ASHGHAL

Interim Advice Note No. 021/14

Cycle Tracks and Footways Pavement Design Guidelines
Revision No. A1

ADVICE

This Interim Advice Note provides guidelines for the structural design of pavements for cycle tracks and footways as well as other recreational paths and trails. This document must be read in conjunction with:

- QCS 2014 – Qatar Construction Specification 2014
- IAN 011 – Cycle Track Design Guidelines
- IAN 016 – Pavement Design Guidelines

In the event of conflicts between these documents, this IAN 021 shall take precedence with respect to the design of cycle track and footway pavements.

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A1	April 2016	Issued for All Relevant Infrastructure Projects	SVDW	MG	DOR
Rev	**Date**	**Reason For Issue**	**Author**	**Chk**	**App**

Contents

1. Foreword

1.1 Interim Advice Notes (IANs) may be issued by Ashghal from time to time. They define specific requirements for works on Ashghal projects only, subject to any specific implementation instructions contained within each IAN.

1.2 Whilst IANs shall be read in conjunction with the Qatar Highway Design Manual (QHDM), the Qatar Traffic Manual (QTM) and the Qatar Construction Specifications (QCS), and may incorporate amendments or additions to these documents, they are not official updates to the QHDM, QTM, QCS or any other standards.

1.3 Ashghal directs which IANs shall be applied to its projects on a case by case basis. Where it is agreed that the guidance contained within a particular IAN is not to be incorporated on a particular project (e.g. physical constraints make implementation prohibitive in terms of land use, cost impact or time delay), a departure from standard shall be applied for by the relevant Consultant / Contractor.

1.4 IANs are generally based on international standards and industry best practice and may include modifications to such standards in order to suit Qatar conditions. Their purpose is to fill gaps in existing Qatar standards where relevant guidance is missing and/or provide higher standards in line with current, international best practice.

1.5 The IANs specify Ashghal's requirements in the interim until such time as the current Qatar standards (such as QHDM, QTM, etc.) are updated. These requirements may be incorporated into future updates of the QHDM, QTM or QCS, however this cannot be guaranteed. Therefore, third parties who are not engaged on Ashghal projects make use of Ashghal IANs at their own risk.

1.6 All IANs are owned, controlled and updated as necessary by Ashghal. All technical queries relating to IANs should be directed to Ashghal's Manager of the Design Department, Infrastructure Affairs.

Signed on behalf of Design Department:

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2. Ashghal Interim Advice Note (IAN) – Feedback Form

Ashghal IANs represent the product of consideration of international standards and best practice against what would work most appropriately for Qatar. However, it is possible that not all issues have been considered, or that there are errors or inconsistencies in an IAN.

If you identify any such issues, it would be appreciated if you could let us know so that amendments can be incorporated into the next revision. Similarly, we would be pleased to receive any general comments you may wish to make. Please use the form below for noting any items that you wish to raise.

Please complete all fields necessary to identify the relevant item			
IAN title:			
IAN number:		Appendix letter:	
Page number:		Table number:	
Paragraph number:		Figure number:	
Description comment: Please continue on a separate sheet if required:			
Your name and contact details (optional):			
Name:		Telephone:	
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Position:		Address:	

Please email the completed form to:

Abdulla Ahin AA Mohd

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We cannot acknowledge every response, but we thank you for contributions. Those contributions which bring new issues to our attention will ensure that the IANs will continue to assist in improving quality on Ashghal's infrastructure projects.

3. Introduction

3.1 This Interim Advice Note takes immediate effect and shall be read in conjunction with:

- QCS 2014 – Qatar Construction Specifications 2014
- IAN 011 – Cycle Track Design Guidelines
- IAN 016 – Pavement Design Guidelines
- SD 6-11-104 - Footway, Shared Use Path & Cycle Track Pavements

4. Withdrawn / Amended Standard

4.1 No particular standard is withdrawn. However, in the event of conflicts between the above listed IANs or any other standard, this IAN 021 shall take precedence with respect to the design of cycle track and footway pavements.

5. Implementation

5.1 This IAN shall be implemented with immediate effect on projects as follows:

- All Ashghal infrastructure projects in design stage
- All Ashghal infrastructure projects in tender stage

5.2 Ashghal infrastructure projects in construction stage shall be reviewed by the Supervision Consultant and Contractor and the implications of adoption of this Interim Advice Note discussed with the respective Ashghal Project Manager. This shall include an assessment on the current design to determine whether it complies with this Interim Advice Note and the practicalities of modifying the design and construction in order to achieve compliance.

5.3 If in doubt, Consultants / Contractors should seek guidance from their respective Ashghal Project Manager or designated Programme Management Consultant (PMC) on a scheme specific basis.

6. Disclaimer

6.1 This Interim Advice Note and its recommendations or directions have been provided for application on Ashghal's infrastructure projects within Qatar only and they are not warranted as suitable for use on other roads, highways or infrastructure with Qatar or elsewhere. Should any third party, consultant or contractor choose to adopt this Interim Advice Note for purposes other than Ashghal's infrastructure projects, they shall do so at their own risk.

Attachment A – Cycle Tracks and Footways Pavement Design Guidelines

Attachment A – Table of Contents

1. Application

This document is intended to provide guidelines for the proper structural design and construction of pavements for cycle tracks and footways as well as other recreational paths and trails, constructed on behalf of Ashghal. This supplementary IAN 021 must be read in conjunction with

- QCS 2014 - Qatar National Construction Specification 2014
- IAN 011 - Cycle Track Design Guideline
- IAN 016 - Pavement Design Guidelines
- SD 6-11-104 - Standard Detail Footway, Shared Use Path & Cycle Track Pavements

In the event of conflicts between these documents, this IAN 021 shall take precedence with respect to cycle track and footpath pavements.

It is intended that the recommendation in this guideline are followed on all Ashghal infrastructure projects unless otherwise directed by the Engineer.

When documenting the design, project specific specifications and drawings for a traditional design, bid and build contract (DBB), the designer shall consider the applicability of the recommendations in this guideline to the particular project and advise Ashghal accordingly.

Similarly when a design for a design and build contract (D&B) is being documented, the recommendations in these guidelines shall be adopted unless otherwise approved by the Engineer. Also in a D&B contract words within this IAN 21 such as “should”, “desirable”, and “recommended”, shall mean “must” or “shall” unless otherwise notified by the Engineer (Ashghal).

2. Objectives

The main objective of cycle track and footway pavements is to provide cyclists, joggers, walkers and all other users with a smooth, comfortable and safe surface. This can be accomplished by applying these guidelines for pavement design to control the smoothness, durability, skid resistance and all weather wear resistance.

These guidelines have been prepared considering various practices available in Qatar for cycle track and footway pavements and asphalt mix designs locally and internationally.

3. Definition

VE = Value Engineering as outlined in the guideline procedure (DXW-GENL-0000-PE-KBR-0007)

4. Design Concept

4.1 General

Cycle Track and footway pavement structures are designed in a similar way as road pavements, using the same design method. The AASHTO design guide can be used as the main reference to design cycle track and footway pavement structures in the same way as highway pavement structures, with the noticeable difference that loading levels and consequent pavement layer thicknesses would be significantly different.

The surface of the pavement must be smooth, hard and durable. A smooth and hard surface will provide good rideability, lower energy requirements, and with an appropriate cycle track alignment will provide for safety and comfort. Uneven surfaces must be avoided as they usually affect cyclists' control negatively and can cause an uncomfortable and potentially unsafe ride.

4.2 Design Factors

Cycle Track and footway pavement design is controlled by many factors. It is a function of vehicle characteristics, design traffic loading, subgrade strength and the prevailing environmental conditions. The primary criteria governing cycle track and footway pavement structures are safety, stability, the ability to support the wheel loads and longevity.

The existing terrain, environment, climate, drainage and pavement loading need to be addressed in the preliminary design and detailing stages. These factors, in conjunction with sub-grade characteristics, will affect the design thickness of the pavement as well as the design of the asphalt mixture.

Asphalt pavements are preferred for cycle tracks as they provide user friendly, cost effective, long lasting surfaces and in general provide the public a surface which is smooth, quiet and safe.

Interlocking block paving is the preferred surface for pedestrian only pavements.

Cycle Tracks and footpaths must also be designed to accommodate occasional use by vehicles for using the path to access to areas needing maintenance. It is expected that the maximum loading on cycle tracks and footways results from construction and maintenance equipment and other motorized vehicles that may use or cross the cycle track and footway. In all cases, the pavement shall be designed to withstand all types of stresses and loadings from cycles, construction equipment, maintenance vehicles and weathering.

The pavement shall be designed to resist, not only the light loading from narrow bicycle tyres, but also the loading from a relatively larger size vehicle such as pickups and small trucks used for construction and maintenance. Consequently the load of these vehicles is

more critical in cycle track and footway pavement design than the loading and stresses caused by bicycles.

5. Design Methods

It is recognized that pavement designs for cycle tracks and footways should be based upon the traffic, soil strength and environmental factors.

AASHTO 1993 provides guidelines on the level of loading and the required pavement structure for low volume and low loading roads.

In this guideline the pavement design for cycle tracks or footways are considered the same as they both serve as low volume and low loading paths and AASHTO 1993 guidelines have generally been followed.

6. Cycle Track and Footway Pavement Types

Pavement for cycle tracks and footways can be constructed using one of the following types:

- Asphalt surfaced pavement
- Concrete surfaced pavement
- Interlock paver block pavement
- Coloured Asphalt pavement

For Ashghal infrastructure projects, asphalt surfaced pavements are recommended. Only in limited or special circumstances should concrete surfaced pavements or interlock paver block pavements be used. For further clarification in this regard, advice should be sought from the Engineer (PMC) on a project-by-project basis. However, guidance on concrete surfaced pavement and interlock paver block pavements can be found in Appendices A and B respectively.

6.1 Asphalt Surfaces

Asphalt is the most common type of material that is used primarily as a surfacing for cycle tracks and footways. It usually comprises a range of sizes of mineral aggregate, bitumen and air that is mixed, placed and compacted whilst hot. Typical aggregate sizes used for cycle track and footway asphalt surface mixtures may include 5, 7, 10, 12.5 and 14 mm.

In Qatar, cycle tracks, footways and recreational paths should be constructed using uncoloured asphalt mixes with a Nominal Maximum Aggregate Size of 12.5mm or 14mm. The gradation and material specifications for each mix are described in detail in Section 11.5 of this document. Asphalt binder shall be 60/70 grade bitumen in accordance with QCS 2014 Section 6, Part 5.

Fine aggregate used in the asphalt mix of cycle tracks and footways shall consist of crushed hard durable rock and shall be of such gradation that when combined with other aggregates in proper proportions, the resultant mixture will meet the required gradation.

Coarse aggregate shall consist of crushed natural stones and gravel. Crushed particles shall be cubic and angular in shape and shall not be thin, flaky or elongated. The gradation shall be such that when combined with other aggregates the resultant mixture will meet the required gradation described in detail in Section 11.5 of this document.

The use of Wadi, beach or dune sand for asphalt works is not permitted. Unless permitted elsewhere in the contract, the aggregate type for Wearing Course and Base Course shall be Gabbro, a coarse-grained, intrusive igneous rock.

Limestone aggregate, which is available in large quantities in Qatar, and recycled concrete aggregate can also be used in the asphalt mixes provided it meets the specification outlined in QCS 2014 Section 6 Part 5 and QCS 2014 and IAN 100 Section 7.3 Amendments to Section 6 – Part 5.

Asphalt wearing course mix design, material specifications and testing procedures shall be as described in Section 11.5 of this document.

Wherever the asphalt pavement includes Asphalt Base Course (Class B) and Asphalt Base Course (Class A), the specifications of the material and asphalt mix shall be as outlined in Qatar National Construction Specifications QCS 2014, Section 6: Part 5 - Asphalt works and Interim Advice Note (IAN) 100 - Section 7.3 Amendments to Section 6: Part 5 - Asphalt works.

Subgrade, road subbase and road base material specifications and testing procedures shall be as described in Qatar National Construction Specifications QCS 2014 and IAN 100 – Section 7.1 Amendments to Section 6: Part 3 and Section 7.2 Amendments to Section 6 Part 4 - Unbound pavement material.

The finer the size, the more closed the asphalt surface is in terms of texture. Larger size mixes have higher stability and shear strength than small size mixes. As the cycle tracks and footways are not subjected to high level of stresses and loading, smaller size mixes are recommended to be used for the surfacing of the cycle track and footway pavement as it can be laid in thinner lifts and they are generally easier to hand place and compact and obtain an even and smooth finish.

If heavy axle loadings are expected to use or frequently cross the cycle tracks and footways, then larger size mixes are recommended. More details on material specifications and pavement layer thickness are presented in Section 11.

6.2 Concrete Surfaces

Concrete pavements for cycle tracks and footways should only be used in special situations and direction is to be sought from the Engineer (PMC) before concrete pavements are used. Concrete mix usually comprises a homogeneous mixture of cement, water and granular material (fine, and course aggregate in addition to sand). Chemical admixtures can also be added to retard set, reduce water or for air entrainment.

Limestone aggregate and recycled concrete aggregate can also be used in concrete surface mixes provided that it meets the required specifications.

The recommended nominal maximum size of aggregate used in cycle track and footway concrete mixes should be 20mm. More details on material specifications and pavement layers thickness are presented in Appendix A.

6.3 Concrete Block Pavers (Interlock)

Concrete block pavers are paving units made of concrete of 60mm, 80mm or 100mm standard thickness. They are often selected for aesthetic purposes and used mainly in recreational areas subjected to heavy foot traffic.

Over weak subgrade, these block pavers require good quality subbase material to provide adequate strength as they are small in size and are not bonded to adjoining units. These pavers can be designed and laid with interlock in both directions.

Structurally, these pavers are placed over one or more unbound granular layer, ranging in thickness from 150mm to 250mm depending on subgrade strength, general use and traffic.

A layer of bedding sand varying between 25mm to 50mm in thickness is used to achieve a smooth and level surface. Jointing sand of a certain gradation is used to assist creating a good frictional bonding mechanism between the interlock pavers.

More details on material specifications and pavement layer thickness related to concrete block pavers are presented in Appendix B.

6.4 Coloured Asphalt Pavement

The use of coloured pavement shall be carefully considered and shall only be used in specific circumstances where there is a potential conflict between the advisory Cycle Track and the carriageway where Cycle Tracks require clear delineation and demarcation.

Designers should consult with PWA Public Realm and Road Safety for further advice when designing Cycle Tracks within the ROW.

Where coloured surfaces are required for the purposes of demarcation or aesthetics, the colour shall be Green RAL 6037 or as otherwise approved by the Engineer. The preferred method of surface colouration shall be with the use of a resin based surface treatment as described in Appendix C and shall be approved by the Engineer.

All colour surface coatings shall be Ultraviolet (UV) stable and shall exhibit no discolouring or colour change for at least 10 years (see typical coating specification in Appendix D of this document). Other coating material of different specifications can also be used subject to the approval of the Engineer (PMC) however the colour stability and guarantee period shall remain as 10 years.

7. Benefits of Using Asphalt Pavement

Factors that should be considered for selecting the preferred pavement type may include the following:

7.1 Client and User Preference

Most joggers and cyclists prefer asphalt surfacing as it is a softer surface compared to concrete or interlock pavers. Furthermore, asphalt surfaced pavements provide a smooth, relatively flexible and joint free surface.

7.2 Constructability

It is easier and more practical to construct asphalt surfaced Pavements in areas of limited space and where the topography is more rugged. Construction time is usually shorter which in turn reduces management and supervision costs. IAN 011 includes further details with regard to the consideration of drainage, etc in the selection process of pavement type.

7.3 Cost

Construction cost for asphalt surfaced pavement is significantly less than the cost of concrete and interlock pavements. A well designed and constructed asphalt pavement will serve a 20 year design life with minimum periodic maintenance works.

7.4 Aesthetics

Construction methods and surface paving techniques for asphalt surfaced pavements allow the pavement to be constructed to varying slopes sometimes dictated by the topography.

The surface can be constructed using different colours by using coloured polymer pigments or specifying coloured aggregate, subject to Section 6.4.

7.5 Maintenance

Proper design and construction of asphalt pavement should require minimum maintenance effort in the first 10 years. Asphalt pavement can be quickly repaired in case defects occur. The repair of concrete pavement is very costly especially if differential settlement takes place.

8. General Guidelines for Cycle Track and Footway Construction

In principle, for cycle track and footway construction, the following shall be noted:

- All material specifications shall be according to QCS 2014, IAN 100 and specifications outlined in this document.
- Cycle Tracks are to be provided in Asphalt Surfacing unless otherwise directed by the Authority (Ashghal) / Engineer.
- Shared use paths to be provided in Asphalt Surfacing unless otherwise directed by the Authority (Ashghal) / Engineer.
- Kerbs and associated foundations shall be used at the edges of all cycle tracks, footways and shared use paths.
- Geometry of cycle tracks is to conform to IAN 011 - Cycle Track Design Guidelines.
- Surface evenness shall comply with QCS 2014 and/or as outlined in Section 9.2 of this document.

9. Cycle Track and Footway Surface Features

9.1 Surface Tolerances

The maximum tolerances for grooves i.e. narrow slot in the surface that could catch a bicycle wheel, such as a gap between two concrete slabs, shall be as follows (Reference: Austroads - Part 6A (2009) and Californian Department of Transportation (2006):

- Perpendicular to travel maximum - 20 mm
- Parallel to travel maximum - 12.5 mm

The maximum tolerances for Steps i.e. ridges in the pavement, such as that which might exist between the pavement and a concrete gutter or manhole cover, shall be as follows:

- Perpendicular to travel maximum - 18 mm
- Parallel to travel maximum - 9 mm

9.2 Surface Evenness

The Contractor shall test the evenness of surface and other pavement layers to determine compliance. The results of such tests shall be provided to the Engineer (PMC) for approval.

The Contractor shall use a 3m long straightedge (with a crown template where necessary) of sturdy and approved design to carry out the checking of the surface evenness.

Any layer containing deviations or variations exceeding the tolerances specified here shall be corrected or removed and replaced in accordance with the instructions of the Engineer (PMC) and to his satisfaction.

The longitudinal regularity of the surface of various pavement layers for Cycle Tracks and Footways shall be within the relevant limits given in Table 1.

Table 1: Evenness and Irregularity Requirements for Asphalt Surfaced, Interlock Paved Surfaces, Base and Subbase Layers of Cycle Tracks and Footways

	Road Base And Subbase Layers of Cycle Tracks And Footways				Interlock Paved Cycle Tracks and Footways		Asphalt And Concrete Surfaced * Cycle Tracks and Footways
Irregularity (mm)	4		7		7		Average IRI value over a 400 metre section < 1.2 m/km.
Length (m)	300	75	300	75	300	75	**Where the width of the cycle tracks and footways allows testing for evenness*
Number of Irregularities	40	18	9	2	9	2	

Any irregularity is a variation of not less than 4mm or 7mm of the profile of the cycle track/footway surface as measured by a rolling straight edge. No irregularity exceeding 10mm shall be permitted.

Compliance with Table 1 above shall be tested with a rolling straight edge along any line or lines parallel to the centre line of the pavement on sections of 300m selected by the Engineer (PMC), whether or not it is constructed in shorter lengths. Sections shorter than 300m forming part of a longer pavement shall be assessed using the number of irregularities for a 300m length prorated to the nearest whole number. Where the total length of pavement is less than 300m the measurements shall be taken in 75m lengths.

Pavements shall also be measured transversely for irregularities at points decided by the Engineer (PMC) by a 3m long straight edge placed at right angles to the centre line of the

cycle track / footway. The maximum allowable differences between the pavement surface and the straight edge shall be 4mm.

10. Cycle Tracks and Footways Pavement Design Inputs

10.1 Design Load

The recommended design load for low volume and low load cycle tracks and footways is 4 tonnes. If the pavement access arrangements are such that heavier loads on the pavement can occur regularly, then the heavier design loads to account for this must be agreed with the Engineer (PMC).

10.2 Pavement Thickness

Determination of pavement layer thicknesses depends largely on the loading imposed on the cycle tracks and footways pavement, soil strength and the properties of the asphalt/concrete mix used in construction.

In general, despite the cycle tracks and footways are designed for cyclist and joggers and pedestrian, but still other types of vehicles may have an access to it for various reasons such as construction, inspection patrols, emergency cars or maintenance vehicles and small size trucks.

10.3 Subsoil Strength in Qatar

Soil in Qatar is considered of high strength and a CBR value of 15% and higher can be achieved almost everywhere in Qatar. Similar to roads, a geotechnical investigation to obtain information on soil strength, gradation, organic matters, water table level, etc shall be undertaken.

Based on the above factors, in particular the soil strength, a layer of base/subbase and/or geotextile material may be used in order to improve the pavement stability and enhance the loading capability of the underneath layers.

Stabilization of the subgrade and subbase using various techniques can be also used in order to enhance the loading capacity of the pavement and to minimize the risk of premature failure due to weak subgrade and low quality material.

10.4 Minimum Asphalt Layer Thickness

For asphalt mixtures with Nominal Maximum Aggregate Size of 14mm**,** the minimum layer thickness for asphalt surface shall be 50mm.

For asphalt mixtures with Nominal Maximum Aggregate Size of 12.5mm**,** the minimum layer thickness for asphalt surface shall be 40mm.

The Nominal Maximum Aggregate Size is defined as one size larger than the first sieve that retains more than 10 percent aggregate.

This limit shall be modified depending on the nominal maximum size of aggregate used in the asphalt mixtures used to pave the cycle tracks and footways pavement.

10.5 Minimum Granular Base Layer Thickness

If required the minimum thickness for the aggregate base layer be 150mm for asphalt surfaced pavement. This thickness is required for both structural capacity and for proper constructability.

10.6 Minimum Granular Subbase Layer Thickness

The subbase layer may be required in areas of poorer quality subgrade material or where high water table exists. A Geotextile material shall be used in conjunction with this subbase layer to protect the pavement structure from the effects of moisture changes in case considerable water table fluctuations.

In case a subbase layer is required, it is recommended that the minimum thickness for the aggregate subbase layer be 150mm for asphalt surfaced pavement.

11. Recommended Pavement Structures for Cycle Tracks and Footways

The recommended pavement structure types for cycle tracks and footways referenced to MMUP Standard Detail SD 6 -11-104 are shown in Table 2 and 3 below.

Table 2: Recommended Pavement Types

Purpose	Location	Asphalt	Interlocking Concrete Pavers	Granite Pavers [A)]
Pedestrian Footways	Commercial / Residential/Rural	A1	B1	G1
	Industrial	A1	B2	-
Cycle Tracks And Shared Use Paths	All Locations	A2	B2	-
Vehicular Loaded Driveways And Plazas	All Locations	-	See Note [B)]	G2

[A)] Granite Pavers Used Subject To Engineer Approval
[B)] Refer To Public Works Authority Standard Detail SD 6-11-102 For Concrete Paver Vehicle Run In

Table 3: Recommended Pavement Structures

Pavement Type	Surfacing	Base Course	Subbase
A1	40mm Asphalt Concrete	Nil	150mm
A2	50mm Asphalt Concrete	Nil	150mm
B1	60mm Paver on 30mm Sand Bed (Straight Edge or Maximum 4mm Bevel)	Nil	150mm
B2	60mm Paver on 30mm Sand Bed (Straight Edge or Maximum 6mm Bevel)	Nil	150mm
G1	70mm Granite Paver on 30mm Sand Bed	Nil	150mm
G2	150mm Granite Paver on 30mm Sand Bed	150mm CBM2	200mm

11.1 Subgrade Preparation

It is recommended that cycle tracks, footways and recreational paths to be constructed to match the profile of existing land topography as closely as possible. The edge of the pavement should be constructed to be at the same level of the native subgrade in order to avoid any sharp drops from the path edges.
Subgrade should be prepared by only removing the loose surface material, rubbish and vegetation, shaping grade, scarifying the surface to a minimum of 150mm then watering /moisturizing the surface and then compacting to the required specification.

In order to provide adequate support to the pavement, the subgrade shall be prepared properly. No vegetation, organic matters shall be allowed. The subgrade shall be compacted in accordance to the specification outlined in QCS 2014, Section 6, Part 3, Clause 3.6.6. This requires that the subgrade shall be compacted to a minimum of 95% of the maximum dry density. The moisture content shall also be controlled during compaction to a maximum 2% as required by QCS 2014, Section 6, Part 3, Clause 3.6.6.

11.2 Cycle Tracks and Footways Lateral Restraint

Cycle Tracks and footways constructed using either asphalt surface, concrete or block pavers require lateral restraint at the pavement edges to maintain their functional and structural integrity. The lateral restraint to be used for footways and cycle tracks is shown in Public Works Authority Standard Detail Drawing SD 6-11-205 Edge Piece Foundation Details.

Figure 1: Detail of Lateral Restraint for Footways and Cycle Tracks

The recommended edge restraints/separations systems and dimensions are described in the Table 3 below. Alternatives such as cast in place concrete kerbs, drainage channels, fences and walls may also serve the same purpose at the approval of the Engineer (PMC).

Table 4: Edge Restraints/Separations Systems and Dimensions

Type	Pavement Type	Dimensions	Reference
Pre-Cast Concrete (PCC)	All Flexible	50mm×250mm (E2) Or 50mm×250mm-Chamfered (K9)	
Additional Width Of Granular Base	All Flexible	300mm Desirable 150 Mm Min.	Austroads - (1999)

The type and location of edge restraint may have implications for the maintenance and aesthetics of the cycle tracks and footways. It will assist in defining the cycle tracks and footways path especially at night, and provide edge that is more easily maintained. The additional support provided by a wider granular base allows better edge compaction of asphalt surfacing.

11.3 Typical Kerbing Construction Details

For detailed kerbing and Edging Details refer to Public Works Authority Standard Details Drawing SD-6-11-104 for the kerbing details between the road carriageway and the cycle tracks.

11.4 Pavement Extent

It is recommended to extend the pavement of the cycle tracks and footways beyond the surface. A minimum width of *150mm* is recommended but an additional width of *300mm* for the granular base/subbase beyond the cycle tracks and footways surface is preferred (Figure 3).

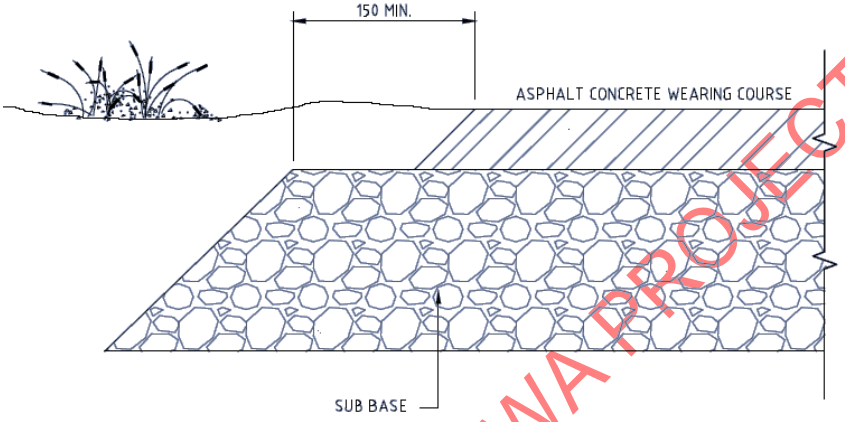


Figure 3: Cycle Tracks and Footways Pavement Extent

11.5 Hot Asphalt Mix Design for Cycle Tracks and Footways

11.5.1 Pavement Asphalt Binder

The pavement asphalt binder for Cycle Tracks and Footways shall be 60/70 grade bitumen in accordance with QCS 2014 Section 6, Part 5.

11.5.2 Aggregate Material for Bituminous Mix

The recommended asphalt mix design for Cycle Tracks and Footways Asphalt Concrete mix is a Wearing Course mix design in accordance with QCS 2014 Section 6 Part 5 Clause 5.3.2.

The quality of the Aggregate used in asphalt mix for the cycle tracks and footways shall meet the requirements in QCS 2014 Section 6, Part 5 and IAN 100 Section 7.3 Amendments to Section 6 – Part 5.

Pavements of the cycle tracks and footways are usually not subjected to heavy loading. Also, these paths are sometimes constructed in areas difficult for large size construction equipment to access. Therefore, in order to have a mix with good durability, it should be relatively of higher asphalt content. This rich asphalt mix will provide good surface texture and reduce segregation or ravelling.

The recommended asphalt mix design criteria for the cycle tracks and footways are shown

in Table 6 below:

Table 6: Recommended Asphalt Mix Design Criteria for Cycle Tracks and Footways

Design Criteria	60/70 Marshall Method	Remarks
Compaction	75 Blows per side or 80 Cycles (Gyration)	
Stability (Kn)	8 Min.	Avg. 3 specimens
Flow, 0.25mm	2-5mm	Avg. 3 specimens
Percent Air Voids (AV)	5-8	Avg. 3 specimens
Stiffness (Stability/Flow)	3 Min.	
Percent Voids in Mineral Aggregate (VMA)	14% Min.	Avg. 3 specimens
Percent Voids Filled with Bitumen (VFB)	50 - 75%	Avg. 3 specimens
Tensile strength ratio, % Retained	75% Min.	Avg. 3 specimens
Density as percent of Maximum theoretical Density	96-101	Avg. 3 cores /200 m.R
Asphalt Content (% AC)	TBD	Individual test

12. References

1 *AASHTO (1993). AASHTO Guide for Design of Pavement Structures. American Association of State Highway and Transportation Officials, AASHTO, Washington D.C., USA.*

2 *Qatar Construction Specifications-QCS 2010, QCS 2014 or the latest version.*

3 *IAN 011 - Cycle Track Design Guidelines, 2012.*

4 *IAN 100 - Amendment to QCS 2014.*

5 *Austroads (1999). A Guide to traffic Engineering Practice - Part 14: Bicycles. Austroads, Sydney, Australia.*

6 *Austroads (2009): A Guide to Road design - Part 6A: Pedestrian and Cyclist Paths, P25. Sydney, Australia.*

7 *California Department of Transportation (2006).*

8 *ASTM D3515-96 – Standard Specification for Hot Mixed, Hot Laid Bituminous Paving Mixtures". American Standards and Testing Materials. USA.*

9 *Qatar Highway Design Manual - QHDM, 1999-Doha-Qatar*

Appendix A – Concrete Surfaced Pavement

A.1 Recommended Concrete Pavement Layer Thickness

Concrete surfaced pavement is only recommended in limited situations or under special circumstances. Approval for the installation of such a surface must be sought from the Engineer (PMC) / Authority (Ashghal) prior to the commencement of any works. Where concrete pavements are agreed to by the Engineer / Authority the recommended thicknesses for concrete pavement for cycle tracks and footways are shown in Table A1 below.

Table A1: Recommended Thickness for Concrete Pavement for Cycle Tracks and Footways

Concrete Pavement		
Pavement Layer	**Cycle Tracks And Footways in Urban Areas (**Residential, Commercial And Industrial	**Cycle Tracks And Footways in Rural Areas**
Surface Layer	100 mm Portland Cement Concrete (PCC) layer	100 mm Portland Cement Concrete (PCC) layer
Granular Road Base, CBR≥80%	-	150 mm
Granular Subbase Layer, CBR≥60%	150 mm	-
Subgrade of CBR≥15%	+300 mm	+300 mm

A.2 Concrete Mix Design for Cycle Tracks and Footways Pavement

If concrete pavement is to be used, the following should be taken into consideration.

1. Design mix should take into account location of pavement.
2. Poured concrete should consider embedded patterns and colours in their design to enhance the aesthetic value.
3. The recommended nominal maximum size of aggregate used in cycle tracks and footways concrete mixes should be 20 mm.
4. Water, cement and aggregate specification shall be as outlined in *Section 5, Part 16 of the QCS 2014.* If the pavement is located in areas exposed to sea spray (e.g. along the Corniche), that would make normal concrete mix prone to spalling and hence should be avoided.
5. If reinforced concrete is recommended, it shall be A393 Reinforcement Steel Mesh manufactured according to BS4483.
6. The concrete slabs for cycle tracks and footways shall be jointed every 2 m, 3 m or 6 m as per the direction of the Engineer (PMC).

8. In places, where the concrete is in contact with the soil, ground water, exposed to seacoast, and sea water, the concrete is exposed to attack from sulphates that are present in excessive amounts, which damage the structure. In this case, it is recommended to use Sulphate Resisting Portland Cement (SRC) which shall comply with BS 4027–1996, Class 42.5N or ASTM C150:09 Type V. This type of cement is a type of Portland cement in which the quantity of tricalcium aluminates is less than 5%.
9. The recommended values of the unconfined compressive strength for different types of cycle tracks and footways paved with concrete surface are described in the Table A2 below:

Table A2: Recommended Minimum Values of the Unconfined Compressive Strength for Concrete Mix under Different Traffic Load Levels

Traffic Load Level	Minimum 7 Days Compressive Strength (MPa)
Cycle Tracks and Footways – Light traffic, Axle load <4kn	22.5
Cycle Tracks and Footways – Heavy traffic, Axle load>4kn	32

Appendix B – Interlock Paver Blocks Pavement

B.1 Structural Design and Performance Specifications

Interlock Paver Blocks are to be used for Footways only, and shall not be used for cycle tracks. Interlock Paver Block shall only be used for Footways at the approval of the Engineer (PMC) / Authority (Ashghal). The following technical requirements shall be read along with the requirements and technical specifications outlined in QCS 2014, Section 6, Part 11 (Kerbs, Footways and Paved Areas). Technical requirements outlined in this document shall supersede the same in QCS 2014.

- Typical Concrete Blocks used in the construction of the pavements of non trafficked areas such as Footways, medians strips, verges and lay-bys shall be 60mm thick.
- Typical Concrete Blocks for vehicular applications are 80mm thick as recommend by the Interlocking Concrete Pavement Institute (ICPI). Thicker concrete blocks of 100mm may be used also if required by the Engineer (PMC) / Authority (Ashghal).
- All units shall be hard, sound, clean with sharp and well defined areas and free of defects.
- The paver blocks shall be manufactured with a dense structure, water proofed surface free from cracks. The wearing surface layer must be formed as an integral part of the core concrete of the block and shall not be less than 5mm thick.
- The 28-days compressive strength of paving blocks shall be as described in Table B1.

Table B1: Compressive Strength Requirements of Paving Blocks

Standard	Sample Size	Specimen Condition	Compressive Strength (N/mm^2) *Average*	Compressive Strength (N/mm^2) *Individual*
BS 6717	16 Nos.	Wet	>49	40
ASTM C939	3 Nos.	Dry	55	50

- To ensure durability, concrete used for paving blocks shall have a cement content of not less than 400kg/m3 of the compacted concrete.
- When tested for durability in accordance with ASTM C 418 “Test Method for Abrasion Resistance of Concrete by Sand Blasting”, the paving bloc ks specimen shall not have a greater volume loss than 15 cm3 per 50 cm2 and average thickness loss shall not exceed 3 mm. ASTM C944 can be used as an alternative to ASTM C 418 for evaluating the wear resistance of paving blocks.
- The minimum recommended thickness of the Bedding Sand layer is 25mm, but preferred to be 50mm.
- Structurally, the layer coefficient (a1) for the concrete pavers and the bedding sand is set to 0.44 as per the AASHTO method which is typical for an asphalt concrete pavement.
- For the Granular Base material, the minimum thickness recommended by the Interlocking Concrete Pavement Institute (ICPI) are shown in Table B2 below:

Table B2: Minimum Thickness Recommended for Granular Base Layer

Traffic Level (ESAL)	Designation	Description	Minimum Base Thickness (mm)*
<500,000	GB	Granular Base Material- Unbound	150
>500,000	GB	Granular Base Material- Unbound	200
	CBM	Cement Bound Material	180
	BBM	Bitumen Bound Material	180

- For the Granular Subbase material, the minimum thickness recommend by the Interlocking Concrete Pavement Institute (ICPI) are shown in Table B3 below:

Table B3: Minimum Thickness Recommended for Granular Subbase Layer

Traffic Level (ESAL)	Designation	Description	Minimum Base Thickness (mm)*
<500,000	GSUB	Granular Subbase Material- Unbound	150
>500,000	GSUB,	GSUB,	200
	CBM / BBM	Cement Bound Material/ Bitumen Bound Material	180
**Average recommended based on soil strength of CBR 15% and good drainage condition. The actual subbase thickness can be calculated using AASHTO design method if weaker subgrade is encountered.*			

- Subbase thickness varies with traffic, climate and subgrade strength. The actual subbase thickness should be determined using AASHTO design method.
- The best international practices recommend that, for Cement stabilized /bound base material, a 150mm of granular base material must be placed underneath for constructability.
- If the subbase layer thickness required is less than 100mm, then that layer would typically be converted to additional granular base material.

B.2 Interlock Pavement Structures

1. Typical interlock pavement structure for non-trafficked areas - Footways

The structure shown in Table B4 below can be used in the construction of the pavements of non trafficked areas such as Footways, medians strips, verges and lay-bys.

Table B4: Recommended Interlock Pavement Structure of Non Trafficked Areas such as Footways, Medians Strips, Verges and Lay-bys

Concrete Block Pavers (Interlock)		
	Footways In Urban Areas, Residential, Commercial And Industrial	**Footways Rural Areas**
Surface layer	60 mm, (7-days CS≥32 N/mm^2) or 28-days CS≥40 N/mm^2)	60 mm, (7-days CS≥32 N/mm^2) or 28-days CS≥40 N/mm^2)
Bedding	Minimum 30mm Sand Material	
Granular Subbase Layer, Class C, CBR>=60%	150 mm	150 mm
Subgrade of CBR≥15%	+300 mm	+300 mm

2. Typical interlock pavement structure for low traffic - Driveways and Parking

For low trafficked road of less than 1.0 million ESAL over the design life, the following typical designs can be adopted:

- ***For traffic <0.5m ESAL***
  80mm Precast Interlock Block
  50mm bedding Sand
  150mm Granular base material, CBR>=80%
  150mm Granular subbase material, CBR>=60%
  +300mm Subgrade of CBR≥15%

- ***For traffic 0.5m -1.0m ESAL***
  80mm Precast Interlock Block
  50mm bedding Sand
  150mm Granular base material, CBR>=80%
  200mm Granular subbase material, CBR>=60%
  +300mm Subgrade of CBR>15%

3. Typical interlock pavement structure for high traffic >1.0m ESAL - Driveways and Parking

Interlock detailed pavement design can be accomplished using AASHTO pavement design method, depending on traffic level, drainage condition and the subgrade type (clay, silt sand rock etc).

The minimum base and subbase limits should be considered during the design calculations.

B.3 Bedding and Jointing Sand

The bedding and jointing sand may be either natural sand or crushed rock fines complying with the grading envelop shown in Table B5 below.

Table B5: Bedding and Jointing Sand Gradation

Nominal Sieve Size (Mm)	% Passing	
	Bedding Sand	Jointing Sand
10	100	100
5	90-100	100
2.36	75-100	95-100
1.18	55-90	90-100
0.60	35-70	55-100
0.30	8-35	15-50
0.15	0-10	0-15
0.075	0-3	0-3

The sand is laid so that after compaction, it forms a bedding layer of 50mm thick. The placement and laying procedure details are given in QCS 2014 Section 6, Part 11 (Kerbs, Footways and Paved Areas).

After placement, the blocks shall be compacted using vibrating plate compactor or any other suitable compaction equipment to ensure that sand is vibrated into the joints (Refer to QCS 2014, Section 6, Part 11 (Kerbs, Footways and Paved Areas and Sections B.5 - B.7 of this document for more details on compaction, laying and placement).

B.4 Natural Stones Pavement Structures

Natural stone pavement structures shall only be used at the approval of the Engineer (PMC) / Authority (Ashghal). If Granite or any other ornamental natural stones are to be used for the Footways or Vehicular loaded driveways, it is necessary to have suitable robust foundation. This usually comes in the form of a concrete slab. The thickness of this slab depends on the function, loading and the intended use of the structure. Depending on level of loading, the following structures are recommended (Table B6).

Table B6: Natural Stones Pavement Structures

	Pedestrian Loaded Footways and Plazas	Vehicular Loaded Driveways
Surface layer	60 mm, Granite Paving	150 mm Granite Paving
Laying Course (Sand and cement mortar)	30mm min. (*preferred 50mm)*	30mm min. (*preferred 50mm)*
Concrete Slab with Dowels, 20mm Ø, 400mm long, 600mm centres	150 mm	200 mm*
Granular Subbase Layer, CBR>=60%	150 mm	150 mm
Subgrade of CBR≥15%	+300 mm	+300 mm
The concrete slab can be replaced by a Cement Bound Material (CBM) layer of equivalent thickness if found more practical.		

B.5 Placement

This includes placing the precast blocks on a compacted course of sand (50mm compacted layer), which may be either natural sand or crushed rock fines complying with envelop complying with grading for Laying Course Sand specified in Table 8.2, of QCS 2014 Section 6, Part 11. The laying course sand layer is laid on compacted granular base and subbase layers.

B.6 Compaction

After placement, the interlock blocks are compacted using a vibrating plate compactor and finally, sand is vibrated into the joint as outlined in Section 6, Part 11, Clause 11.4 of QCS-2014. Compression using Vibrator Roller can be used for heavy traffic interlock structures.

The following practices during the design/construction works are recommended:

- Thicker bases may be required in weak soils.
- During construction, the bottom elevation of the existing asphalt pavement must be below bedding sand.
- Concrete beams at the ends of pavement may be necessary if asphalt is subject to heavy traffic which may cause rutting.
- The edge restraints to the paved area shall be laid in advance of the laying course and all permanent obstacles within the area, such as manhole covers, shall be adjusted to the correct finished levels.
- No need for drain holes to subgrade when water table is less than 0.6m from the top of the soil subgrade. In this case, drain hole to catch basins are required.
- It is recommended to use interlock in areas subjected to car traffic only.
- The profile of the laying course before compaction shall be similar to that of the finished surface. During laying, the sand shall be uniform in moisture content and shall be carefully, screened to form a smooth compacted surface to receive the paving blocks. The maximum deviation from the design levels shall be +5 mm.

B.7 Recommended Design / Paving Shape

The paving shape recommended by international standards is the herringbone pattern at 45o and 90o. This shape is recommended by the Interlocking Concrete Pavement Institute (ICPI), as it was found to be the most effective laying pattern that offers improved structural capacity.

Herringbone pattern is ideally suited for driveways and other places within the lot that is ordinarily used by cars because it can provide a structural enhancement for the surface of the decking to accept and accommodate heavy loads such as cars and trucks. Herringbone patterns promote even load bearing and reduces the possibility for movement of the paving units and pavement system as a whole.

In a situation where it is anticipated that vehicles will brake heavily or accelerate consistently or make repeated turns, the Stretcher bond pattern (a side-by-side appearance which is considered the simplest to install) should be implemented.

Appendix C – Surface Coating Specification

C1. Surface Coating Specification

Materials used for the coating of the Cycle Tracks and Footways asphalt pavement shall consist of the following:

- A resin based coating specifically designed for application on asphalt pavement to provide a safe, durable long lasting colour and texture to the asphalt pavement surface.
- The coating shall have a light fast binder system available in colours to match the colour scheme approved by ASHGHAL.

The following tables include the specifications and the minimum performance properties of two coating materials applied onto asphalt pavement to demarcate Cycle Tracks and Footways lanes.

The selection of the coating type is a project specific and at the discretion of the Engineer/Client.

Table C-1: Typical Physical Properties of Coating

Characteristic	Test Specification	Coating Type 1 Specification	Coating Type 2 Specification
Solids by Volume	ASTM D-2697	93.7%	55%
Solids by Weight	ASTM D-2369	>97.0%	69%
Density	ASTM D-1475	1.52 kg/l	1.6 kg/l

Table C-2: Typical Performance Properties of Coating

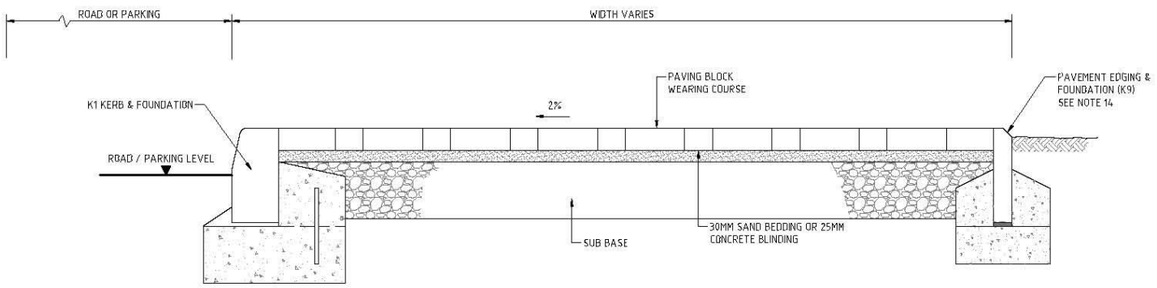
Characteristic	Test Specification	Coating Type 1 Specification	Coating Type 2 Specification
Dry Time (To re-coat)	26^0 C 50 % RH ASTM D-5895, $23^{.0}$ C 37 % RH	4 hours	35 min
Taber Wear Abrasion Dry H-10/000g	BS EN ISO 5470-1 ASTM D-4060 7 days cure	1423 mg/1000 cycles	980mg/10000 cycles
Taber Wear Abrasion Wet H-10/000g	ASTM D-4060 7 days cure	NPD	3400mg/10000 cycles
Accelerated Weathering Environment	BS EN 1062-11, 2000 hrs	No blistering, cracking or flaking.	NPD
Accelerated Weathering Environment	ASTM G-154, Delta E 1500 hrs	NPD	0.53
Hydrophobicity Water Absorption -9 days immersion	ASTM D-570	NPD	8.3%
Shore hardness	ASTM D-2240	>45 Type D	63 Type D
Mandrel Bend	ASTM D552-93A	NPD	6.1mm (1/4") @21^0C
Performance	BS EN 1062-3	1.3 g/m^2/$hr^{0.5}$	NPD
Performance	ASTM D1653	NPD	3.45 g/m2/hr (1.32mm)
Volatile Organic Compound (VOC)	EPA-24 ASTM D 3960-05	7.6 g/l	18.7 g/l
Adhesion to Asphalt	BS EN 1542 ASTM D-4541	Substrate failure	Substrate failure
Measurement of Slip/Skid Resistance (Pendulum Test)	BS EN 13036-4	Wet 64 Dry 104	NPD
Friction (Wet) - Wheel Path Coated	ASTM E 303 British Pendulum Tester		64
Friction (Wet) – Wheel Path Uncoated	ASTM E 303 British Pendulum Tester		57
Friction (Wet) – Adjacent Kerb Coated	ASTM E 303 British Pendulum Tester		73
Friction (Wet) – Adjacent Kerb Uncoated	ASTM E 303 British Pendulum Tester		60

Table C-3: Typical Coating Thickness

Characteristic	Test Specification	Coating Type 1 Specification	Coating Type 2 Specification
Passes	No.	1	9
Thickness	Dry (DFT)	>1.0 mm	>1.0mm

The recommended method of substrate or surface preparations, equipment and application procedures for the coating shall be as per the instructions of the material supplier and subjected to Engineers approval.

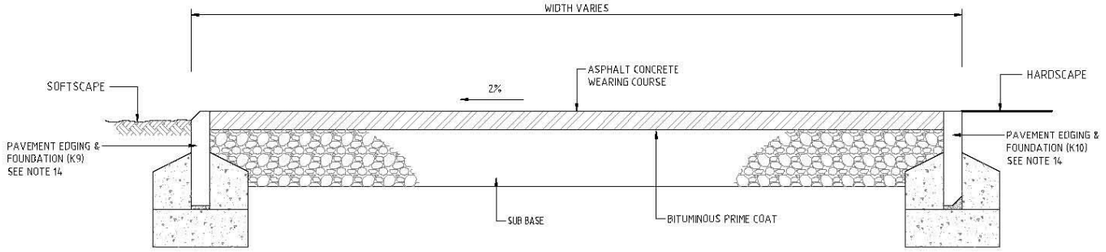
The manufacturer shall provide a guarantee for at least a 10 year period.



PEDESTRIAN FOOTWAY OR SHARED USE PATH (PAVING BLOCK SURFACE) SEE TABLE FOR ASPHALT PAVEMENT

PURPOSE	LOCATION	ASPHALT	INTERLOCKING CONCRETE PAVERS	GRANITE PAVERS (NOTE 16)
PEDESTRIAN FOOTWAYS	COMMERCIAL / RESIDENTIAL/RURAL	A1	B1	G1
	INDUSTRIAL	A1	B2	-
CYCLE TRACKS AND SHARED USE PATHS	ALL LOCATIONS	A2	B2	-
VEHICULAR LOADED DRIVEWAYS AND PLAZAS	ALL LOCATIONS	-	NOTE 15	G2

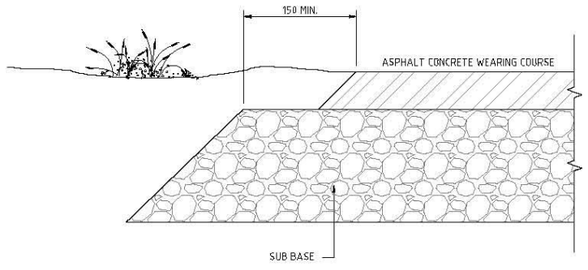
ALLOWABLE PAVEMENT TYPES



CYCLE TRACK (ASPHALT CONCRETE WEARING COURSE) SEE TABLE FOR CONCRETE PAVING BLOCK PAVEMENT

PAVEMENT TYPE	SURFACING	BASE COURSE	SUBBASE
A1	40MM ASPHALT CONCRETE		150MM
A2	50MM ASPHALT CONCRETE		150MM
B1	60MM PAVER ON 30MM SAND BED (STRAIGHT EDGE OR MAXIMUM 4MM BEVEL)		150MM
B2	60MM PAVER ON 30MM SAND BED (STRAIGHT EDGE OR MAXIMUM 6MM BEVEL)		150MM
G1	70MM GRANITE PAVER ON 30MM SAND BED		150MM
G2	150MM GRANITE PAVER ON 30MM SAND BED	150MM CBM2	200MM

PAVEMENT TYPES - STRUCTURE



CYCLE TRACKS AND FOOTWAYS PAVEMENT EXTENT (UNCONFINED EDGE)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE CURRENT Q.C.S. UNLESS OTHERWISE AGREED WITH THE ENGINEER.
3. SHARED USE PATH TO BE PROVIDED IN BLOCK PAVING SURFACING UNLESS OTHERWISE AGREED
4. CYCLE TRACKS TO BE PROVIDED IN ASPHALT SURFACING UNLESS OTHERWISE AGREED.
5. A 1.5m WIDE LANDSCAPED BUFFER BETWEEN ROAD EDGELINE AND CYCLE TRACK/SHARED USE PATH IS PREFERRED IN URBAN AREAS.
6. WHERE FOOTPATH OR SHARED USE PATH DOES NOT ABUT ROAD OR PARKING USE K9/K10 EDGE PIECE & FOUNDATION INSTEAD OF KERB & FOUNDATION.
7. WHERE CYCLE TRACK/LANE ABUTS ROAD OR PARKING USE KERB & FOUNDATION INSTEAD OF EDGE PIECE & FOUNDATION.
8. WIDTHS, CLEARANCES & HEADROOM OF SHARED USE PATHS & CYCLE TRACKS TO BE IN ACCORDANCE WITH MMUP "TYPICAL ROAD CROSS SECTIONS & UTILITY CORRIDORS" AND INTERIM BICYCLE DESIGN GUIDELINE.
9. GEOMETRY OF CYCLE TRACKS TO CONFORM TO INTERIM BICYCLE DESIGN GUIDELINES & UK TA 90/05 CHAPTER 4. SIGNING & LANE MARKING TO CONFORM TO UK TRAFFIC SIGNS MANUAL UNLESS OTHERWISE REQUIRED IN QATAR TRAFFIC MANUAL OR INTERIM BICYCLE DESIGN GUIDELINES.
10. PEDESTRIAN FOOTPATH OR SHARED USE PATH CONSTRUCTED IN PAVERS SHALL CONFORM TO THE NEW QATARI STREET - NATIONAL PUBLIC REALM GUIDELINES.
11. PAVER BEVELS & LAYING PATTERNS SHALL CONFORM TO INTERIM BICYCLE DESIGN GUIDELINES.
12. SURFACE IRREGULARITY SHALL COMPLY WITH THE QCS SPECIFICATION FOR MINOR ROADS, BITUMINOUS CARRIAGEWAY WEARING COURSE.
13. WHERE PORTIONS OF A CYCLE TRACK OR FOOTWAY ARE USED AS ACCESS, OR SUBSTANTIAL HEAVY VEHICLE USE IS EXPECTED DURING THE DESIGN LIFE, THESE PORTIONS SHALL BE DESIGNED IN ACCORDANCE WITH QHDM FOR THE TRAFFIC LEVEL EXPECTED.
14. REFER TO DRG No. SD 6-11-205 FOR EDGE PIECE FOUNDATION DETAILS.
15. REFER TO STANDARD DETAIL DRG. No. SD 6-11-102 FOR CONCRETE PAVER VEHICLE RUN IN.
16. GRANITE PAVERS USED SUBJECT TO ENGINEER APPROVAL.

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QCS Section:
Section 6 - Road Works
Part 11 - Kerbs, Footways and Paved Areas

Drawing Title:
FOOTWAY, SHARED USE PATH & CYCLE TRACK PAVEMENTS

Approved:	Sheet No: 1 OF 1
Date: JULY 2015	Scale: N.T.S.
Drawing Number: SD 6-11-104	Revision: 3