07-00- Road Pavement Materials

07-01 Carriageway Shape and Tolerances

a. The acceptable tolerances for the various layers are as follows.

Table 07-01

Surface Course	+6 mm	-6 mm
Binder Course	+6 mm	-6 mm
Base Course	+15 mm	-15 mm
Sub-base	+10 mm	-30 mm
Capping Layer	+20 mm	-30 mm
Formation	+20 mm	-30 mm

b. Notwithstanding the tolerances permitted in surface levels, the cumulative tolerance shall not result in a reduction in thickness of the pavement (asphalt layers) excluding sub-base by more than 15 mm form the specified thickness nor the reduction in the surface course depth by more than 5 mm form that specified.

c. Where any tolerances are exceeded, the area shall be made good as required by the Engineer.

d. The Binder course and Surface coat may be checked for irregularities at points identified by the Engineer with a 3 m straight edge. The straight edge will be used parallel to the kerb line or at right angles to the centre line of the road. The maximum allowable deviation to the surface bellow the straight edge will be 3mm for Surface Coat and 6mm for Binder Course. A suitable 3m straight edge shall be provided by the Developer.

e. Sub-base, base course and binder courses are to be inspected by the NYC Engineer prior to laying any subsequent course. If any course is found to be substandard or defective it must be replaced at the developer's expense.

07-02 Formation

a. For the avoidance of doubt, in this specification "formation" refers to the top of the natural or Engineered Subgrade, prior to laying of any pavement construction material including capping materials.

b. Preparation and surface treatment of the formation shall be carried out only after completion of all sub-grade drainage.

c. Trenches for ducts, gully connections and utilities located in roads or footpaths shall be back filled with Type 1 Sub-Base in layers not exceeding 225mm that shall be compacted thoroughly using suitable plant, as detailed in paragraph 07-06, with the specified number of passes. All such trench fill shall be to the Engineers satisfaction. Where the quality or the workmanship of the backfilling is questioned, the Engineer may require CBR tests to be undertaken.

d. To avoid damage construction traffic shall not run on the formation. Any damage that occurs shall be made good to the satisfaction of the Engineer. The formation shall be covered the day it has been exposed.

07-03 Capping Layer

a. All material used for capping layers shall comply with SHW Series 600 and be certificated from an approved testing Laboratory. Certification for all capping 6F5 shall be provided to the Engineer.

b. All materials used shall pass a 125mm BS sieve but no more than 12% shall pass a 63-micron BS sieve. The wet 10% fines value of the material shall not be less than 30 kN when tested in accordance with BS 812.

c. The capping material shall be compacted in conjunction with National Standards as set out in Table 07-02. Capping layer (200mm compacted thickness) shall be compacted in a minimum of two layers using Vibratory rollers in the 1300 to 1800 Kg/m range. For restricted areas, plate compactors in the 1400 to 1800 kg/m^2 may be used. Fill shall be laid in 110mm maximum thickness layers using the recommended number of roller passes. Any changes from the above shall be agreed in writing by the Engineer before compaction commences.

d. Materials used within 450mm of the surface of the road shall not be frost susceptible as defined by the test described in BS 812 part 124 and SHW. The material shall be deemed to be none frost susceptible if in the tests the heave is less than 15 mm.

e. Any recycled materials brought onto site for use in connection with any part of road or footway construction shall have the prior written approval of the Engineer and shall comply fully with SHW Clause 710 (See appendix H)

f. The capping layer materials, once compacted, shall achieve a minimum CBR of 15% on a plate-bearing test on a 600mm plate.

Table 07-02

Capping material	**Requirements**
minimum 200mm compacted thickness unless otherwise agreed in writing	SHW series 600, Table 6/1 Class 6F5
Grading	SHW Table 6/5
Resistance to Fragmentation	Los Angeles Coefficient (LA) of 50 or less in accordance with SHW Series 800
Water content	To BS EN 1097-5 Optimum to Optimum – 2% range
Recycled aggregates	To SHW Clause 710 and Appendix H
Compaction	As Table 07-06 and 07-07 below

07-04 Granular Sub-Base Type 1

a. Unbound Granular mixtures shall comply with the requirements BS 13285 and the SHW series 800 Clause 801.

b. Type 1 Sub-Base for use in the Highway shall comply with the requirements of BS EN 13285 and SHW paragraph 803. It shall not be frost susceptible and shall comply with the definition in SHW Series 800 and be certified from an independent NAMAS or UKAS approved testing Lab. Unbound Granular mixtures shall comply with the requirements BS 13285 and the SHW Series 800 Clause 801.

c. Type 1 Granular sub-base shall conform to the requirements of SHW Series 800 Clause 803. The key requirements are indicated below in Table 07-03

Table 07-03

Type 1 Grading requirement	**Percentage by Mass passing**		
Sieve size, mm	Overall grading range	Supplier declared value grading range	Tolerance on the supplier declared value
63	100		
31.5	75 to 99		
16	43 to 81	54 to 72	+/- 15
8	23 to 66	33 to 52	+/- 15
4	12 to 53	21 to 38	+/- 15
2	6 to 42	14 to 27	+/- 13
1	3 to 32	9 to 20	+/- 10
0.063	0 to 9		

d. The size fraction of the unbound mixture passing the 0.425 mm size test sieve shall be non-plastic as Defined by BS 1377-2 and tested in compliance therewith.

e. The material shall have a maximum Los Angeles Co-efficient of 50 in accordance with BS EN 1097-2.

f. The material shall be resistant to freezing and thawing and have a magnesium sulphate (MS) soundness value of 35 or less in accordance with BS EN 1367-2.

g. Type 1 unbound mixtures shall be produced from crushed rock, crushed slag, or crushed concrete. Recycled & Secondary aggregates may be acceptable subject to compliance with NYC's formal approval procedures detailed in Appendix H and the prior written approval of the Engineer.

Table 07-04

Type 1 Granular Sub-Base	**To meet requirement**
Grading range	As Table 07-03 above
Resistance to fragmentation	LA 50 or less
Resistance to Freezing & Thawing	MS 35 or less
Frost Heave	Material used with 450mm of the road surface shall not be frost susceptible. The material shall have a mean heave value of 15mm or less when tested in accordance with BS 812-124
Water soluble sulphates (WSS)	Any material placed with 500mm of any concrete, cementitious material or stabilised capping shall have WSS not exceeding 1500mg as (SO_4) per litre when tested in accordance with BS EN 1744 – 1 Clause 10.
Recycled Aggregate requirements	In accordance with SHW Clause 710 and NYC Recycled Granular materials briefing note.
Compaction requirements	In accordance with Table 7-06 and 07-07 and the additional guidance below

h. Additional testing of materials delivered to site may be requested by the Engineer. This shall be undertaken at an independent certified Laboratory at the developer's expense.

i. Repeat testing may be requested by the Engineer. This shall be undertaken at the Developer's expense.

j. Copies of all supplier certification for Type 1 Sub-Base shall be provided to the Engineer.

k. The approved Type1 Sub-Base shall be placed, spread to the correct thickness, and compacted in accordance with Table 07-06 and Table 07-07 and the SHW, all to the satisfaction of the Engineer.

l. Type 1 Sub-Base once laid and compacted shall have a minimum CBR value of 30% on a 600 mm plate test.

07-05 Carriageway Construction Thicknesses

Unless otherwise specified the thicknesses given in Table 07-05 shall be the minimum compacted thickness of road construction for varying widths of carriageway. The construction of classified roads shall be designed in accordance with CD series of Documents within DMRB.

Table 07-05

MINIMUM LAYER THICKNESSES FOR CARRIAGEWAY CONSTRUCTION						
Carriageway Width	**Capping Layer (mm)**	**Type 1 Sub-Base (mm)**	**Road-Base (mm)**	**Binder-Course (mm)**	**Surface – Coat (mm)**	**Road Type**
Classified Roads	Designed to DMRB but no less than thicknesses below for the road width					
Industrial Roads	Min. 200(*)	450	160	90	45	Industrial Estate Road
7.3 m +	Min. 200(*)	300	140	80	45	Unclassified Residential Estate Road
5.5m to 7.3 m	Min. 200(*)	250	110	60	45	Unclassified Residential Estate Road
5.5 m or less	Min. 200(*)	200	90	60	45	Unclassified Residential Estate Road
(*) Refer to CBR Values below for Capping Layer Thicknesses						

	(*) CBR Values on Formation Layer					
	<2%	2% to <3%	3% to <5%	5% to <10%	10% to <15%	15%+
Capping Layer Thickness	600mm	450mm	350mm	250mm	225mm	200mm

a. Table 07-05 is based on a minimum formation CBR of 2%. Where this CBR cannot be achieved, the developer shall be required to undertake additional CBR testing and shall provide details of additional works to mitigate the poor ground conditions. The remediation shall be provided in accordance with Table 06-01.

b. It is unlikely that CBRs of less than 0.5% will be acceptable to NYC without specialist interventions. These will need to be supported by relevant design documents that shall be submitted to and approved in writing by the Engineer prior to works commencing. The calculations shall be undertaken by a suitably experience professional Engineer

c. Table 06-01

CBR%	Capping mm depth	75mm clean stone mm depth	Geo-textile
1.5%>	600	N/A	YES
1.25%>	600	N/A	YES
1%>	300	300	YES
0.75%>	300	300	YES
0.5%>	Determined by detailed design	Determined by detailed design	YES in accordance with detailed design

For block paving see paragraph 07-25.

d. When traffic conditions dictate the Engineer may request the requirements of Table 07-05 shall be replaced by a pavement design undertaken in accordance with DMRB Vol 7 and submitted for the Engineer's written approval. The material thicknesses shall be adjusted in accordance with the approved design.

07-06 Compaction Requirements for Granular Materials

a. When considering the choice of roller, the mass per 1.0m width of roll is the total weight on the roll divided by the total roll width. In the case of a smooth-wheeled roller having more than one axle, the assessment is based on the highest value axle.

b. The requirements for vibratory rollers are on a traveling speed of 1.5 to 2.5 kph or 0.9 to 1.5 mph, if speeds faster than this are used then more passes shall be needed. NYC recommend working at low speeds at all times to achieve satisfactory compaction.

Table 07-06

Compaction Equipment Types			
Plant- Rollers based on Mass Per 1 m width of roll	**Material**	**Maximum layer depth**	**Minimum number of passes should be halved for double drums**
Vibratory rollers 700 – 1300 Kg range (Roll width/series 80.100.120, Inc. Ramax type trench rollers etc.)	Type 1 GSB	110mm	16
As above 1300–1800 Kg Roller width/series - 130. 135, 138 Range	As above	150mm	16
Large single drum vibratory 1800 Kg – 5000 Kg	As above	225mm	6 to 10 depending on model
Large Single drum vibratory rollers over 5000 Kg	As above	225 to 300 mm	5
Plate compactors Based on Mass per unit area of base plate Kg/m^2 (Fwd. & Reverse type)			
1400 – 1800 Kg range	As above	110mm	8
1800 -2100 kg range	As above	150mm	8
Plate compactors above 2100 kg Machine attachment type	As above	150 -225 mm	6 to 10

Table 07-07

Compaction Equipment ~ number of Passes				
Type of Compaction Plant	Category	Number of passes for: -		
		Not greater than 110mm thickness	Not greater than 150mm thickness	Not greater than 225mm thickness
	(mass per metre width of roll)			
Smooth wheeled roller	2700-5400 kg	16	Unsuitable	Unsuitable
	Over 5400kg	8	16	Unsuitable
Vibrating roller	700-1300kg	16	Unsuitable	Unsuitable
	1300-1800kg	6	16	Unsuitable
	1800-2300kg	4	6	10
	2300-2900kg	3	5	9
	2900-3600kg	3	5	8
	3600-4300kg	2	4	7
	4300-5000kg	2	4	6
	Over 5000kg	2	3	5
Vibrating plate compactor	Mass per unit area of base plate (kg/m^2)			
	1400-1800	8	Unsuitable	Unsuitable
	1800-2100	5	8	Unsuitable
	Over 2100	3	6	10

c. For a machine attached vibrating plate (Hoepack or similar) an initial layer of 500mm shall be laid followed by maximum 300 mm thick layers.

d. Where the choice of appropriate plant is unclear, the matter should be referred to the Engineer.

e. Vibratory rollers shall only be operated with their vibration mechanism operating at the manufacturers recommended frequency. All such rollers shall be equipped with a means of automatically indicating the frequency at which the vibration is given. Vibratory rollers not vibrating shall be treated as smooth wheeled rollers.

f. Where Vibrating Plate Compactors are used, the static pressure under the plate is calculated by dividing the total working mass of the machine by the area of contact with the compacted stone in metres squared. Plate compactors shall normally be operated at travelling speeds of less than 1.0 kph (0.6 mph). If higher speeds are used, the minimum the number of passes shall be increased in proportion to the increase in speed of travel.

07-07 Cold Weather Working with Granular Materials

a. No Material in a frozen condition shall be incorporated into the works. It shall be set aside on site for consideration for use when thawed. Any thawed material shall be tested to prove acceptability at an approved laboratory prior to use.

b. No materials for use in roads or footpaths shall be laid on any surface that is frozen or covered with ice or snow.

HOT ROLLED ASPHALT

07-08 Site-specific Assessments

a. Site-specific assessments will be required to determine the following, which shall be agreed in writing by the Engineer in advance of the work commencing.

- Coarse Aggregate PSV
- Pre coated chipping size requirement and PSV value
- Rate of Spread of chippings
- Required Surface Texture depth. The minimum shall be 1.2 mm with an absolute minimum of 1.0 mm.
- Bond Coat and Joint sealing requirements
- Material Testing regime
- Skid resistance to be determined in accordance with DMRB – CD 236 - Table 3.3a with Investigatory levels determined as set out in DMRB - CS 228.

Site conditions may dictate that different PSV values will be required for different lengths of carriageway i.e. at roundabouts, approaches to junctions and traffic lights.

07-09 Hot Rolled Asphalt Surface

a. Hot Rolled Asphalt Surfacing shall be used in the following locations: -

- All A and B class roads,
- Ghost island right turning lanes and roundabouts on all classes of roads
- All Industrial estate roads
- Residential estate roads with a width of 7.3 m or greater.
- Residential estate roads with a width of 6.5 m that are to be used as bus routes.
- Other junctions and locations as requested by the Engineer.

b. Hot Rolled Asphalt Surface Coat shall comply with BS EN 13108 – 4, and SHW Series 900.

c. Standard recipe mix shall be HRA 35/14 F Surf 40/60 pen, unless otherwise agreed in writing by the Engineer prior to any surface course being laid on site. The Engineer may request the mix to take account of site-specific design mixes incorporating wheel tracking rate (WTR) requirements. The binder shall be 40/60 Pen bitumen complying with BS 13924-1. The coarse aggregate content shall be 35% by mass of total mix and shall have a PSV of not less than 45. The material shall be delivered, laid & compacted in accordance with BS 594987.

d. For Hot Rolled Asphalt Surfacing Binder and Base Courses over Structures refer to Clause 22-13 and 22-14 in Section 22-00 Bridges and Structures of the NYC Specification.

e. The use of High Stone Content surfacing materials is not yet approved by NYC at the time of publication of this Specification and shall therefore be subject to Engineer approval prior to

its use, having a full assessment been made in consultation with an experienced surfacing contractor.

f. The use of Thin Surfacing materials is not yet approved by NYC at the time of publication of this Specification and shall therefore be subject to Engineer approval prior to its use, having a full assessment been made in consultation with an experienced surfacing contractor.

g. The environmental benefits of Warm Mix Asphalt (WMA) with its lower production temperatures and therefore reduced carbon emissions are resulting in the more widespread use of WMA. The use of WMA shall be subject to the Engineers approval based on the production of a comprehensive assessment undertaken in consultation with an experienced asphalt contractor, taking into consideration factors such as climate conditions, traffic volume, specification goals (durability and performance).

07-10 Pre-Coated Chippings

a. Pre coated chippings shall be 20 mm nominal size. The use of 14mm nominal size may be permitted in specific locations subject to the agreement of the Engineer.

b. The minimum PSV at roundabout circulatory areas and approaches to roundabouts (minimum distance 60 m) shall not be less than 65 and other locations as requested by the Engineer.

c. The minimum PSV at controlled crossings and on the approaches to controlled crossings (minimum distance of 28 m to the stop line) shall be not less than 68.

d. The binder coat to the chippings shall be 40/60 pen conforming to BS EN 13108 – 4.

e. Pre-Coated chippings shall be uniformly spread at a rate of 12 kg/m^2 and rolled into the surface coat so they are effectively held using a dead weight roller.

f. In some locations the use of Red Pre-Coated chippings may be requested by the Engineer.

g. “Thin surfacing” materials have not been approved at the time of this Specification being published and therefore shall be subject to the Engineers approval prior to use, having a full assessment having been made in consultation with an experienced surfacing contractor.

COATED MACADAM CARRIAGEWAYS

07-11 Limestone Aggregate

Limestone aggregate shall not be used for the Wearing or Binder Course, it may be used for Road-base.

07-12 Dense Base and Binder Course Asphalt Concrete (Recipe Mixtures)

Dense base & Binder asphalt concrete (formerly macadam) recipe mixtures shall be Asphalt Concrete conforming to BS EN 13108-1.

07-13 Dense Road Base

a. Dense Road Base Asphalt Concrete shall be AC 32 dense base 100/150 or AC 32 dense base 40/60 (HDM).

b. The minimum thickness shall be 90 mm. Greater depths may be required by site conditions. Designs for the details of additional thickness shall be submitted to and agreed by the Engineer prior to works commencing on site.

c. The material shall not be laid in layers thicker than 5 times the aggregate size. It should not be laid in layers of thickness less than 2.5 times the aggregate size, without the Engineers prior agreement.

d. The Engineer may request the use of a heavy duty Road-base in certain locations. i.e.180mm 40/60 AC32 Dense Base HDM to BS EN 13108-1

07-14 Binder Course Material

a. Binder Course material shall be Asphalt Concrete 20 dense binder 100/150 or Asphalt Concrete 20 dense binder 40/60 (HDM)

b. The minimum thickness shall be 50 mm and the maximum thickness shall be 100 mm.

c. The Engineer may request the use of a heavy-duty Binder-Course in certain locations. i.e. 100mm 40/60 AC20 Dense Bin HDM to BS EN 13108-1.

d. Binder Course not to be covered with a surface coat within 3 days shall be sealed with 1-3mm sealing grit spread evenly to fill all voids. See Clause 07-16.

07-15 Close Graded Asphalt Concrete Surface Course

a. Close graded Asphalt Concrete (formerly macadam) surface course recipe mixes shall be Asphalt Concrete conforming to BS EN 13108-1, using Asphalt Concrete 10mm close surface 100/150 or Asphalt Concrete 10mm close surface 70/100. Pen Bitumen

b. The minimum thickness shall be 40 mm and the maximum thickness shall be 50 mm.

07-16 General Requirements for Laying Bituminous Materials

a. All Binder courses in roads shall be sealed using a sealing grit of 3 mm down fine surface 160/220. This may only be omitted by prior written agreement of the Engineer.

b. Road-base shall not be left uncovered for more than 24 hours without the written approval of the Engineer.

c. All bituminous materials for carriageways shall be delivered, laid and compacted in accordance with BS 594987.

d. All bituminous materials shall be produced in batching plants operating to BS EN 13108 -21 (Factory Production Control). Material shall be supplied by batching plants operating at

Operational Compliance Level (OCL) **A**. Where this is not met additional testing may be requested.

e. All works under Section 278 of the Highways Act 1980 shall be carried out to a quality assurance scheme based on National Highway Sector Scheme 16 (NHSS -16). The surfacing contractor shall be registered to this Quality Assurance scheme and approved in writing by the Engineer prior to works commencing on site.

07-17 Defective Materials

a. Where any surfacing is found to be defective by the Engineer the minimum patch shall be machine laid and shall not be less than 15 m in length and not less than the width of the formed surfacing joint.

b. In some instances, the Engineer may instruct the area to be surfaced to the full carriageway width

c. If multiple areas have failed or are considered defective the Engineer may instruct the multiple areas to be combined and are to be repaired as a single patch. If widespread defects are identified the Engineer may instruct the whole road to be resurfaced.

d. Any rework required is to be completed at the Developers expense.

07-18 Regulating Course

Any regulating course to be provided under the Surface Coat or under Block Paving shall have the prior written approval of the Engineer.

07-19 Hot Applied Bond Coat

a. Hot Applied Bond Coat shall be used before the laying of surface coat on a cleaned surface.

b. Hot Applied Bond Coat shall be applied using a tanker applicator unless agreed in writing by the Engineer before work commence.

c. The Hot Applied Bond Coat shall be Polymer Modified Binder classified in accordance with BS EN 13808 or BS EN 15322 or BS EN 14023 (generally cationic modified emulsions such as C50 BP3 or C65 BP3).

d. Hot Applied Bond Coats shall cover a minimum of 95% of the area to be surfaced.

e. Hot Applied Bond Coats shall be used in all cases between every layer of tarmac laid on a carriageway.

f. Spread rates and accuracy for the spread of Hot Applied Bond Coat shall comply with BS EN 12272-1

g. Once the Hot Applied Bond Coat has been applied, no trafficking of the surface shall be permitted until the Hot Applied Bond Coat has been allowed to “break completely” (turn from brown to black).

h. The surface to which the Hot Applied Bond Coat is applied shall be free of standing water but may be damp. The Engineer's definition of "standing water" shall apply.

i. Table 07-08 identifies minimum target rates of spread for Hot Applied Bond Coats in litres per m^2.

Table 07-08

Manufacturers Bond coat rates of spread		
Class of polymer modified bituminous emulsion	Newly laid and existing asphalt substrates Residual binder 0.2Kg/m^2	Planed (milled) substrates Residual binder 0.35Kg/m^2
C50 BP (2 to5)	0.40 L/m^2	0.70 L/m^2
C60 BP (2 to 5)	0.33 L/m^2	0.58 L/m^2
C65 BP (2 to 5)	0.31 L/m^2	0.54 L/m^2
K1-70	0.60 L/m^2	0.90 L/m^2

07-20 Tack Coat

Tack Coat shall only be used on cleaned cycle tracks, footpaths and footways (cycle track as defined in paragraph 1.45 of LTN 1/20). It shall be spray applied with a minimum coverage of 85% applied at a rate of no less than 0.5 Litre per m^2. The Tack Coat shall be K1-40 to BS 434-1. It shall be used only on cycle tracks, footways and footpaths, and shall be applied undiluted.

07-21 Laying of Bituminous Materials for Carriageway

a. Laying of Road-base material shall only be undertaken when: -

- Any edge restraint where specified is in place and laid to line and level.
- Where in exceptional cases the specified edge restraint is not in place, the laid width of the carriageway shall be increased to create a sacrificial strip that shall be cut back immediately prior to the edge restraint being laid. The increase in width and the detail for cutting back the sacrificial strip and laying the edge restraint shall all be agreed in writing prior to any material being laid.
- The underlying Type 1 Sub-Base has been confirmed to comply with the approved tolerances and has been formally approved in writing by the Engineer.

b. Unless otherwise approved in writing by the Engineer, all bituminous material shall be laid with an approved Mechanical Paving Machine that shall be capable of laying to the required width and applying the required initial compaction.

c. Hand laying will only be permitted in areas where it is impractical for a mechanical paver to operate.

d. With the exception of adjustment of levels around ironwork or at the channel line, hand raking of Surface-Coat material that has been laid by a mechanical paver shall not be undertaken.

e. All work, whether hand or machine laid shall comply, in all respects, with the recommendations for laying contained in BS 594987.

f. Tolerances on the finished surface shall be +6 or -6mm in accordance with Clause 07-01.

g. Final compaction on Hot Rolled Asphalt surface-coat or High Stone Content Surface-coat shall be undertaken using an 8 to 12 tonne dead weight smooth-wheeled roller.

h. Final compaction of 10mm Surface-Coat may be undertaken using a twin smooth-wheeled roller. The roller shall not be less than a 100AD and should preferably be 135AD.

Table 07-09

Minimum rolling temperatures for Asphalt to BS EN 13108-4		
	Type	Temperature (Centigrade)
Maximum at any stage	40-60 pen bitumen Surface Course and Binder/Base	90°C
Minimum Delivery *	40-60 pen bitumen Surface Course	140
	40-60 pen bitumen Binder/Base	130
Minimum Rolling	40-60 pen bitumen Surface Course	110
	40-60 pen bitumen Binder/Base	105
	The above temperatures are those by which all compaction shall be substantially completed	
The use of Warm Mix Asphalt will require a comprehensive assessment as detailed in section 07-09(g)		

i. When Tarmac is at or near the temperatures in Table 07-09, the supplier shall be required to increase the delivery temperature in accordance with BS 594987.

Table 07-10

Dense / Close Graded Asphaltic Concretes BS EN 13108-1		
	Type	Temperature (Centigrade)
Maximum at any stage	40-60 pen Bitumen Macadam	190
	100-150 pen Bitumen	170
Minimum Delivery *	40-60 pen Bitumen Macadam	120
	100-150 pen Bitumen	115
Minimum Rolling	40-60 pen bitumen Macadam ** 1	105
	100-150 pen Bitumen	75
	All temperatures given are immediately prior to rolling	

The use of Warm Mix Asphalt will require a comprehensive assessment as detailed in section 07-09(g)

Table 07-11

Longitudinal Rolling Straight Edge Measure			
Irregularity	4mm	7mm	>10mm
Permitted max number of irregularities per 40m length	10	1	Nil
Permitted max number of irregularities per 75m length	18	2	Nil

j. Cross trenches that are cut through any carriageway surface shall be restored to coincide with the mean level of the immediately adjacent surface.

k. Texture depths as set out in Table 07-12 below shall be achieved using the sand patch method in accordance with BS EN 13036 - 1. The chippings shall be adequately embedded and evenly spread.

Table 07-12

Housing Estate Roads	1.0mm minimum
Junctions with principal, non-principal and classified roads (Class A, B & C)	1.2mm minimum
within 60 m of junctions with principal, non-principal and classified roads (Class A, B & C)	1.2mm minimum
Roundabout circulatory carriageway	1.2mm minimum
within 60m of roundabouts	1.2mm minimum
within 60m of Pedestrian crossings	1.2mm minimum

07-22 Substitution of Materials

Where the overall design pavement thickness exceeds the 600mm the depth of sub-base material may, with the prior written approval of the Engineer, be reduced by increasing the Bituminous Base thickness in the proportion of 1 part Bituminous Material to 3 parts Granular material, subject to:

- Overall construction thickness shall not be less than 600mm
- Sub-base thickness shall not to be less than 200mm
- Geotextiles approved by the Engineer shall be used at formation level

07-23 Jointing into Existing Construction

Where any new carriageway joins an existing carriageway, the existing carriageway shall be cut or planed back to sound vertical faces providing staggered joints with a minimum length of 300mm for each layer. A Hot Applied Bond Coat shall be applied between all layers.

07-24 Working in Adverse Weather Conditions with Bituminous Materials

a. The laying of bituminous macadam and other bituminous materials shall cease if the temperature of the surface to be covered is at or falls below 2°C. However, where the surface is dry, unfrozen and free of ice or snow, laying may proceed at temperatures at or above -1 °C on a rising thermometer.

b. Laying of bituminous macadam and other bituminous materials shall be avoided as far as practicable during wet weather and shall stop when free standing water is present on the surface, or when the rain becomes more than light rain (1 mm/hr). No bituminous material shall be laid during periods of rain, that are predicted to last more than two hours or when more than 1 mm/hr falls.

Table 07-13

Adverse Weather Requirements for Bituminous Materials			
Material	**Commence Working Air Temp**	**Additional Requirements**	**Cease Working Air Temp**
Asphaltic Concrete to BS EN 13108-1	-1°C & rising	Ground unfrozen and free from ice	0°C & falling
HRA base and Binder course to BS EN 13108-4	-1°C & rising	Ground unfrozen and free from ice	0°C & falling
High stone content HRA surface course to BS EN 13108-4	-1°C & rising	Ground unfrozen and free from ice	0°C & falling

PRE-CAST CONCRETE BLOCK PAVING

07-25 Pre-Cast Concrete Block Paving

a. Pre-Cast Concrete Block Paving shall be chamfered and conform to BS EN 1338. They shall be hydraulically pressed. Blocks shall be pigmented throughout the material; they shall and not be surface dyed or painted without the prior written approval of the Engineer.

b. The mixing of Blocks from different manufacturers shall not be permitted within any road without the prior written approval from the Engineer.

c. The use of Pre-Cast Concrete Block Paving is permitted as a carriageway surface in cul-de-sac's and for speed tables and other lightly trafficked areas with the prior written approval of the Engineer. Pre-Cast Concrete Block paved road shall not be used on through routes.

d. The use of Pre-Cast Concrete Block Paving as a footway surface may, on limited occasions, be permitted subject to the prior written approval of the Engineer.

e. All Pre-Cast Concrete Blocks shall be 100 mm x 200 mm and 80 mm thick. The colour shall be brindle, red or charcoal. Other colours may be accepted subject to the prior written approval of the Engineer; other colours shall subject to a commuted sum.

f. Pre-Cast Concrete Block Paving shall be laid and constructed in accordance with BS 7533-3 and NYC Standard Details A3. The Pre-Cast Concrete Block Paving replaces the Surface-coat.

g. Pre-Cast Concrete Blocks shall be laid in herringbone pattern at a 45-degree angle to the kerb; preformed edge blocks shall be used. The Blocks shall be laid on 30 mm compacted thickness of sand which shall comply with BS 7533-3; the sand shall be naturally formed. Crushed rock and Recycled material shall not be used.

h. All block paving shall be laid with a minimum cross fall of 1 in 40. There shall be no camber or changes of fall direction within any block-paved area.

i. The acceptable tolerance for the laid surface of blocks shall be + or – 6 mm, with a maximum reflective difference between adjacent blocks of 2 mm.

j. Block cutting shall be done using a purpose made block splitter or saw. The minimum size of a laid block shall be 33% of a full block. The bond shall be broken as needed to accommodate the minimum block size.

k. Full edge restraint shall be provided prior to the laying of blocks.

l. Where Pre-Cast Concrete Block Paving abuts a bituminous surface a 150mm x 150mm channel shall be laid to provide a restraining edge; this shall be laid flush. Where the block paving adjoins “iron work” a “picture frame” shall be formed with the blocks. Any gaps should be filled with colour matched granolithic concrete. The use of in-situ concrete infill is not acceptable.

m. Pre-Cast Concrete Block paving shall be compacted on the day of laying. A rubber soled vibrating plate shall be used which shall be in the range of not less than 0.25 m^2 transmitting a force of 75 to 100 kN/m^2.

n. Any blocks damaged during compaction shall be replaced immediately.

o. The joints between blocks shall be filled with kiln-dried sand that shall comply with BS EN 16236& BS EN 933-1.

p. Any Pre-Cast Concrete Block Paving approved by the Engineer for use in footpaths or footways or as a Lamp Column surround shall be laid in accordance with Clause 07-24. They shall be laid on 50 mm of Binder Course compacted thickness, of AC20 mm nominal size dense Binder course, using 100 /150 Pen bitumen binder. The blocks shall be laid on 30mm compacted thickness of sand which shall comply with BS 7533-3 the sand shall be naturally formed. Crushed rock and Recycled material shall not be used. The use of blocks less than 80mm thick is not permitted.

q. The use of a Vacuum Sweeper is not permitted on Block Paved areas for a minimum period of twelve (12) weeks after completion, to allow the jointing sand to become fixed in the joints.

r. The use of clay pavers is not permitted.

07-26 Joint Sealants

a. Before new surfacing is laid adjacent to existing or newly cured surfacing joints shall be made by: -
Cutting or planing back the edge to a sound vertical face that exposes the full thickness of the layers providing staggered joints with a minimum length of 300mm for each layer.
- Discarding all loosened material
- Painting or spraying the vertical face completely with a thin uniform coating of hot applied 40/60 or 70/100 paving grade bitumen, or cold Applied thixotropic emulsion of a similar grade or modified bitumen emulsion bond coat as previously agreed in writing by the Engineer.

b. The above treatment shall also be applied for kerb/channel faces and chamber covers, gratings etc.

c. The over-banding of joints is generally permitted when an anti-skid, HAPAS approved, product is used. Approval should be sought from the Engineer prior to use.

07-27 Existing Carriageways and Footways

a. Where an existing carriageway or footway is not up to the current NYC Adoptable Standards and is included within the Developers Scope of Works. Core samples or trial holes shall be done to prove the existing construction at the developer's expense.

b. It is at the NYC Engineers discretion to advise on any remedial works required to bring the road up to an Adoptable Standard. This may consist of resurfacing or replacement of macadam courses. In extreme cases the sub-base and capping layer may need to be replaced and the road reconstructed.