

Session : 1

Orange Book Updates

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Orange Book Updates

Guidelines on the Depth of Overlay to be used on Rural Regional & Local Roads



An Roinn Iompair
Department of Transport



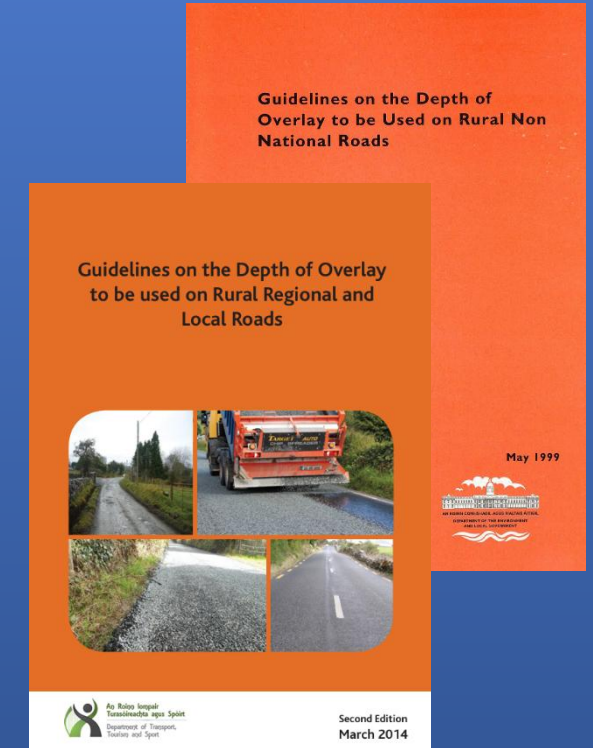
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Contents

1. What are the Orange Book Guidelines?
2. Why the Need to Update?
3. What has Changed?

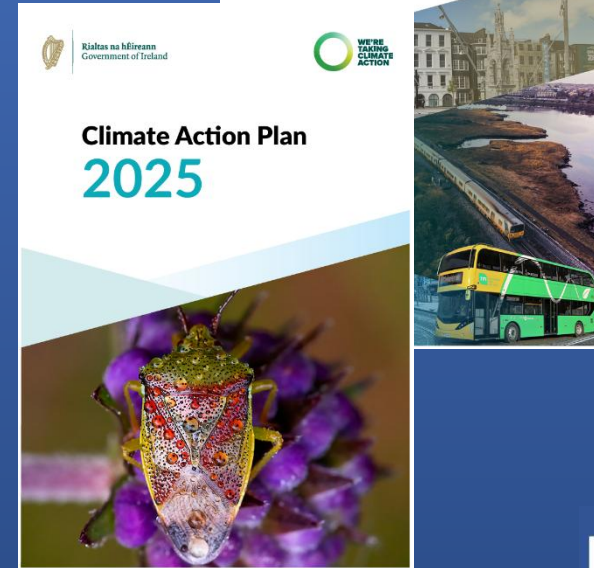
What are the Orange Book Guidelines?

1. Guidelines on the Depth of Overlay to be used on Rural Regional & Local Roads
2. First published in 1999, with 2nd Edition in 2014 by DTTAS
3. Practical guidance for Local Authority Engineers for overlay designs on the Rural RLR Network
4. Purpose of the 2nd Edition:
 1. Assist in pavement maintenance decisions
 2. Facilitate overlay design using FWD data
 3. Provide engineering guidance on overlay thickness design for granular overlays & equivalent thicknesses for Asphalt Concrete
 4. Designs were based on 20-year design life, 3% per annum growth rate, 10% HCV content
5. Applies to Rural RLR Network



Why the Need to Update?

1. Policy
 - I. National Development Plan
 - II. National Investment Framework for Transport in Ireland
 - III. Climate Action Plan
 - Sustainability
 - Climate Resilience
2. National Standards
 - I. TII Specifications & Standards
 - II. Introduction of IS 844
3. Material Innovations
4. Industry Practice



Working Group Contributors

Chair:

James McCrum, Senior Advisor, Department of Transport

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Sean Cassidy, Quality Asphalt

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Local Authority Representatives:

John Mitchell, Senior Engineer, Offaly County Council

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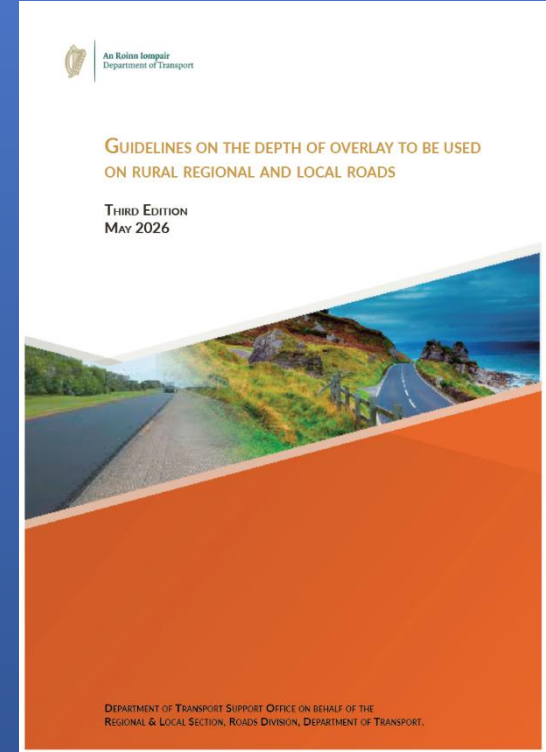
TII Representative:

Kevin Crawley

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Road Management Office

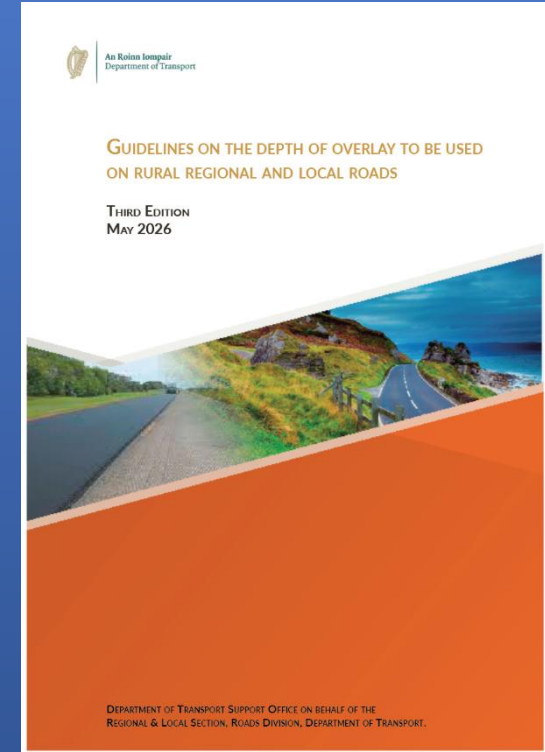
Department of Transport Support Office



What has Changed?

Revision to Contents Layout

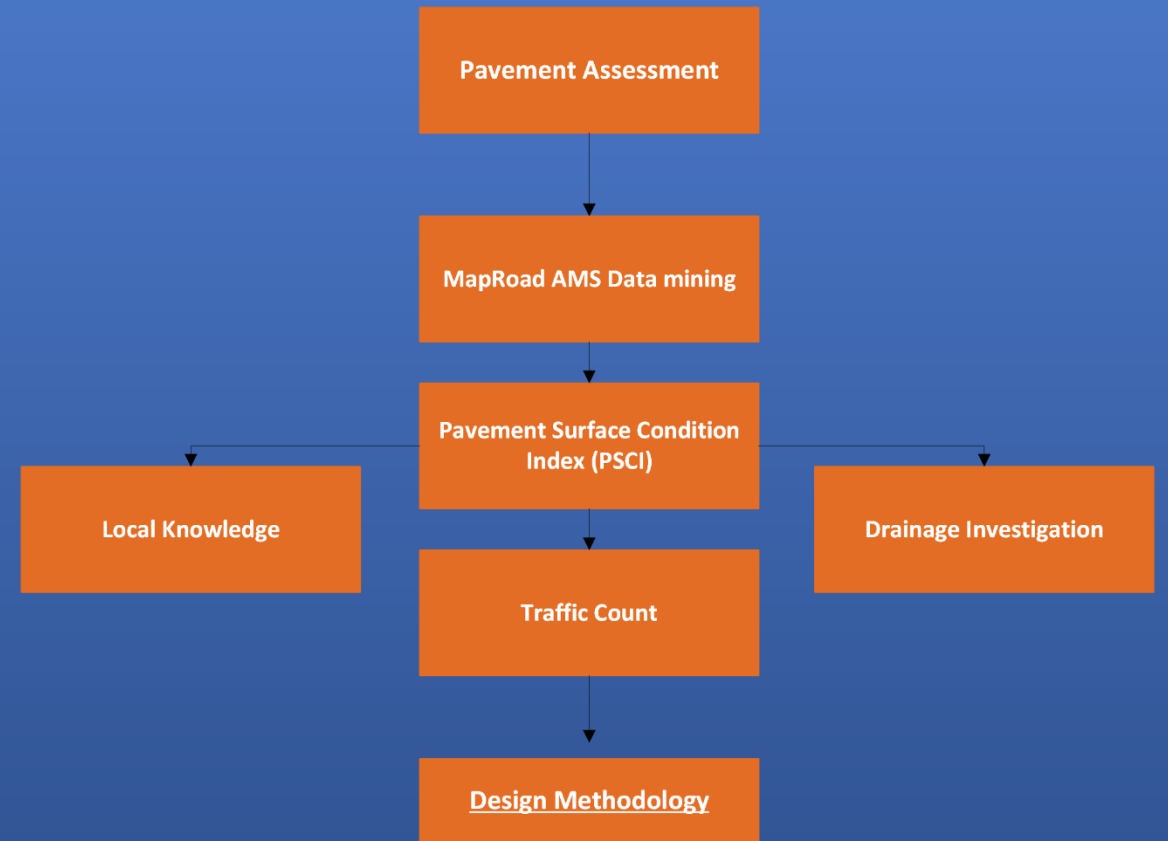
- I. Introduction & Policy Context
- II. Overview of Flexible Pavement Composition
- III. Pavement Evaluation Considerations
- IV. Design – Road Level Categories & Design Methods
- V. Rational Overlay Design Solutions
 - I. Table 5.1
 - II. Typical Overlay Details
 - III. Material Selection Choice Tables 5.2 & 5.3
- VI. Appendices



Pavement Evaluation

1. Network & Project Level Assessments
2. MapRoad Data Mining – Central Source of Network Data
 - i. Public Road Schedule
 - ii. Bridge Inventory
 - iii. Previous Pavement Works
 - iv. PSCI & Mechanical Data
3. Drainage Guidance
 - i. Safety, Pavement Preservation & Erosion Control
 - ii. Complements Road Drainage Guidelines
4. Traffic Counts
 - i. Introduction to methods
 - ii. Types of counters
 - iii. Appendix D

Pavement Assessment



Design & Road Level Categories

1. Design Methodology Selection
2. Category 1, 2 & 3 Roads
3. Traffic Count Data
 - i. AADT
 - ii. Equivalent msa
 - iii. 20-year Design Period
 - iv. 2% Growth
 - v. 5% HCV Content

Table 4.1: Road Level Categories for Pavement Design

	Rural Regional and Local Road Design Categories		
	Category 1	Category 2	Category 3
AADT	>8200	>5000 to ≤8200	≤5000
Equivalent msa ¹	>4.1	>2.5 to ≤4.1	≤2.5
Design Method	IAPDM ² (National Road Module)	IAPDM ² (Non-National Road Module)	Table 5.1
Traffic Count	14 day	14 day	Table 5.1
FWD	Required	Required	Optional

Notes to Table

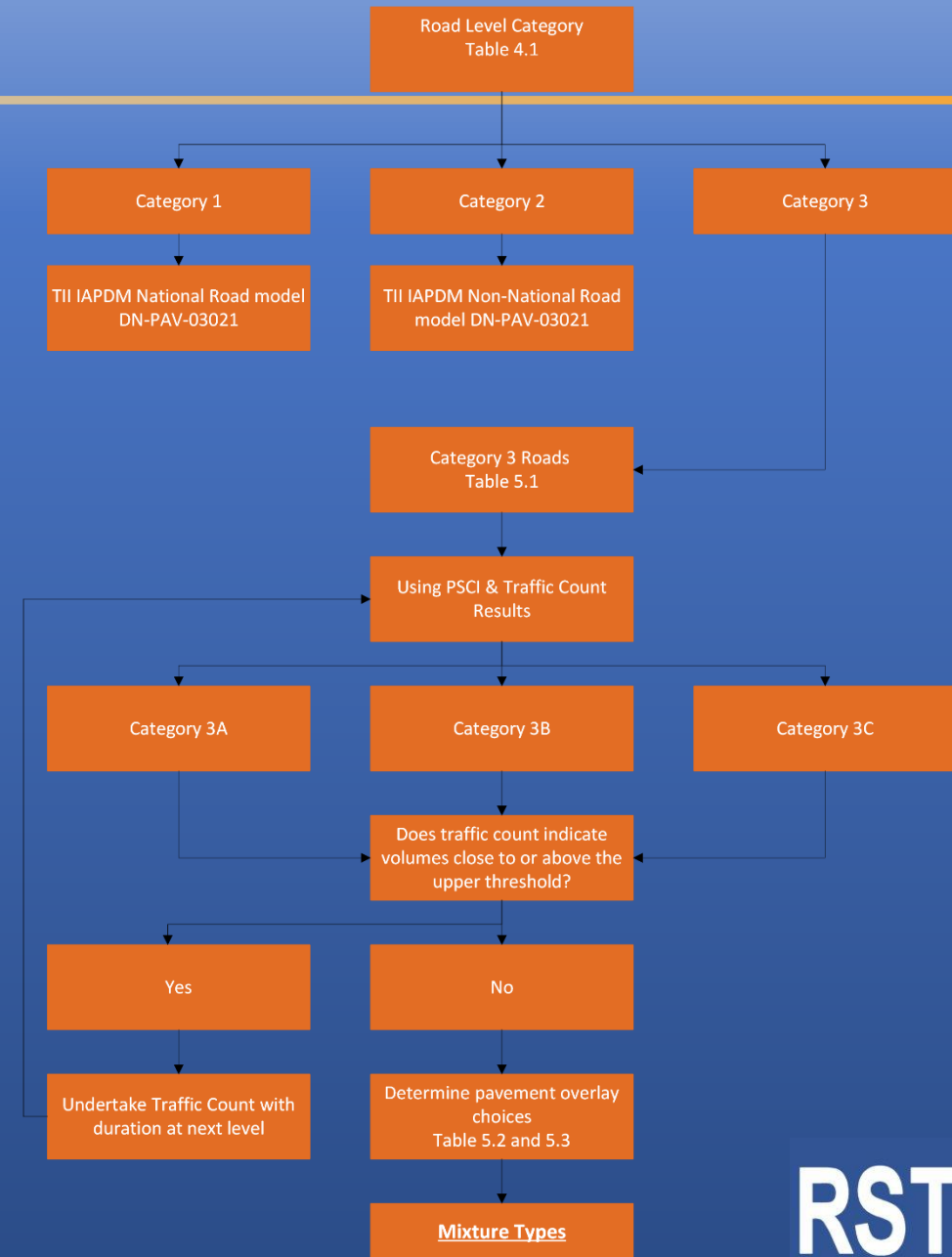
¹ The Equivalent msa is based on the AADT (two way traffic) over a 20 year design period with 2% growth and 5% HVC content

² The Irish Analytic Pavement Design Method (IAPDM) National road module uses an 85th percentile model and the Non-national road module uses a 50th percentile model

Design & Road Level Categories

1. Table 4.1 Assigns Road Category Based on AADT
2. Category 1 & 2 Roads
 - i. Design to IAPDM
 - ii. Refer to DN-PAV-03021
3. Category 3 Roads
 - i. Refer to Table 5.1
 - ii. Sub-categories 3A, 3B & 3C
4. Flow Diagram outlines Decision Process & Provides for Confirmation of Category

Design Methodology



Tables 5.1 & 5.2

1. Provided Overlay Typical Design Thicknesses
2. Thicknesses selected by
 - i. Existing Granular Thickness
 - ii. AADT
 - iii. Subgrade CBR
3. Approximate Equivalent Thickness Values
 - i. Stabilised Wet Mix
 - ii. Wet Mix / Asphalt Concrete
 - iii. Asphalt Concrete

Existing Granular Thickness: 100 - 200mm				
Current AADT (total in one direction)**				
Subgrade CBR	<500vpd	500 - 1000vpd	1000 - 2500vpd	2500 - 4000vpd
	< 1.1 MSA	1.1 - 2.3 MSA	2.3 - 5.8 MSA	5.8 - 9.3 MSA
1.5 - 3	150	200	300	-
3 - 5	100	150	250	300
> 5	100	150	200	250

Existing Granular Thickness: 201 - 300mm				
Current AADT (total in one direction)**				
Subgrade CBR	<500vpd	500 - 1000vpd	1000 - 2500vpd	2500 - 4000vpd
	< 1.1 MSA	1.1 - 2.3 MSA	2.3 - 5.8 MSA	5.8 - 9.3 MSA
1.5 - 3	100	150	250	300
3 - 5	-	150	200	250
> 5	-	-	150	200

Existing Granular Thickness: 301 - 400mm				
Current AADT (total in one direction)**				
Subgrade CBR	<500vpd	500 - 1000vpd	1000 - 2500vpd	2500 - 4000vpd
	< 1.1 MSA	1.1 - 2.3 MSA	2.3 - 5.8 MSA	5.8 - 9.3 MSA
1.5 - 3	-	150	200	250
3 - 5	-	-	150	200
> 5	-	-	150	150

Table 5.1: Typical Wet Mix Macadam Overlay Design Thickness Values for Rural Regional and Local Roads

** On roads narrower than 4m, use current AAD T (total of both directions)

Note 1: Clause 804 may be substituted for Wet Mix Macadam for current AADT ≤ 500. For current AADT > 500, Clause 804 thickness should be 50 mm greater than the indicated Wet Mix Macadam design thickness

Note 2: Where the existing granular layer thickness is less than 100 mm, the difference between the existing thickness and 100 mm should be added to the design overlay.

Note 3: This table is not applicable when subgrade CBR is less than 1.5. When this is the case, consideration should be given to the use of increased thickness and/or the use of geotextiles.

Note 4: This table is based on a 20 year design life, 3% per annum growth rate and 10% Heavy Commercial Vehicle content.

Note 5: Good Drainage is essential in order to maintain road bearing capacity.

Wet Mix Macadam (mm)	Stabilised Wet Mix (mm)	Wet Mix / Asphalt Concrete (mm)	Asphalt Concrete (AC) (mm)
150*	100	-	70**
200*	150	-	100**
250*	180	150 / 50	120**
300*	200	200 / 50	140**

Table 5.2: Approximate Equivalent Thickness values

* Clause 804 may be substituted for Wet Mix Macadam for current AADT ≤ 500. For current AADT > 500, Clause 804 thickness should be 50 mm greater than the indicated Wet Mix Macadam design thickness

** Asphalt Concrete alone should not be used for SCI > 250 microns (40 kN wheel load)

Table 5.1 - Updates

1. Category 3 Roads
2. Sub-categories 3A, 3B & 3C
3. Design Traffic Values
4. Recommend Traffic Count Durations
5. PSCI Ratings 3 to 6
6. Material Choice
7. Layer Thickness
8. Table based on MapRoad data

Table 5.1: Typical Overlay Design Thickness Values for Category 3 Rural Regional & Local Roads

	Rural Regional & Local Road Design Category 3								
	Category 3A			Category 3B			Category 3C		
Design Traffic (Maximum)	2.5 msa / 5000 AADT / 2500 AADF			1.0 msa / 2000 AADT / 1000 AADF			0.5 msa / 1000 AADT / 500 AADF		
Traffic Count	7 day			3 day			1 day		
Material	UGM A ²	LEBM ³	Asphalt ⁴	UGM A ²	LEBM ³	Asphalt ⁴	UGM A ²	LEBM ³	Asphalt ⁴
PSCI Rating	Thickness (mm)								
6	125	100	70	Note ⁵	Note ⁵	Note ⁵	Note ⁵	Note ⁵	Note ⁵
5	150	120	80	110	100	60	Note ⁵	Note ⁵	Note ⁵
4	175	140	90	125	100	70	110	100	60
3	200	160	100	150	120	80	125	100	70

Notes to Table:

¹ This Table is not applicable for PSCI ratings 1 and 2 where further testing and advice should be sought from a qualified and experienced ground engineering professional

² UGM A shall receive a layer of double Surface Dressing as a minimum prior to trafficking, see Table 5.2 for surface course options

³ LEBM shall receive a surface course prior to trafficking, see Table 5.2 for surface course options.

⁴ The choice of Asphalt types shall align with the minimum thicknesses in Tables 5.2 and 5.3; the final layer shall always be an appropriate surface course chosen from Table 5.2

⁵ For these situations a layer of surface dressing should be sufficient, with localised repairs where required.

GENERAL NOTES

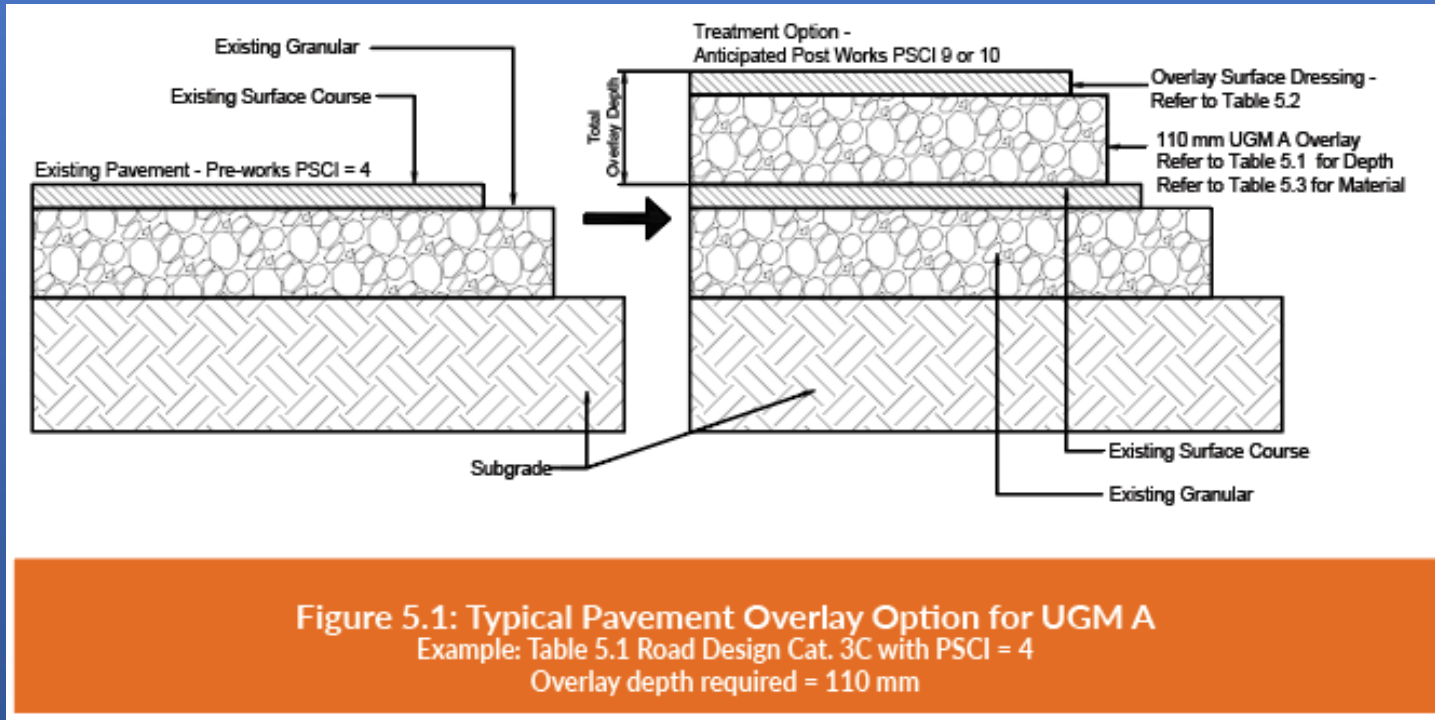
Where isolated sections of the existing pavement are in poor condition, undertake localised repairs first prior to application of overlay.

The thicknesses are based on a review of data obtained from the Rural Regional & Local Road Network and are expected to be suitable in most instances. However, exceptions do occur and if in doubt, specialist advice should be sought

The provision and maintenance of appropriate pavement drainage solutions are essential to maintain road bearing capacity.

Surface dressing does not provide any structural strength to the pavement overlay and should not be included as part of the overall overlay thickness.

Rational Overlay Design Solutions



Rural Regional & Local Road Design Category 3			
Category 3C			
Design Traffic (Maximum)	0.5 msa / 1000 AADT / 500 AADF		
Traffic Count	1 day		
Material	UGMA ²	LEBM ³	Asphalt ⁴
PSCI Rating	Thickness (mm)		
6	Note ⁵	Note ⁵	Note ⁵
5	Note ⁵	Note ⁵	Note ⁵
4	110	100	60
3	125	100	70

Rational Overlay Design Solutions

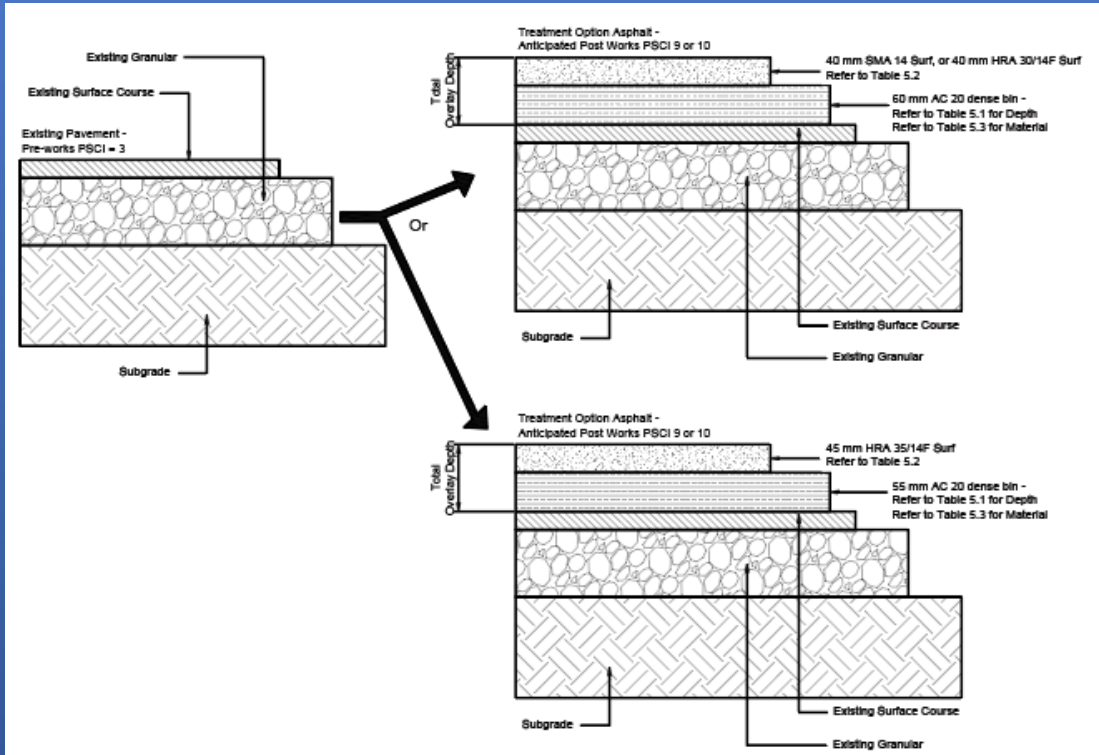
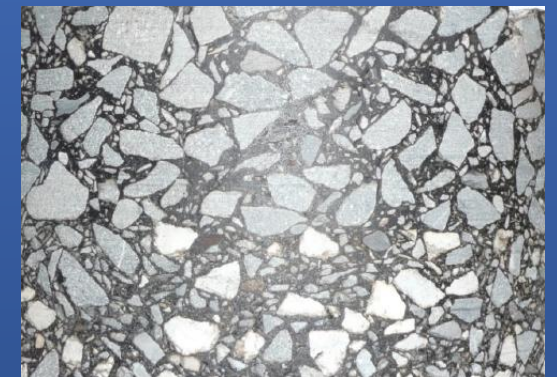


Figure 5.5: Typical Pavement Overlay Option for Asphalt
 Example: Table 5.1 Road Design Cat. 3A with PSCI = 3
 Overlay depth required = 100 mm

Rural Regional & Local Road Design Category 3			
Category 3A			
Design Traffic (Maximum)	2.5 msa / 5000 AADT / 2500 AADF		
Traffic Count	7 day		
Material	UGM A ²	LEBM ³	Asphalt ⁴
PSCI Rating	Thickness (mm)		
6	125	100	70
5	150	120	80
4	175	140	90
3	200	160	100

Material Choices

1. Section 5.3 – Material Choices
 - i. Surface Course
 - ii. Binder Course & Regulating
 - iii. Base Course
 - iv. Sub-base
 - v. Geosynthetics
 - vi. Other Considerations
 - Product Durability
 - Climate Change & Material Resilience



Materials

1. Table 4.1 – Summary of Granular & Cold Bituminous Materials

- i. CI 804
- ii. CI 806 Wet Mix
- iii. Cement Bound Granular Material

Material	Advantages	Disadvantages	Factors/Conditions to note
Clause 804 (Granular Material Type B)	<ul style="list-style-type: none"> • High quality material • Readily accessible • Provides sub-surface drainage and frost protection 	<ul style="list-style-type: none"> • Poor construction can lead to water ingress and damage at pavement edge • Difficult to maintain road profile during compaction 	<ul style="list-style-type: none"> • When using this material consideration must be given to specific site suitability • Refer to NRA SRW Clause 804 and Department requirements • Specific requirements for this material outlined in the NRA SRW Clause 804.3 (laying, compaction and maintaining the material within specified moisture content)
Wet Mix Macadam (Clause 806) (Granular Material Type D)	<ul style="list-style-type: none"> • High quality material • Low energy requirements - Cold applied material • Fast setting material (typically 15 – 20 minutes) • Cost effective • Excellent dry strength 	<ul style="list-style-type: none"> • Poor wet strength • If placed at a moisture content above the optimum, material can become spongy and unstable • Poor construction can lead to water ingress and damage at pavement edge 	<ul style="list-style-type: none"> • Refer to 'Guidelines on Construction Practice with Wet-Mix Macadam' [22] (RC.342), NRA SRW Clause 806 and Department requirements • When using this material consideration must be given to specific site suitability. • Specific requirements for this material outlined in the NRA SRW Clause 806.4 (laying, compaction and maintaining the material within specified moisture content) • After laying, surface should be sealed with a cationic bitumen emulsion with chippings applied

Table 5.2 – Summary of Surface Course Options

Layer	Material	Characteristics										Factors to Note	Specification Reference	Further Readings
		Cost	Durability	Resistance to Deformation	Load Spreading Ability	Skidding Resistance	Noise	Impermeability	Resistance to Cracking	Ride Quality	Laying Season			
	Surface Dressing	Low	Med	None	None	High	Med	High	High	n/a	April - Sept.	High daily outputs Durability concerns on high stressed areas Reduced traffic disruption due to speed of process Several types available including single, double, sandwich, inverted and racked in Site specific designs required and works to match design Aftercare needed in short term Advisable for training to be undertaken, see note in Table	DoT Circular RW 01 (2025) IAT Guidelines 3rd Edition For National Primary and Secondary: CC-SPW-00900 Clause 7.2.2 (Recipe) CC-SPW-00900 Clause 7.2.3 (End Performance)	Appendix A contains details of the different Surface Dressing Specification requirements. DN-PAV-03024 Clause 2.3 DN-PAV-03024 Clause 8 DN-PAV-03074 Clause 4 CC-GSW-00900 Clause 10.2.3 CC-PAV-04013

Table 5.3 – Summary of Binder, Base & Subbase Options

Layer	Material	Characteristics								Factors to Note	Specification Reference	Further Readings	
		Cost	Durability	Resistance to Deformation	Load Spreading Ability	Minimum Layer Thickness (mm)	Impermeability	Resistance to Cracking	Ride Quality				Laying Season
Subbase	UGM (A)	Low	Med	Med	High	110mm	Low	n/a	n/a	All Year	<p>Readily accessible</p> <p>Up to 30% Reclaimed aggregates can be used</p> <p>Poor construction can lead to water ingress and damage at pavement edge</p> <p>Must be laid and compacted at a moisture content within the range of the optimum to 2 percent below the optimum percentage.</p> <p>The material must be maintained within the 2% moisture content range</p> <p>Compaction in CC-SPW-00800 is end performance only (density)</p> <p>Must consider the placement location as additional chemical requirements apply if placed adjacent to cementitious materials UGM Ac or adjacent to metallic materials UGM Am</p> <p>UGM A should not be left exposed; after laying, the surface should be sealed with surface dressing or asphalt as appropriate</p> <p>UGM A can be installed all year round, however outside of the April - September window, moisture content can become more difficult to manage. Extra vigilance concerning ambient conditions is merited,</p>	CC-SPW-00800 Clause 2	Appendix XX contains guidance on compaction; however the definitive requirement is density in accordance with CC-SPW-00800 Clause 2.4.2.1

Appendices

1. Best Practice Guide for Pavement Works on Rural Regional & Local Roads
2. Optioneering
3. Sustainability & Lifecycle Considerations
4. Short Term Traffic Survey Requirements for Overlay Designs
5. Key Steps for Delivery of Overlay Schemes on Rural Regional & Local Roads

Short Term Traffic Surveys

1. Guidance on Short Term Traffic Counts
2. Table D1 – Recommended & Required Traffic Counts by Road Category
3. Category 1 & 2 Roads
4. Category 3 Roads
5. Circular RW08 of 2025

Table D1 - Recommended & Required Traffic Counts by Road Category for Overlay Design

	Road Design Category				
	Category 3C	Category 3B	Category 3A	Category 2	Category 1
Anticipated daily traffic both directions (AADT)	≤1000	>1000 to ≤2000	>2000 to ≤5000	>5000 to ≤8200	>8200
Traffic Count	Recommended	Recommended	Required	Required	Required
Traffic Count Duration ¹	1 day	3 day	7 day	14 day	14 day

Notes to Table:

¹ Where results indicate traffic volumes close to or above the upper threshold for the duration chosen, a further survey at the next highest duration should be considered.

Key Steps for Delivery of Overlay Scheme

Table 3.2: Key steps for delivery of overlay schemes on rural regional & local roads

Element	Purpose	Document Link	Document Section
Pavement Evaluation			
MapRoad AMS	Data mine for PSCI, traffic data plus other relevant data	MapRoad AMS	
Pavement Surface Condition Rating (PSCI)	Carry out visual assessment to determine defects	Rural Flexible Roads Manual	
Local knowledge	To ascertain notable aspects or if issues have occurred		
Drainage investigation	To ascertain notable aspects or if issues have occurred	3.6 Drainage	
Traffic assessment	For assessment of appropriate design methodology	Appendix D	
Design Methodology			
Determine Road Category Level	To establish design level required	This Document	Table 4.1
If Category 3	Use this document		
If Category 2 or 1	Use IAPDM	DN-PAV-03021 DN-PAV-03022	
Traffic Assessment	If IAPDM use TII requirements	PE-SMG-02002	
Category 3 Roads			
Establish pavement overlay thickness requirements	Determine sub-category using traffic count	This Document	Table 5.1
	Determine sub-category using PSCI rating		
Traffic Assessment	Where results indicate traffic volumes close to or above the upper threshold for the duration chosen, a further survey at the next highest duration should be considered	This Document	Appendix D
Mixture Selection	Review options based on constraints, season & objectives	This Document	Tables 5.2 & 5.1
Unbound Granular Mixtures			
Subbase layer, UGMA	Access criteria & product properties	CC-SPW-00800	Clause 2

Element	Purpose	Document Link	Document Section
Low Energy Bound Materials			
LEBM Types	Determine best product suited for location	CC-SPW-00900	Clause 8.1
Bituminous Bound Materials			
Bituminous mixture types	Determine best products suited to location	CC-SPW-00900 Orange Book	Clauses 3, 4, 5, 6.
Surface dressing		IAT Guidelines 3 rd Ed. CC-SPW-00900	
Product Approval & Conformity			
Unbound	To ensure correct documentation is requested and provided	CC-SPW-00800	Clause 2
LEBM		CC-SPW-00900	Clause 2
Bituminous mixtures		CC-SPW-00900	Clause 1
Surface dressing		IAT Guidelines 3 rd Ed. CC-SPW-00900	
Works			
All Products	To determine installation requirements and to assess conformity during installation	CC-SPW-00700	
Unbound		CC-SPW-00800	Clause 2.4.2
LEBM		CC-SPW-00900	Clause 10.3
Bituminous Mixtures		CC-SPW-00900	Clauses 10.1
Surface Dressing		IAT Guidelines 3 rd Ed. CC-SPW-00900	
Works Assistance			
Checks and Key Points documents	Hot Rolled Asphalt	CC-PAV-04011	
	Surface Dressing	CC-PAV-04013	
	Stone Mastic Asphalt	CC-PAV-04014	
	Asphalt Concrete	CC-PAV-04015	
	Site documentation & traceability	CC-PAV-04016	
	Storage & Retention of Bituminous Mixtures	CC-PAV-04017	

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**Questions must include name
and associated Local Authority
to be considered by the panel.**

