



YARNBROOK AND WEST ASHTON RELIEF ROAD

PAVEMENT DESIGN REPORT

CEREP III AND PERSIMMON HOMES WESSEX

September 2023

PFA Consulting
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

Tel: 01793 828000
Fax: 01793 835500
Email: admin@pfapl.com
Web: www.pfapl.com

engineering the future

PAGE LEFT INTENTIONALLY BLANK

DOCUMENT CONTROL

Job No	P876	
File Reference	G:\workfiles\P876 YARNBROOK & ASHTON\REPORTS\DOC07 Pavement Design\P876-DOC07 Pavement Design Report - Issue 5.docx	
	Name	Date
Prepared By	G Beaton	12.07.2019
Checked By	C Isherwood	03.02.2020

Issue	Approved	Date	Comments
Draft No. 1	C Isherwood BSc CEng DipM MICE MCIHT MCMI Managing Director	03.02.2020	
Draft No. 2	C Isherwood BSc CEng DipM MICE MCIHT MCMI Managing Director	20.04.2021	Updated to Refer GIR May 2020, and to DMRB April 2020 (CD224, 225, 226)
Issue 1	C Isherwood BSc CEng DipM MICE MCIHT MCMI Managing Director	20.08.2021	Draft No. 2 stamp removed for Tech Approval
Issue 2	C Isherwood BSc CEng DipM MICE MCIHT Managing Director	20.04.2022	All subbase specified as CI 801- 807
Issue 3	C Isherwood BSc CEng DipM MICE MCIHT Managing Director	29.06.2022	All subbase specified as CI 821- 822 for YWARR
Issue 4	C Isherwood BSc CEng DipM MICE MCIHT Managing Director	06.06.2023	Surface course changed to Unilayer
Issue 5	C Isherwood BSc CEng DipM MICE MCIHT Managing Director	28.09.2023	Technical Approval

This document has been prepared for the exclusive use of the client in connection with the project and its copyright remains vested in PFA Consulting. Unless otherwise agreed in writing by PFA Consulting, no person or party may copy, reproduce, make use of or rely upon its contents other than for the purposes for which it was originally prepared and provided.

Opinions and information provided in this document have been provided using due care and diligence. It should be noted and is expressly stated that no independent verification of any information supplied to PFA Consulting has been made.

Warning: This document may contain coloured images which may not print satisfactorily in black and white. It may also contain images originally created at a size greater than A4 which may not print satisfactorily on small printers. If copying is authorised but difficulty is incurred in reproducing a paper copy of this document, or a scaled copy is required, please contact PFA Consulting. Authorisation for reproducing plans based upon Ordnance Survey information cannot be given.

© PFA Consulting Ltd 2023



PAGE LEFT INTENTIONALLY BLANK

CONTENTS

PAGE NO.

1.	INTRODUCTION	1
2.	GROUND INVESTIGATION	1
	Geology	1
	California Bearing Ratios.....	1
3.	A350 TRAFFIC ASSESSMENT	2
	Traffic Data	2
	Design Traffic	2
	Growth Factor	2
	Wear Factor	2
	Heaviest Traffic Lane	3
	Design Traffic	3
4.	ROAD PAVEMENT DESIGN	9
	Estimated CBR Value	9
	Road Foundation.....	9
	Road Pavement.....	10
	Design Thicknesses	10
	Polished Stone Value	12
5.	PREFERRED PAVEMENT DESIGN	13

1. INTRODUCTION

- 1.1. This report sets out the road pavement design for Section 38/278 Technical Approval by Wiltshire Council of the A350 Yarnbrook and West Ashton Relief Road to the south-east of Trowbridge. The road will have a two-lane single carriageway (S2).
- 1.2. The design has an assumed Pavement Design Life of 40 years using “standard” growth factors.

2. GROUND INVESTIGATION

- 2.1. *A Phase 1 Review and Phase 2 Geo-Environmental Assessment – Ashton Park, Trowbridge* report was prepared by Geo Environmental Group for Persimmon Homes Wessex and CEREP III in March 2019.
- 2.2. Stantec prepared a GIR for YWARR in May 2020. That report focused on the YWARR, in particular the design conditions for the embankments and structures.

Geology

- 2.3. An overview of the site geology is given in section 8.1, which states:
 - “Alluvium was encountered underlying topsoil and locally Made Ground in the central area of the site along the western bank of the River Biss to depths of 0.70m to 3.80m.”
 - “Head Deposits were discovered underlying the topsoil and locally Made Ground across the majority of the north-western and southern site sections to depths of 0.30m to 3.00m, being typically deeper towards the River Biss (1.50m to 3.00m).”
 - “The Oxford Clay Formation was encountered underlying the Alluvium, Head Deposits, and Naturally Reworked Oxford Clay Formation across the site from depths of 0.15m to 4.80m.”
- 2.4. Thus, the report indicates that the subgrade of the proposed road is likely to be either Head Deposits or Oxford Clay. However, the possibility of discovering a pocket of Alluvium in the vicinity of the River Biss should not be discounted, but the road at this point will be on embankment constructed to Series 600.
- 2.5. The May 2020 report summarised the ground conditions as
 - “Head Deposits are present across the majority of the site underlain by the Oxford Clay Formation. Alluvium is recorded adjacent to the River Biss”.

Thus, the findings are similar to the March 2019 report.

California Bearing Ratios

- 2.6. California Bearing Ratios (CBR) results were discussed in section 8.10 – Road Pavement Design. The report states:
 - “In view of the cohesive nature of the soils, the equilibrium CBR values have been determined in accordance with HA Interim Advice Note 73/06 to reflect long term conditions.”
 - “An equilibrium CBR design value of 2-3% is recommended for the Head and Oxford Clay Formation.”
 - “An equilibrium CBR design value of <2% is recommended for the Alluvium”

- 2.7. Therefore, a CBR value of 2% will be used for the purpose of road pavement design. However, this is subject to further testing to confirm the actual CBR value of the subgrade before or at construction stage.
- 2.8. The report recommends that where Alluvium is encountered, ground improvement techniques such as soil stabilisation using cement or lime should be employed, (update when further geotech work received).
- 2.9. The May 2020 report advises:
- “A long-term design CBR value of 2.5% is recommended for pavement design.”**

3. A350 TRAFFIC ASSESSMENT

Traffic Data

- 3.1. The traffic flows are based on the data gathered by an automatic traffic counter (ATC) that was installed on the A350 to the north of West Ashton crossroads for a seven-day period from Friday 17 to Thursday 23 January 2014, Wiltshire Council’s updated Trowbridge SATURN traffic model and the traffic data from a manual classified count (MCC) site on the A350 to the north of West Ashton crossroads in 2017 (DfT Count No. 38027). Annual Average Daily Traffic (AADT) flows, broken down by vehicle class, have been generated for the three sections of the relief road listed below.
- Between roundabouts 1 (R1) and 2 (R2).
 - Between roundabouts 2 (R2) and 3 (R3).
 - To the east of roundabout 3 (R3).

Design Traffic

- 3.2. Design traffic calculations have been carried out in accordance with highways directive CD 224, *Traffic Assessment*.

Growth Factor

- 3.3. The growth factor has been taken from CD224 Table 2.12, the tabulated part of which has been reproduced below as **Table 3.1**.

Table 3.1: Extracted Growth Factor (G) for future traffic

Design Period (years)	5	10	15	20	25	30	35	40
OGV1 + PSV	1.02	1.05	1.08	1.11	1.14	1.17	1.21	1.24
OGV2	1.04	1.10	1.16	1.23	1.30	1.37	1.46	1.54

- 3.4. Therefore, for a 40 year design life, the growth factors are OGV1 + PSV = 1.24 and OGV2 = 1.54.

Wear Factor

- 3.5. The wear factor has been taken from CD224 Table 2.18, which has been reproduced below as Table 3.2. As this road will be new construction, the wear factors in the right-hand column apply.

Table 3.2: Wear Factors for cv Classes and Categories

Wear Factors	Maintenance W	New W
Buses and Coaches	2.6	3.9
2-axle rigid	0.4	0.6
3- axle rigid	2.3	3.4
4-axle rigid	3.0	4.6
3 and 4-axle articulated	1.7	2.5
5-axle articulated	2.9	4.4
6-axle articulated	3.7	5.6
OGV1 + PSV	1.3	1.9
OGV2	3.2	4.9

Heaviest Traffic Lane

- 3.6. Since the road is to be constructed as a two-lane single carriageway (S2), all of the vehicles in each direction will be travelling in the same lane and so the proportion of (goods) vehicles travelling in the heaviest traffic lane, **P**, will be 100%.

Design Traffic

- 3.7. For the section road between roundabouts 1 (R1) and 2 (R2), the design traffic is calculated in **Table 3.3** below.

Table 3.3: Relief Road Design Traffic – Roundabout 1 (R1) to Roundabout 2 (R2)

Commercial vehicle class of category	AADF (F)	Growth Factor (G)	Wear Factor (W)	Weighted Annual Traffic (by class or category)
Either by class				
Buses and Coaches (PSV)	21	1.24	3.9	0.037
OGV1				
2-axle rigid	180	1.24	0.6	0.049
3-axle rigid	79	1.24	3.4	0.121
OGV2				
4-axle rigid	48	1.54	4.6	0.124
3 and 4-axle articulated	92	1.54	2.5	0.129
5-axle articulated	0	1.54	4.4	0
6-axle articulated	157	1.54	5.6	0.494
Or by category				
OGV1 + PSV				
OGV2				
Total daily flow (cv/d)	577	Total weighted annual traffic		0.954
$T = 365 \times F \times Y \times G \times W \times P \times 10^{-6} \text{ msa}$ Weighted annual traffic = $365 \times F \times G \times W \times 10^{-6} \text{ msa}$ Design traffic (T) = Total weighted annual traffic $\times Y \times P$		Percentage of vehicles in heaviest traffic lane (P)		100
		Design Period (Y)		40
		Design Traffic (T)		38.2

- 3.8. Paragraph 2.7 in CD224 requires that the minimum proportion of Class OGV2 vehicles used in the design is no less than 70%. For a total of 577 commercial vehicles per day, of which OGV2 is 297.

Total daily flow (cv/d) = 577
Proportion of OGV2 = 297
Total daily flow of OGV2 (cv/d) = 51.5%

51.5% is less than 70%. Therefore, this requirement has not been met.

- 3.9. Consequently, the design traffic has been recalculated in Table 3.4 below, using the same total design flow of vehicles but with their proportions adjusted in order to satisfy the requirements of paragraph 2.7.

Table 3.4: Recalculated Relief Road Design Traffic – Roundabout 1(R1) to Roundabout 2 (R2)

Commercial vehicle class of category	AADF (F)	Growth Factor (G)	Wear Factor (W)	Weighted Annual Traffic (by class or category)
Either by class				
Buses and Coaches (PSV)				
OGV1				
2-axle rigid				
3-axle rigid				
OGV2				
4-axle rigid				
3 and 4-axle articulated				
5-axle articulated				
6-axle articulated				
Or by category				
OGV1 + PSV	173	1.24	1.9	0.149
OGV2	404	1.54	4.9	1.113
Total daily flow (cv/d)	577	Total weighted annual traffic		1.262
		Percentage of vehicles in heaviest traffic lane (P)		100
T = 365 x F x Y x G x W x P x 10 ⁻⁶ msa		Design Period (Y)		40
		Design Traffic (T)		50.48

Weighted annual traffic = 365 x F x G x W x 10⁻⁶ msa

Design traffic (T) = Total weighted annual traffic x Y x P

- 3.10. For the section road between roundabouts 2 (R2) and 3 (R3), the design traffic is calculated in **Table 3.5** below.

Table 3.5: Relief Road Design Traffic – Roundabout 2 (R2) to Roundabout 3 (R3)

Commercial vehicle class of category	AADF (F)	Growth Factor (G)	Wear Factor (W)	Weighted Annual Traffic (by class or category)
Either by class				
Buses and Coaches (PSV)	43	1.24	3.9	0.076
OGV1				
2-axle rigid	372	1.24	0.6	0.101
3-axle rigid	163	1.24	3.4	0.250
OGV2				
4-axle rigid	100	1.54	4.6	0.258
3 and 4-axle articulated	190	1.54	2.5	0.267
5-axle articulated	0	1.54	4.4	0
6-axle articulated	325	1.54	5.6	1.023
Or by category				
OGV1 + PSV				
OGV2				
Total daily flow (cv/d)	1193	Total weighted annual traffic		1.975
		Percentage of vehicles in heaviest traffic lane (P)		100
		Design Period (Y)		40
		Design Traffic (T)		79.00

$$T = 365 \times F \times Y \times G \times W \times P \times 10^{-6} \text{ msa}$$

$$\text{Weighted annual traffic} = 365 \times F \times G \times W \times 10^{-6} \text{ msa}$$

$$\text{Design traffic (T)} = \text{Total weighted annual traffic} \times Y \times P$$

- 3.11. Paragraph 2.7 in CD224 requires that the minimum proportion of Class OGV2 vehicles used in the design is no less than 70%. For a total of 1193 commercial vehicles per day, of which OVC2 is 615, shows the minimum proportion of OGV2 vehicles to be 62%.

$$\begin{aligned} \text{Total daily flow (cv/d)} &= 1193 \\ \text{Total daily flow of OGV2 (cv/d)} &= 615 \\ \text{Proportion of OGV2} &= 51.5\% \end{aligned}$$

51.4% is less than 70%. Therefore, this requirement has not been met.

Consequently, the design traffic has been recalculated in **Table 3.6** below, using the same total daily flow of vehicles but with their proportions adjusted in order to satisfy the requirements of paragraph 2.7.

$$\begin{aligned} \text{Total daily flow (cv/d)} &= 1193 \\ \text{Proportion of OGV2} &= 70\% \\ \text{Total daily flow of OGV2 (cv/d)} &= 740 \end{aligned}$$

Table 3.6: Recalculated Relief Road Design Traffic – Roundabout 2 (R2) to Roundabout 3 (R3)

Commercial vehicle class of category	AADF (F)	Growth Factor (G)	Wear Factor (W)	Weighted Annual Traffic (by class or category)
Either by class				
Buses and Coaches (PSV)				
OGV1 2-axle rigid 3-axle rigid				
OGV2 4-axle rigid 3 and 4-axle articulated 5-axle articulated 6-axle articulated				
Or by category				
OGV1 + PSV	358	1.24	1.9	0.308
OGV2	835	1.54	4.9	2.300
Total daily flow (cv/d)	1193	Total weighted annual traffic		2.608
$T = 365 \times F \times Y \times G \times W \times P \times 10^{-6} \text{ msa}$		Percentage of vehicles in heaviest traffic lane (P)		100
		Design Period (Y)		40
		Design Traffic (T)		104.32

Weighted annual traffic = $365 \times F \times G \times W \times 10^{-6} \text{ msa}$

Design traffic (T) = Total weighted annual traffic x Y x P

3.12. For the section road to the east of roundabout 3, the design traffic is calculated in **Table 3.7** below.

Table 3.7: Relief Road Design Traffic – East of Roundabout 3 (R3)

Commercial vehicle class of category	AADF (F)	Growth Factor (G)	Wear Factor (W)	Weighted Annual Traffic (by class or category)
Either by class				
Buses and Coaches (PSV)	27	1.24	3.9	0.048
OGV1				
2-axle rigid	235	1.24	0.6	0.064
3-axle rigid	103	1.24	3.4	0.158
OGV2				
4-axle rigid	63	1.54	4.6	0.163
3 and 4-axle articulated	120	1.54	2.5	0.169
5-axle articulated	0	1.54	4.4	0
6-axle articulated	206	1.54	5.6	0.648
Or by category				
OGV1 + PSV				
OGV2				
Total daily flow (cv/d)	754	Total weighted annual traffic		1.25
T = 365 x F x Y x G x W x P x 10⁻⁶ msa		Percentage of vehicles in heaviest traffic lane (P)		100
		Design Period (Y)		40
		Design Traffic (T)		50.00

$$\text{Weighted annual traffic} = 365 \times F \times G \times W \times 10^{-6} \text{ msa}$$

$$\text{Design traffic (T)} = \text{Total weighted annual traffic} \times Y \times P$$

3.13. Paragraph 2.7 in CD224 requires that the minimum proportion of Class OGV2 vehicles used in the design is no less than 70% a total of 754 commercial vehicles per day, which 389 are OGV2.

$$\begin{aligned} \text{Total daily flow (cv/d)} &= 754 \\ \text{Total daily flow of OGV2 (cv/d)} &= 389 \\ \text{Proportion of OGV2} &= 51.6\% \end{aligned}$$

51.6% is less than 70%. Therefore, this requirement has not been met.

3.14. Consequently, the design traffic has been recalculated in Table 3.8 below, using the same total design flow of vehicles but with their proportions adjusted in order to satisfy the requirements of paragraph 2.7.

- 3.15. Consequently, the design traffic has been recalculated in Table 3.4 below, using the same total design flow of vehicles but with their proportions adjusted in order to satisfy the requirements of paragraph 2.7.

Total daily flow (cv/d) = 754
Proportion of OGV2 = 70%
Total daily flow of OGV2 (cv/d) = 528

Table 3.8: Recalculated Relief Road Design Traffic – East of Roundabout 3 (R3)

Commercial vehicle class of category	AADF (F)	Growth Factor (G)	Wear Factor (W)	Weighted Annual Traffic (by class or category)
Either by class				
Buses and Coaches (PSV)				
OGV1				
2-axle rigid				
3-axle rigid				
OGV2				
4-axle rigid				
3 and 4-axle articulated				
5-axle articulated				
6-axle articulated				
Or by category				
OGV1 + PSV	226	1.24	1.9	0.194
OGV2	258	1.54	4.9	1.454
Total daily flow (cv/d)	754	Total weighted annual traffic		1.648
T = 365 x F x Y x G x W x P x 10 ⁻⁶ msa		Percentage of vehicles in heaviest traffic lane (P)		100
		Design Period (Y)		40
		Design Traffic (T)		66.00

Weighted annual traffic = 365 x F x G x W x 10⁻⁶ msa

Design traffic (T) = Total weighted annual traffic x Y x P

- 3.16. In summary, the Design Traffic (T) for each section of the relief road is:

Between roundabouts 1 (R1) and 2 (R2) = 50.48 msa
Between roundabouts 2 (R2) and 3 (R3) = 104.32 msa
To the east of roundabout 3 (R3) = 66.00 msa

4. ROAD PAVEMENT DESIGN

Estimated CBR Value

- 4.1. The geotechnical reports advise that the subgrade is most likely to be Head Deposits or Oxford Clay Formation (see **Section 2** above). Also, it advised that a CBR value of between 2 and 3% should be used for these materials. Should any small pockets of Alluvium be encountered, these should be treated as 'soft spots' and excavated and replaced with stronger material to achieve a CBR of at least 2.5%. In the case of more extensive areas of Alluvium, the report recommends the use of cement or lime soil stabilisation techniques to improve the bearing capacity. A CBR of 2.5% is used here, although it is recognised a higher value may provide for the length R1-R2 which is an embankment. Therefore, subject to the selected fill material and compaction results, on-site CBR tests are recommended.

Road Foundation

- 4.2. The road pavement foundation design has been carried out in accordance with CD225 Design for New Pavement Foundations. The design approach shall be 'restricted'.
- 4.3. The note to Paragraph 3.7 of CD225 advises that Foundation Class 4 is only permitted as a performance foundation and Paragraph 3.14 advises that Foundation Class 1 shall not be used for traffic loading greater than 20 MPa. Therefore, only Foundation Class 2 and 3 are suitable.
- 4.4. For a subgrade CBR of 2.5%, the subgrade surface modulus, **E**, can be calculated as follows.

$$\begin{aligned}
 \mathbf{E} &= 17.6 (\text{CBR})^{0.64} \\
 &= 17.6 (2.5)^{0.64} \\
 &= \mathbf{31 \text{ MPa}}
 \end{aligned}$$

- 4.5. Para 2.7 of CD225 where the design subgrade is lower than 30 MPa, improvement of the subgrade shall be undertaken. The design value is 31 MPa, thus improvement is not required, but the design value is just above the threshold, thus on-site testing recommended. Furthermore, paragraph 3.12 advises where the short-term surface modelling is 50 MPa or lower, the foundation design shall consist of subbase and capping. Whilst short term modelling is not calculated it is unlikely to be greater than 50 MPa, therefore a subbase plus capping foundation to be applied.
- 4.6. Paragraph 3.16 of CD225 gives the Thickness Charts as follows:

Figure 3.20	Class 2	420mm capping	MCH W1	613
		250mm subbase	MCH W1	803-807
Figure 3.21	Class 3	420mm capping	MCH W1	613
		320mm subbase	MCH W1	820, 822 or 840
Figure 3.22	Class 2	280mm capping	MCH W1	614, 615, 643
		280mm subbase	MCH W1	803-807
Figure 3.23	Class 3	280mm capping	MCH W1	614-643
		330mm subbase	MCH W1	821, 822 or 840

Road Pavement

- 4.7. The Road pavement design has been carried out in accordance with CD226 Design for New Pavement Construction using standard designs for flexible pavements.
- 4.8. Alternative pavement designs have been prepared for the two foundation classes shown above, namely:

Foundation Class 2	≥ 100 MPa
Foundation Class 3	≥ 200 MPa

CD226 paragraph 2.5, states that Foundation Class 2:

“Where a pavement is being designed for a new carriageway, Foundation Class 2 shall only be used for design traffic 80msa or less”.

Class 2 only permitted for R1-R2 and east of R3, whereas Class 3 can be used throughout.

Design Thicknesses

- 4.9. The design thicknesses for alternative base materials for the section of carriageway between roundabouts 1 (R1) and 2 (R2) – design traffic 50.48msa – obtained from CD226 Figure2.20 are shown in **Table 4.2**.

Table 4.2: Design Thickness for Flexible Pavement – Roundabouts 1 (R1) to 2 (R2)

Foundation Class	Base Material	Thickness
Foundation Class 2:	AC 40/60	340mm total asphalt thickness
	EME 2	280mm total asphalt thickness
	HBM Category A -	240mm bound base thickness
	HBM Category B -	200mm bound base thickness
	HBM Category C -	170mm bound base thickness
	HBM Category D -	150mm bound base thickness
Foundation Class 3:	AC 40/60 -	300mm total asphalt thickness
	EME 2	250mm total asphalt thickness
	HBM Category A -	220mm bound base thickness
	HBM Category B -	180mm bound base thickness
	HBM Category C -	150mm bound base thickness
	HBM Category D -	150mm bound base thickness
Surfacing thickness over HBM, H		180mm of flexible surfacing

- 4.10. The design thicknesses for alternative base materials for the section of carriageway between roundabouts 2 (R2) and 3 (R3) – design traffic 104.32msa – obtained from CD226 Figures 2.20 are shown in **Table 4.3** for Foundation Class 3 only as design traffic greater than 80msa.

Table 4.3: Design Thickness for Flexible Pavement – Roundabouts 2 (R2) to 3 (R3)

Foundation Class	Base Material	Thickness
Foundation Class 2: (see Para 4.8)		
Foundation Class 3:	AC 40/60	320mm total asphalt thickness
	EME 2	270mm total asphalt thickness
	HBM Category A -	240mm bound base thickness
	HBM Category B -	200mm bound base thickness
	HBM Category C -	170mm bound base thickness
	HBM Category D -	150mm bound base thickness
Surfacing thickness over HBM, H		180mm of flexible surfacing

- 4.11. The design thicknesses for alternative base materials for the section of carriageway to the east of roundabouts 3 (R3) – design traffic 66.0msa – obtained from CD226 Figure 2.20 are shown in **Table 4.4**.

Table 4.4: Design Thickness for Flexible Pavement – To the East of Roundabout 3 (R3)

Foundation Class	Base Material	Thickness
Foundation Class 2:	AC 40/60	350mm total asphalt thickness
	EME 2	290mm total asphalt thickness
	HBM Category A -	250mm bound base thickness
	HBM Category B -	210mm bound base thickness
	HBM Category C -	180mm bound base thickness
	HBM Category D -	150mm bound base thickness
Foundation Class 3:	AC 40/60	320mm total asphalt thickness
	EME 2	260mm total asphalt thickness
	HBM Category A -	230mm bound base thickness
	HBM Category B -	190mm bound base thickness
	HBM Category C -	160mm bound base thickness
	HBM Category D -	150mm bound base thickness
Surfacing thickness over HBM, H		180mm of flexible surfacing

- 4.12. Paragraph 2.20 of CD226 states:

“For flexible pavements with an asphalt base, the base and binder course should use the same material type i.e. both layers contain AC 40/60 or both layers contain EME2”.

- 4.13. Paragraph 2.22 of CD226 states:

“Where traffic exceeds 80msa, the course aggregate in all the asphalt material shall contain only crushed rock or slag”.

Polished Stone Value

- 4.14. The traffic levels at design life for each section of the road are given in **Table 4.5**.

Table 4.5: Traffic levels at Design Life

Road Section	Category	AADF	Growth	Traffic Flow	Traffic Level
Between R1 and R2 (From Table 3.4)	OGV1 + PSV	173	1.24	215	
	OGV2	404	1.59	642	
	TOTAL =	577			
Between R2 and R3 (From Table 3.6)	OGV1 + PSV	358	1.24	444	
	OGV2	835	1.59	1328	
	TOTAL =	1193			
To the East of R3 (From Table 3.8)	OGV1 + PSV	226	1.24	280	
	OGV2	528	1.54	840	
	TOTAL =	754			

- 4.15. From CD 236 Rev. 3 *Surface Course Materials for Construction* Table 3.2a: PSV for chippings or coarse aggregate in surfacing's (excluding thin surface course systems complying with clause 942 of the Specification (MCHW1)) and Table 3.2b: PSV for coarse aggregate in thin surface course systems complying with clause 942 of the Specification (MCHW1), the polished stone values (PSV) for each section of road are as listed in **Table 4.6**. The lengths comprising the 'approach to roundabouts' are shown on the drawings.

Table 4.6: Polished Stone Values for Chippings or Coarse Aggregate in Surfacing's

Road Section	Site Category	Site Description	PSV (Table 3.2a)	PSV (Table 3.2b)
Between R1 and R2	C	Non-event Carriageway with two-way traffic	65	58
	Q	Approaches to roundabouts	68+	68+
Between R2 and R3	C	Non-event Carriageway with two-way traffic	65	58
	Q	Approaches to roundabouts	68+	68+
To the East of R3	C	Non-event Carriageway with two-way traffic	65	58
	Q	Approaches to roundabouts	68+	68+

- 4.16. From CD 236, Table 3.4: *Maximum AAV of chippings, or coarse aggregates in unchipped surfaces, for new surface courses*, the maximum aggregate abrasion values (AAV) for each section of road are as listed in **Table 4.7**.

Table 4.7: Maximum AAV for Chippings or Coarse Aggregate in Unchipped Surfaces

Road Section	Maximum AAV for Chippings in Hot Rolled Asphalt Surface Course	Maximum AAV for Coarse Aggregate in Asphalt Concrete Surface Course
Between R1 and R2	12	16
Between R2 and R3	10	14
To the East of R3	12	14

5. PREFERRED PAVEMENT DESIGN

- 5.1. The preferred pavement design for the YWARR is listed in **Table 5.1** below. The design is based on the highest Design Traffic loading (Table 3.6) as required by Wiltshire Council, who requested the most robust were alternatives exist.

Table 5.1: Preferred Pavement Design – YWARR

(Excludes R2 access road and access road at R5 see text below)

Layer	Thickness	Material
Surface Course:	45mm	Tarmac Ultilayer 10 with 10mm stone PSV 68+* or Tarmac Ultilayer 14 with 14mm stone PSV 65.
Binder Course:	65mm	AC20 dense bin 40/60 to BS EN 13108:2016 (SHW Cl. 906)
Base:	210mm	AC32 dense base 40/60 to BS EN 13108-1:2016 (SHW Cl. 906) - laid in two equal thickness layers
Sub-base:	320mm	MCHWI 821-822 C3/C4
Capping	420mm	MCHWI 613
Total Thickness:	1060mm	

*PSV 68+ on the approaches to roundabouts and circulatory carriageway – refer to drawings for application length.

- 5.2. Save for the surface course which shall be as Table 5.1, for the length of road from Roundabout R2 into the development area, the pavement design shall be to Wiltshire Council's Standard Detail WC-HCD-700-D001, Road Category AR1 with CBR @ 2.5%. For the length from road from R5, the Standard Detail shall prevail including the surface course.
- 5.3. **Table 5.2** compares the requirements within Wiltshire Councils' Standard Detail WC-HCD-700-D001 Flexible Pavements (Speed Limit 40 mph or less) and Road Category AR1 with Table 5.1.
- 5.4. The length R1-R2 is proposed to have a speed limit of 40 mph; whereas R2-R3 is 50 mph and east of R3 is 60 mph. Therefore, using CD224/225 and 226 is the correct approach, particularly given the status of the YWARR as the A350, but the comparison findings are duly summarised for information.

Table 5.2: Comparison of Layer Thickness between WC Standard Detail and Table 5.1 – 5.3

Layer	Standard Detail Thickness AR1	Table 5.1 – Preferred Thickness
Surface Course:	45mm	45mm
Binder Course:	60mm	65mm
Base:	150mm	210mm
Sub-base:	350mm	320mm
Capping	250mm	420mm
Total Thickness:	855mm	1060mm

- 5.5. The preferred layer thicknesses are equal to or greater than the Standard Detail which is to be expected for what is to be an 'A' road, except for subbase which is lower. However, when the Foundation Layers (subbase and capping) are combined the Standard Detail total thickness is 600mm, whereas the preferred is 740mm, thus the preferred foundation is satisfactory.