THE REPUBLIC OF THE UNION OF MYANMAR

PANEL DISCUSSION ON PAVEMANT

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IMMEDIATE PAST PRESIDENT

MYANMAR ENGINEERING SOCIETY

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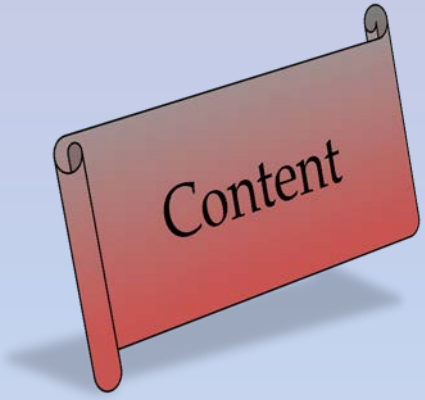


Myanmar Profile

Population

60 Million (2010-2011)

Road Length

148689.9 km (2012)

Area

- 676578 km^2
- 936 km (East – West)
- 2051 km (North – South)

Number of Registered Vehicles

- 2476672 (June 2012)

Neighboring Countries

- Bangladesh, India, China, Laos, Thailand

I Myanmar Profile

Myanmar National Data

Composition

- 7 States & 7 Regions
- 138 National Races

Capital City

- Naypyitaw (Government)
- Yangon (Economic)
- Mandalay (Culture)

Official Language

- Myanmar

Climate

- Seasons (Summer, Raining, Winter)
- Temperature (Mean max: 31˚C)
- Humidity (Mean ~ 70 %)
- Avg. Annual rainfall (~ 1800 mm)

Economy

- Currency – Kyat (1 US $ ~ 900 kyats)
- Per capita GDP – 700 US $ (March 2011)

Major Issues on Pavement

Major Issues on Pavement

(1) Geometric Design

(For Safety, Beauty, Comfort and Economy)

(2) Structural Design

(For Stability of Road Structure)

(3) Maintenance

(4) Problems of Roads encountered in Delta Areas

(1)Geometric Design of Road (Public Works)

Class	AADT	No. of lane	Pavement/ Lane Width
D-VI	< 50	Single Lane	12’
D-V	50~200	Single Lane	16’
D-IV	200~500	Two Lane	9’
D-III	500~2500	Two Lane	11’ (minimum) 12’ (desirable)
D-II	> 2500	Four Lane	11’ (minimum) 12’ (desirable)
D-I	> 2500	Four Lane (Divided)	12’

(1) Geometric Design
Standard Class DV and DVI
(Public Works)

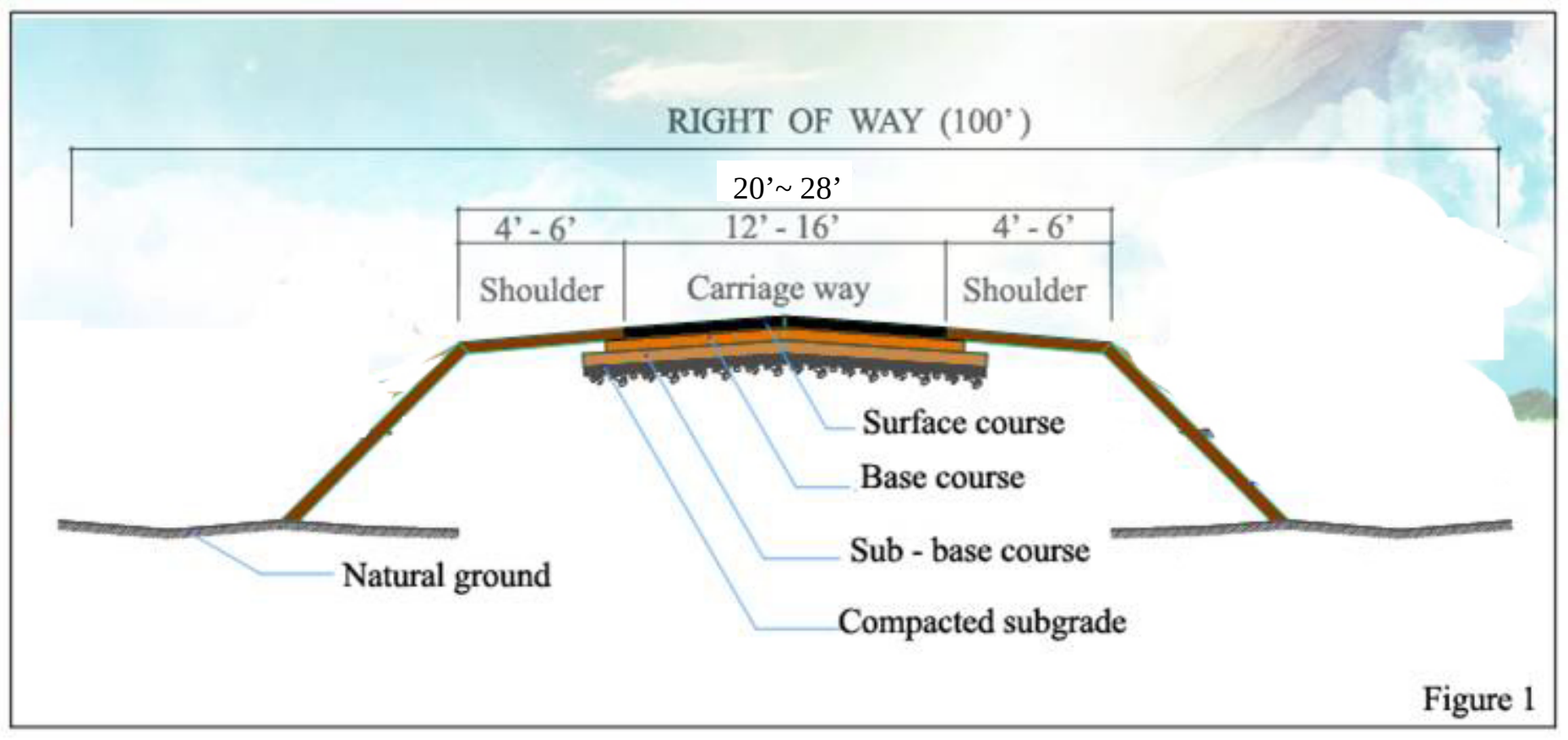


Figure 1

(2) Structural Design of Road

- For Flexible Pavement Design, Public Works is using Road Note 31 and Oversea Road Note 31

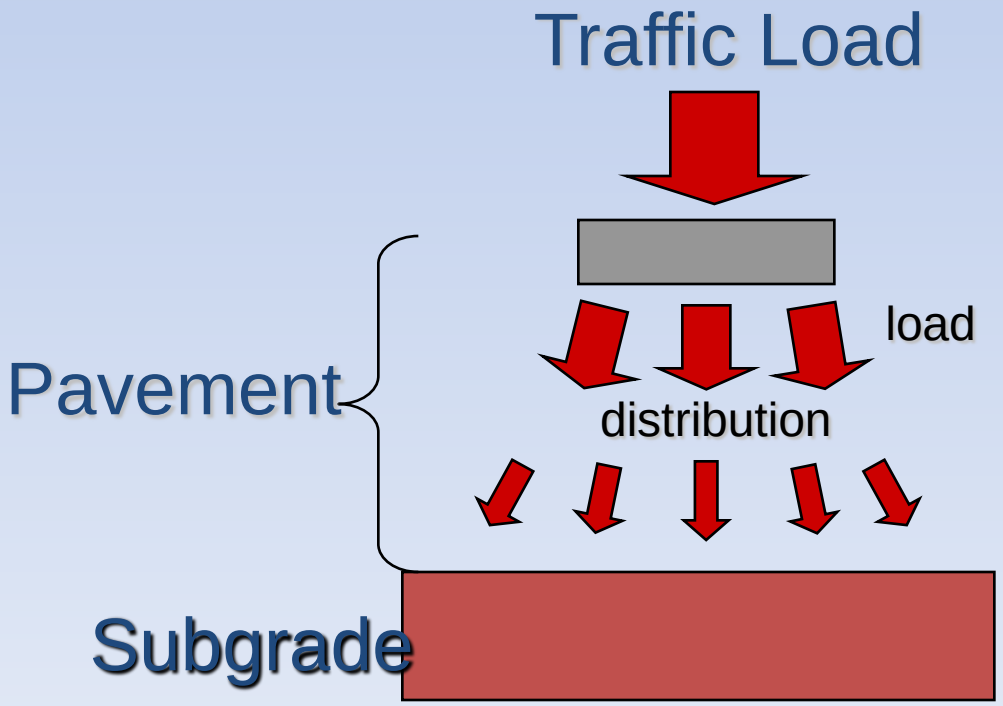
- Both come out from the research works made by Transport and Road Research Laboratory (U.K.).

- For Rigid Pavement Design, Road Note 29, Transport and Road Research Laboratory, U.K. is adopted.

(2) Structural Design of Road

Basic Principle

- To distribute traffic load to subgrade
- To make its stress smaller than the bearing capacity of the subgrade



KEY TO STRUCTURAL CATALOGUE

Traffic classes
(10⁶ esa)

T1 = < 0.3
T2 = 0.3 - 0.7
T3 = 0.7 - 1.5
T4 = 1.5 - 3.0
T5 = 3.0 - 6.0
T6 = 6.0 - 10
T7 = 10 - 17
T8 = 17 - 30

Subgrade strength classes
(CBR%)

S1 = 2
S2 = 3 , 4
S3 = 5 - 7
S4 = 8 - 14
S5 = 15 - 29
S6 = 30+

Material Definitions


Double surface dressing

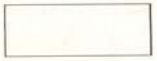

Flexible bituminous surface

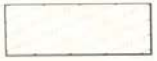

Bituminous surface
(Usually a wearing course, WC, and a basecourse, BC)

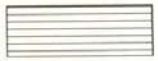

Bituminous roadbase, RB


Granular roadbase, GB1 - GB3


Granular sub-base, GS

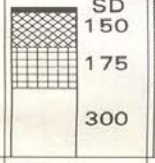
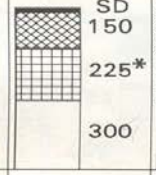
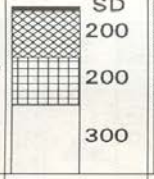
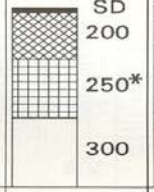
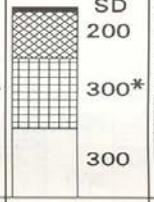
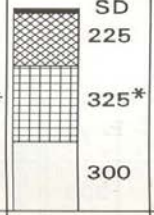
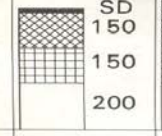
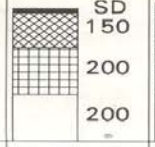
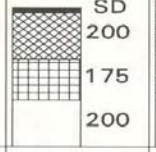
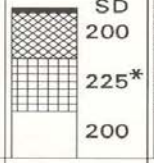
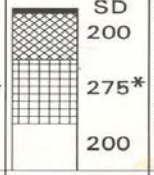
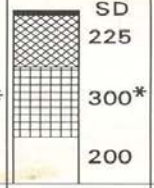
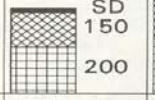
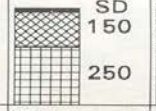
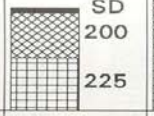
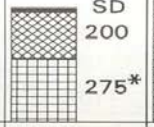
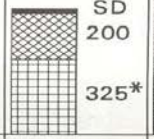
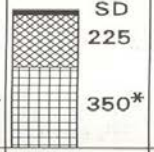
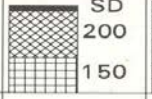
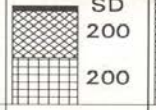
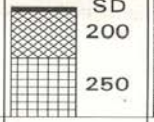
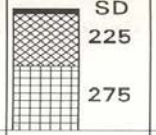
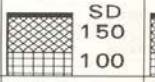
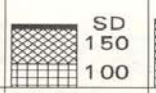
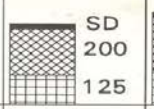
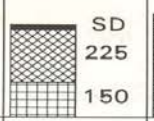
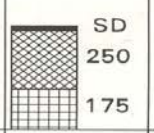

Granular capping layer or selected subgrade fill, GC


Cement or lime-stabilised roadbase 1, CB1


Cement or lime-stabilised roadbase 2, CB2


Cement or lime-stabilised sub-base, CS

CHART 1 GRANULAR ROADBASE / SURFACE DRESSING

	T1	T2	T3	T4	T5	T6	T7	T8
S1								
S2								
S3								
S4								
S5								
S6								

Note: 1 * Up to 100mm of sub-base may be substituted with selected fill provided the sub-base is not reduced to less than the roadbase thickness or 200mm whichever is the greater. The substitution ratio of sub-base to selected fill is 25mm : 32mm.

2 A cement or lime-stabilised sub-base may also be used.

Figure 11 **Concrete: minimum thickness of slabs**

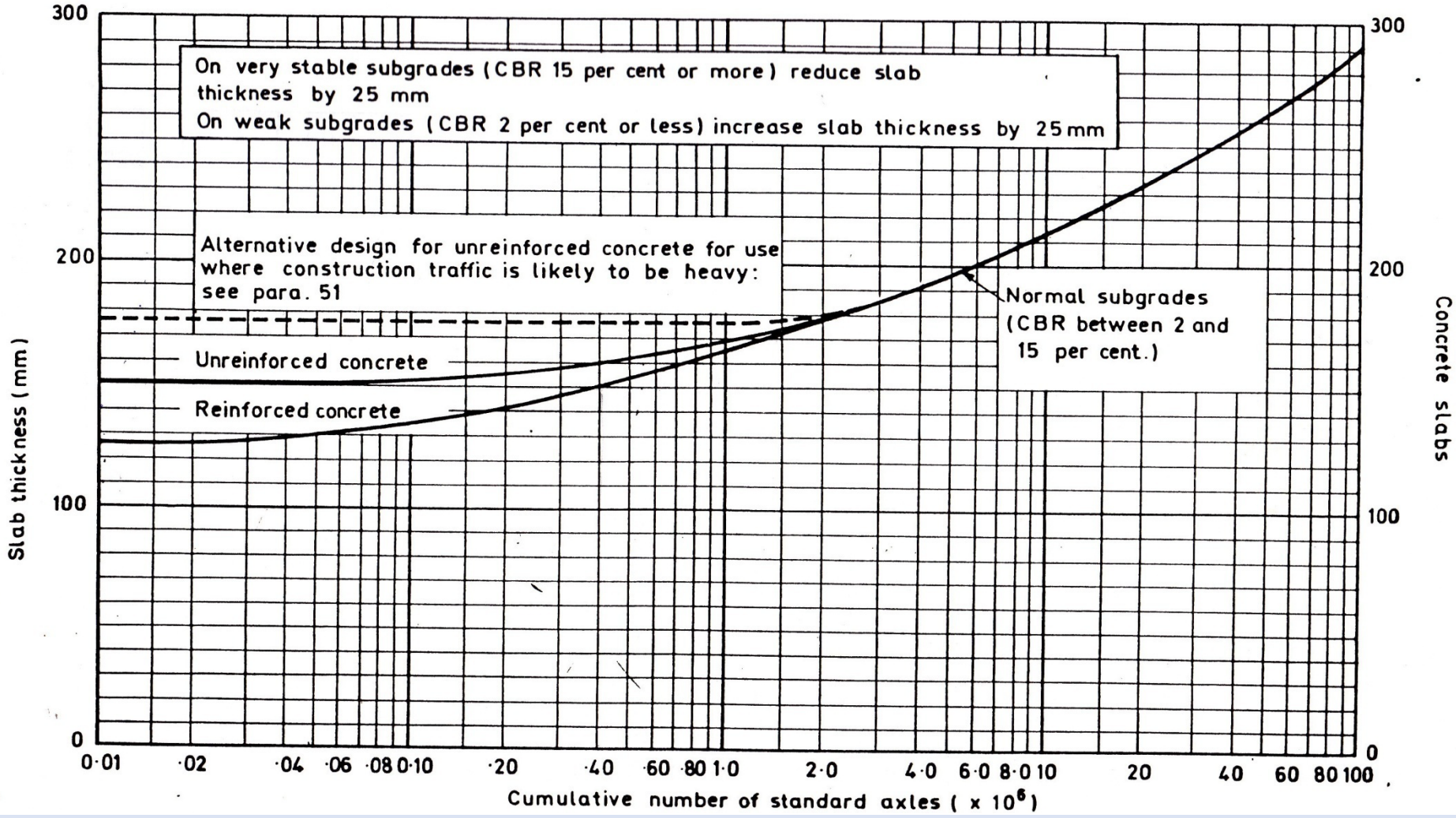


Fig: Concrete minimum thickness of slabs

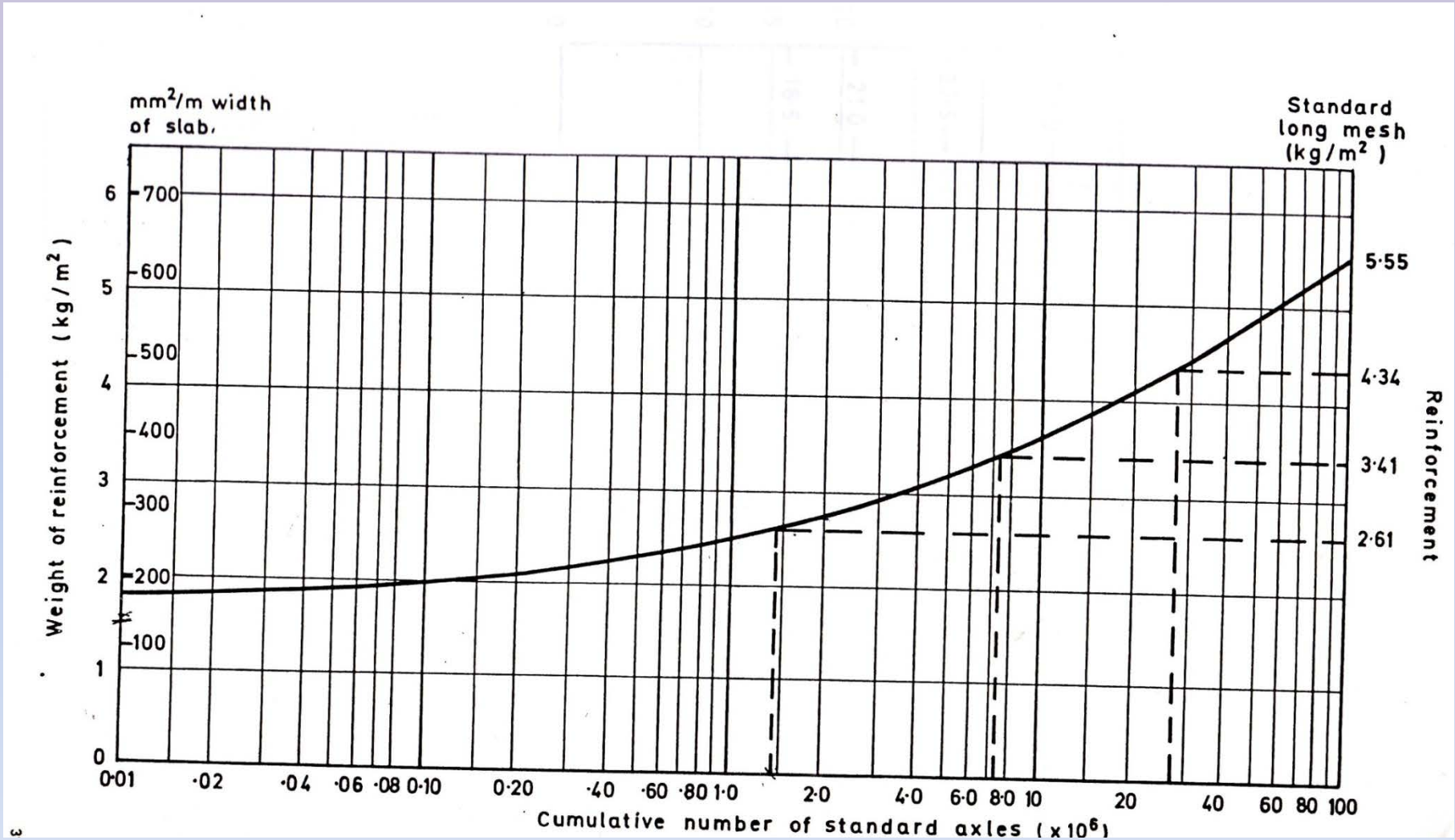


Fig : Reinforcement: minimum weight for concrete slabs

(3) Maintenance

- Maintenance Manual for Bituminous Road (Public Works) is used.

- Manual for maintenance of concrete roads and management of maintenance system are needed to maintain economically and effectively within limited budget.

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CHART 1 GRANULAR ROADBASE / SURFACE DRESSING

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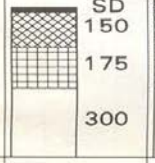
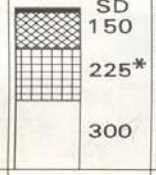
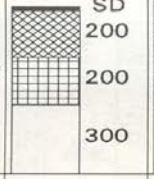
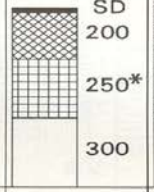
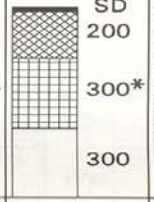
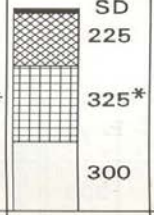
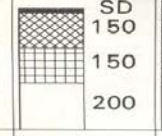
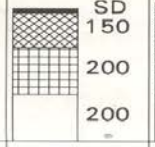
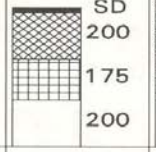
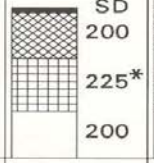
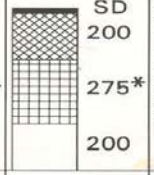
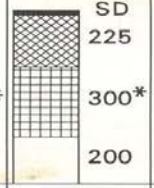
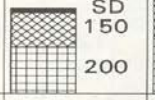
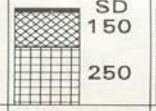
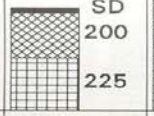
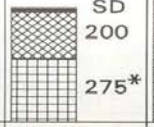
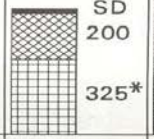
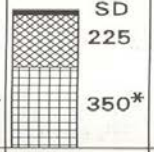
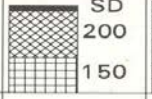
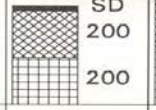
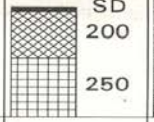
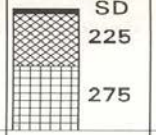
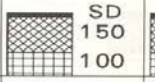
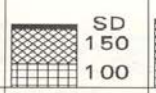
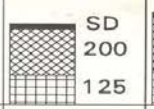
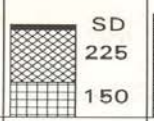
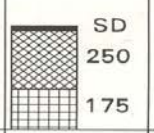
S1								
S2								
S3								
S4								
S5								
S6								

Note: 1 * Up to 100mm of sub-base may be substituted with selected fill provided the sub-base is not reduced to less than the roadbase thickness or 200mm whichever is the greater. The substitution ratio of sub-base to selected fill is 25mm : 32mm.

2 A cement or lime-stabilised sub-base may also be used.

Figure 11 **Concrete: minimum thickness of slabs**

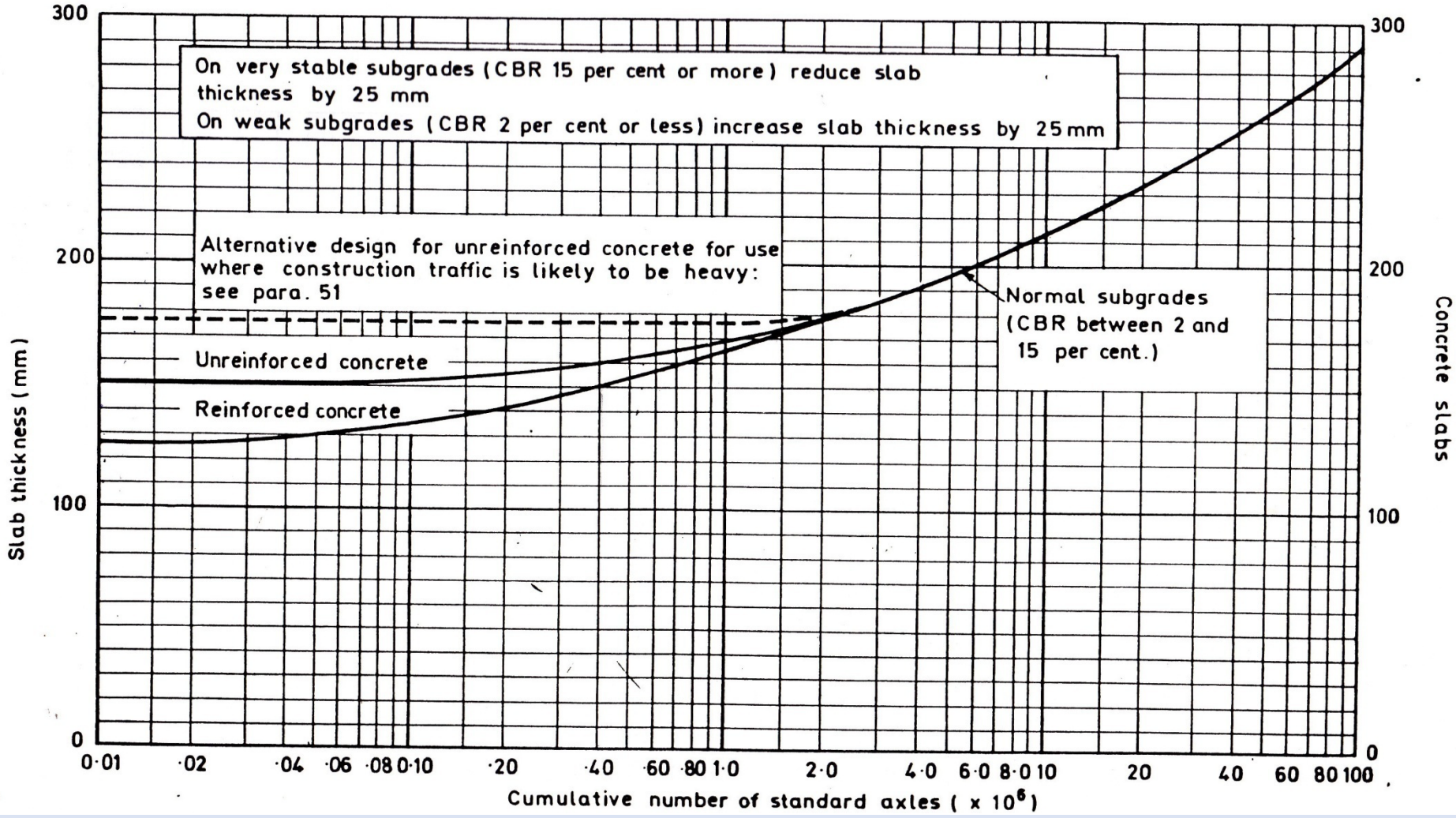


Fig: Concrete minimum thickness of slabs

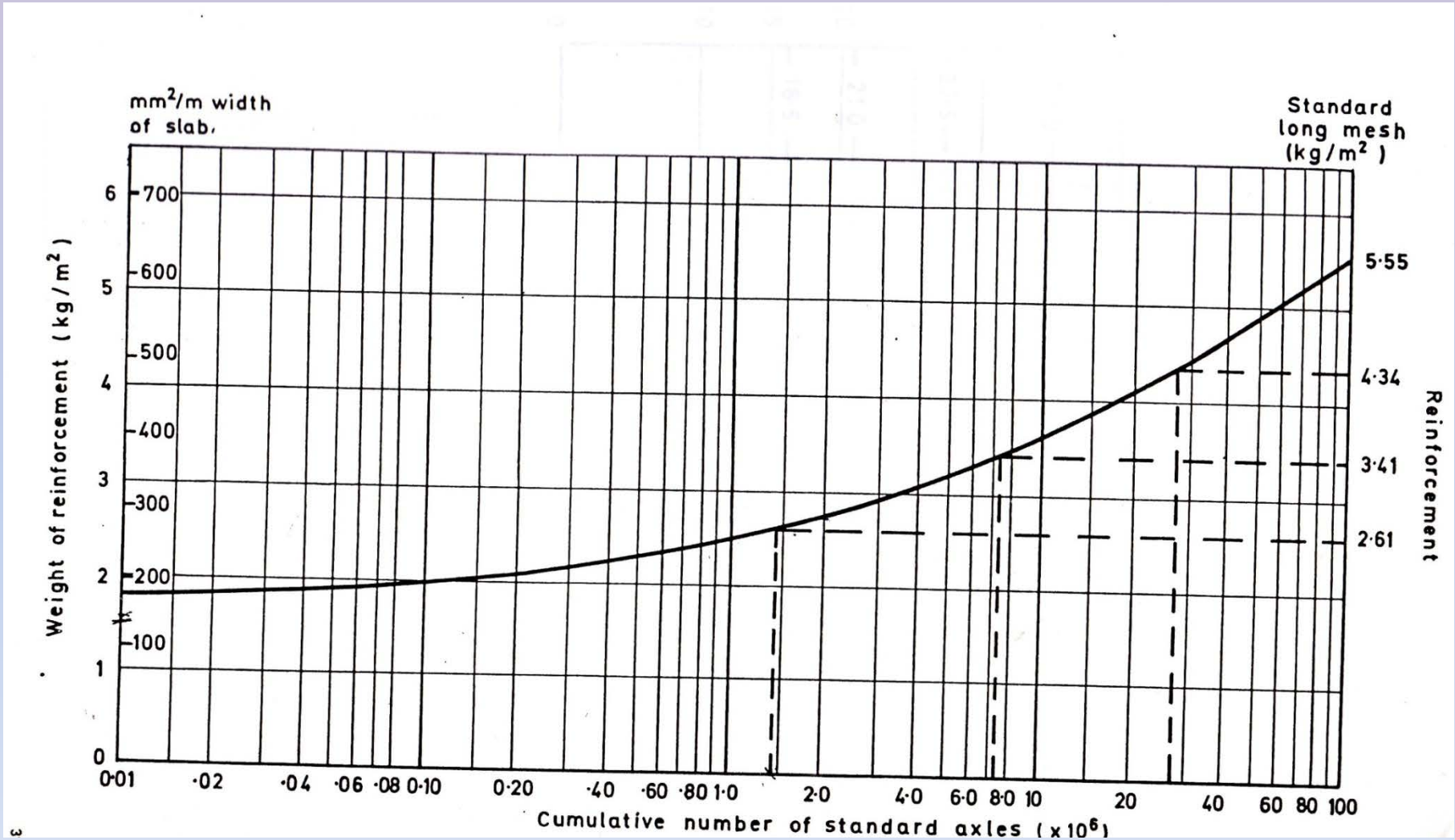


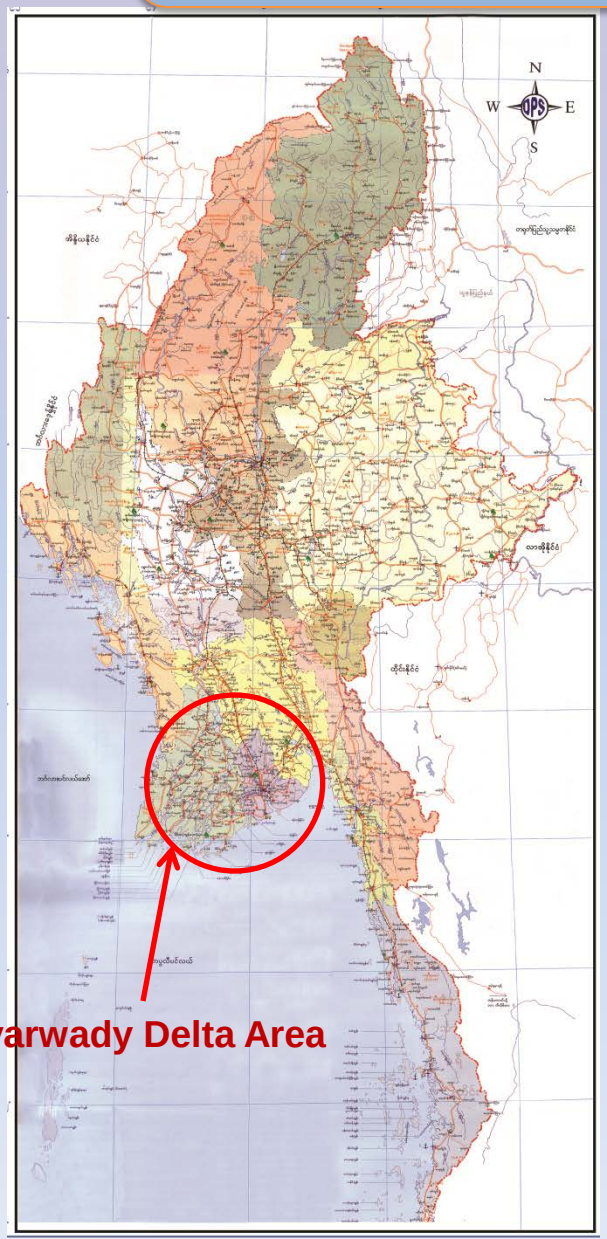
Fig : Reinforcement: minimum weight for concrete slabs

(3) Maintenance

- Maintenance Manual for Bituminous Road (Public Works) is used.

- Manual for maintenance of concrete roads and management of maintenance system are needed to maintain economically and effectively within limited budget.

(4) Problems of Ayeyarwady Roads (Delta Area)



- Soft Soil
- High Embankment (high flood level, high level of bridges)
- Shortage of Good Quality Crushed Rock
- Drainage

Data of Ayeyarwady Region

Location - the southern part of the central plains of Myanmar

Area - 13,567 sq-mile (35,138 sq-km)

Population - over 6.5 million

Annual Rainfall - approximately 100 in. (2,500 mm)

Soil Type - mostly Alluvial soil

- A low-lying region and criss-crossed with rivers and lakes
- A flood-prone and tidal area

Establishment and operation of technical standards

Factors considered in the Structural Design

- Design CBR of Subgrade
- Traffic Loading (cumulative number of standard axles during the design life)
- Type and strength of pavement layer

Cumulative Nos. of Equivalence Standard Axles Load During the design life

- Commercial Vehicle = Unladen weight of vehicle 1.5 tons and above
- Standard Axle = 18000 pounds.
- Equivalence Factor $= \left\{ \frac{\text{axle load (lbs)}}{18000} \right\}^{4.5}$

  = The damage that an be done equivalent to a standard axle
- Design life (n)
- Annual Growth Rate (r) (Growth rate = 1~2 x GDP)

  In developed countries - 3 ~ 6 %

  In developing countries > developed countries
- $F = \left\{ \frac{2 + (n-1)\, r}{2} \right\}$
- Cumulative Nos. of Equivalence Standard Axles Load During the design life

  = n x 365 x F { Total equivalence factor x AADT of each type of C.V of each type of C.V }

Percentage (%) of commercial Vehicle on Design Lane

Pavement width	% of Commercial Vehicle (both directions) on Design Lane
12’	100 %
14’ ~ 18’	85 %
20’	80 %
22’	75 %

Damaging Factor

	Front Wheel					Rear Wheel	Damaging Factor
13 t (2 axle)	3.5 t / 0.0221					9.5 t / 1.9746	2.0
16 t (2 axle)	6 t / 0.2497					10 t / 2.4873	2.74
21 t (3 axle)	5 t / 0.1099				8 t / 0.9112	8 t / 0.9112	1.93
25 t (4 axle)	4.2 t / 0.0501	4.2 t / 0.0501			8.3 t / 1.0754	8.3 t / 1.0754	2.25
34 t (4 axle)	6 t / 0.2497	10 t / 2.4873			9 t / 1.5482	9 t / 1.5482	5.83
46 t (5 axle)	6 t / 0.2497	10 t / 2.4873	10 t / 2.4873		10 t / 2.4873	10 t / 2.4873	10.2
55 t (6 axle)	5 t / 0.1099	10 t / 2.4873	10 t / 2.4873	10 t / 2.4873	10 t / 2.4873	10 t / 2.4873	12.55

$$DF = \left(\frac{\text{axle load x } 2204}{18000 \text{ lb}} \right)^{4.5}$$

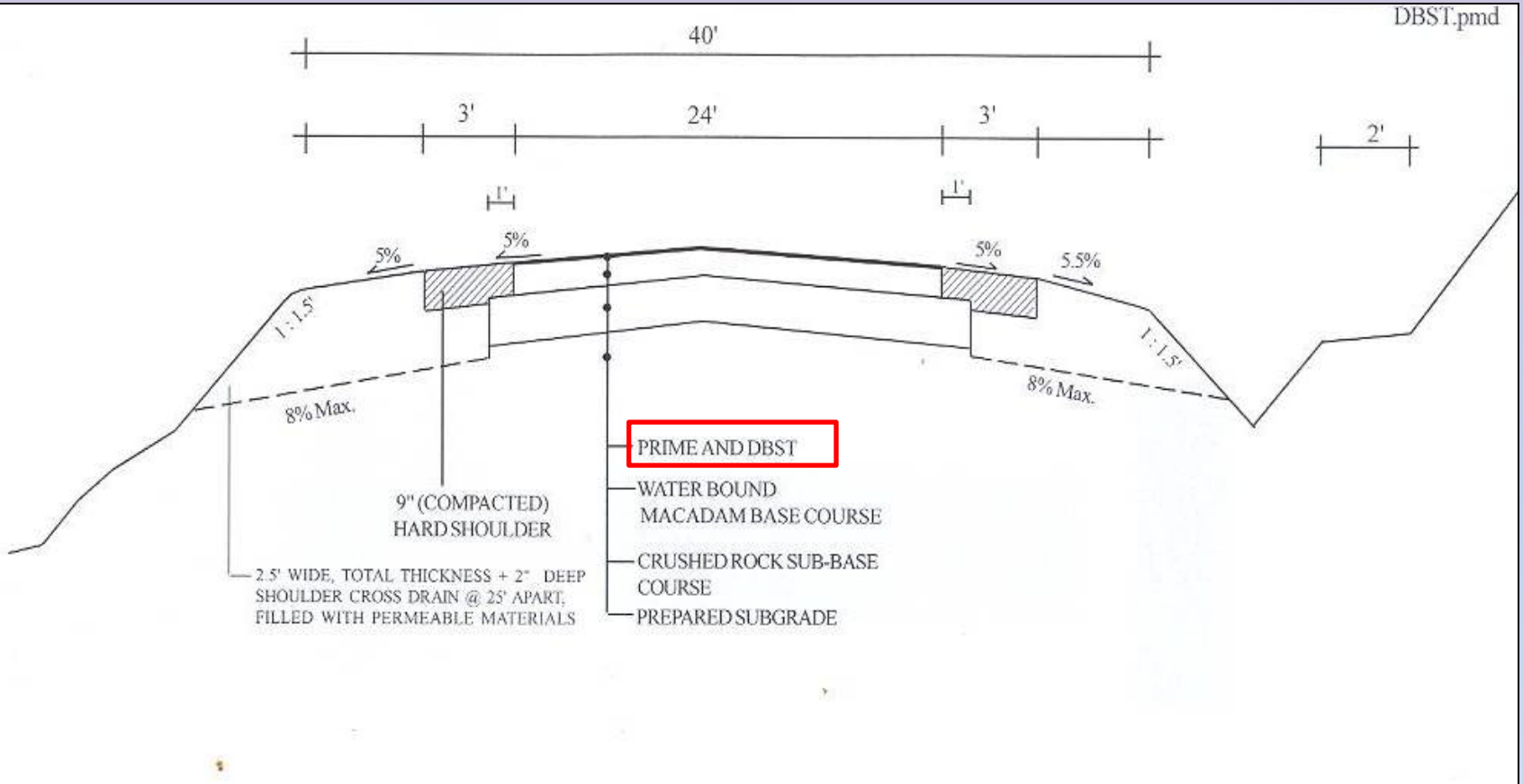


Fig: Typical Flexible Pavement Cross Section

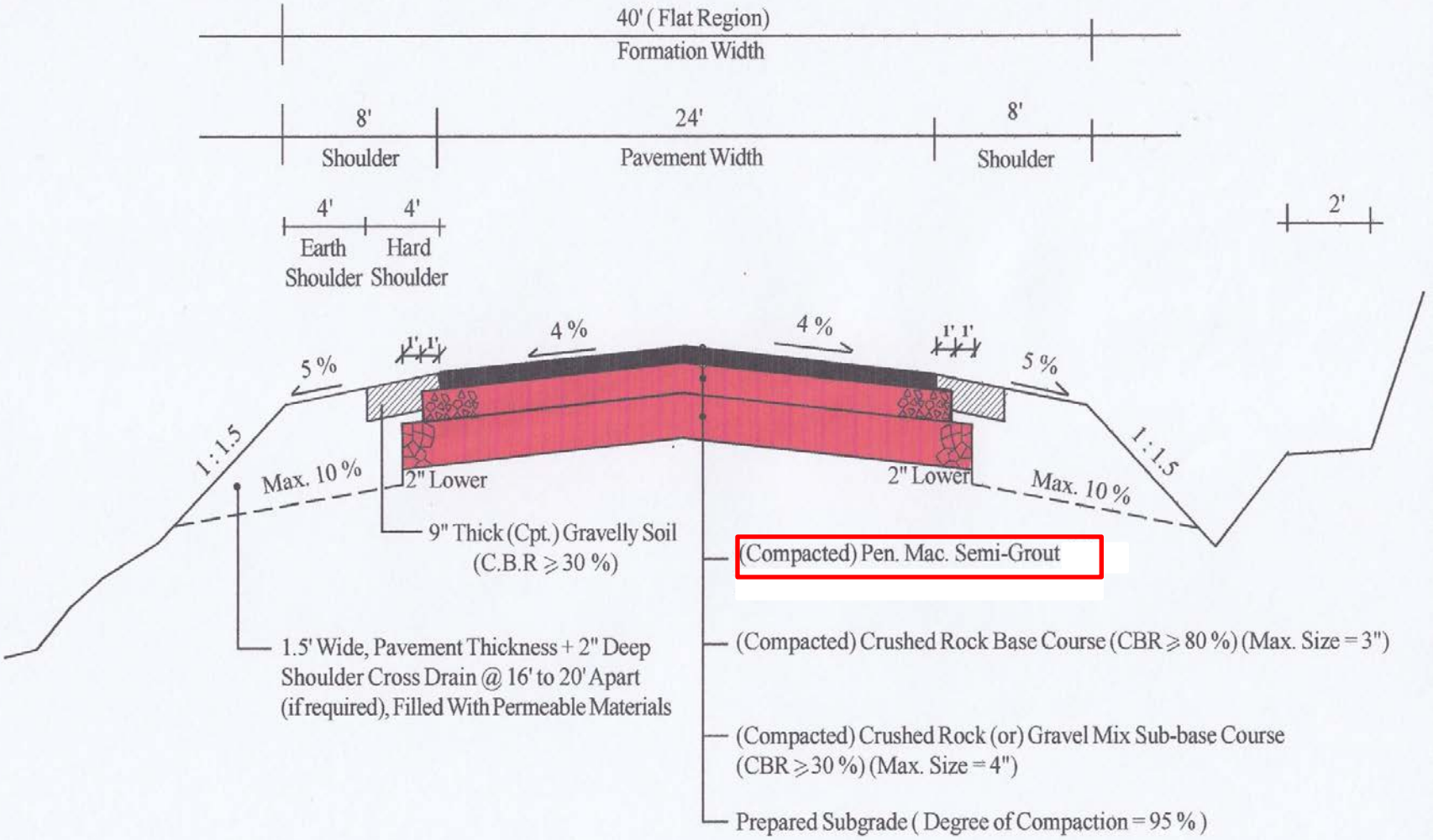


Fig: Typical Flexible Pavement Cross Section

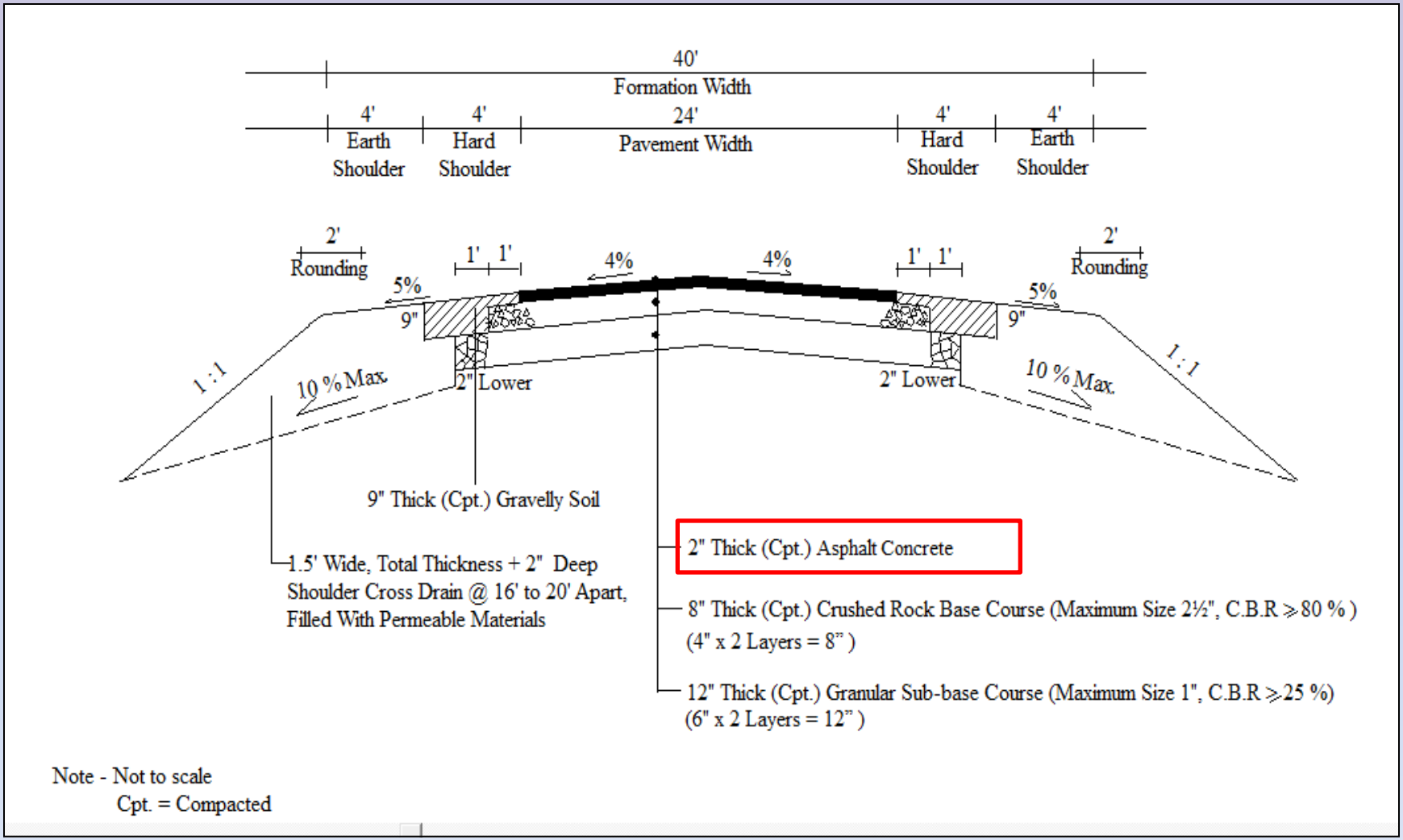


Fig: Typical Flexible Pavement Cross Section

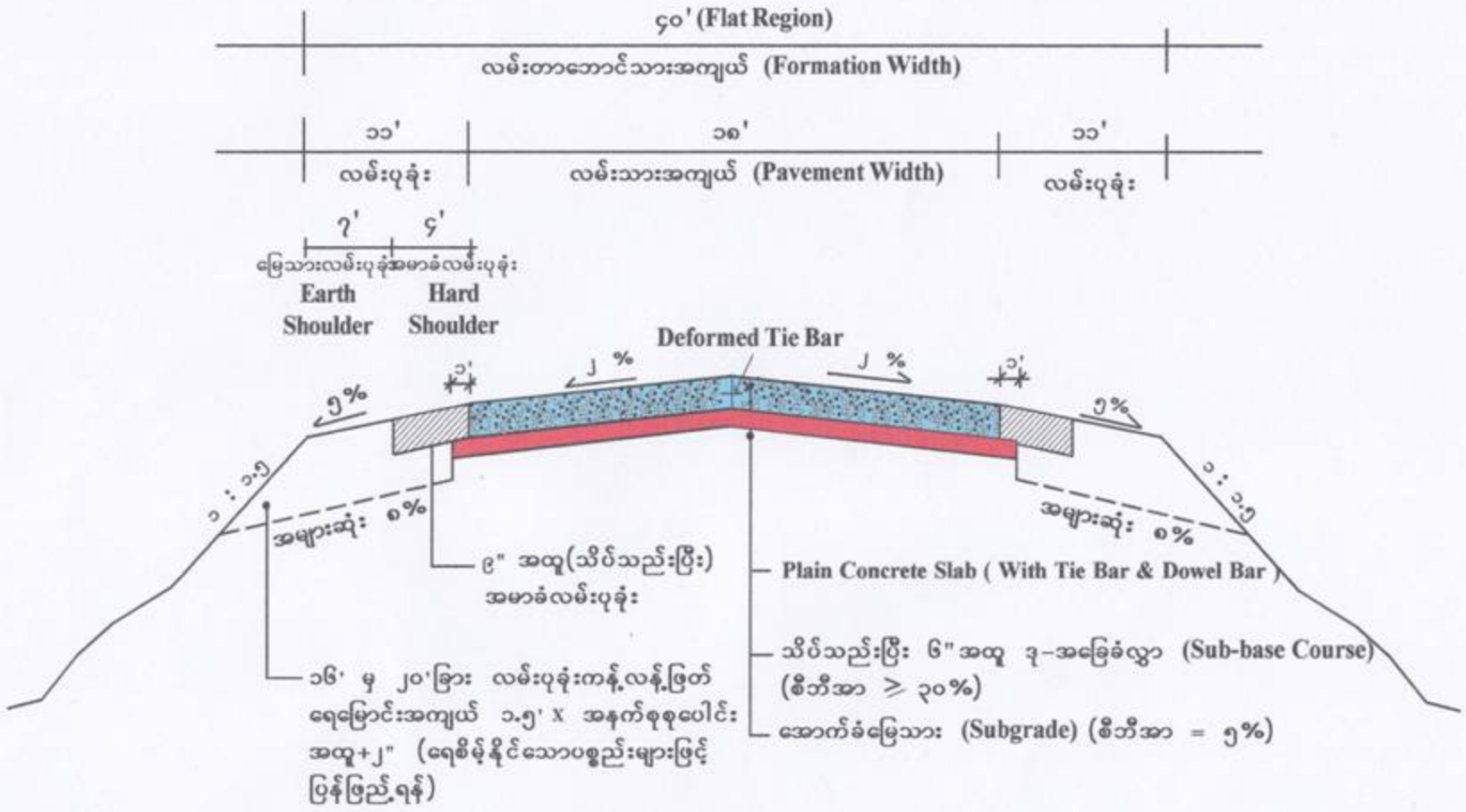
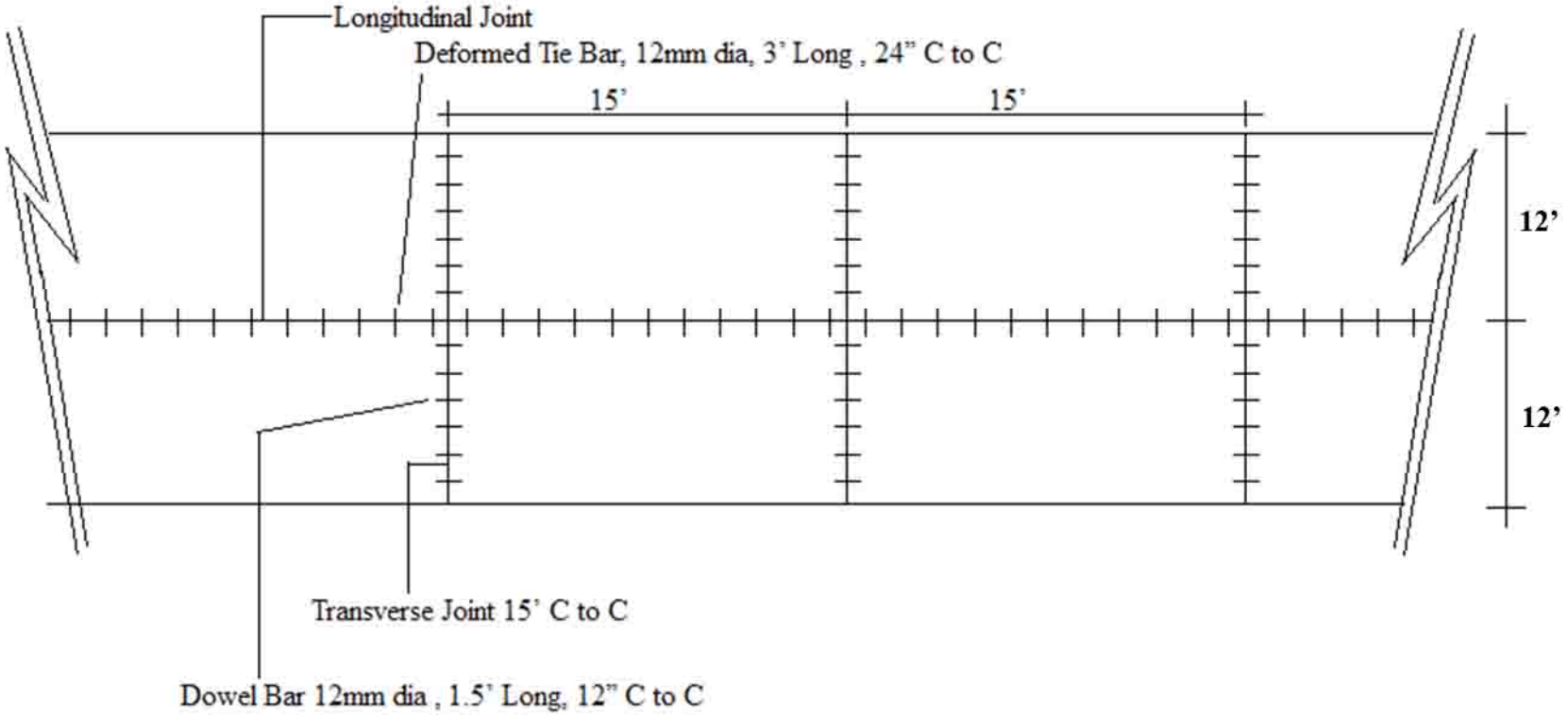
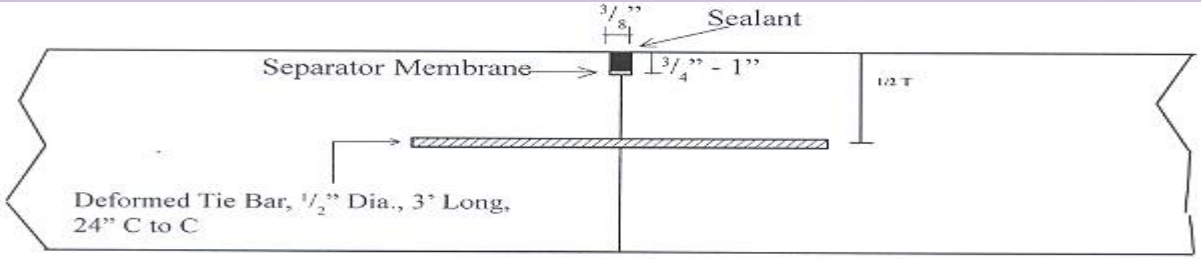


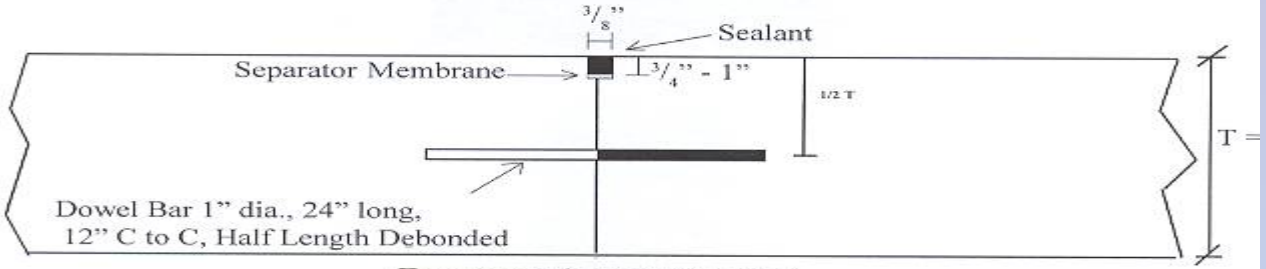
Fig: Typical Rigid Pavement Cross Section (Plain Concrete Type)



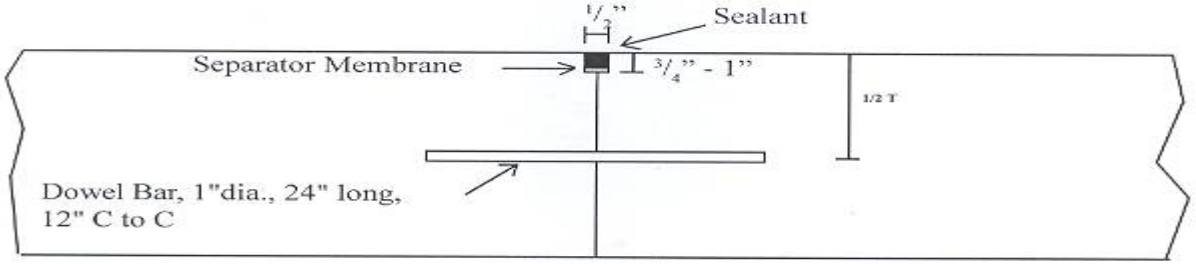
Layout Plan of Rigid Pavement



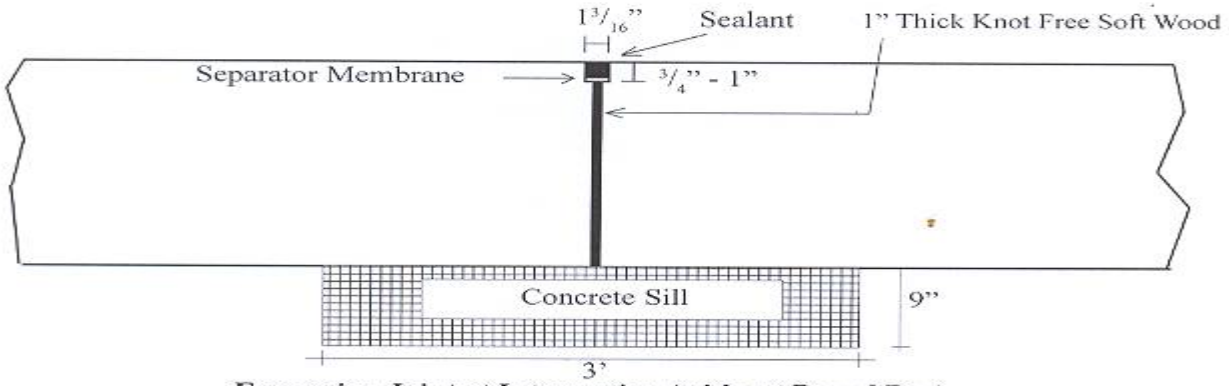
Longitudinal Construction Joint



Transverse Contraction Joint



Transverse Construction Joint



Expansion Joint at Intersection (without Dowel Bar)

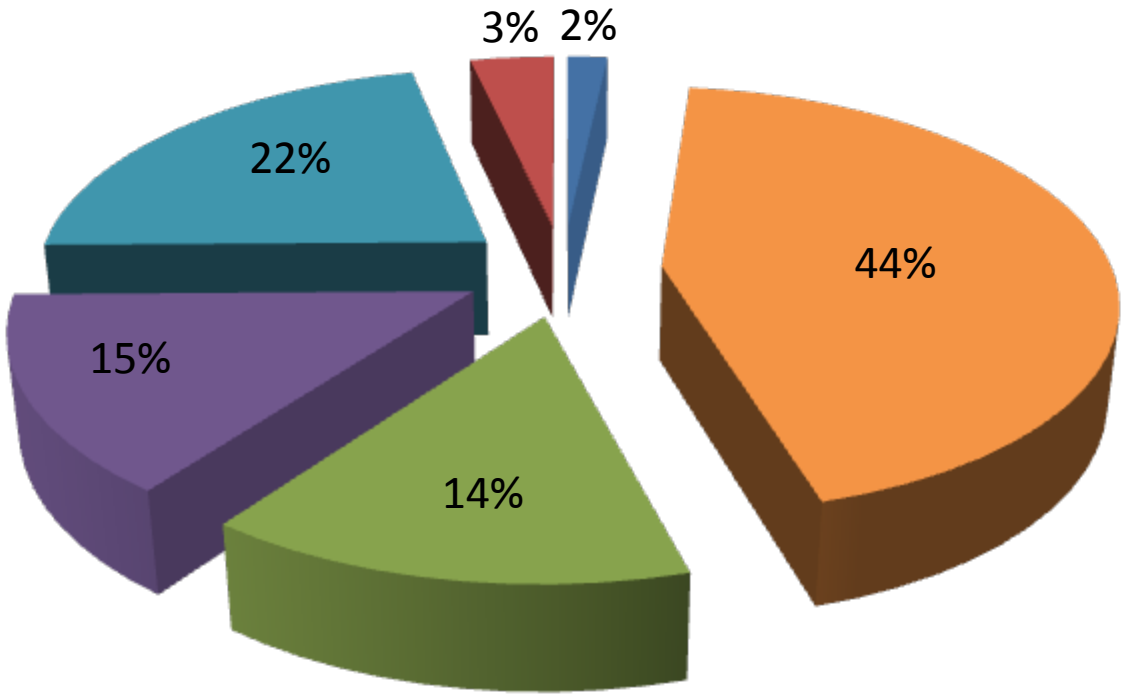
Specifications

- There is manual for construction of roads and bridges.
- Specifications are written based on above manual and specifications specified in the design manuals.

Construction of pavement

Roads managed by Ministry of Construction

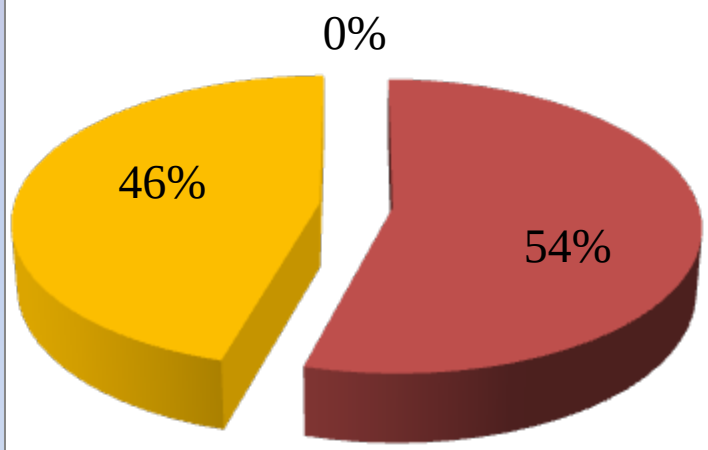
Total road length – 39,082.72 km (March, 2012)



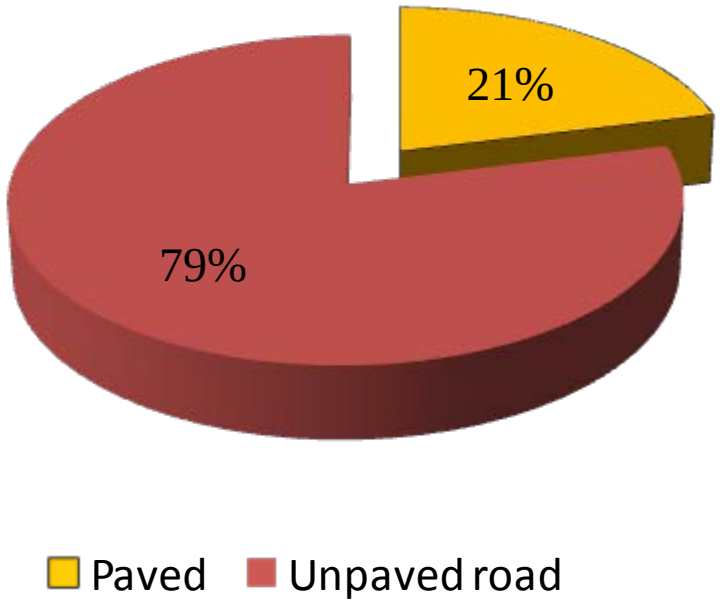
- Concrete - 661.3 km
- Bituminous - 17184.8 km
- Metalled - 5641.7 km
- Gravel - 5740.3 km
- Earth - 8470.6 km
- Donkey - 1384 km

Ratio of Paved and Unpaved Road

Public Works

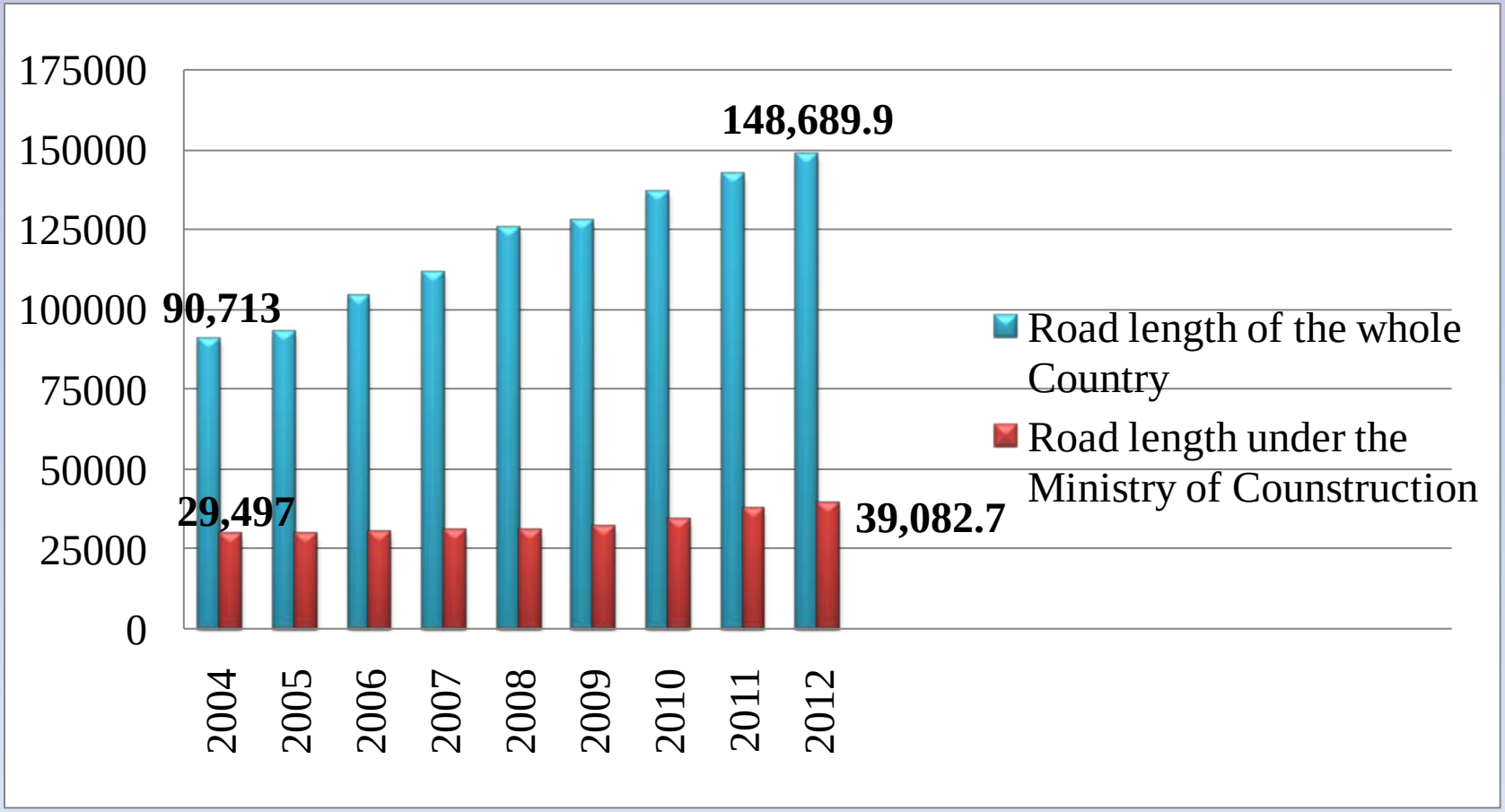


Whole Country



(As of March, 2012)

ROAD PROGRESS IN MYANMAR (March, 2012)



Achievements in Road Sector

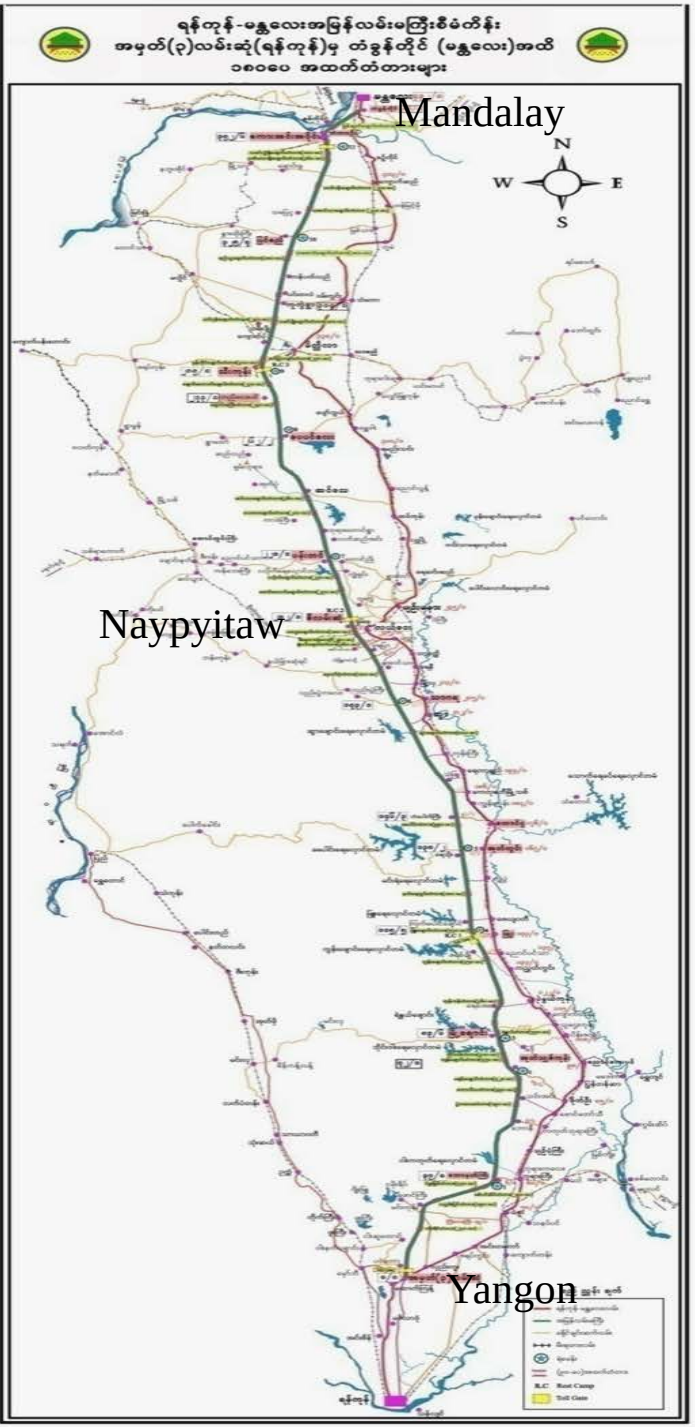
Nyaung Oo – Myingyan Road

Pathein – Monywa Highway

Pyimanar - Yamethin Road

Meiktila – Taunggyi Road

Yangon-Mandalay Expressway (586.2km)



Yangon-Mandalay Expressway (Rigid pavement) Project Data

S.N	Particular	Construction Period	Length (km)	Opened to Public
1	Yangon - Naypyitaw	10/2005 – 3/2009	323.4	25-3-2009
2	Naypyitaw - Sakainn	7/2008 – 12/2010	241	29-12-2010
3	Sakainn – Tadaoo - Tagonedine	1/2011 – 12/2011	21.8	23-12-2011
	Total Length		586.2	

Two Organizations constructed this expressway are-

1.Public Works
(under the Ministry of Construction)

2. **Directorate of Military Engineers**
(under the Ministry of Defence)

Expected technical supports from Japan

- To Establish Myanmar Road & Bridge Association, based upon the present Road & Bridge Technical Division of Myanmar Engineering Society,
- To monitor and approve Myanmar Specifications for the Design, Construction, Operation & Maintenance of Roads & Bridges,
- To introduce pavement management system and maintenance management system so that management of roads can be made systematically within the limited budget.
- Technical Cooperation & Support of Japan Road Association for realization of the above three issues.

Conclusion

- Great Gratitude to this Japan Road C0nference for sharing us chances to know about the development of road sector of Japan and other Asian countries;
- Hope for the future cooperation in learning, sharing, exchange and transferring of road pavement technology ; and
- Difficulties and problems, encountered in our country to be solved in the near future.

Thank you for Kind Attention