SECTION 421 - BITUMEN CRUMB RUBBER ASPHALT

##This section cross-references Section 407.
If Section 407 is relevant, it should be included in the specification.
If Section 407 is not included in the specification, all references to it should be struck out, ensuring that the remaining text is still coherent:

421.01 GENERAL

This section is a supplement to Standard Section 407 - Asphalt and covers special requirements for Bitumen Crumb Rubber Asphalt that are in addition to, or override the requirements of Section 407.

421.02 DESCRIPTION

Bitumen Crumb Rubber Asphalt is asphalt which contains crumb rubber obtained from tyre shredding to improve flexural and elastic recovery properties of an asphalt layer.

421.03 AGGREGATES

Unless otherwise specified, properties of the aggregates used in Bitumen Crumb Rubber Asphalt shall comply with the requirements specified in Clause 407.03.

421.04 FILLER

Added filler shall be hydrated lime.

421.05 GRANULAR CRUMB RUBBER

(a) General Requirement

Granular crumb rubber shall consist of synthetic rubber from car tyres or natural rubber from truck tyres or a mixture of both and shall be free from cord, wire, fluff and other deleterious material.

(b) Grading and Particle Size

The grading shall comply with Table 421.051 and shall not contain particles greater than 3 mm in length.

Table 421.051

Sieve Size AS (mm)	1.18	0.600	0.150
Percentage Passing (by mass)	100	80 - 100	0 - 20

(c) Bulk Density

The maximum bulk density shall not exceed 350 kg/m3 as determined by the ARRB Transport Research test method described in AIR 286-3.

421.06 MIX DESIGN REQUIREMENTS

(a) Mix Design

The asphalt mix proposed for use shall be registered in accordance with Clause 407.06.

The Contractor shall also submit Marshall Stability and Marshall Flow properties.

(b) Grading

Unless otherwise specified, the grading of aggregate with added filler after mixing but before compaction, and the proportions of aggregate, added filler, granular crumb rubber and bitumen in the mix shall comply with Tables 421.061 and 421.062.

Table 421.061 Grading of Aggregate with Added Filler

Sieve Size AS (mm)	Percentage Passing (by Mass)	
	Mix Size 14	Mix Size 10
19.0	100	-
13.2	90 – 100	100
9.5	65 – 75	90 - 100
6.7	40 – 50	64 – 74
4.75	30 – 40	36 – 46
2.36	15 – 25	20 – 30
1.18	10 – 19	12 – 22
0.600	7 – 15	8 – 17
0.300	5 – 10	6 – 11
0.150	4 – 8	4 – 8
0.075	3 – 5	3 – 5

Table 421.062 Proportions of Aggregate, Added Filler, Granular Crumb Rubber and Bitumen

Sieve Size AS (mm)	Percentage Passing (by Mass)	
	Mix Size 14	Mix Size 10
Aggregate	86 - 89	86 – 89
Added Filler	1.0 - 2.0	1.0 - 2.0
Granular Crumb Rubber	2.5 - 3.0	2.5 - 3.0
Bitumen	7.5 - 9.0	7.5 - 9.0

(c) Marshall Test Properties

The Marshall cylinder test properties of the mix shall comply with Table 421.063.

Table 421.063

Size	Stability (kN) (min)	Flow (mm)	Air Voids (%)	Voids in Mineral Aggregates (min) (%)	Bitumen Film Thickness (microns)
14	3.0	3.0 - 5.5	5.0 - 6.5	27	19 - 25
10	2.5	3.0 - 5.5	5.0 - 6.5	27	19 - 25

Notes: 1. For purposes of calculation of Voids in Mineral Aggregates, granular crumb rubber is not considered as part of the aggregates.

2. Bitumen film thickness shall be calculated as bitumen distributed over the surface of the aggregates including granular crumb rubber.

421.07 MIXING AND MIXING TEMPERATURES

(a) Granular crumb rubber is added to the mix before the binder (Dry Mixing).

A pugmill batch mixing plant shall be used.

The temperature limits shall be 20°C higher than those shown in Table 407.081.

Following discharge of aggregate and filler into the mixer, the required quantity of granular rubber shall be added and dry mixed for a minimum period of 10 seconds.

Following addition of bitumen, the whole mixture shall be mixed for a minimum of 60 seconds or until the whole of the mix is homogeneous and proper digestion of the rubber into the bitumen has occurred.

(b) Granular crumb rubber / bitumen binder has been pre-blended prior to being added to the mix (Wet Mixing).

The mixing plant may be a drum plant or a pugmill batch plant.

The crumb rubber bitumen mixture shall not contain carrier oils, cutters or flux oils.

The temperature limits shall be 20°C higher than those shown in Table 407.081.

421.08 AMBIENT CONDITIONS FOR PLACING

Bitumen Crumb Rubber Asphalt shall not be placed when the pavement temperature is less than 15°C.