if any engineering works depart or deviate from the approved plan.

5.14.2 An application for approval of amendment plans shall be accompanied by one set of the following documents prepared, signed and submitted by the qualified person:

(a) A copy of the amendment plans showing the amended proposal; and

(b) Engineering evaluation report accompanied by plans for engineering works, if applicable.

No person shall carry out any engineering works in departure or deviation from the approved plan unless the amendment plan has been approved.
PART III – TECHNICAL REQUIREMENTS

SECTION 6
UTILITY WORKS

6.1 GENERAL

6.1.1 This section stipulates the technical requirements, sets standards of quality of materials and workmanship when carrying out utility works within the public streets.

6.2 RESTRICTED AREA

6.2.1 “Restricted area” refers to any public street where no breaking up or opening up of a street is allowed. The objective of the restriction is to enhance road safety and reduce inconvenience to road users.

6.2.2 There shall be no openings or works allowed on “restricted areas”. These areas include:

a) Road reserves of expressway;

b) Carriageways with ‘specially treated’ areas such as rigid pavement, semi-rigid pavement, enhanced school zone, street print, etc.;

c) Bridges and underpasses; and

d) Roads which are under “no-opening period”.

6.3 TRIAL HOLES

6.3.1 Trial holes are usually dug up to detect existing utilities and determine the available space for new utility.

6.3.2 A maximum of only two (2) trial holes are permitted to be opened up at any one time on carriageway along the same road.

6.3.3 All trial holes shall be properly backfilled and affected road surface shall be reinstated to the Authority’s requirements.
6.4 **POSITION OF UTILITIES**

6.4.1 All utilities shall be laid at a minimum depth as prescribed in Table 6.1 below. The minimum depth of utility laid below the public streets shall be measured from the road surface/sidetable to the top of utilities pipes/cables.

<table>
<thead>
<tr>
<th>Road Category/Location</th>
<th>Minimum Depth Requirements</th>
<th>Alternative Depth Requirement for Fibre Optic Cables (FOC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expressway</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Carriageway</td>
<td>No services allowed</td>
<td>No services allowed</td>
</tr>
<tr>
<td>Sidetable</td>
<td>1.2m</td>
<td>0.3m</td>
</tr>
<tr>
<td><strong>Major Arterial</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Carriageway</td>
<td>1.0m</td>
<td>1.0m</td>
</tr>
<tr>
<td>Sidetable</td>
<td>1.2m</td>
<td>0.3m</td>
</tr>
<tr>
<td><strong>Primary Access/Local Access</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Carriageway</td>
<td>1.0m</td>
<td>0.8m</td>
</tr>
<tr>
<td>Sidetable</td>
<td>1.2m</td>
<td>0.3m</td>
</tr>
</tbody>
</table>

*Table 6.1 Minimum depth requirements for laying of utility*

6.4.2 Utility owner may consider the alternative depth requirements for fibre optic cables (FOC) laying only, subject to compliance with the following conditions:

(a) Telecommunication companies (Telcos) /cable owners to look into necessary safeguarding measures and identification markers to protect their cables from damage.

(b) No one after taking reasonable precautions should be held liable for damaging cables laid at shallow depth.
(c) Telcos/ Cable owners to bear diversion costs when their cables laid at revised shallow depth are affected by public infrastructure works.

(d) Telcos/Cable owners to ensure that their cable route meets the statutory requirements of other utility agencies/service providers e.g. no new services are currently allowed to be laid over other existing services.

6.4.3 All utilities laid shall have a lateral clearance from the rigid pavement. The minimum lateral clearance is 2.0 metre or the depth of the utilities, whichever is greater, from the edge of rigid pavement.

6.4.4 Utility owner shall seek planning approval from LTA Road Infrastructure Management Division for laying of services over / under-crossing culverts and other road structures

6.4.5 All utilities laid shall also comply with the statutory requirements of other utility owners.

6.5 LOCATION OF MANHOLES, VALVES, HYDRANTS AND OVER-GROUND BOXES

6.5.1 There shall not be any new manholes, inspection chambers or valves constructed on road or on ramps of footpath and cycling track.

6.5.2 There shall not be any new Over-Ground (OG) boxes, fire hydrants or any other apparatus erected on footpath and cycling track.

6.5.3 The Authority may consider waiver of the requirements in this sub-section on a case by case basis. The applicant is required to submit valid reasons in writing to the Authority for consideration. If the waiver is given, the applicant shall ensure that

- the apparatus shall not be placed on the carriageway in a way that will affect the riding quality of the road e.g. manholes shall not be constructed in a cluster or along the wheel path of vehicles;

- the apparatus shall not be placed on the footpath in a way that will obstruct road-related facilities or endanger road users. The minimum passable width of 1.5m along the footpath must be maintained;

- the owner shall be responsible for maintaining the
apparatus so as to ensure the safety of the road users and the riding quality of the road; and

- the owner shall bear the cost of raising, lowering or relocating the apparatus as and when required by the Authority.

6.5.4 The applicant shall seek concurrent approval from relevant authorities for erection of new Over-Ground (OG) boxes, fire hydrants or any other apparatus at back lane and service road.

6.6 PROTECTION TO ROAD CARRIAGEWAYS/ADJOINING STRUCTURES/ROAD-RELATED FACILITIES

6.6.1 The applicant shall take measures to protect all road carriageways, road structures, apparatus and road-related facilities during the course of work on public streets. Any damages caused by the work shall be reinstated immediately.

6.6.2 For works above road structures, excavation by mechanical means shall not be allowed within 500 millimeters from the top of the structure.

6.6.3 Road structures includes the followings:

a. Vehicular flyovers, viaducts and bridges;
b. Box-culverts;
c. Road tunnels and underpasses;
d. Pedestrian overhead bridges; and
e. Pedestrian underpasses.

The applicant shall propose a system to monitor the integrity of all road structures and to detect any damages or defects to these road structures. The applicant shall submit regular monitoring reports to the Authority once the system is approved. Notwithstanding the regular reports, the applicant shall inform the Authority immediately of any defects that appear in the course of work.

6.6.4 Road related facilities include traffic signs, traffic lights, railings, traffic light controllers and poles, street light posts, etc. The applicant shall ensure that these facilities are not damaged, moved, removed, or being obstructed as a result of the work.

<table>
<thead>
<tr>
<th>Back lane</th>
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<tbody>
<tr>
<td>6.5.4</td>
</tr>
<tr>
<td>The applicant shall seek concurrent approval from relevant authorities for erection of new Over-Ground (OG) boxes, fire hydrants or any other apparatus at back lane and service road.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Precautionary measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.6.1</td>
</tr>
<tr>
<td>The applicant shall take measures to protect all road carriageways, road structures, apparatus and road-related facilities during the course of work on public streets. Any damages caused by the work shall be reinstated immediately.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protection to road structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.6.3</td>
</tr>
<tr>
<td>Road structures includes the followings:</td>
</tr>
<tr>
<td>a. Vehicular flyovers, viaducts and bridges;</td>
</tr>
<tr>
<td>b. Box-culverts;</td>
</tr>
<tr>
<td>c. Road tunnels and underpasses;</td>
</tr>
<tr>
<td>d. Pedestrian overhead bridges; and</td>
</tr>
<tr>
<td>e. Pedestrian underpasses.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protection to road related facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.6.4</td>
</tr>
<tr>
<td>Road related facilities include traffic signs, traffic lights, railings, traffic light controllers and poles, street light posts, etc. The applicant shall ensure that these facilities are not damaged, moved, removed, or being obstructed as a result of the work.</td>
</tr>
</tbody>
</table>
6.7 TEMPORARY EARTH RETAINING STRUCTURE FOR EXCAVATION WORKS

6.7.1 All temporary earth retaining structures (TERS) for excavation works must be structurally safe and robust. For excavation exceeding 1.5m deep, the applicant shall ensure that the TERS is designed and endorsed by a professional engineer. The professional engineer and contractors shall take adequate precautions & considerations to ensure the safety of the public and the workers, and to protect the adjoining road carriageways and road structures in his design and construction of the TERS. The technical requirements for TERS are set out in Section 7 of this Code.

6.7.2 All construction materials used for the temporary earth retaining system such as sheetpiles, walers and struts shall be removed completely upon completion of the works.

6.8 TEMPORARY TRAFFIC CONTROL

6.8.1 The requirements, specifications and arrangements for temporary traffic control shall be in accordance with the latest edition of LTA’s Code of Practice for Traffic Control at Work Zone.

6.8.2 The applicant / contractor shall seek clearance from LTA's Intelligent Transport Systems Centre (ITSC) before commencing works on major arterial roads and / or near traffic junctions.

6.9 EXTENT OF LANE OCCUPATION

6.9.1 For contractors who need to carry out works on public streets, the occupation of carriageway for these works shall be restricted to only one (1) traffic lane width at any one time.

6.9.2 The roads (including slip roads) are not allowed to be closed completely at any time for any works.

6.9.3 Traffic lane shall not be occupied during the peak hours; the applicant is required to use construction methods such as covering trenches with steel decking, pipe jacking and
tunnelling to avoid the occupation of the lanes. Otherwise, the Authority may require the applicant to temporarily provide an alternative to replace the affected traffic lane.

6.9.4 Traffic lane shall not be occupied such that it affects traffic in two or more directions e.g. traffic junctions.

6.9.5 The Authority may consider waiver of the requirements in this sub-section on a case by case basis. The applicant is required to submit valid reasons in writing to the Authority for consideration. The submission should include a study on the proposed utility works with traffic impact assessment of the affected road and the proposed traffic control plan. The submission shall be duly endorsed by a traffic consultant.

6.10 WORKING HOURS

6.10.1 Lane occupation for works on public streets is not permissible during the peak hours. The stipulated peak hours for the respective roads are classified as follows:

a. Roads under “Red” list:

<table>
<thead>
<tr>
<th>Peak Hour Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday – Sunday</td>
</tr>
<tr>
<td>(including public holiday)</td>
</tr>
</tbody>
</table>

b. Roads under “Yellow” list:

<table>
<thead>
<tr>
<th>Peak Hour Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday – Saturday</td>
</tr>
<tr>
<td>(except public holiday)</td>
</tr>
</tbody>
</table>

c. Roads under “Green” list:

<table>
<thead>
<tr>
<th>Peak Hour Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday – Friday</td>
</tr>
<tr>
<td>(except public holiday)</td>
</tr>
<tr>
<td>5.00pm to 8.00pm</td>
</tr>
</tbody>
</table>

The full listing of roads under the respective classification (“Red”/ “Yellow”/ “Green”) is available on LTA.PROMPT system at URL – https://prompt.lta.gov.sg and will be updated from time to time.

6.10.2 The applicant shall obtain permission from National Environment Agency (NEA) and to notify all the affected...
stakeholders including residents, hotels, grassroot organizations, etc before the commencement of works.

<table>
<thead>
<tr>
<th>6.10.3</th>
<th>The applicant shall also notify NEA-Call Centre and LTA-Call Centre if the work has to be carried out from 7pm to 7am on weekdays or the entire day on weekends and public holidays.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.10.4</td>
<td>There shall be no noisy night work allowed in residential areas, hotels, hospitals, etc.</td>
</tr>
</tbody>
</table>

### 6.11 CONTINGENCY PLANS

**6.11.1** Notwithstanding the Peak Hours requirement, the affected traffic lane shall be restored and re-opened timely to traffic if the continuation of work is likely to cause traffic to pile up and the road to reach its optimal level of service.

**6.11.2** The contractor shall provide adequate standby materials, equipment and necessary resources to effect remedial action and re-open the affected traffic lane when any of the following situations is observed:

1. traffic tailback of more than 200m; or
2. motorists take 3 or more traffic cycle to clear traffic junction.

**6.11.3** The contractor shall plan and limit the extent of excavation work according to the availability of his resources such that the affected traffic lane can be re-opened to traffic should the need arises.

### 6.12 TEMPORARY STEEL DECKING SYSTEM

**6.12.1** Steel decking shall be used to cover trenches on public streets to allow traffic flow while works are being carried out beneath. The decking shall be laid flush with the road level and shall be properly secured to avoid movement and noise generation.

**6.12.2** The applicant shall submit the following items prior to opening of the completed temporary decking for traffic use:

a. design calculations and construction drawings, duly endorsed by the professional engineer; and

b. a letter certified by the professional engineer on his
inspection of the Temporary Steel Decking System as constructed fully in accordance with his design calculations and details. This certificate shall be submitted within 3 days of completion of the temporary decking and prior to opening for traffic use.

c. Letter of clearance from BCA on the temporary steel decking system.

6.12.3 The professional engineer shall ensure that the steel decking is designed to relevant code & standard to carry the traffic loading and to maintain a skid resistance value of not less than 65 (BPN) at all time.

6.13 RAILWAY PROTECTION ZONE

6.13.1 The applicant shall apply and obtain clearance of the Authority's Development and Building Control Division (Rail Section) to carry out the restricted activities describe in the Rapid Transit Systems (Railway Protection, Restricted Activities) Regulations and any subsequent amendments within the Railway Protection Zone and Railway Safety Zone.

6.13.2 The applicant shall comply with the Authority's latest Code of Practice for Railway Protection in carrying out these works and services laying within the Railway Protection Zone. The Applicant may refer to the 'Guide to Carrying out Restricted Activities within Railway Protection and Safety Zones' published by the Authority for guidance.

6.14 HOUSEKEEPING

6.14.1 The cleanliness of the public streets within the vicinity of temporary road access and work site, shall be supervised and maintained during the entire duration of works.

6.14.2 Immediate remedial actions must be taken to clear any spillage onto the surrounding public streets resulting from the works, failing which the Authority may clear the spillage and recover all cost incurred from the applicant.

6.14.3 There shall not be any parking of vehicles or deposition of debris, building materials, skip, etc. on the public streets including sidetable and footpath.

6.14.4 At locations where the footpath is affected, a safe alternative temporary footpath of equivalent standard to the permanent
footpath shall be provided for pedestrians at all times.

6.14.5 Any damages to the footpaths, road pavement, lane markings and other road furniture caused by the works shall be made good immediately.
**PART III – TECHNICAL REQUIREMENTS**

**SECTION 7**

**ENGINEERING WORKS**

7.1 **GENERAL**

7.1.1 This section stipulates the technical requirements for compliance at the design and construction stages of engineering works being carried out on public street.

7.1.2 This Section shall be read in conjunction with Section 6 of the Code with respect to the requirements/conditions for occupation of carriageway.

7.1.3 Engineering works refer to construction works that are likely to affect the structural integrity and safe operation of any public streets.

7.1.4 The Authority reserves the right to impose any additional requirements deemed necessary to safeguard the road infrastructures.

7.1.5 The applicant and/or the appointed professional engineer shall also ensure full compliance with the relevant regulations e.g. Building Control Act, Rapid Transit System (RTS) Act and Regulation, etc.

7.2 **TEMPORARY EARTH RETAINING SYSTEMS (TERS)**

7.2.1 All TERS shall be designed and executed to minimise ground movements.

7.2.2 The design of temporary and permanent Works shall comply with LTA’s traffic loading as stipulated in the Civil Design Criteria Chapter 3.

7.2.3 All TERS designs shall be carried out and endorsed by a professional engineer.

7.2.4 All TERS works which fall within the public street shall be designed for removal upon completion of works.

7.2.5 TERS shall be designed such that there is no risk of damage to the adjoining road and road structures during removal.
### 7.2.6 All voids left in the ground due to the extraction of TERS shall be immediately filled with grout. The grout mix and method of grouting shall be proposed and endorsed by the appointed professional engineer.

### MONITORING OF ROAD AND ROAD STRUCTURES

#### 7.3.1 The ground shall be monitored for changes in ground conditions and movements which may result from the proposed works.

#### 7.3.2 Typical ground instruments such as water standpipes, inclinometers, piezometers, borehole extensometers and settlement markers shall be provided where applicable.

#### 7.3.3 The type of ground instrument to be provided shall be appropriate for the ground conditions.

#### 7.3.4 Ground settlement points shall be installed such that the movement of the ground can be measured. Where points have to be installed on road carriageway, then the ground settlement points shall be anchored into the ground below the road pavement. Sleeves shall be provided through the road pavement so that the measured settlement is not affected by the presence of the road pavement. A grid of surface points to monitor heave or settlement shall be established with spacing between points in both directions shall not be more than 5m.

#### 7.3.5 The monitoring shall extend along the full length of the work, and cover the zone of influence for excavation work and engineering works.

#### 7.3.6 Adequate monitoring instruments shall be provided. The spacing of instruments shall be such that adverse changes in the ground conditions can be captured. The frequency of monitoring must tie-in with the criticality of the stage of works. Instrumentation proposal shall be submitted to the Authority for approval.

#### 7.3.7 Before termination of monitoring, the engineering works must be completed, the ground conditions and monitoring readings both shown to have stabilized and thereafter no further change is expected in the long term.

#### 7.3.8 Upon cessation of monitoring works, all instruments installed within public streets shall be removed and the ground and any affected road and road structure shall be made good to the acceptance of the Authority.
7.4 INTERVENTION VALUES FOR MOVEMENTS OF ROAD CARRIAGeway

7.4.1 Intervention value defines the maximum severity of a defect at or before which remedial action must be taken.

The intervention values for movements of road carriageway are as follows:

<table>
<thead>
<tr>
<th>Intervention values for movements of road carriageway (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>&gt; +/- 30mm beneath a 3m straight edge</td>
</tr>
</tbody>
</table>

7.5 PROTECTION OF ROAD AND ROAD STRUCTURES

7.5.1 Preventive measures shall be taken during construction stage of engineering work to prevent any damage to the existing road and road structures.

7.5.2 The appointed professional engineer shall be responsible to:

a. ensure that the works comply with the construction method statements and good engineering practice;

b. monitor compliance of criteria;

c. ensure that contingency measures are implemented in a timely manner; and

d. take any other necessary measures to ensure that at no time shall the work being carried out pose any danger to the safety of the public.

7.5.3 The professional engineer shall exercise due diligence and reasonable care in monitoring the effects of engineering works on the road and road structures. He shall analyse the monitoring results, predict the likely trends and notify the Authority of any deviation from the predicted results and trends. He shall also make proposal to change the method of working or to implement contingency measures as a result of monitoring.

7.5.4 Once the monitoring readings are taken, they shall be submitted to the Authority as required. A report of the review of the monitoring results endorsed by the professional engineer shall be submitted to the Authority within a week from the date of monitoring.
All monitoring results shall be analysed and compared with the alert and work suspension levels specified by the professional engineer. The report shall also include description on progress of works and conditions of road infrastructures.

7.5.5 During the progress of the works, should it become apparent from the monitoring results that the ground movement and/or the structural movement are likely to exceed the limits; the Authority may revoke the permit. The constructor shall take immediate measures to control movements within the acceptable limits, all at the cost and expense of the contractor. The work will only be allowed to resume if it can be demonstrated that the continuity of works will not adversely affect the public street and/or road structure.

7.5.6 In the event of an incident relating to the works, the applicant shall notify LTA Call Centre (1800-2255582) and LTA RIM Division immediately. The interim incident report must reach LTA RIM within the next 12 hours. The detailed incident report must be submitted within the next 7 working days.

7.6 COMPLETION OF WORK

7.6.1 Condition surveys of the public streets shall be carried out upon completion of the proposed works or at intermediate stages as directed by the Authority. Defects found shall be highlighted and compared with the findings of precondition survey.

7.6.2 A proposal on making good of all defects arising from the work found in the public streets prepared and endorsed by the professional engineer shall be submitted to the Authority for prior approval.

7.6.3 Making good of defects arising from the work shall be completed to the satisfaction of the Authority. The contractor shall bear all direct or indirect costs arising from the rectification works. A report on the remedial work done shall be submitted upon completion of all remedial work.

7.6.4 Defects and damages rectified shall be highlighted with photograph and compared with those found after the completion of work indicated in the final condition survey report.
7.7 OTHERS

7.7.1 The general technical requirements as in section 6.7, 6.8, 6.9, 6.10, 6.11, 6.12 and 6.13 of the Code shall be complied with for carrying out engineering works on public streets.
PART III – TECHNICAL REQUIREMENTS

SECTION 8
GENERAL REINSTATEMENT OF PUBLIC STREETS

8.1 GENERAL

8.1.1 The Applicant shall carry out the reinstatement of the affected public streets upon completion of works according to the current practices, requirements and standards of the Authority. The existing condition of the public streets may not be taken as the standards of the Authority.

8.1.2 For road pavement, the reinstated work shall comply with the permitted materials and layer thickness as specified in Figure 8.1 – Pavement Reinstatement Details.

8.1.3 The reinstatements of public streets with the use of unsuitable materials, insufficient depth of backfilling, improper compaction and settlement or cave in of public streets arising from works are not acceptable. These defective reinstatements shall be rectified to the requirement of Authority at the expense of the applicant. Section 9 of Part III lists the characteristics and requirements for the reinstatement of public streets.

8.1.4 The edges shall be neatly cut with straight edge and the finished level flush with the existing road surface even if the surface is to be milled-and-patched later on. Depending on site condition, the Authority may allow the finished level of the temporary reinstatement with tolerance of not more than 10mm higher than the surrounding road surface.

8.1.5 Surfacing works such as mill-and-patch works for the permanent reinstatement shall start within 21 days after the initial reinstatement. If the trench is more than 300 metres long, the surfacing works shall be done progressively at intervals of 100 metres.

8.1.6 The applicant shall notify the affected residents/developers of the scheduled mill-and-patch works before commencement.

8.1.7 The applicant shall bear the cost for lowering/raising of utilities manhole/s on public streets as and when required by the Authority and shall also liaise with the respective utilities owners on the lowering/raising of affected utilities manhole/s on public streets.
Figure 8.1. Pavement Reinstatement Details

Notes:
1. Asphalt concrete: asphalt concrete of 100mm B1, 50mm W3B compacted independently in one operation. W1 (fine mix) is not allowed to be used.
2. Base course: graded granite of maximum size 50mm and shall conform to LTA’s Material and Workmanship Specifications or Recycled Concrete Aggregate in accordance to Section 9.5.
3. Backfill material: backfill material shall conform to Section 9.2.
4. All services must be laid to minimum depth of 1.0m from the surface of the carriageway to the top of the services.
5. Foam concrete mix or Flowable Fill may be used for the entire backfill material (except for the asphalt layer) in accordance to Section 9.2.3 and 9.2.9 respectively.
8.2 CONDITIONS FOR REINSTATEMENT TO CARRIAGEWAY

8.2.1 The following are conditions for the type of reinstatement that is required for carriageway. Notwithstanding these conditions, the Authority may specify any other conditions as and when it deems necessary.

8.2.2 Milling and patching of asphalt concrete to the carriageway shall comply with the following:

- Minimum thickness of 50mm for W3B and 75mm for steel slag is to be laid.

- The area shall cover the full width of the affected lane within this area.

- If any two or more openings are less than 30 metres apart, the mill-and-patch area shall include the area between these openings. The area shall form a rectangular segment at full lane width covering the affected lanes.

- For opening carried out within a signalized cross traffic junction, the area shall cover the full lane width. Road markings within the whole junction shall be re-marked inclusive of pedestrian crossing lines on all approaches (“STOP” line shall be taken as reference).

- For temporary road diversion, full width carriageway shall be resurfaced when the affected carriageway is realigned to the permanent alignment.

- For openings in front of entrance driveway and side roads, the milling and patching shall cover full width of affected entrance driveways and side roads/accesses. (“STOP” line shall be taken as reference for side roads/access).
8.3 CONDITIONS FOR REINSTATEMENT OF FOOTPATHS

8.3.1 The reinstatement of footpath shall meet the following requirements:

- The reinstatement shall cover the full width of the footpath according to details as shown in the latest issue of LTA’s Standard Details of Road Elements.

- The length of the footpath reinstatement shall be at least 1 metre. However, if there is more than one reinstatement within a single 6 meter stretch, the area between them has to be reinstated.
- The new tiles to be used for reinstatement to the footpath shall match existing colours and texture of surrounding tiles. If such tiles are not available/out of production, the applicant shall propose an alternative design for the Authority's approval prior to commencement of works.

- The tiled footpath shall cover 6 metre length or to the nearest joint, whichever is shorter, at full width of the footpath, forming a rectangular segment.

- The reinstatement of footpath ramp shall be in accordance with the current standards of the Authority for barrier-free accessibility.

8.4 RIGID PAVEMENT

8.4.1 All rigid pavement of carriageway shall not be opened. If the opening is unavoidable, the applicant has to reinstate the rigid pavement according to details shown in the latest issue of LTA’s Standard Details of Road Elements.

8.4.2 Rigid pavements are to be constructed in panel of individual full lane width at minimum length 10 meter measured from the nearest expansion joint, or the full length between nearest expansion joints, whichever is shorter.
8.5 ROAD MARKINGS

8.5.1 The road lines affected by road openings shall be restored with thermoplastic road marking materials within 3 days upon completion.

However, the critical road lines including the ‘STOP’ lines, pedestrian crossing and arrow markings shall be restored immediately upon completion of works and before the reinstated area is opened to traffic.

8.5.2 For temporary reinstated areas that require surfacing works such as mill-and-patch works at a later date, stick on materials or any other materials approved by the authority may be used to temporarily restore the affected road lines.

8.6 WORKS AFFECTING TRAFFIC MANAGEMENT DEVICES

8.6.1 The, Road Infrastructure Management (RIM), must be notified in advance of the commencement of the works if any pavement markings for school zone e.g. StreetPrint are affected by works.

8.6.2 The Deputy Director, Intelligent Transport Systems Centre (ITSC), must be notified in writing 7 days in advance of the commencement of the works if any traffic detector loops/feeder cables for traffic lights/ intelligent road studs are
affected by works. Please refer to section 8.6.4 for address.

8.6.3 For emergency opening, the applicant has to notify the Deputy Director, ITSC via fax (fax no. 63328127) and telephone (at tel no. 63328129/63328130/63328131) immediately if detector loops/ intelligent road studs are affected.

8.6.4 Any accidental damage to detector loops/feeder cables for traffic lights/intelligent road studs must also be reported immediately in writing and by fax to:

LTA Intelligent Transport Systems Centre  
181, River Valley Rd,  
ITS Centre, Level 4  
Singapore 179034

8.6.5 The Deputy Director, Traffic Management (TM), must be notified in writing 7 days in advance of the commencement of the work if any traffic counting stations are affected by the work.

8.6.6 For emergency opening, the applicant has to notify TM via fax (fax no. 63961163) and telephone (tel no. 63961209/63962621) immediately if detector loops, piezo cables, feeder cables, housings, etc. are affected.

8.6.7 Any incidental damage to the detector loops, piezo cables, feeder cables, housings, etc. must be reported immediately in writing and by fax to:

LTA Traffic Management  
(Traffic Monitoring & Technology Section)  
No. 1 Hampshire Road  
Block 9 #03-00  
Singapore 219428

8.6.8 The Deputy Director, Road Pricing (RP), must be notified in writing 14 days in advance of the commencement of the work if any Electronic Road Pricing (ERP)’s structure/detector loops are affected by work.

8.6.9 The applicant must report to RP in writing at the address below and via fax (fax no. 65535399) and page (pager no. 93061907) immediately for any incidental damage to ERP’s structure/detector loops, etc.

LTA Road Pricing (ERP Systems Section)
8.7 SPECIAL REINSTATEMENT MATERIALS

8.7.1 The Authority has used special materials for the roads and footpaths where necessary. If the Applicant's works affect such roads and footpaths, the Applicant shall reinstate with the same material or materials specified by the Authority. Thus the applicant shall have to satisfy the Authority that he has the expertise and the materials available to do a satisfactory reinstatement of such roads and footpaths before commencement of works.
PART III – TECHNICAL REQUIREMENTS

SECTION 9
MATERIAL SPECIFICATIONS & QUALITY CONTROL

9.1 GENERAL

9.1.1 This section stipulates the basic standard of quality of materials and workmanship required by the Authority. In the absence of any other technical requirements, the latest edition of the LTA’s Standard Details of Road Elements and/or the Material and Workmanship Specifications published by LTA shall prevail.

9.2 Backfill Materials

9.2.1 All backfill materials within the road carriageway shall be granular material (see Section 9.2.2), flowable concrete, or foamed concrete.

Any other materials not stipulated above are unsuitable materials and shall not be used for back-filling. Unless otherwise approved by the Authority, materials indicated below are not acceptable:

i) material from swamps,

ii) peat, logs, stumps, perishable material and soft clay,

iii) material susceptible to spontaneous combustion,

iv) soil of liquid limit exceeding 70 and/or plasticity index exceeding 35,

v) excavated asphalt concrete from existing road.

9.2.2 Granular materials that are used as backfill materials shall conform to the following characteristics:

i) Not more than 35% fines passing through sieve 75µm,

ii) The fraction passing through sieve 75µm shall have plasticity index (maximum) and liquid limit 35 (maximum),

iii) Dry density to be 1760 kg/ m³ (minimum).
9.2.3 All aggregates used for foamed concrete shall pass a 3.75mm BS sieve and shall not contain more than 5% by weight of clay contamination, determined in accordance with BS 882:1983 Clause 5.4.

9.2.4 All foamed concentrates shall be diluted in accordance with the manufacturer's recommendations and aerated using an appropriately designed foam generating system. Foam concentrates and diluted solutions shall be stored according to the manufacturer's recommendations and used within the recommended shelf life.

9.2.5 Subject to experience of their suitability that is obtained by prior development testing, all accelerators, plasticisers, water reducing agents and other admixtures shall be used in accordance with the manufacturer's recommendations.

9.2.6 Foamed Concrete mixes shall be prepared using a ready-mixed base mortar delivered to site, and in accordance with a mix formulation proven by prior development testing.

9.2.7 The foamed concrete shall achieve a minimum density of 1050kg/m³. Plastic sheeting, etc., shall be provided to protect the existing utility apparatus so that foamed concrete is prevented from flowing into and blocking any damaged apparatus that exist within, or are immediately adjacent to the excavation.

9.2.8 Reinstatement of the surface layers shall not be carried out until the foamed concrete has attained sufficient strength to allow compaction of the asphalt materials.

9.2.9 Ready-mix flowable fill is a mixture of Portland cement, aggregates, water and mineral admixtures. Flowable fill has a cementitious content that is lower than that of Portland cement, and has a reduced strength development for easy removal. Chemical admixtures may also be used to modify the fill's performance properties in strength, flow, set and permeability.

9.2.10 The mix shall be prepared using a ready-mix base mortar delivered to site. Mineral admixtures shall be pozzolanic materials used in standard ready-mix concrete production.

9.2.11 Chemical admixtures shall be liquid or powder form used in standard ready-mix concrete production or other permissible products as follows:
   a) High air generators specifically designed for flowable fill to lower unit weights, reduce shrinkage and subsidence, and to control compressive strength.
b) Air entraining admixtures conforming to ASTM C-260.

c) High-range water-reducers conforming to ASTM C-494 Type F or G.

d) Accelerating admixtures conforming to ASTM C-494 Type C such as calcium chloride. However where metals are present in concrete or embedded members, accelerators that are non-chloride and non-corrosive shall be used.

 Pipes and all other members to be encased in the flowable fill shall be temporarily secured in place to prevent displacement during the flowable fill placement. To reduce hydrostatic pressure and limit displacement potential, a high air generator admixture in the flowable fill mixture is recommended to lower unit weights.

9.3 PORTLAND CEMENT CONCRETE

9.3.1 Cement used for public streets shall be ordinary Portland cement, rapid hardening Portland cement complying with SS26, sulphate resisting Portland cement to BS4027, Supper- sulphated cement to BS4248 or low heat Portland-blast-furnace cement to BS4246.

9.3.2 Cement of different manufacture and of different types shall not be used in the same mix.

9.3.3 Cement that becomes lumpy or has deteriorated shall not be used for concreting and shall be removed from site immediately.

9.3.4 Fine aggregate shall be natural sand or crushed stone sand complying with the requirements of SS31. Coarse aggregate shall be gravel or stone complying with SS31.

9.3.5 Water shall be clean fresh water free from chemical and organic impurities.
9.3.6 Concrete mixes shall generally comply with the specification in Table 9.1.

<table>
<thead>
<tr>
<th>Characteristic strength N/mm² at 28 days</th>
<th>40</th>
<th>35</th>
<th>30</th>
<th>25</th>
<th>20</th>
<th>15</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum cement content in kg/m³ of fully compacted concrete</td>
<td>350</td>
<td>350</td>
<td>325</td>
<td>300</td>
<td>270</td>
<td>205</td>
<td>175</td>
</tr>
<tr>
<td>Maximum cement content in kg/m³ of fully compacted concrete</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>Maximum water/cement ratio</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.55</td>
<td>0.60</td>
<td>0.70</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Table 9.1 Specifications for Concrete Mix for different grades of concrete.

9.3.7 Concrete shall be thoroughly mixed in a batch type mechanical mixer. No concrete shall be mixed by hand. For amount in excess of 3 m³, no in-situ mixing is allowed. Ready-mixed concrete, conforming to SS 119 and the specification as listed in Table 9.1, might be used.

9.3.8 The reinforcement shall be either (i) steel complying with SS 2, (ii) steel complying with SS 18, or (iii) steel fabric complying with SS 32.

9.4 ASPHALT CONCRETE

9.4.1 Coarse Aggregates for asphalt concrete shall be clean, well-graded, angular, crushed stone or steel slag of approved quality. They shall be free from dust, dirt and other deleterious materials; and there shall not be an excess of flat, elongated or weathered pieces. The properties of coarse aggregates shall conform to the requirements in Table 9.2 and 9.3.

9.4.2 Fine aggregates for asphalt concrete shall consist of clean, sound durable, angular particles produced by crushing stone, slag or gravel and shall be free from coatings of clay, silt or other deleterious materials. They shall meet the soundness and wear requirements as specified for coarse aggregate.

9.4.3 Filler, in addition to those naturally present in the aggregate, shall meet the requirements of ASTM D242.

<table>
<thead>
<tr>
<th>Property</th>
<th>Allowable Standard</th>
<th>Method of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification for Asphalt concrete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Impact Value  | Not more than 30%  | BS 812: Part 112:1985
Crushing Value | Not more than 25%  | BS 812: Part 110:1985
Water Absorption (in term of surface dry mass) | Not more than 1% | BS812: Part 2:1975
Flakiness Index | Not more than 35% | BS812: Part 105.1:1985
Elongation Index | Not more than 35% | BS 812: Part 105.2:1985
L.A. Abrasion Value (500 revolutions) | Not more than 35% | SS73:74
Silt content of raw aggregate (by weight) | Not more than 2% | BS812: Part 1:1975
Silt content of aggregate in drum/hot bin (by weight) | Not more than 0.3% | BS812: Part 1:1975

Table 9.2. Requirements for Properties of Coarse Aggregate (Granite Stone)

<table>
<thead>
<tr>
<th>Property</th>
<th>Allowable Standard</th>
<th>Method of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing Value</td>
<td>Not more than 25%</td>
<td>BS 812: Part 110:1985</td>
</tr>
<tr>
<td>Flakiness Index</td>
<td>Not more than 25%</td>
<td>BS812: Part 105.1:1985</td>
</tr>
<tr>
<td>L.A. Abrasion Value (500 revolutions)</td>
<td>Not more than 25%</td>
<td>SS73:74</td>
</tr>
<tr>
<td>Silt content of steel-slag in hot bin (by weight)</td>
<td>Not more than 0.3%</td>
<td>BS812: Part 1:1975</td>
</tr>
</tbody>
</table>

Table 9.3. Requirements for Properties of Coarse Aggregate (Steel slag). Granite filler may be used if steel-slag filler is not available.

9.4.4 Bitumen Emulsion shall be homogeneous and rapid-setting cationic bitumen that conforms to the requirement of Table 9.4.

9.4.5 Bitumen shall be approved type petroleum bitumen of 60/70 penetration grade. No mineral matter other than that naturally contained in such bitumen shall be present. The bitumen shall be homogeneous, free from water and shall not foam when heated to 175 °C. The bitumen shall conform to the requirements of Table 9.5.
<table>
<thead>
<tr>
<th>Property</th>
<th>Grade CRS-1</th>
<th>Grade CRS-2</th>
<th>Method of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test on emulsions:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol at 50°C SFS</td>
<td>20</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Storage stability test, 24-h, %(^A)</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Demulsibility, 35mL, 0.8% dioctyl sodium sulfosuccinate, %</td>
<td>40</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>Particle charge test</td>
<td>positive</td>
<td>-</td>
<td>positive</td>
</tr>
<tr>
<td>Sieve test, %(^A)</td>
<td>-</td>
<td>0.10</td>
<td>-</td>
</tr>
<tr>
<td><strong>Distillation:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil distillate, by vol of emulsion, %</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Residue, %</td>
<td>60</td>
<td>-</td>
<td>65</td>
</tr>
<tr>
<td><strong>Tests on residue from distillation test:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration, 25°C, 100g, 5s</td>
<td>100</td>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>Ductility, 25°C, 5cm/min, cm</td>
<td>40</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>Solubility in trichloroethylene, %</td>
<td>97.5</td>
<td>-</td>
<td>97.5</td>
</tr>
</tbody>
</table>

\(^A\)This test requirement on representative samples is waived if successful application of the material has been achieved in the field.

Table 9.4 : Requirements for Cationic Emulsified Asphalt
<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>60/70 Penetration Grade</th>
<th>Method of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetrating at 25°C 100g, 5s</td>
<td>0.1 mm</td>
<td>Min 60 Max 70</td>
<td>ASTM D5</td>
</tr>
<tr>
<td>Flash Point, Cleveland Open Cup</td>
<td>ºC</td>
<td>Min 232 Max -</td>
<td>ASTM D92</td>
</tr>
<tr>
<td>Ductility at 25°C, 5 cm per min</td>
<td>cm</td>
<td>Min 100 Max -</td>
<td>ASTM D113</td>
</tr>
<tr>
<td>Solubility in trichloroethylene</td>
<td>% wt</td>
<td>Min 99 Max -</td>
<td>ASTM D2042</td>
</tr>
<tr>
<td>Softening Point, Ring and Ball</td>
<td>ºC</td>
<td>Min 47 Max 56</td>
<td>ASTM D36</td>
</tr>
<tr>
<td>Specific Gravity at 25°C</td>
<td>-</td>
<td>Min 1.0 Max 1.11</td>
<td>ASTM D70</td>
</tr>
<tr>
<td>Thin-film oven test, 3.2 mm, 163°C, 5 hrs :</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Loss on heating</td>
<td>% wt</td>
<td>Min - Max 0.8</td>
<td>ASTM D6</td>
</tr>
<tr>
<td>b) Penetration of residue at 25°C</td>
<td>% of original</td>
<td>Min 54 Max -</td>
<td>ASTM D6</td>
</tr>
<tr>
<td>c) Ductility of residue at 25°C, 5 cm per min</td>
<td>cm</td>
<td>Min 50 Max -</td>
<td>ASTM D113</td>
</tr>
</tbody>
</table>

*Table 9.5: Requirements for Bitumen*

9.4.6 For Mix Design, the aggregate grading for various types of mix design shall be in accordance with the mix design specification of Table 9.8.

9.4.7 Temperature of Hot Asphalt Concrete shall not be lower than 130°C at the time of laying.
9.4.8 Cold Instant Premix that conforms to BS4987: 1988 may be used in cases where the area is small (less than 1 tonne of premix required). The binder used shall be bitumen based; and shall contain resin, adhesive, polymers, and solvent. The mix design for base course of the aggregate grading and bitumen binder content shall conform to Table 9.6 and the following:

- Bitumen Binder Content: 3.6% to 4.2%
- Type of aggregate: Grit stone

<table>
<thead>
<tr>
<th>BS Sieve Passing</th>
<th>Percentage by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.00mm</td>
<td>100</td>
</tr>
<tr>
<td>20.00mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>14.00mm</td>
<td>65 - 85</td>
</tr>
<tr>
<td>10.00mm</td>
<td>55 - 72</td>
</tr>
<tr>
<td>6.30mm</td>
<td>39 - 55</td>
</tr>
<tr>
<td>3.35mm</td>
<td>32 - 46</td>
</tr>
<tr>
<td>300µm</td>
<td>7 - 21</td>
</tr>
<tr>
<td>75µm</td>
<td>3 - 8</td>
</tr>
</tbody>
</table>

*Table 9.6 Grading of Aggregates for Mix design for Base Course of instant premix*

The mix design for wearing course of the aggregate grading and bitumen binder content shall conform to Table 9.7 and the following:

- Bitumen Binder Content: 5.0% to 6.0%
- Type of aggregate: Dolerite

<table>
<thead>
<tr>
<th>BS Sieve Passing</th>
<th>Percentage by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.00mm</td>
<td>100</td>
</tr>
<tr>
<td>6.30mm</td>
<td>80 - 100</td>
</tr>
<tr>
<td>3.35mm</td>
<td>25 - 45</td>
</tr>
<tr>
<td>1.18mm</td>
<td>10 - 30</td>
</tr>
<tr>
<td>75µm</td>
<td>2 - 9</td>
</tr>
</tbody>
</table>

*Table 9.7 Grading of Aggregates for Mix design for Wearing Course of instant premix.*
<table>
<thead>
<tr>
<th>Type of Mix</th>
<th>Wearing Course</th>
<th>Binder Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of Course (mm)</td>
<td>WWS*</td>
<td>W1</td>
</tr>
<tr>
<td>40-70</td>
<td>15-20</td>
<td>25-45</td>
</tr>
<tr>
<td>% Soluble Bitumen (60/70 Pen Grade) (% by Wt of Total Mix)</td>
<td>5 ± 0.5</td>
<td>6 ± 0.5</td>
</tr>
<tr>
<td>Void in mix (%)</td>
<td>3 - 5</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Max Size of Stone (mm) (BS)Passing:</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>50.0mm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>37.5mm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>25.0mm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19.0mm</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>13.2mm</td>
<td>80 - 90</td>
<td>-</td>
</tr>
<tr>
<td>9.5mm</td>
<td>63 - 77</td>
<td>100</td>
</tr>
<tr>
<td>6.3mm</td>
<td>-</td>
<td>90 - 100</td>
</tr>
<tr>
<td>3.15mm</td>
<td>-</td>
<td>65 - 82</td>
</tr>
<tr>
<td>2.36mm</td>
<td>46 - 56</td>
<td>-</td>
</tr>
<tr>
<td>1.18mm</td>
<td>-</td>
<td>39 - 55</td>
</tr>
<tr>
<td>600µm</td>
<td>16 - 26</td>
<td>-</td>
</tr>
<tr>
<td>212µm</td>
<td>8 - 18</td>
<td>-</td>
</tr>
<tr>
<td>75µm</td>
<td>6.5 - 10.5</td>
<td>3 - 8</td>
</tr>
</tbody>
</table>

Table 9.8 Mix Specification

* Note: Only steel - slag aggregate is permitted. The use of granite filler is permitted if there is insufficient steel slag filler available.
9.5 RECYCLED CONCRETE AGGREGATE

9.5.1 The graded RCA shall be free from harmful contamination and conform to the following requirements.

   a) Coarse aggregate shall consist of sound, tough, durable particles, free from adherent coatings of clay, organic matter and other deleterious substances. The properties of coarse aggregate shall comply with the following requirements:

   b) The gradation of RCA and the liquid limit, plasticity index and linear shrinkage of fine aggregates shall comply with the requirements as shown in Table 10.3 and Clause 10.3.2.3 of the LTA’s Materials and Workmanship Specification (Revision A8, 2008).

<table>
<thead>
<tr>
<th>Property</th>
<th>Allowable Standard</th>
<th>Method of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact value</td>
<td>Not more than 45%</td>
<td>BS 812 Part 112</td>
</tr>
<tr>
<td>L.A. abrasion</td>
<td>Not more than 50%</td>
<td>SS 73: 1974</td>
</tr>
<tr>
<td>Flakiness index</td>
<td>Not more than 40%</td>
<td>BS 812 Part 105.1</td>
</tr>
<tr>
<td>Fines content*</td>
<td>Not more than 3%</td>
<td>SS 73: 1974</td>
</tr>
<tr>
<td>% impurity (by mass)</td>
<td>Not more than 5%</td>
<td>**</td>
</tr>
<tr>
<td>Acid-soluble sulphate</td>
<td>Not more than 1%</td>
<td>SS EN 12620</td>
</tr>
</tbody>
</table>

Table 9.9. Requirements for Properties of Recycled Aggregate
* Fine is particle size fraction of an aggregate which passes the 0.063 mm sieve
** Impurities such as ferrous and non-ferrous metal, brick, plastic, wood, ceramic, asphaltic material and soil shall be removed. The percentage of impurity by mass shall not exceed 5%.

9.6 RECYCLED CONCRETE AGGREGATE DUST

9.6.1 Recycled concrete aggregate (RCA) dust is produced from the processing of construction and demolition waste. It shall be produced from a proper processing plant. The processing shall include but not limited to the following processes:

   i) Crushing via primary and secondary crushers into the required particle sizes
   ii) Removal of ferrous metals via magnetic separator
   iii) Removal of foreign materials such as brick, ceramic, wood, plastic and asphaltic material
   iv) Sieving of RCA into the required sizes

Recycled concrete aggregate dust material for sub-base layer
9.6.2 RCA dust shall consist of mainly granite aggregate and cementitious materials such as cement paste and mortar. It shall contain not more than 5% (by mass) of impurities such as metal, brick, ceramic, wood, plastic and asphaltic material. The gradation of RCA dust shall comply with the grading limits as shown in the Table below:

<table>
<thead>
<tr>
<th>BS Sieve Size (mm)</th>
<th>% Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.70</td>
<td>100</td>
</tr>
<tr>
<td>4.75</td>
<td>70 – 100</td>
</tr>
<tr>
<td>0.600</td>
<td>20 – 55</td>
</tr>
<tr>
<td>0.075</td>
<td>6 – 20</td>
</tr>
</tbody>
</table>

Note: Based on LTA Materials & Workmanship Specification for quarry dust (2001)

In addition, RCA dust shall have a minimum soaked California Bearing Ratio of 30% when tested in accordance with BS 1377, using the dynamic compaction method with a 4.5kg rammer at the dry density and moisture content likely to be achieved in the field.

9.7 SPECIAL MATERIALS

9.7.1 SEMI-RIGID PAVEMENT

9.7.1.1 The semi-rigid pavement shall consist of an open graduated asphalt with a void between 25 % to 30 % by volume (Marshall), flood filled with high strength cementitious mortar possessing high fluidity and internal cohesion. It shall achieve a compressive strength of 7-10 MN/m² at 28 days and a flexural strength of approximately 3.5 MN/m². The components of the open graduated asphalt are listed in Table 9.10.

<table>
<thead>
<tr>
<th>Components</th>
<th>Percentage by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitumen (60/70 pen)</td>
<td>Between 3.6% to 4.6%</td>
</tr>
<tr>
<td>Lime Filler</td>
<td>4.0 %</td>
</tr>
<tr>
<td>Cellulose Fibres</td>
<td>0.2%</td>
</tr>
<tr>
<td>Crushed Aggregates</td>
<td>91.7%</td>
</tr>
</tbody>
</table>

Table 9.10. Components of open-graduated asphalt.

9.7.1.2 Coarse aggregates of semi-rigid pavement shall consist of clean, angular, crushed granite stone of approved quality, free from dust, dirt and other deleterious materials; and free from an excess of flat, elongated or weathered pieces. The proportion of the coarse aggregates shall conform to Table
9.11.

<table>
<thead>
<tr>
<th>Property</th>
<th>Allowable Value</th>
<th>Method of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing Value</td>
<td>Not more than 20%</td>
<td>BS 812: Part 110:1985</td>
</tr>
<tr>
<td>Flakiness Index</td>
<td>Not more than 20%</td>
<td>BS 812: Part 105.1:1985</td>
</tr>
<tr>
<td>L.A. Abrasion Value (500 revolutions)</td>
<td>Not more than 20%</td>
<td>SS73:74</td>
</tr>
<tr>
<td>Silt content of aggregate in hot bin (by weight)</td>
<td>Not more than 0.3%</td>
<td>BS 812: Part 1:1975</td>
</tr>
</tbody>
</table>

Table 9.11. The proportion of the coarse aggregates in semi-rigid pavements

9.7.1.3 Lime filler used shall be hydrated lime.

9.7.1.4 Cellulose Fibres shall be raw cellulose, long fibres and grey possessing the following properties:

- Cellulose Content: Approximately 80%
- Average fibre length: 1,100µm
- Average fibre thickness: 45 µm
- Bulk density: 20g/l to 40g/l
- Residue on ignition: approx. 15% (at 850°C, 4 hrs)
- pH - value: 7.5 ± 1

Air jet sieve analysis (DIN 53734) shall have the following residue on the screen:

<table>
<thead>
<tr>
<th>Size of Interior Mesh Aperture</th>
<th>Max % of residue</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 µm</td>
<td>Max 60%</td>
</tr>
<tr>
<td>32 µm</td>
<td>Max 99%</td>
</tr>
</tbody>
</table>


9.7.1.5 High Strength Cementitious Mortar shall consist of a dense packing of cementitious inorganic material and shall be mixed with water to form a free flowing mortar having a high internal cohesion. It shall conform to the following requirements:

- Compressive strength:
  1 day: 55 MN/m²
  28 days: 110 MN/m²
- Flexural strength: 15 MN/m³
• Density: 2200kg/m³
• Water Absorption (DIN 52103): 6.9 by weight %
• Water Absorption (drying-out of concrete at 20°C and 65% relative humidity): 0.5 by weight %
• Chemical resistance: 3 to 5 times more resistance than grade 50 concrete
• Setting time: 8 to 12 hours

9.7.1.6 Mixing of Open Graduated Asphalt-The components shall be added in the following sequence:

i) Crushed aggregates and cellulose fibres
ii) Lime filler
iii) Bitumen

The mixing temperature shall be approximately 165°C at a mixing time of between 39 and 45 seconds per batch. Storing of mix in the silo is not allowed.

9.7.1.7 Mixing of High Strength Cementitious Mortar - Amount of water to be added shall be approximately 4.7 kg per 25 kg of high strength cementitious mortar dry powder, or the water/binder ratio shall range between 0.266 and 0.278.

9.7.2 CONCRETE SURFACE PAVING

9.7.2.1 Concrete surface paving on footpath shall be approved spray-on acrylic modified UV stable pigmented cementitious topping with minimum thickness of 1 mm, minimum cured compressive strength of 45 N/mm² and skid resistance not less than 50.

9.7.2.2 Concrete Surface paving on carriageway shall be approved spray-on acrylic modified UV stable pigmented cementitious topping with minimum thickness of 1 mm, minimum cured compressive strength of 60 N/mm² and skid resistance not less than 65.

9.8 THERMOPLASTIC ROAD MARKINGS

9.8.1 Thermoplastic materials shall be used for all the road markings. The thermoplastic material to be used shall comply generally with British Standard BS 3262: 1989 - "Hot Applied Thermoplastic Road Marking Materials", or the latest Singapore Standards (SS).

9.8.2 The material shall be tough, durable, elastic and of heavy-duty product formulated to adhere excellently on pavements of all descriptions and to provide superior resistance to abrasion. The
material shall be able to withstand the traffic impacts, the effects of staleness and flaking, and damages caused by petroleum spillage.

9.8.3 The thermoplastic material shall be so manufactured to be applied by extrusion into the pavement in molten form with glass beads mixed in and also dropped into the material immediately after it is applied. Retro-Reflectorisation with solid glass beads of a suitable grading shall be used to improve the visibility of road marking at night.

9.8.4 The aggregate shall consist of light colours silica sand, calcite, quartz and calcined flint.

9.8.5 PIGMENT

9.8.5.1 White material shall be titanium dioxide complying with the requirements of type A (anatase) or type R (rutile) or BS 1851.

9.8.6.2 Yellow material shall consist of sufficient yellow pigment or lead chromate of sufficient heat stability when heated to temperature of 200°C to substitute part or all of the titanium dioxide. The colour pigment shall comply with BS 381C: 1980 Colour No. 355 lemon or equivalent.

9.8.6.3 Red material shall consist of sufficient red pigment to substitute part or all of the titanium dioxide. The colour shall be approved by the Authority before it can be used.

9.8.7 The extender shall be whiting (calcium carbonate prepared from natural chalk) complying with BS 1795.

9.8.8 Binder shall consist of synthetic hydrocarbon resin plasticised with mineral oil.

9.8.9 SOLID GLASS BEADS

9.8.9.1 Solid glass beads shall provide the retro-reflectivity required of the road markings. Table 9.13 shows the appropriate classes to be used. Table 9.14 and 9.15 list the requirements for Class A and Class B beads respectively.

<table>
<thead>
<tr>
<th>Class</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Incorporation in thermoplastic road marking compounds</td>
</tr>
<tr>
<td>B</td>
<td>Surface applied for thermoplastic pavement marking compounds and pavement marking paints</td>
</tr>
</tbody>
</table>

Table 9.13. Classes of Beads that may be used in
thermoplastic.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>% Retained</th>
<th>Min. % spherical* beads by mass</th>
<th>Max. % defective beads **</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.18 mm</td>
<td>0 to 3</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>850 µm</td>
<td>0 to 10</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>425 µm</td>
<td>90 to 100</td>
<td>70</td>
<td>30</td>
</tr>
</tbody>
</table>

**Table 9.14. Requirements of Class A beads.**
*As tested in accordance with Appendix C of BS 3262
**As tested in accordance with Appendix D of BS 3262

<table>
<thead>
<tr>
<th>Sieve</th>
<th>% Retained</th>
<th>Min. % spherical * beads by Microscope</th>
<th>Max. % defective beads*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.18 mm</td>
<td>0 to 3</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>850 µm</td>
<td>0 to 5</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>600 µm</td>
<td>5 to 20</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>300 µm</td>
<td>30 to 75</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>180 µm</td>
<td>10 to 30</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>Below 180 µm</td>
<td>0 to 15</td>
<td>80</td>
<td>20</td>
</tr>
</tbody>
</table>

**Table 9.15. Requirements of Class B beads.**
*As tested in accordance with Appendix D of BS 3262

9.8.6.2 The solid glass beads shall be made from soda glass and not less than 70% by mass shall be of transparent glass, reasonably spherical and free from flaws. Table 9.16 gives the chemical composition of the solid glass beads.

Chemical composition of the solid glass beads
### Table 9.16. Chemical composition of the solid glass beads.

<table>
<thead>
<tr>
<th>Chemical Composition</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon Dioxide, SiO$_2$</td>
<td>not less than 70%</td>
</tr>
<tr>
<td>Calcium Oxide, CaO</td>
<td></td>
</tr>
<tr>
<td>Magnesium oxide, MgO</td>
<td></td>
</tr>
<tr>
<td>Sodium oxide, Na$_2$O</td>
<td>together not less than 8 %</td>
</tr>
<tr>
<td>Potassium oxide, K$_2$O</td>
<td></td>
</tr>
<tr>
<td>Aluminium oxide, Al$_2$O$_3$</td>
<td>together not more than 18%</td>
</tr>
<tr>
<td>Ferric oxide, Fe$_2$O$_3$</td>
<td></td>
</tr>
</tbody>
</table>

9.8.9.2 The solid glass beads may be applied by either gravity or air assisted feed and may have a moisture proof coating or a flotation coating.

9.8.10 The proportions of the constituents of the mixed materials shall comply with the following requirements:

### Table 9.17. Required proportions of the constituents of the mixed materials.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Percentage by Mass of Total Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binder (resin and oil)</td>
<td>Minimum 18  Maximum 22</td>
</tr>
<tr>
<td>Solid glass beads</td>
<td>Minimum 20** Maximum -</td>
</tr>
<tr>
<td>Aggregate, pigment extender and solid glass beads*</td>
<td>Minimum 78  Maximum 82</td>
</tr>
</tbody>
</table>

*Where specified

** 20% will be maintained even in the case of materials to which solid glass beads are to be applied by pressure application

The grating of the combined aggregates, pigment, extender and solid glass beads as found on analysis shall comply with the following requirements:

### Table 9.18. Required grading of the combined aggregates, pigment, extender and solid glass beads as found on analysis.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by mass passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.80 mm</td>
<td>100</td>
</tr>
<tr>
<td>600µm</td>
<td>75 - 95</td>
</tr>
</tbody>
</table>

Composition of mixture
9.8.11 The luminance factor of white shall not be less than 70 (as delivered) while that for yellow shall not be less than 50 (as delivered), when tested in accordance with BS 3262: 1989 Appendix F.

9.8.12 The density of the thermoplastic material shall not be less than 1.65 kg/l.

9.8.13 When measured in accordance with Appendix E of BS 3262: 1987 on samples taken and prepared in accordance with Appendix B of BS 3262:1989 shall be at a temperature of not less than 65°C.

9.8.14 The luminance factor of the white and yellow material as measured in accordance with Appendix B of BS 3262: 1989 shall not be less than 65 and 45 respectively, when tested in accordance with Appendix G of BS 3262: 1989.

9.8.15 A cone made and tested in accordance with Appendix H of BS 3262: 1989 shall not slump by more than 25%.

9.8.16 The material when immersed in a strong solution of calcium chloride for a period of four (4) weeks shall remain completely unaffected.

9.8.17 The material must possess the following characteristics:
- solid at 20°C, and
- thick fluid at 170°C

9.8.18 SKID RESISTANCE

9.8.18.1 The skid resistance of white or yellow marking material sampled tested in accordance with Appendix B of BS 3262: 1989 shall not be less than 45, when tested in accordance with Appendix J of BS 3262: 1989.

9.8.18.2 When tested in accordance with Appendix J of BS 3262: 1989, the skid resistance of the newly placed road marking or any road marking that is still within the one-year liability period shall not be less than 45.

9.8.19 | Colour of Marking | Immediately after the hardening of road marking | Five months after application |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>300 mcd/lx.m²</td>
<td>150 mcd/lx.m²</td>
</tr>
<tr>
<td>Yellow</td>
<td>200 mcd/lx.m²</td>
<td>100 mcd/lx.m²</td>
</tr>
</tbody>
</table>

Table 9.19. Required retro-reflection reading for white and yellow.
For enhanced skid resistance and reflectivity, glass beads conforming to the following specifications are used:

<table>
<thead>
<tr>
<th>Sieve Size (microns)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
</tr>
<tr>
<td>1700</td>
<td>95 - 100</td>
</tr>
<tr>
<td>1400</td>
<td>80 - 95</td>
</tr>
<tr>
<td>1180</td>
<td>10 - 40</td>
</tr>
<tr>
<td>1000</td>
<td>0 - 5</td>
</tr>
<tr>
<td>850</td>
<td>0 - 2</td>
</tr>
</tbody>
</table>

Table 9.20. Rounds : 75 % by optical count Reflective Index: 1.50 - 1.55

9.9 QUALITY CONTROL

9.9.1 The type and number of tests shall follow Table 9.21:

<table>
<thead>
<tr>
<th>Tests for reinstatement works</th>
</tr>
</thead>
<tbody>
<tr>
<td>L &lt; 50m</td>
</tr>
<tr>
<td>Depth &amp; Thickness</td>
</tr>
<tr>
<td>Compaction</td>
</tr>
<tr>
<td>Reflectivity</td>
</tr>
<tr>
<td>Compressive Strength</td>
</tr>
<tr>
<td>Absorption</td>
</tr>
<tr>
<td>Extraction</td>
</tr>
<tr>
<td>Sieve Analysis</td>
</tr>
</tbody>
</table>

Table 9.21. Number of tests required for different length of opening.

9.9.2 The cost incurred in carrying out the various tests is to be borne by the Applicant. All test results shall be submitted to the Authority electronically through the LTA.PROMPT.

9.9.3 The Authority at its own discretion may carry out additional tests whose cost shall be borne by the Applicant.

9.9.4 All tests, except the Depth and Thickness Tests, shall be carried out by Productivity Standards Board or its accredited laboratories.
9.10  **DEPTH AND THICKNESS TEST**

9.10.1 The depth of utilities and the thickness of the reinstatement materials shall be determined by non-destructive equipment or by the open-cut method. The open-cut method shall be carried out before the milling and patching process.

9.10.2 On completion of the test(s), the Applicant shall submit the result(s) to the Authority indicating the location(s) tested.

9.10.3 The Depth and Thickness Test result(s) shall be endorsed by the Applicant.

9.11  **COMPACTION TEST**

9.11.1 The field density of the cored samples shall be used to determine the degree of compaction of the asphalt concrete.

9.12  **REFLECTIVITY TEST**

9.12.1 The reflectivity of thermoplastic materials shall be measured in the field by the retroreflectometer. The retroreflection readings shall conform to Section 9.8.19.

9.13  **COMPRESSIVE STRENGTH TEST**

9.13.1 The compressive strength of concretes shall be measured by crushing tests on nominal 150 mm cubes. All sampling, curing and testing of cubes shall be carried out in accordance with BS 1881. The compressive strength of concrete shall comply with Table 9.1 of Section 9.3.

9.13.2 Notwithstanding the above, the Authority reserves the right to instruct the Applicant to core any number of samples from any portion of the works for the purpose of determining the concrete compressive strength. The minimum depth of cored concrete sample is 75 mm for footpaths, and 100mm for slabbed-over-drains and rigid pavements. The Applicant shall supply and backfill voids with similar material left by the coring.

9.13.3 The minimum average value of the 28th day in-situ compressive core strength shall not be less than 18 N/mm² for 75 mm thick cast-in-situ concrete footpaths and 22 N/mm² for 125mm thick slabbed-over-drains.

9.13.4 The maximum allowable thickness tolerances for footpath, slabbed-over-drain and rigid pavement is ±5mm.
9.14 **ABSORPTION TEST**

9.14.1 The quality of all the precast concrete units shall comply with LTA’s prevalent Materials and Workmanship Specification. The number of test(s) required shall conform to Table 9.21 of this Section.

9.14.2 For Precast Concrete Slab - When tested in the manner described in Appendix C of BS 368, the average increase in weight of the test pieces from each slab by absorption of water shall not exceed the appropriate values in Table 3 of BS 368.

9.14.3 For Precast Kerbs and Channels - When tested in accordance with Appendix C of BS 340, none of the three specimen absorptions shall exceed the appropriate values in Clause 9.3 of BS 340.

9.15 **EXTRACTION TEST**

9.15.1 The Extraction Test to determine the bitumen content in asphalt concrete shall conform to Table 9.8 of Section 9.4.6 and the number of test(s) shall conform to Table 9.21 of Section 9.9.1.

9.16 **SIEVE ANALYSIS TEST**

9.16.1 The sieve Analysis Test determines the grading of aggregates in asphalt concrete, and shall conform to Table 9.8 of Section 9.4.6.

9.17 **ASPHALT CONCRETE CORE TEST**

9.17.1 The Authority may require the Applicant to core any number of samples from any portion of the works for the purpose of examination and testing. All cored samples shall be neatly cut by a 100 mm diameter core drill. The Applicant shall supply and backfill all voids with similar materials left by coring.

9.17.2 The cored samples shall be used to determine the field density and for the Extraction Test shall conform to Table 9.8 of Section 9.4.6.

9.18 **RECYCLED CONCRETE AGGREGATE CORE TEST**

9.18.1 The Authority may require the Applicant to core at the rate of one per 100 m³ of graded RCA laid and at least 3 samples
shall be taken for the purpose of examination and testing. For site with more than 400 m³ of graded RCA laid in a day, a maximum of 5 samples shall be taken. All cored samples shall be neatly cut by a 100 mm diameter core drill. The Applicant shall supply and backfill all voids with similar materials left by coring.

**9.19  RECYCLED CONCRETE AGGREGATE DUST TEST**

9.19.1 The Authority may require the Applicant to take at least 3 samples of RCA dust at each site in a day for the purpose of examination and testing. The samples shall be tested for aggregate grading. These samples shall be marked with the date laid and location identification, and test at an accredited laboratory.

**9.20  NON-DESTRUCTIVE TESTS**

9.20.1 The Authority may require the Applicant to conduct non-destructive tests where appropriate. The type of non-destructive tests may either be required by the Authority or be proposed by the Applicant. When proposing the type of test, the Applicant shall prove to the Authority's satisfaction that the test can:

- determine the thickness of the layers of reinstatement for pavement reinstatement;
- determine the type of apparatus, its depth and location.
PART IV – DEMERIT POINTS SYSTEM

SECTION 10
ADMINISTRATION OF DEMERIT POINTS SYSTEM

10.1 OBJECTIVE

10.1.1 The main objective of the demerit points system is to encourage desirable good performance, quality of works and timely completion of works.

10.2 DEMERIT POINTS SYSTEM FOR CONTRACTORS

10.2.1 Under Regulation 9 of the Street Works (Works on Public Streets) Regulations, demerit points will be meted out to the contractor who has, in the course of carrying out any works on any public street, committed any of the defaults as listed in the Schedule of the Street Works (Works on Public Streets) Regulation.

The Schedule

10.2.2 The Authority will monitor and assess the contractor’s performance. Contractors who accumulate 200 or more demerit points within a calendar month will be suspended from carrying out new work on public streets.

Performance of contractor

10.2.3 Any contractor who has, within any one calendar month been awarded a total of 200 or more demerit points will be suspended by the Authority.

Allowable limits for demerit points

10.2.4 The length of the suspension depends on the number of suspensions that the contractor already had in the past two years. Please see Table below.

<table>
<thead>
<tr>
<th>Number of Suspensions in the past two years</th>
<th>Period of Suspension</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3 months</td>
</tr>
<tr>
<td>1</td>
<td>3 months</td>
</tr>
<tr>
<td>2</td>
<td>6 months</td>
</tr>
<tr>
<td>3</td>
<td>24 months, i.e., 2 years</td>
</tr>
</tbody>
</table>

Length of suspension

10.2.5 During the period of suspension, the defaulting contractor cannot be appointed for any new work application. However, the Authority will allow those ongoing works as listed in the Authority’s record to continue till completion. It is therefore important for the applicants/contractors to notify the Authority of the start of their work as it will have a bearing on the works that can be allowed to continue should the contractor be suspended.
10.3 PROCEDURE FOR APPEAL

10.3.1 The recipient of the Notice of Road Opening Infringement may appeal to Deputy Director, Road Infrastructure Management, for a waiver of the demerit points within 14 days from the date of the Notice.

The appeal must be put in writing to the following address:

LTA’s Road Infrastructure Management
No.1, Hampshire Road,
Block 3 #03-00
Singapore 219428
Appendix A

STRUCTURE OF CODE

Code of Practice for Works on Public Streets

Introduction

Section 1
General

Section 2
Structure of Code

Submission Procedure & Requirements

Section 3
Work Proposal on Public Streets

Section 4
Application for Approval to Commence Works on Public Streets

Section 5
Engineering Works Proposal on Public Streets

Technical Requirements

Section 6
Utility Works

Section 7
Engineering Works

Section 8
General Reinstatement

Section 9
Material Specifications & Quality Control

Demerit Points System

Section 10
Administration of Demerit Points System
Appendix B
Submission Process for Permit to Carry Out Works on Public Streets

START

Submit application electronically through LTA.PROMPT

Approved

Inform LTA of actual commencement date within 28 days from the date approved by the Authority for commencement of the works

To request any change of contractor/ site supervisor through LTA.PROMPT

Works completed

Inform LTA of actual completion date within 7 days upon completion

To request extension of time through LTA.PROMPT if works cannot be completed by the estimated completion date

Works completed

Submit reinstatement test report

Carry out reinstatement tests

Maintain reinstatement work for the duration of the DLP

Handing-over of reinstatement works

END
Appendix C

Format for use for Banker's Guarantee furnished by the Applicant
Please use exact wordings

SAMPLE

DRAFT BANKER'S GUARANTEE

(To be prepared on the Bank's / Insurance Company's letterhead)

To: Deputy Director
   Road Infrastructure Management
   Land Transport Authority
   1 Hampshire Road
   Singapore 219428

   THIS GUARANTEE is made the ____________________day of
   ____________________ 20 ______________ BETWEEN ______________________________________________
   (Name of Bank/Insurance Company)
   having its registered office at ____________________________________________________________
   (herein called "the Guarantor") of the one part and the Land Transport Authority of
   Singapore(herin called the "the Authority") a statutory body established under the Land
   Transport Authority of Singapore Act (Chapter 158A) and having an office at 1 Hampshire
   Road, Singapore 219428, of the other part.

   WHEREAS

   1 ______________________ of _________________________________________
   (Name of Applicant) (Address)
   (herein called "the Applicant") proposed to carry out works on public streets at____________
   ___________________________________________________________________________
   for the purpose of laying service utility or any other purpose in accordance with the approved
   plan.
2 The Applicant made a Road Opening Application No. __________________________ under Regulation 5 of The Street Works (Works on Public Streets) Regulation (as amended from time to time and herein referred to as "the Regulations") for the Authority's approval to commence street works stipulating the commencement date and completion date (herein referred to as "the Completion date").

3 On such application being made as aforesaid, the Authority has determined the sum of Singapore Dollars ___________________________________________ $__________________) as the amount that is required to be deposited (hereinafter referred to as "the Security Deposit ") by the Applicant for execution of the aforesaid street works in accordance with the provision of Regulation 10 of the Regulations.

4. The Applicant has requested and the Authority has agreed to accept an unconditional guarantee covering the Security Deposit.

5. The Guarantor has agreed to enter into his Guarantee to satisfy the Applicant's obligations as above mentioned.

**NOW IT IS HEREBY AGREED AS FOLLOWS:**

1 The Guarantor hereby unconditionally undertakes and covenants to forthwith pay to the Authority on demand any amount or amounts which from time to time be demanded in writing by the Authority up to the maximum aggregate sum not exceeding the Security Deposit.
2 The Guarantor shall not be discharged or released from this Guarantee by any arrangement made between the Applicant and the Authority with or without the consent of the Guarantor or by any alteration in the obligations undertaken by the Applicant or by any alterations in the obligations imposed on the Applicant by the Street Works Act or regulations made thereunder or by any forbearance whether as to amount, time, performance or in any other way.

3 This Guarantee shall take effect from [insert contract commencement date] to [insert initial expiry date to be: Contract Period plus Defects Liability Period plus 6 months] provided always that the expiry date of this Guarantee and the Guarantor's liability thereunder shall be automatically extended for successive periods of 12 months unless the Guarantor gives the Authority 90 day's written notice prior to the expiry of its liability of the Guarantor's intention not to extend this Guarantee in respect of any future extension and provided further that the Authority shall be entitled, upon receiving such notice of the Guarantor's intention (and within the period specified in Clause 4 hereof), either to:

a. Make a claim under this Guarantee; or

b. Direct the Guarantor to pay such amount (not exceeding the Security Deposit) as the Authority may specify into a suspense account to be governed and disbursed by the Guarantor subject to the Association of Banks in Singapore's Guidelines for operation of a Suspense Account; or

c. Direct the Guarantor to extend the validity of this Guarantee for a further period not exceeding 12 months (and this Guarantee shall then expire at the end of such further period)
4. This Guarantee is conditional upon a claim or direction as specified herein being made by the Authority by way of a notice in writing addressed to the Guarantor and the same being received by the Guarantor at (insert address of Guarantor's notification office: ____________) within 90 days from the expiry of this Guarantee.

5. The Guarantor shall be obliged to effect the payment required under such a claim or direction within 14 business days of the Guarantor's receipt thereof. The Guarantor shall be under no duty to inquire into the reasons, circumstances or authenticity of the grounds for such claim or direction and shall be entitled to rely upon any written notice thereof received by the Guarantor (within the period specified in Clause 4 hereof) as final and conclusive.

6. The Authority may make more than one claim on this Guarantee.

Dated this ____________ day of __________________20______

NAME, DESIGNATION AND SIGNATURE OF THE OFFICER

) ______________________ Name

) ______________________ Designation

AUTHORISED TO SIGN FOR

) ______________________

AND ON BEHALF OF THE

) ______________________

AFOREMENTIONED BANKER

) ______________________ Signature

OR INSURANCE CO

) ______________________

Bank/Insurance Company Stamp
in the presence of : ________________________________

NAME : ________________________________

DESIGNATION : ________________________________

SIGNATURE : ________________________________

ADDRESS : ________________________________

__________________________________________
Appendix D

Format for use for Banker's Guarantee furnished by the Contractor
Please use exact wordings

SAMPLE
DRAFT BANKER'S GUARANTEE

(To be prepared on the Bank's / Insurance Company's letterhead)

To: Manager
   Road Management
   Land Transport Authority
   1 Hampshire Road
   Singapore 219428

   THIS GUARANTEE is made the ____________________day of ____________________
   20 __________________ BETWEEN ____________________________________________
   having its registered office at _________________________________________________

   (herein called "the Guarantor") of the one part and the Land Transport Authority of
   Singapore(herein called the "the Authority") a statutory body established under the Land
   Transport Authority of Singapore Act (Chapter 158A) and having an office at 1 Hampshire
   Road, Singapore 219428, of the other part.

   WHEREAS

   1 (Name of Applicant) (hereinafter called "the Applicant") has
   made

   a Road Opening Application No. ______________________________

   under Regulation 5 of The Street Works (Works on Public Street) Regulations (as amended
   from time to time and herein referred to as "the Regulations") for the Authority's approval to
commence street works stipulating the commencement date and completion date (herein referred to as "the Completion Date").

2  
(Name of Contractor) of (Address)

(herein called "the Contractor") has been appointed by the Applicant to carry out works on public streets at for the purpose of laying service utility or any other purpose in accordance with the approved plan.

3  On such application being made as aforesaid, the Authority has determined the sum of Singapore Dollars ($___________________) as the amount that is required to be deposited (hereinafter referred to as "the Security Deposit") by the Contractor for the execution of the aforesaid street works in accordance with the provision of Regulation 10 of the Regulations.

4  The Contractor has requested and the Authority has agreed to accept an unconditional guarantee covering the Security Deposit.

5  The Guarantor has agreed to enter into this Guarantee to satisfy the Contractor's obligations as above mentioned.

**NOW IT IS HEREBY AGREED AS FOLLOWS:**

1  The Guarantor hereby unconditionally undertakes and covenants to forthwith pay to the Authority on demand any amount or amounts which from time to time be demanded in writing by the Authority up to the maximum aggregate sum not exceeding the Security Deposit.
2 The Guarantor shall not be discharged or released from this Guarantee by any arrangement made between the Contractor and the Authority with or without the consent of the Guarantor or by any alteration in the obligations undertaken by the Applicant or the Contractor or by any alterations in the obligations imposed on the Applicant or the Contractor by the Street Works Act or regulations made thereunder or by any forbearance whether as to amount, time, performance or in any other way.

3 This Guarantee shall take effect from [insert contract commencement date ___________] to [insert initial expiry date to be: Contract Period plus Defects Liability Period plus 6 months ___________] provided always that the expiry date of this Guarantee and the Guarantor's liability thereunder shall be automatically extended for successive periods of 12 months unless the Guarantor gives the Authority 90 day's written notice prior to the expiry of its liability of the Guarantor's intention not to extend this Guarantee in respect of any future extension and provided further that the Authority shall be entitled, upon receiving such notice of the Guarantor's intention (and within the period specified in Clause 4 hereof), either to:

a. Make a claim under this Guarantee; or

b. Direct the Guarantor to pay such amount (not exceeding the Security Deposit) as the Authority may specify into a suspense account to be governed and disbursed by the Guarantor subject to the Association of Banks in Singapore's Guidelines for operation of a Suspense Account; or

c. Direct the Guarantor to extend the validity of this Guarantee for a further period not exceeding 12 months (and this Guarantee shall then expire at the end of such further period)
4. This Guarantee is conditional upon a claim or direction as specified herein being made by the Authority by way of a notice in writing addressed to the Guarantor and the same being received by the Guarantor at (insert address of Guarantor's notification office: ____________) within 90 days from the expiry of this Guarantee.

5. The Guarantor shall be obliged to effect the payment required under such a claim or direction within 14 business days of the Guarantor's receipt thereof. The Guarantor shall be under no duty to inquire into the reasons, circumstances or authenticity of the grounds for such claim or direction and shall be entitled to rely upon any written notice thereof received by the Guarantor (within the period specified in Clause 4 hereof) as final and conclusive.

6. The Authority may make more than one claim on this Guarantee.

Dated this ___________ day of ________________ 20_____

NAME, DESIGNATION AND SIGNATURE OF THE OFFICER ) __________________ Name

AUTHORISED TO SIGN FOR ) __________________ Designation

AND ON BEHALF OF THE ) __________________

AFOREMENTIONED BANKER ) __________________

OR INSURANCE CO ) __________________

Bank/Insurance Company Stamp
in the presence of: ________________________________

NAME: ________________________________________

DESIGNATION: _________________________________

SIGNATURE: ___________________________________

ADDRESS: _____________________________________

_____________________________________________
## Appendix E

### Checklist for Temporary Earth-Retaining Structures of WORKS ON, BELOW OR BESIDE THE PUBLIC STREETS
(References: LTA Design Criteria (DC), CP 65, BS 8002, BS5950:2000)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Qualified Person’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td><strong>GENERAL</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>The Design Brief on the approach and concepts is attached. The Design Brief addresses all points listed below for geotechnical design and structural design.</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>All Temporary Earth-Retaining Structures have been designed for removal as per LTA, Design Criteria clause 16.13.</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td><strong>GEOTECHNICAL</strong></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td><em>Geotechnical Parameters &amp; Surcharge</em></td>
<td></td>
</tr>
<tr>
<td>2.1.1</td>
<td>All geotechnical parameters had been justified using the soil investigation data, laboratory test results and other published information (Please state relevant pages in attached calculations).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(For c’ and φ’, the design values should be based on p-q plot)</em>.</td>
<td></td>
</tr>
<tr>
<td>2.1.2</td>
<td>The level of the ground and the ground water table had been verified and attached. The surcharge load of <strong>25 kPa</strong> in accordance with LTA, Design Criteria has been used.</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td><strong>Stability Checking</strong></td>
<td></td>
</tr>
<tr>
<td>2.2.1</td>
<td>Toe-in stability has been checked to ensure adequate embedment of the retaining wall (Please state relevant pages in the attached design calculations).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(The method in NAVFAC DM-7.2 is one of the acceptable methods. Mobilisation factors should be used for the soil parameters. Both drained and undrained parameters should be used for most soil types, except for marine clay and fluvial clay).</em></td>
<td></td>
</tr>
<tr>
<td>2.2.2</td>
<td>The stability of the excavation base been checked against basal heave failure due to shear failure of the soil at the base.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(This check must be carried out for excavation in soft clay such as the marine clay, fluvial clay and peaty clay).</em></td>
<td></td>
</tr>
<tr>
<td>2.2.3</td>
<td>The stability of the base has been checked for hydraulic uplift.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(This check must be carried out if the underlying layer is more permeable than the base of the excavation, such as Old Alluvium underlying the marine clay at the base of excavation or highly weathered granite underlying the residual soils of the Bukit Timah Granite).</em></td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Description</td>
<td>Qualified Person’s Comments</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>2.2.4</td>
<td>Seepage analyses have been carried out to justify the pore water pressures used for the above stability checking. <em>(For seepage analysis, attentions should be paid to the permeability values and the boundary conditions in the model).</em></td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Analysis of Retaining Walls</td>
<td></td>
</tr>
<tr>
<td>2.3.1</td>
<td>The soil profile assumed in the analysis matches with the borehole log.</td>
<td></td>
</tr>
<tr>
<td>2.3.2</td>
<td>The design has taken into consideration situations where the loading on both sides of the excavation is not balanced.</td>
<td></td>
</tr>
<tr>
<td>2.3.3</td>
<td>The drainage condition (drained or undrained) assumed for each soil layer matches with the permeability of the layer. <em>(e.g., for marine and fluvial clays, undrained condition can be used; and for fluvial sand and sandy fill, drained condition should be used. For the mixed soils, such as Old Alluvium and weathered rocks, both drained and undrained conditions should be analysed and the worst of two analyses should be adopted)</em></td>
<td></td>
</tr>
<tr>
<td>2.3.4</td>
<td>All the stages of excavation considered in the analyses, including the excavation, strut removal &amp; backfilling stages had been checked. Other appropriate redundancy checks had been carried out - please state.</td>
<td></td>
</tr>
<tr>
<td>2.3.5</td>
<td>The unplanned excavation has been safely considered for every stage of excavation as per BS8002 Cl. 3.2.2.2.</td>
<td></td>
</tr>
<tr>
<td>2.3.6</td>
<td>There is no over-stressing in the design of the retaining systems.</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>INSTRUMENTATION</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>The monitoring plans are attached and have been provided as per LTA, DC Chapter 19.</td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>The alert and suspension levels for the retaining system for each stage of excavation have been indicated in the attached Drawings. <em>(Allowable values for struts and retaining wall system should be set at the allowable capacity of the struts or the walls)</em></td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>The review levels are consistent with the damage assessment to adjacent structures and utilities as per LTA, DC Chapter 20.</td>
<td></td>
</tr>
</tbody>
</table>
## Checklist for Temporary Earth-Retaining Structures of WORKS ON, BELOW OR BESIDE THE PUBLIC STREETS  
(References: LTA Design Criteria (DC), CP 65, BS 8002, BS5950:2000)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Qualified Person’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.0</strong></td>
<td><strong>STRUCTURAL</strong></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td><strong>Sheetpiles</strong></td>
<td></td>
</tr>
<tr>
<td>4.1.1</td>
<td>The sections have been checked for bending moment and shear force. Load factors should be used if the design is based on BS5950.</td>
<td></td>
</tr>
<tr>
<td>4.1.2</td>
<td>Where Z profile sheetpile is used, the section modulus of Z profiles will have a 15% reduction in section modulus due to 5 deg. of rotation. This has been considered in the design. (Based on CIRIA 95)</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td><strong>Traffic Decking</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 4.2.1 | The most onerous of the following design loading has been used for the design of the temporary decking system:  
(a) HA Loading as given in BD 37/01.  
(b) 25 units of Type HB loading  
(c) Loading from construction vehicles.  
<p>| | | |
| | | |
| | | |
| 4.2.2 | The Drawings of the decking beam layout are attached. The span shown on the Drawings for all beams tally with the design calculations. | |
| 4.2.3 | The decking panels and beams have been designed as shown in attached calculations (please state pages). | |
| 4.2.4 | The connection details have been adequately designed for their structural requirements. Allowance has been made to allow for eccentricity as per Code BS5950. Drawings have been checked that the connection details tally with the design. | |
| 4.3 | <strong>Strut</strong> | |
| 4.3.1 | The pre-loading in struts has been specified on drawings as per LTA, M&amp;W Specification. | |
| 4.3.2 | Allowance has been made for bending due to self-weight and any anticipated imposed loads such as access ways, intermediate struts or staging for materials. | |
| 4.3.3 | The struts have been designed for accidental loading (maximum 20kN applied normal to the strut at any point in any direction). | |
| 4.3.4 | The struts have been designed for eccentric axial loadings (Based on CIRIA 95/CIRIA C517). | |
| 4.3.5 | Both flanges of strut are restrained (by plates and bars) and these restraints have been designed according to BS5950:2000 Cl. 4.3.2.2. | |
| 4.3.6 | Where second hand structural steel are used, they have been checked for section size, steel grade, tolerances and damage as shown in attached calculations (please state pages). | |
| 4.4 | <strong>Supporting /Tie Beam</strong> | |</p>
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Qualified Person’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The supporting/tie beams have been designed according to BS 5950:2000 Cl. 4.3.2.2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 Cross Bracing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The cross bracing designed for forces as per BS 5950:2000 Cl. 4.3.2.2 and 4.7.1.2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6 Connection Details</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6.1 The connection details have provided for the transfer of forces from strut to waler and to the retaining wall.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I, _____________________ (Qualified Person for Structural Works) hereby certified that the attached structural plans and design calculations prepared by me are/are not* fully in accordance with the above.

(QUALIFIED PERSON FOR STRUCTURAL WORKS’ STAMP & SIGNATURE)

Date : ____________________
## Appendix F

### Contractor Category (Workheads/License Types) and Associated Work Type

<table>
<thead>
<tr>
<th>Work Type Description</th>
<th>BCA Category or License Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Works</td>
<td>CR14, CW01, CW02</td>
</tr>
<tr>
<td>Connection / Supply Scheme to Development Area/Public Lighting/Traffic Light/HouseHold Consumer</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Diversion Scheme on request from other Department</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Drainage Work</td>
<td>CW01, CW02, GB1, GB2</td>
</tr>
<tr>
<td>Engineering Works within Road Safety Zone e.g. deep excavation, retaining system, etc</td>
<td>CW01, CW02</td>
</tr>
<tr>
<td>Improvement Scheme</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Conversion/Reinforcement/Upgrading Projects</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Landscaping</td>
<td>CR01, CR07, CR12, CR14, CW01, CW02, MW03</td>
</tr>
<tr>
<td>Lane Closure (pls specify reason)</td>
<td>CR01 to CR15, CW01, CW02, GB1, GB2, ME01, ME02, ME04 to ME15, MW02, MW03, MW04, RW01, RW02, SY01, SY02, SY04 to SY12, SY14</td>
</tr>
<tr>
<td>Lifting/Hoisting Operation</td>
<td>CR01 to CR15, CW01, CW02, GB1, GB2, ME01, ME02, ME04 to ME15, MW02, MW03, MW04, RW01, RW02, SY01, SY02, SY04 to SY12, SY14</td>
</tr>
<tr>
<td>Manhole/ Valve Chamber maintenance work</td>
<td>CR01, CW01, CW02, ME05, ME10, ME11, ME12, ME14, MW02</td>
</tr>
<tr>
<td>Minor Construction Works(with excavation) e.g. temporary access, minor A &amp; A, entrance culvert, external work, etc</td>
<td>CR07, CW01, CW02, GB1, GB2</td>
</tr>
<tr>
<td>Minor Construction Works(without excavation) e.g. hoarding etc</td>
<td>CR01, CR07, CW01, CW02, GB1, GB2</td>
</tr>
<tr>
<td>New Scheme</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Pipe Laying &amp; Road Reinstatement</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Private Sewer Connection</td>
<td>CR07, CW01, CW02</td>
</tr>
<tr>
<td>Repair Scheme Replacement/General Repairs</td>
<td>CR07, CW02</td>
</tr>
<tr>
<td>Road Marking</td>
<td>CR14, CW01, CW02</td>
</tr>
<tr>
<td>Soil Investigation, Improvement &amp; Stabilisation Work</td>
<td>CR12, CW02, SB(GS)</td>
</tr>
<tr>
<td>Tree Pruning</td>
<td>CW01, CW02, GB1, GB2, MW03</td>
</tr>
<tr>
<td>Trial Holes</td>
<td>CR12, CW02, SB(GS)</td>
</tr>
</tbody>
</table>