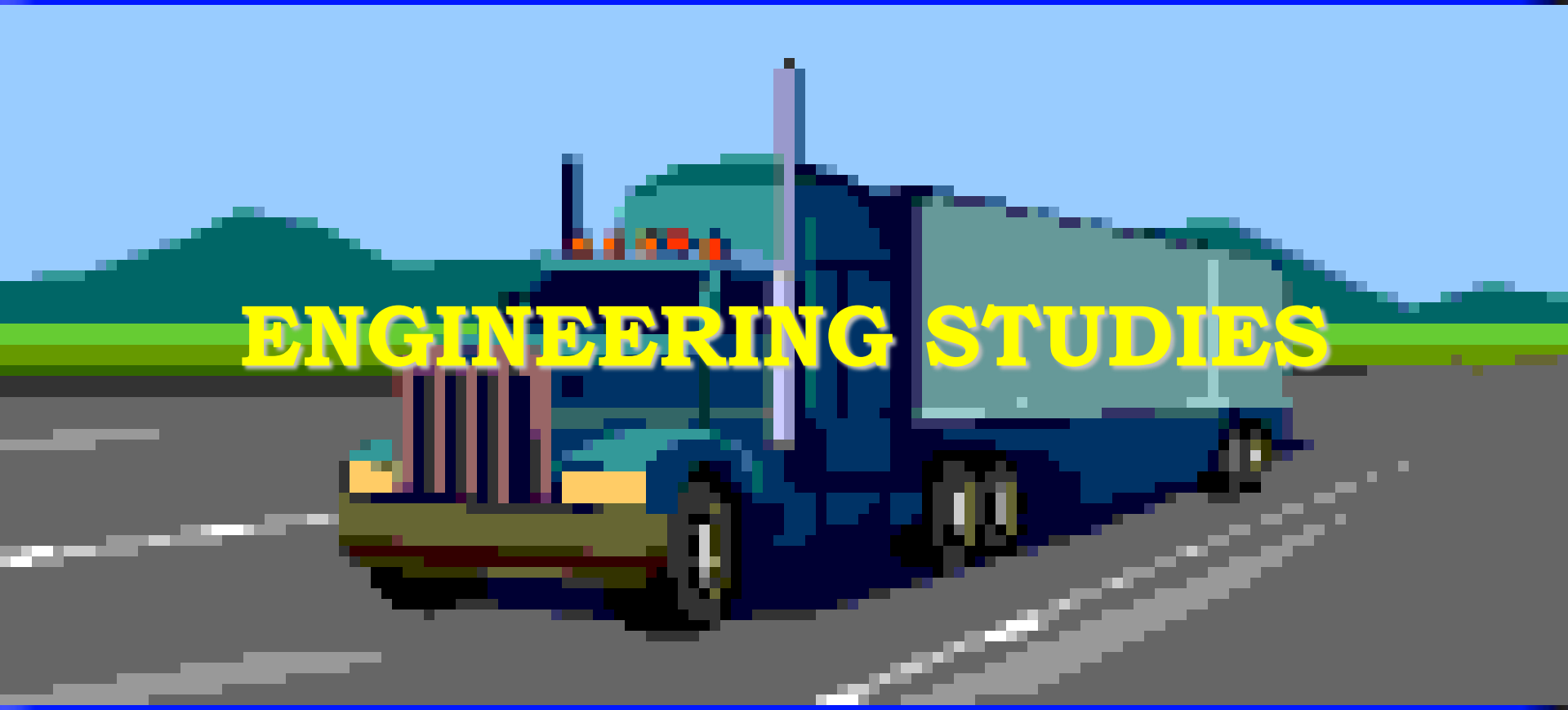
PMO-Feasibility Studies

Department of Public Works and Highways

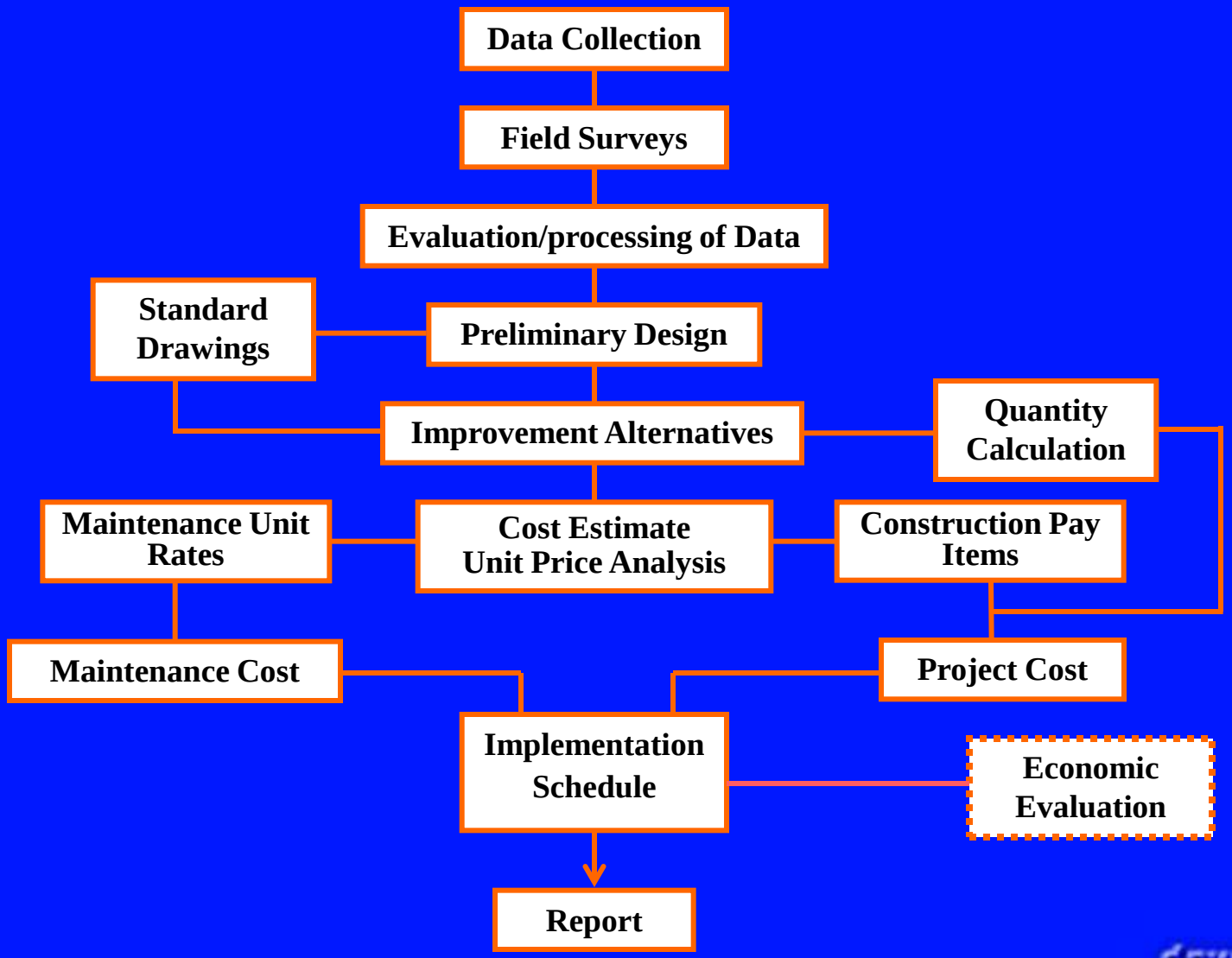


Road Feasibility Study

Presented By: Engr. Giles J. Miranda

dpwh:pmo-fs

Engineering Activities



Overview

Engineering studies mainly focus on:

- preliminary engineering design
- alternative design schemes
- construction cost estimates of ± 20%
- maintenance strategies and cost
- cost comparison of each alternatives

Basic Components

- Methodology
- Existing Situation
- Preliminary Engineering Design
- Improvement Alternatives
- Cost Estimate
- Project Cost
- Maintenance Cost
- Implementation Schedule

Data Collection

- Review of existing documents
- Topographic maps
- Aerial photographs
- Climatological and Rainfall Data
- Material Sources Map
- Construction Materials Price List
- Labor Wage
- Equipment Rates (ACEL Ed. 24)

Engineering Surveys

- Road
- Bridge
- Side Drains
- Slope / Embankment
- Terrain
- Environment

Inventory of Existing Condition

Road

- Stationing
- Terrain
- Carriageway & shoulder/widths
- Pavement & shoulder types/condition
- Gradient & curvatures
- Roadside friction
- Drainage structures
- Flood/disaster prone areas
- River crossings
- New alignment/re-alignments (bypasses)

Inventory of Existing Condition

Bridge structure

- Stationing
- Bridge and/or stream name
- Carriageway & sidewalk/widths
- Number of spans and span length
- Overall length
- Type of Structure (super & sub)
- Posted load or load limit
- Condition of structure (sub & super)
- Others (e.g. protection works/geometry of approaches

Road Condition Rating

Paved Road

- **Good - smooth surface, no major cracks, < patched areas (good riding quality)**
- **Fair - some surface irregularities i.e. cracks, potholes with less patched areas**
- **Bad - severely cracked road surface, corrugations, potholes and ruts**
- **Very bad - completely deteriorated surface**

Road Condition Rating

Unpaved Road

- Good - well-graded gravel, well defined cross falls & adequate side drains
- Fair - presence of loose gravel & minor depressions on the surface
- Bad - aggregates accumulate along the roadside, depression on the traveled way, presence of sizeable potholes
- Very bad - aggregates are scarce exposing subgrade, severe depressions

Bridge Condition Rating

Good : Bridges that have been carrying traffic for a period of time with no signs of distress or deterioration.

Fair : Bridges that show signs of deterioration on the superstructure and substructure Such as spalling on concrete deck, light cracks on concrete surface, rusty steel Trusses, scouring on piers, damaged slope protection.

Bad : Bridges that show signs of heavy deterioration on the structure such as heavy longitudinal cracks / random cracks, splitting of concrete at tension reinforcement level, heavy spalling of concrete surface; exposed rusty reinforcing bars at girders and bridges that are extensively damaged and structurally unsafe for vehicular traffic.

Very Bad : Bridges incapable of carrying traffic, structurally and hydraulically deficient, high probability of collapse.

Road Distress Survey

Pavement Distresses

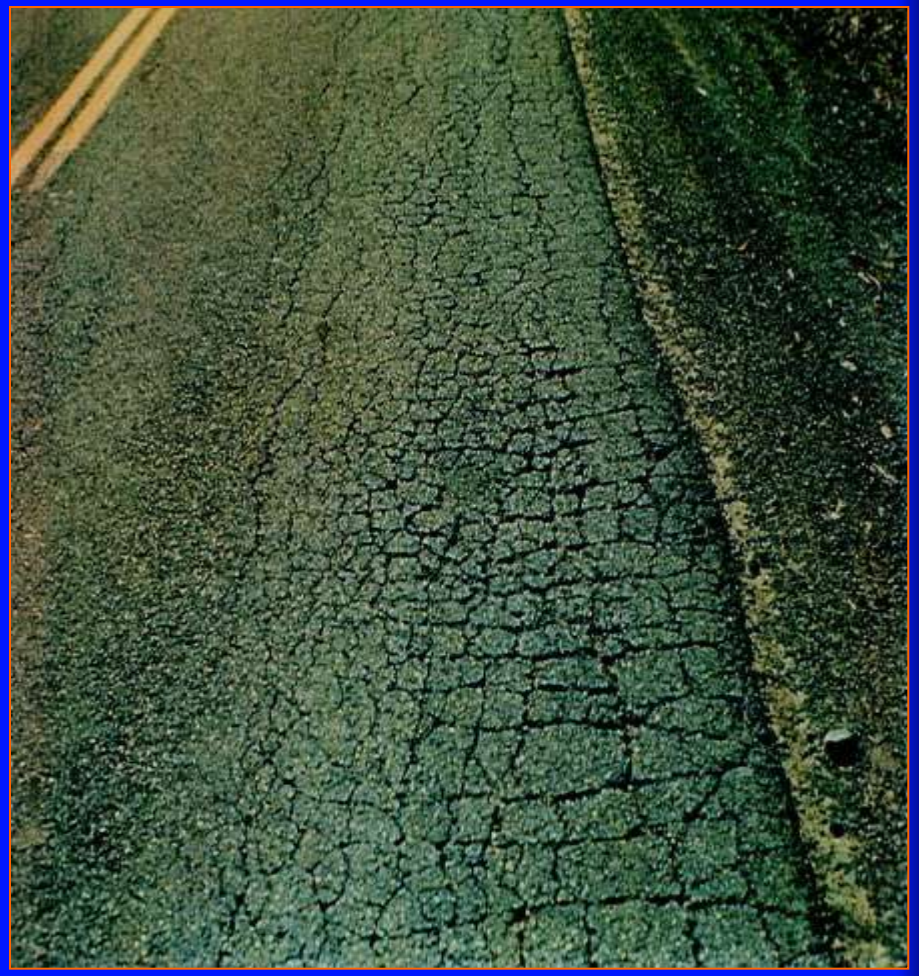
Bituminous	Concrete	Gravel
Cracking	Cracking	Gravel loss
Rutting	Joint spalling	Roughness
Raveling	Faulting	
Potholing	Failures	
Edge break	Roughness	
Surface texture		
Skid resistance		
Roughness		

Asphalt Pavement Distresses

Alligator Cracking

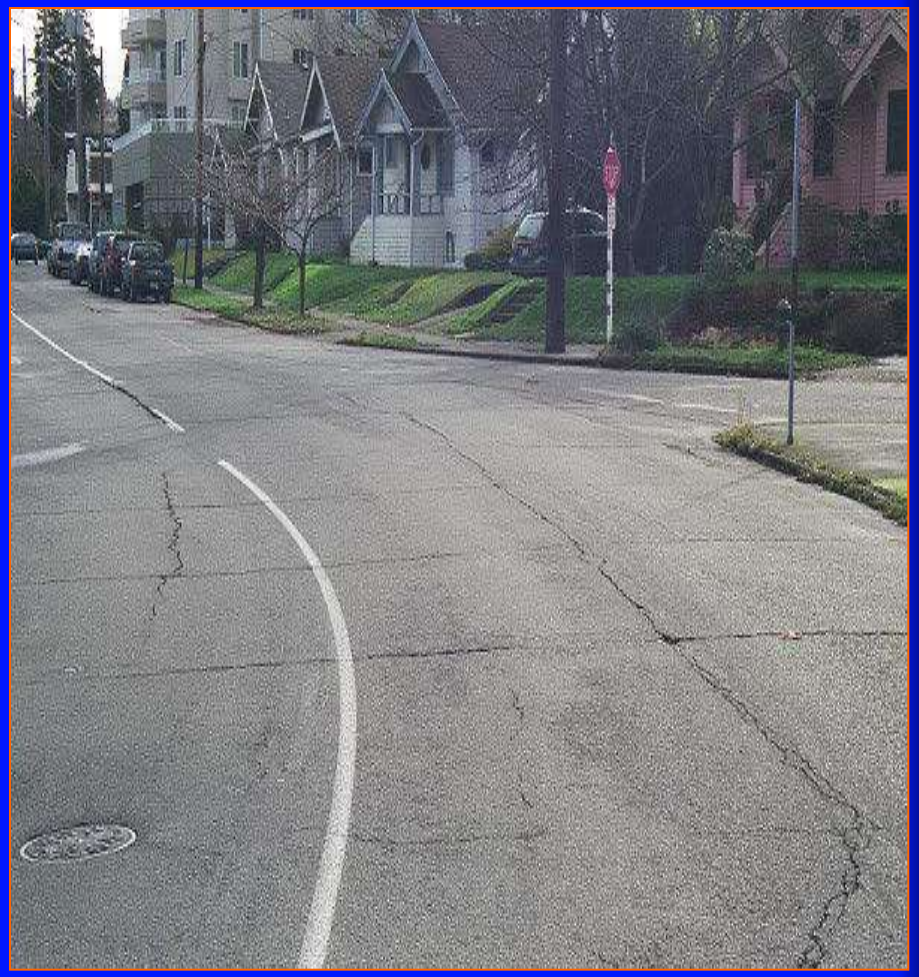
Asphalt Pavement Distresses

Fatigue cracking due to edge failure



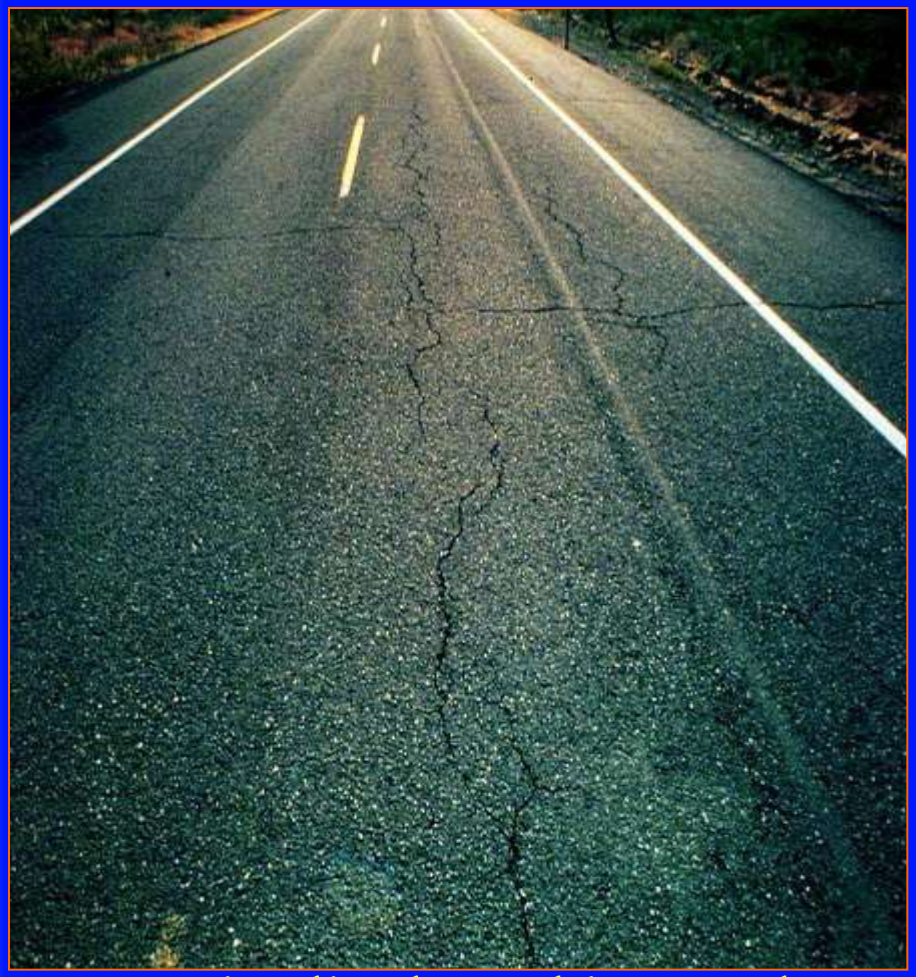
Bad fatigue cracking

Asphalt Pavement Distresses



Joint reflection cracking

Asphalt Pavement Distresses



Longitudinal cracking as the onset of fatigue cracking

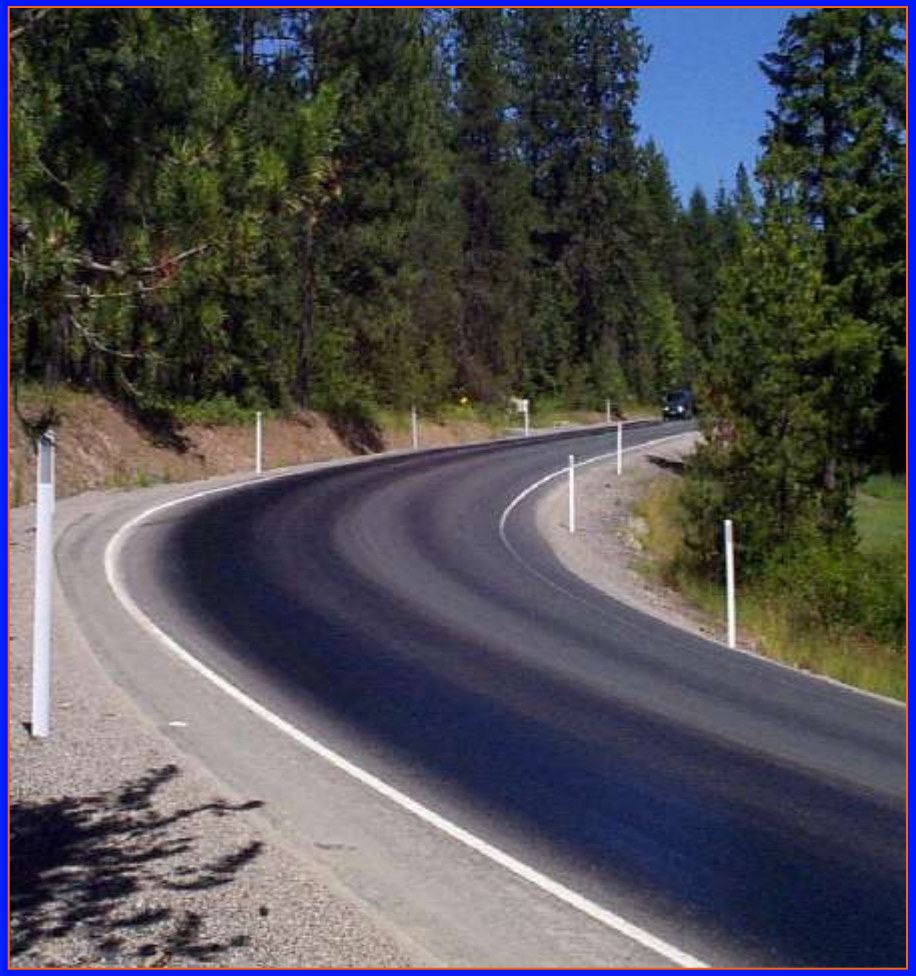
Longitudinal cracking from the poor join construction

Asphalt Pavement Distresses

Large patched thermal crack

Smaller patched thermal crack

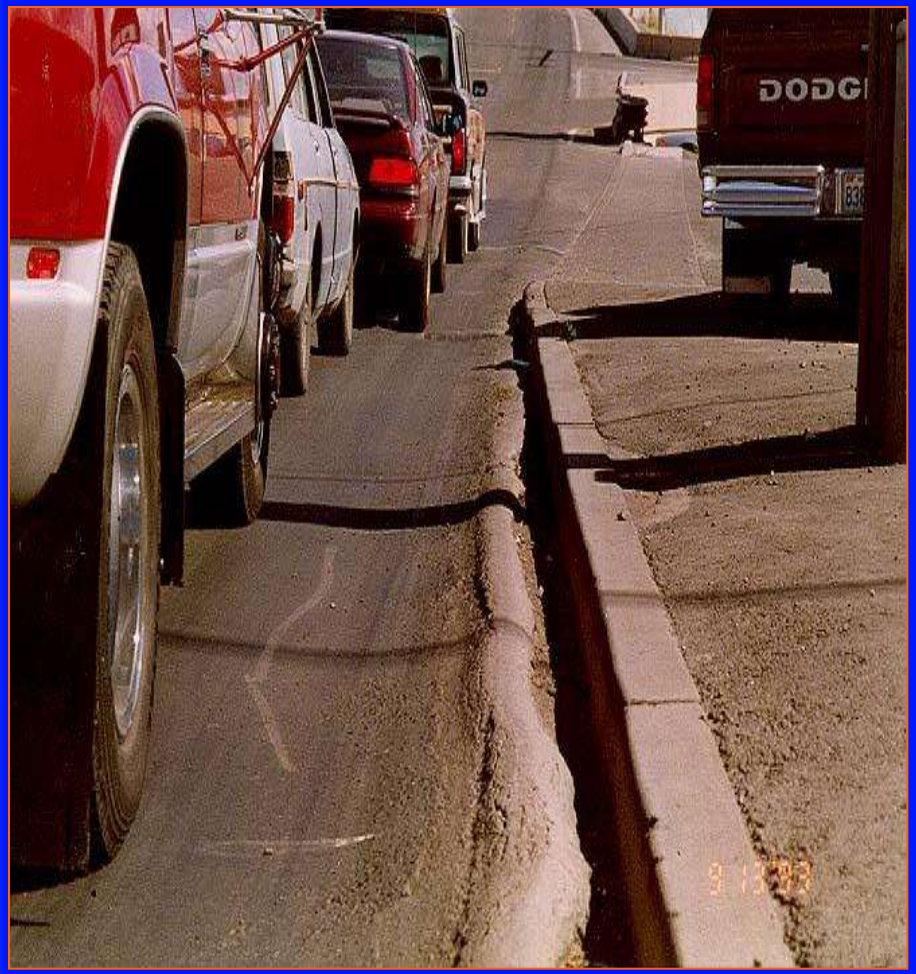
Asphalt Pavement Distresses

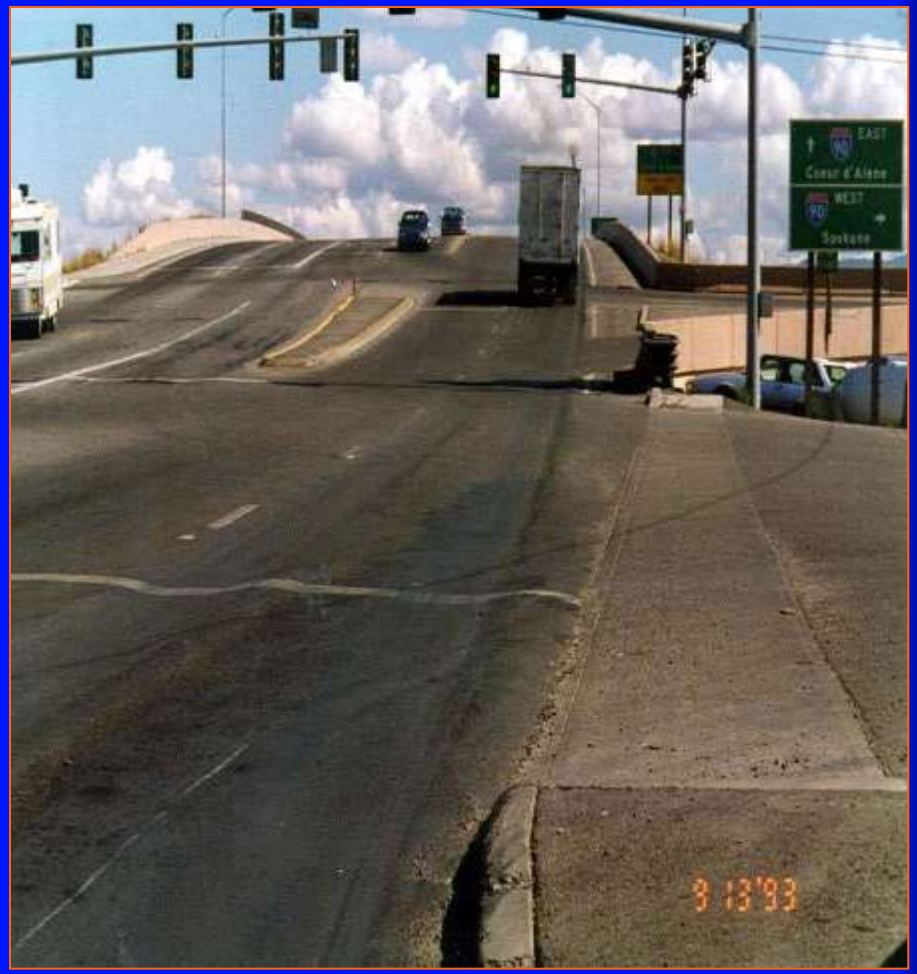


HMA bleeding on wheelpaths

BST bleeding on wheelpaths

Asphalt Pavement Distresses



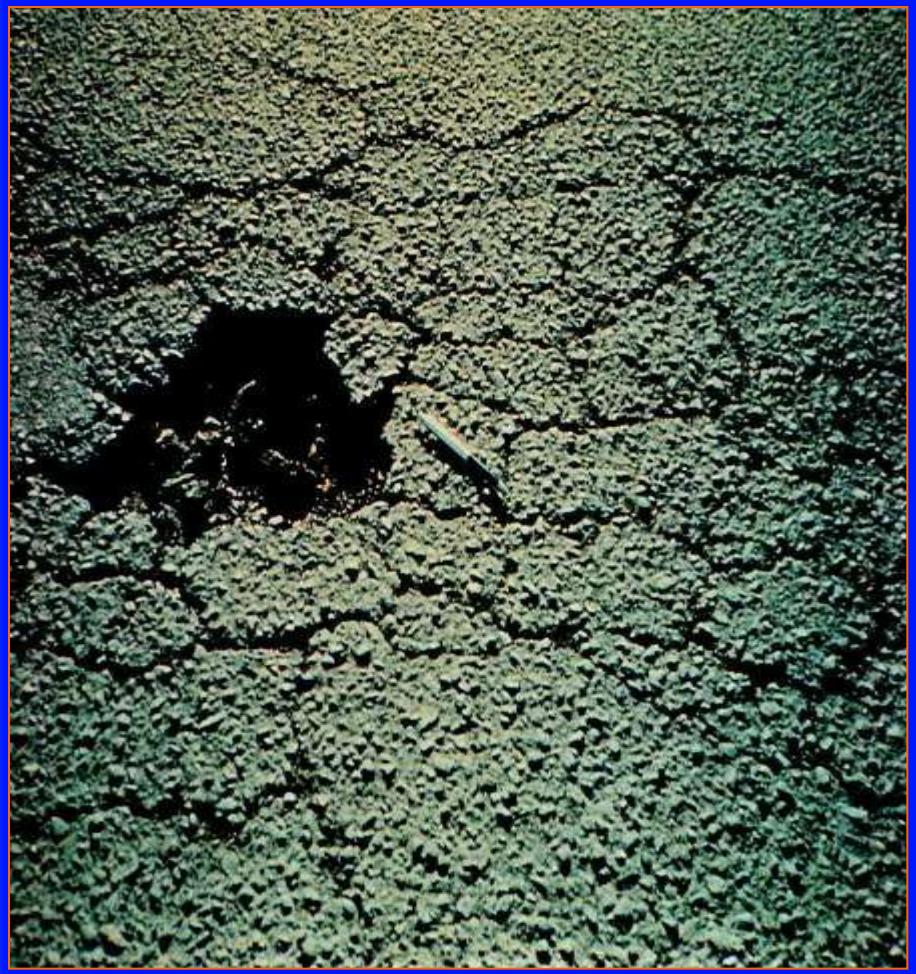


Rutting

Asphalt Pavement Distresses

Raveling

Asphalt Pavement Distresses



Potholes

Asphalt Pavement Distresses

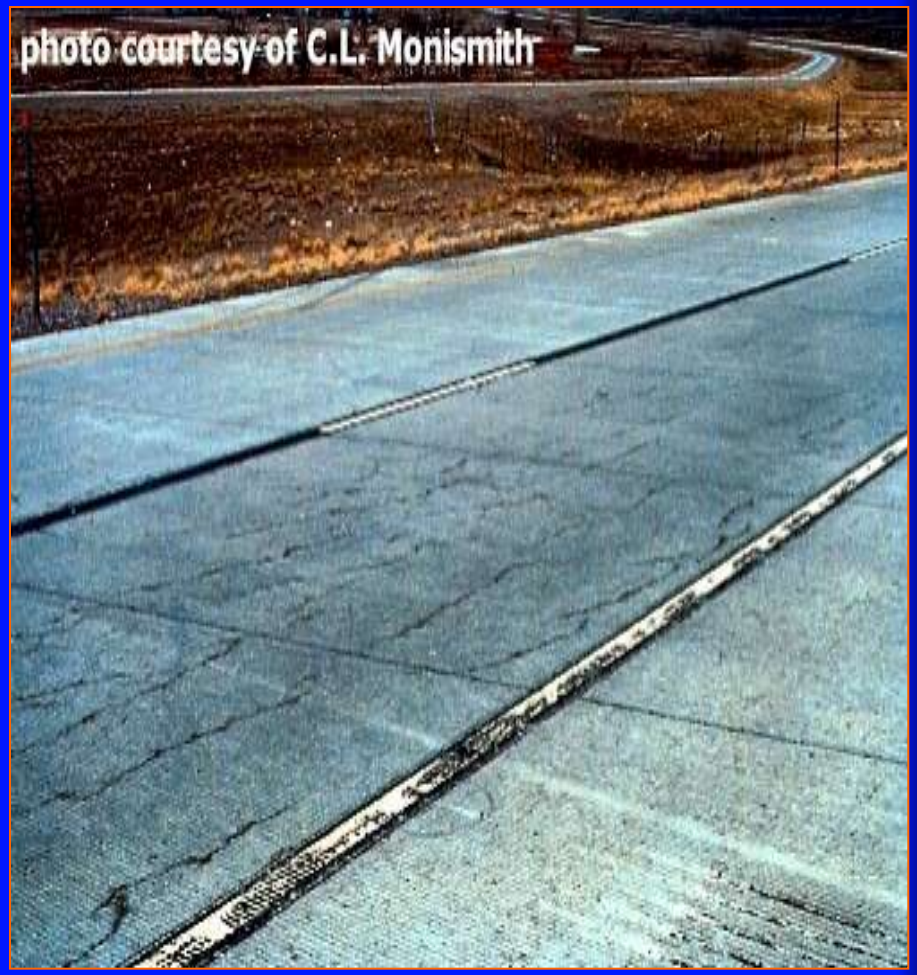
Corrugation and shoving

Cement Concrete Pavement Distresses

Cracking

Cement Concrete Pavement Distresses

Shrinkage cracks on brand new slabs



Severe shrinkage cracking

Cement Concrete Pavement Distresses

Spalling on set

Spalling from a bad construction joint

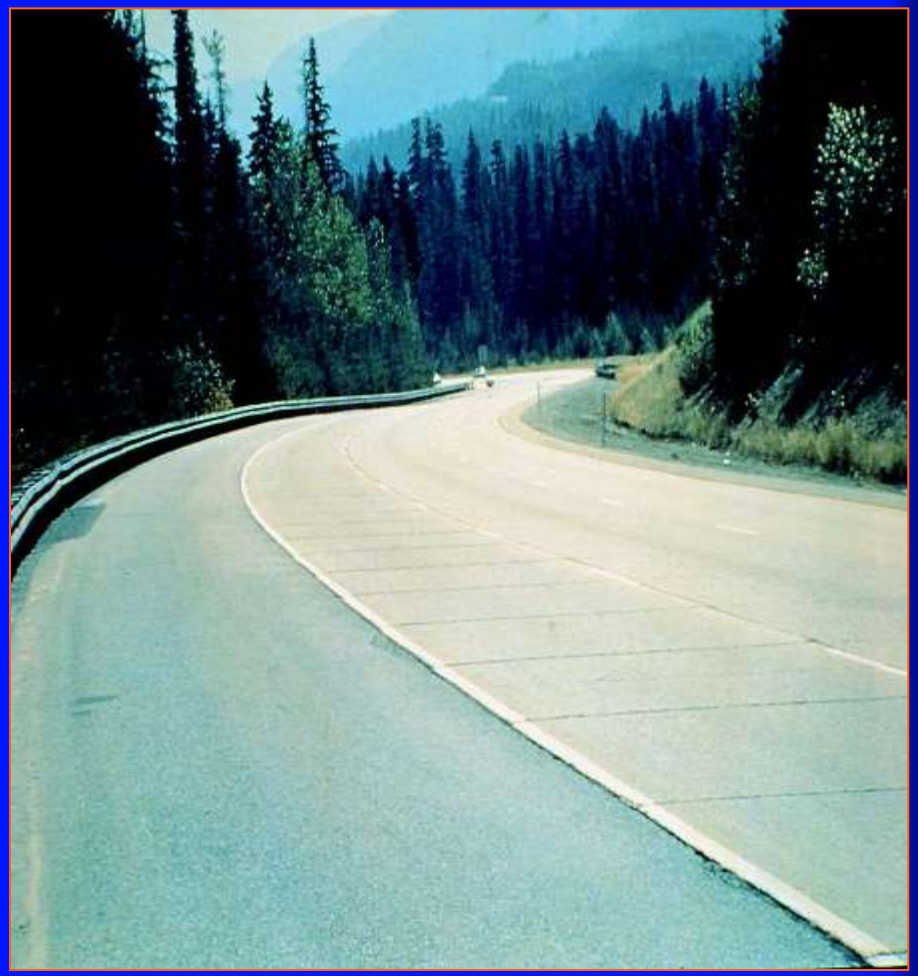
Cement Concrete Pavement Distresses

Exposed failure with rusted dowel bars

Patched failure

Joint Load Transfer System Deterioration

Cement Concrete Pavement Distresses



Faulting

Cement Concrete Pavement Distresses

Corner break on a residential street

Corner break on a highway

Road Inventory Sample

													REGION:	V							
NAME OF ROAD :		Lagonoy - Presentacion											PROVINCE:	CAMARINES SUR							
FROM:		0+ 000					TO:	10 + 250					LENGTH:	31.65 KMS.							

STATIONING	TERRAIN	CROSS SECTION									ROAD SIDE FRICTION	ALIGNMENT				DRAINAGE		STRUCTURE				REMARKS
		Carriageway width	Shoulder Width	Type of Surface and Condition					Shoulder			HORIZONTAL (radius)		VERTICAL		Side Drains	Missing Culverts					
		(m)	(m)	PCC	AC	BST	G	E	Type	Condition		25-40 m	<25 m	Grade %	Length (m)	Condition	Number	Types	Width (m)	Length (m)	Condition	
0+000	F	6.1	1	G					E	F	H					L/R (U-Type Riprap Lined ditch 900 m.)						Brgy. Sta. Maria,Lagonoy Town Proper(KM. 496+102)
0+900	F	6.10	1.00	G							M					N						
1+600	F	6.10	1.00	G							L					R.S.(100 m U-Type Riprap)						
1+700	M	6.10	1.00	G										7		N		SPG	7.50	111.00	B	*Lagonoy Bridge*
3+350	M	6.10	1.00	G										7				RCDG	4.10	54.35	G	*Caguiscan Bridge*
3+600	M	6.10	1.00	G							N			6								
3+900	M	6.00					F		N		L			7								
4+800	F	6.00					F				L					L.S.(50 m U-Type Riprap)						
5+200	F	6.00					B									N		RCPC	2-0.6Φ		B	Brgy. Baliwag
5+350	F	6.00					B											ST	7.30	61.30	G	Baliwag Bridge
6+500	F	6.00					B				M											Brgy. Manamoc
7+500	M	6.00					F				L			6								
7+750	M	6.00					F							6				ST	7.30	68.80	G	Quinayangan Bridge
7+800	M	6.00					F				L			7								
8+600	M	6.00					F				M			6								Brgy. San Sebastian
9+500	M	6.10	0.50	G					E	B	L			8	120							
9+800	M	6.00					F		N		L			7								
10+200	M	5.00	0.50	G					E	B	M			7								Brgy. Panagan
10+250	M	5.00	0.50	G										6				ST	7.30	61.30	G	Panagan Bridge

• Bridge Inventory Format

BRIDGE INVENTORY FORMAT

NAME OF ROAD :
FROM : TO:

REGION:
PROVINCE:
LENGTH: PAGE: OF

NO.	NAME OF BRIDGE AND STATION	EXISTING STRUCTURE							EXISTING APPROACHES	HYDROLOGY		REMARKS AND RECOMMENDATIONS
		TYPE AND YEAR BUILT	POSTED LOAD (tonne)	SPAN/TOTAL LENGTH (meter)	SUPERSTRUCTURE AND CONDITION	PIERS TYPE AND CONDITION	ABUTMENT 1 & 2 TYPE AND CONDITION	ABUTMENT 1 & 2 CONDITION OF PROTECTION	CONDITION AT 1 & 2	A (km^2)	Q (cm^3)	

LEGEND:

BRIDGE TYPE:
- RCDG = Reinforced Concrete Deck Girder
- PCDG = Prestressed Concrete Deck Girder
- RCBG = Reinforced Concrete Box Girder
- PCBG = Prestressed Concrete Box Girder
- SPG = Steel Plate Girder
- ST = Steel Truss
- BB = Bailey Bridge
- TbTe = Timber Trestle

CONDITION:
- G = Good
- F = Fair
- B = Bad
- VB = Very Bad

RIVER CROSSING:
- FORD = unbridged river crossing
- SPILLWAY = overflow structure

STATION: KM stationing

Road Roughness Survey

- **Vertical measurement of road's surface express in quantitative terms.**
- **IRI = 0.7 + 0.0215(R_p)**
- where: IRI = International Roughness Index, in/km
- R_P = Philippine roughness, in/km
- **Average initial IRI for pavements:**
- **PCC - IRI =< 4.22 m/km**
- **AC - IRI >= 3.46 m/km**

Average Roughness (IRI)

Highway Planning Manual		Road Condition Rating
Good = 3	⟹	Good
Fair = 5	⟹	Fair
Poor = 7	⟹	Bad
Failed = 12	⟹	Very Bad

Road Roughness Survey

Pavement Condition Rating

FLEXIBLE PAVEMENTS (AC,BS)			R values (in/km)
1	V. Good	No cracks, as new.	<70
2	Good	No cracks, low roughness.	70-120
3	Fair	Some cracks but no developed pattern, slight surface deformation.	120-170
4	Poor	Developed continuous cracking pattern, no loss of material, moderate surface deformations, few potholes.	170-220
5	Bad	Extensive cracking pattern with loss of material, large surface deformations,some potholes.	220-270
6	V. Bad	Highly deformed pavement, extensive potholing, complete failure.	>270

RIGID PAVEMENTS (PCC)			R values (in/km)
1	V. Good	No cracks, as new.	<80
2	Good	Low roughness, cracks < 100m/100m.	80-110
3	Fair	Slight surface deformation, cracks 100 - 200m/100m.	110-140
4	Poor	Developed cracking, no loss of material, cracks 200 - 300m/100m	140-180
5	Bad	Extensive cracking with loss of material, deformed pavement, cracks 300 - 400m/100m	180-230
6	V. Bad	Highly deformed pavement, complete failure, high loss of material, cracks > 400 m/100 m.	>230

UNPAVED SURFACES (G, E)			R values (in/km)
1	V. Good	Surface not restrictive to speed.	<200
2	Good	Surface slightly restrictive to speed.	200-250
3	Fair	Slight surface deformations, a few potholes.	250-300
4	Poor	Deformed surface, frequent potholes.	300-360
5	Bad	Highly deformed surface, continuous potholes, passable only at low speed.	360-450
6	V. Bad	Passable only by jeep.	>450

Note: To convert Philippine Roughness (Rp in/km) to Roughness IRI the equation is: Roughness IRI = 0.7+0.0215 x Rp; IRI units are in/km

Surface Condition, Speed and Roughness

PAVEMENT TYPE	CONDITION	SCON NO.[1]	SPEED km/hr.	SURFACE ROUGHNESS		ROUGHNESS RATING
				in/km	m/km	
Paved	Good	1	70-80	80	2.03	4.4 - 5.0
Paved	Good/Fair	2	65-70	100	2.54	3.7 - 4.3
Paved	Fair	3	55-65	150	3.81	3.0 - 3.6
Paved	Fair/Bad	4	45-55	205	5.21	2.3 - 2.9
Paved	Bad	5	35-40	265	6.73	1.6 - 2.2
Paved	Bad/V. Bad	6	25-35	330	8.38	0.9 - 1.5
Paved	Very Bad	7	20-25	465	11.81	0.2 - 0.8
Gravel	Good	8	65-70	205	5.21	4.4 - 5.0
Gravel	Good/Fair	9	60-65	255	6.48	3.7 - 4.3
Gravel	Fair	10	50-60	340	8.64	3.0 - 3.6
Gravel	Fair/Bad	11	40-50	390	9.91	2.3 - 2.9
Gravel	Bad	12	30-40	455	11.56	1.6 - 2.2
Gravel	Bad/V. Bad	13	25-30	515	13.08	0.9 - 1.5
Gravel	Very Bad	14	20-25	600	15.24	0.2 - 0.8
Stone	Very Bad	15	10-15	830	21.08	0.2 - 0.8
Earth	Bad	16	20-25	600	15.24	1.6 - 2.2
Earth	Very Bad	17	10-15	755	19.18	0.2 - 0.1
Impassable		18	-	-	-	0.0 - 0.1

1 SCON NO. - is DPWH surface condition rating.

Road Distress Survey

A vehicle outfitted with sensor-based pavement distress data collection technology.

Road Distress Survey

Image-based technology collects pavement distress data using photography, videotape, and digital imaging.

Project Design

- **Existing Situation**
- **Preliminary Engineering Design**
  - Highway Engineering
  - Bridge/Structural Engineering
  - Hydrology/Drainage Design
- **Improvement Alternatives**
  - Route Alignment
  - Pavement Types
  - Bridge Type
  - Other necessary improvements

TRRL Design Method

Basic Design Requirements

1. Design Life

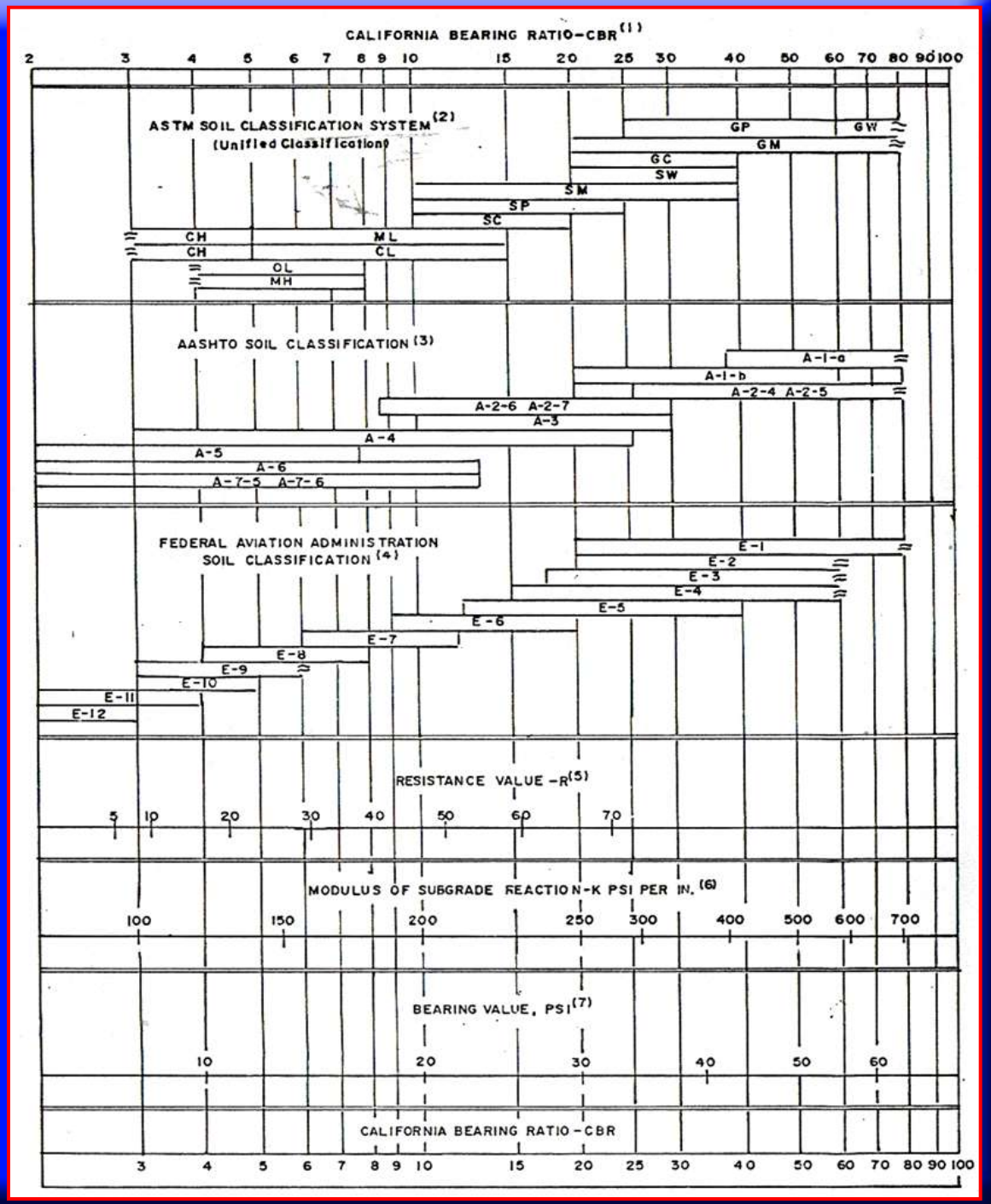
2. Traffic Loading (CESAL)

3. Subgrade Strength (CBR)

TRRL Design Method

Chart 1a

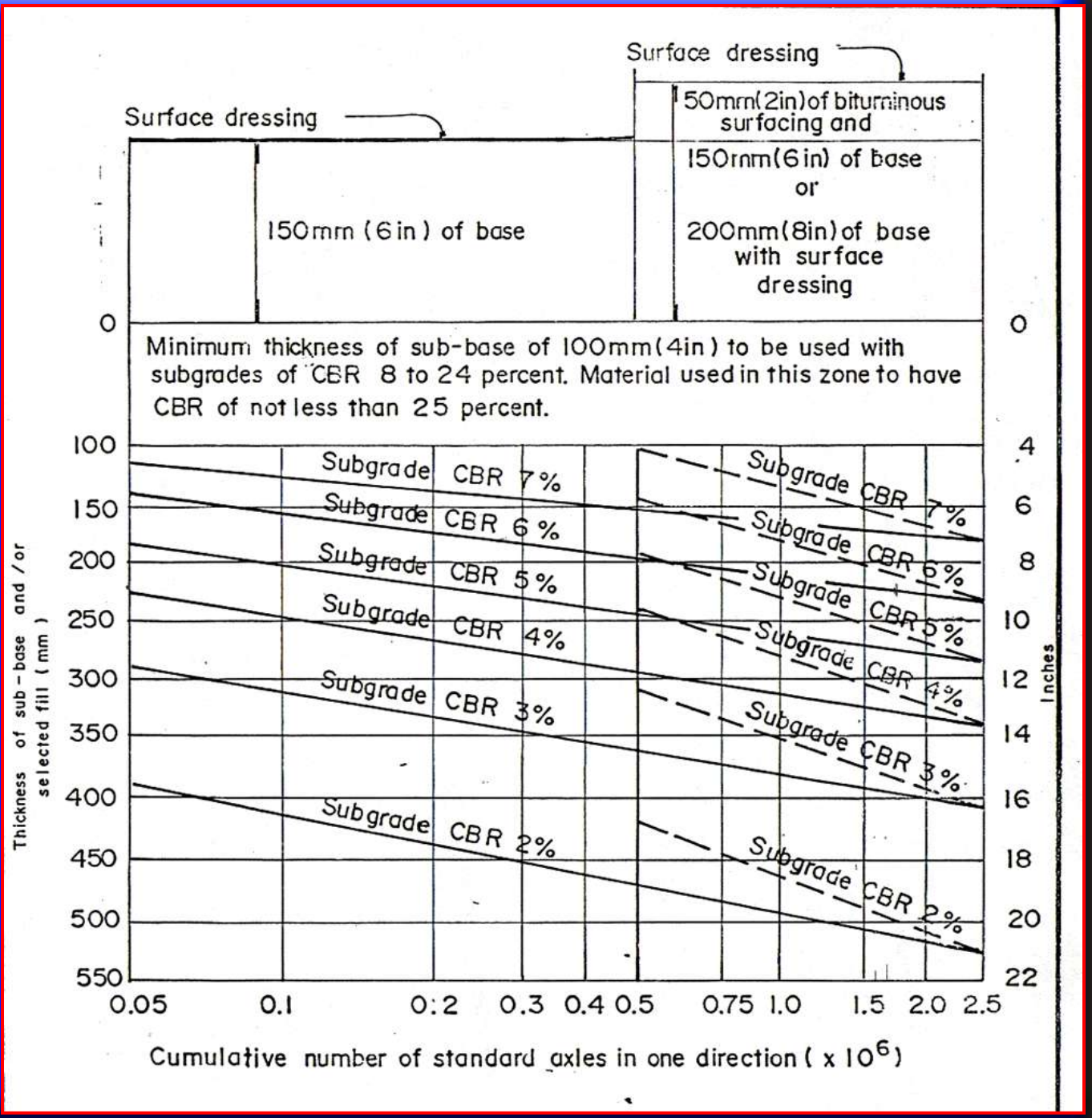
Approximate Interrelationships of Soil Classifications and Bearing Values



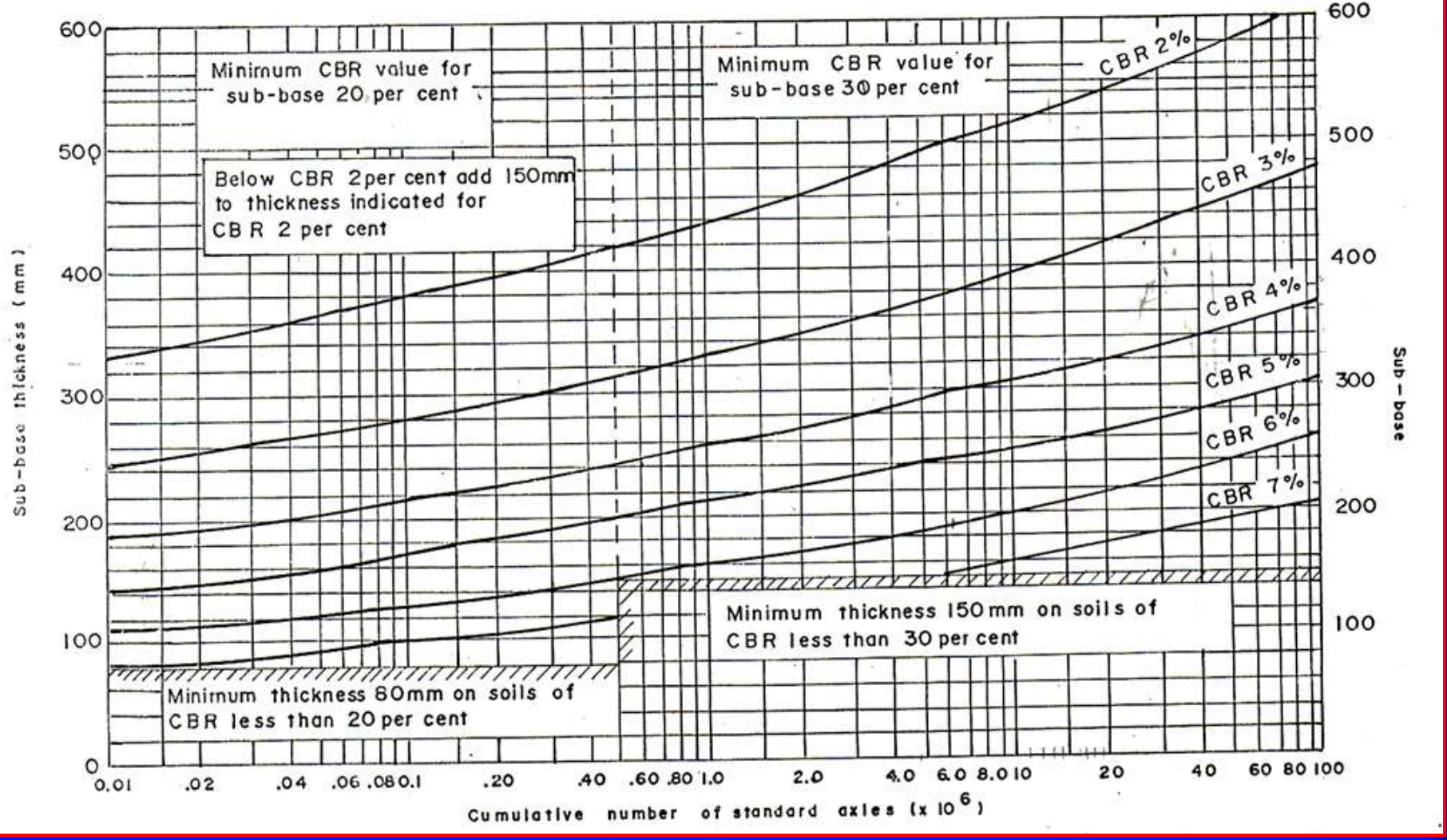
TRRL Design Method

Design of Flexible Pavement

Determining subbase & AC thicknesses



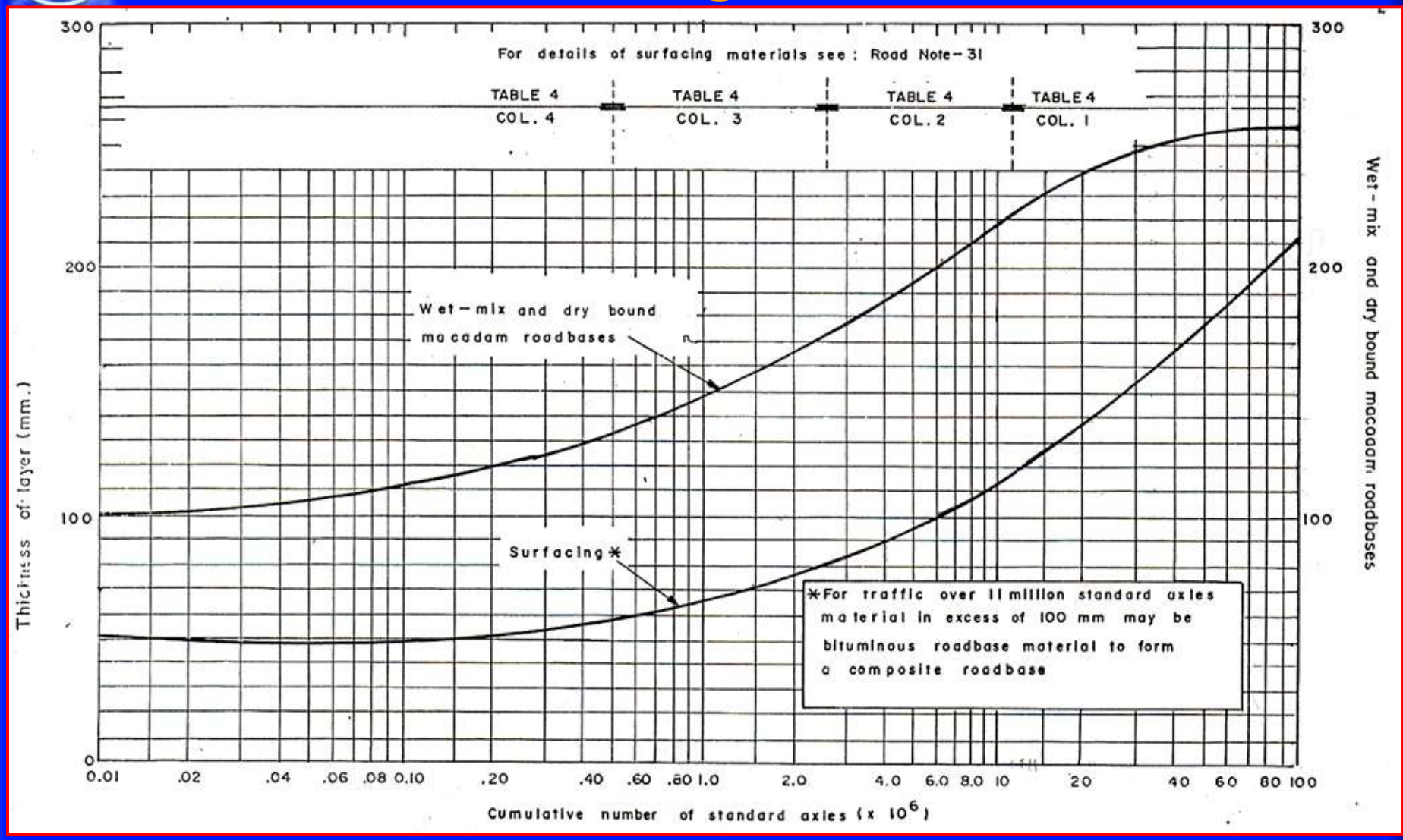
TRRL Design Method



Design of Flexible Pavement

Determining subbase thickness

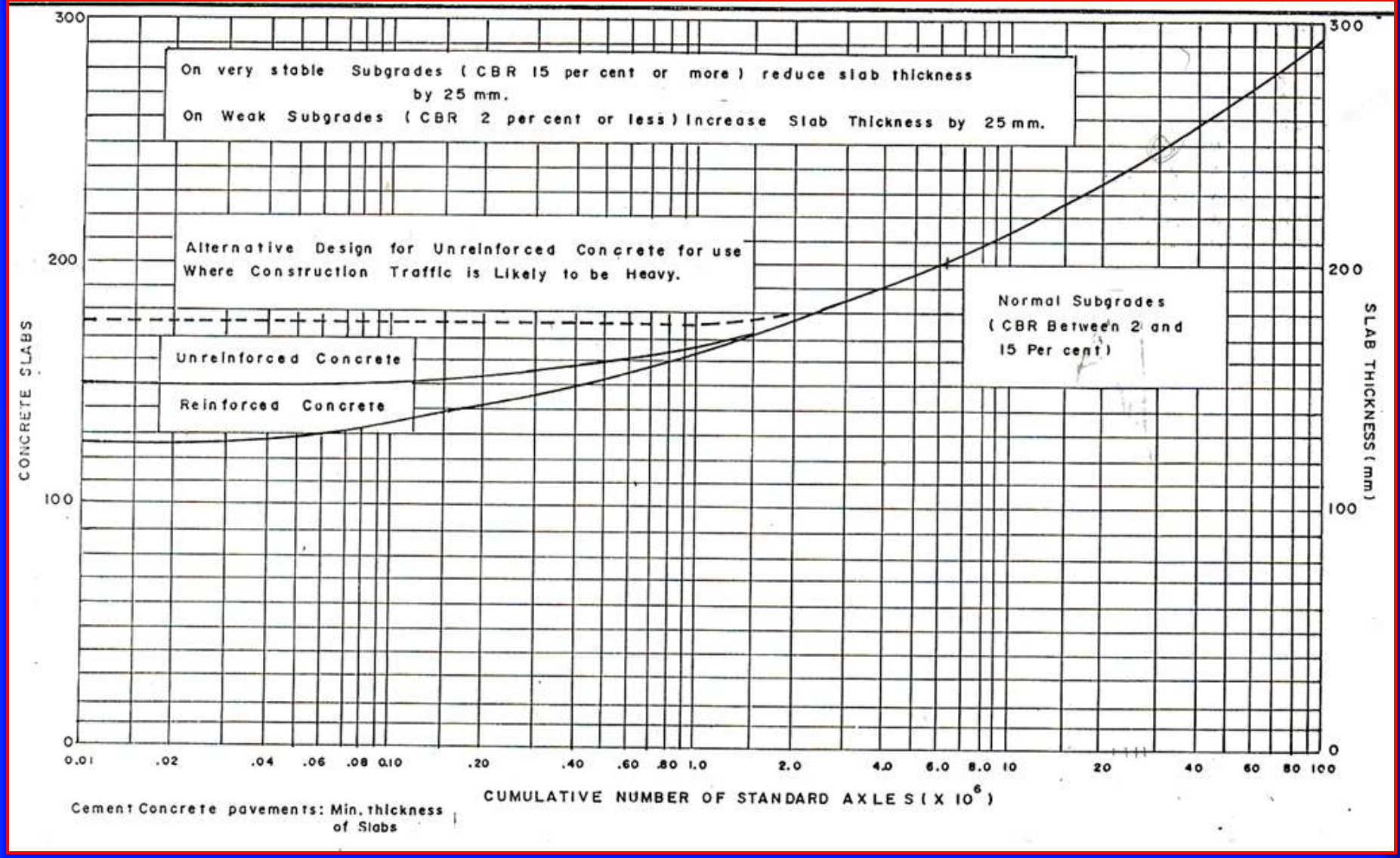
TRRL Design Method



Design of Flexible Pavement

Determining Base & AC thickness

TRRL Design Method



Design of Rigid Pavement

Determining PCC thickness

TRRL Design Method

Design of Rigid Pavement
Determining Subbase thickness

Thickness of Subbase Required for Cement Concrete Road

SUBGRADE CBR	UNDER 2%	2–4%	4–6%	6–15%	OVER 15%
Subbase Thickness	280mm	180mm	130mm	100mm	100mm

Note: If subgrade is free draining and has a CBR over 15% then no subbase is required

Source: DPWH Design Guidelines Criteria for Public Works and Highways, Volume II

TRRL Design Method

Design of Rigid Pavement

Classification of Subgrade for Concrete Roads and Minimum Thickness of Subbase Required

Type of Subgrade	Definition	Minimum Thickness of Subbase Required
Weak	All subgrade of CBR value 2 percent or less as defined in the Table for estimated CBR values for soils compacted at the natural moisture content.....	150 mm
Normal	Subgrades other than those defined by the other categories.....	80 mm
Very Stable	All subgrades of CBR value 15 percent or more as defined in the Table for estimated laboratory CBR values for soils compacted at the natural moisture content.....	0

TRRL Design Method

Design of Rigid Pavement

Estimated Laboratory CBR Values for Compacted at the Natural Moisture Content

Type of Soil	Plastic Index (percent)	CBR (percent)	
		Depth of water-table below formation level	
		More than 600mm	600mm or less
Heavy clay	70	2	1
	60	2	1.5
	50	2.5	2
	40	3	2
Silty clay	30	5	3
Sandy clay	20	6	4
	10	7	5
Silt	-	2	1
Sand (poorly graded)	Non plastic	20	10
Sand (well graded)	Non plastic	40	15
Well graded Sandy gravel	Non plastic	60	20

British Soil

Design of Unpaved Roads

RECOMMENDED THICKNESS OF GRAVEL LAYERS TO BE PLACED ON THE SUBGRADE OF A GRAVEL ROAD

TRAFFIC ADT (in both directions)	Subgrade Soil	Recommended Total Minimum Thickness of Gravel+
< 200	A1, A2, A3 soils or if CBR > 7	150mm
	A4, A5, A6, A7 soils or if CBR is between 3 and 7	200mm
> 200	A1, A2, A3 soils or if CBR > 7	200mm
	A4, A5, A6, A7 soils or if CBR is between 3 and 7	250mm

+ if drainage is bad (water-table less than 600mm below subgrade formation) use additional 50mm gravel.

= if CBR of soil is less than 3%, add 50mm of gravel to recommended minimum thickness.

Source: DPWH Design Guidelines Criteria for Public Works and Highways, Volume II

Construction/Project Cost

Unit Price Analysis

- **Labor**
  - basic wage
  - fringe benefits
  - bonuses
  - social security & other social charges
- **Equipment**
  - bare hourly & rental operating cost
  - fuels & lubricants
  - repairs & maintenance
  - labor
- **Materials**
  - labor
  - equipment
- **Production Rate**

UNIT PRICE ANALYSIS

PROJECT :

DATE :

Pay Item No. 100 (1) Clearing and Grubbing

	Description		P/unit	Unit Cost	Foreign Component	Local Component	Taxes	Economic	Financial
A.	Equipment:								
1	Bulldozer , 140 hp.		P/hr	2,619.01	1,484.33	680.88	453.81	2,165.20	2,619.01
1	Wheel Loader, 1.53 cu.m.		P/hr	1,656.58	934.21	450.08	272.29	1,384.29	1,656.58
1	Dump Trucks , 9 - 11.46 cu.m.		P/hr	2,201.63	1,280.92	599.41	321.29	1,880.34	2,201.63
	Minor Tools (10 % of Unskilled Laborers)		P/hr			26.02	3.22	26.02	29.23
		Total A			3,699.45	1,756.39	1,050.62	5,455.85	6,506.46
B.	Labor :								
1	Capataz		P/hr	62.90		55.98	6.92	55.98	62.90
2	Skilled Laborer		P/hr	44.33		78.91	9.75	78.91	88.66
4	Unskilled Laborer		P/hr	35.19		125.28	15.48	125.28	140.77
		Total B				260.17	32.16	260.17	292.33
		Total A + B			3,699.45	2,016.57	1,082.77	5,716.02	6,798.79
C.	Output : 0.12	Ha/hr.							
	Cost of (Equipment + Labor) (A + B) / C		P/Ha.		30,828.78	16,804.71	9,023.09	47,633.49	56,656.58
D.	Materials : NONE								
		Total D							
	Total Direct Cost (C + D)		P/Ha.		30,828.78	16,804.71	9,023.09	47,633.49	56,656.58
E.	VAT (10% of Total Direct Cost		P/Ha.		3,082.88	1,680.47	902.31	4,763.35	5,665.66
F.	Bond and Insurance (1% of TD		P/Ha.		308.29	168.05	90.23	476.33	566.57
G.	Overhead and Profit (16%)		P/Ha.		4,932.60	2,688.75	1,443.70	7,621.36	9,065.05
	Total Indirect Cost (E + F + G		P/Ha.		8,323.77	4,537.27	2,436.24	12,861.04	15,297.28
	TOTAL COST		P/Ha.		39,152.55	21,341.98	11,459.33	60,494.53	71,953.86
	Cost Component		%		54	30	16	84	100

Construction/Project Cost

Quantity Estimates

Maintenance Cost

Highway Maintenance

- is defined as the act of preserving and keeping each highway type of highway as nearly as possible in its original conditions as constructed or as subsequently improved. It does not include rehabilitation, betterment and improvement

Two calculation methods for maintenance cost

- EMK (Equivalent Maintenance Kilometrage)
- Traffic Dependent Method

MAINTANANCE COST
EMK FACTORS

Surface and Traffic Factor		Traffic, AADT																					
		1 - 25	25 - 50	50 - 75	75 - 100	100 - 150	150 - 200	200 - 300	300 - 400	400 - 600	600 - 1K	1K - 1500	1500 - 2K	2K - 3K	3K - 5K	5K - 10K	10K - 15K	15K - 20K	20K - 30K	30K - 50K	50K - 70K	70K- 100K	>100K
UNPAVED	Low No Granular Surface	0.35	0.40	0.50																			
	Medium 100mm - 200mm GS	0.40	0.60	0.90	1.40	1.90	2.20	2.40	2.50	2.60	2.80	3.10											
	High 200mm > GS			0.85	1.00	1.45	1.90	2.10	2.30	2.50	2.90	3.50											
BITUMINOUS	Low 10mm - 30mm							1.10		1.55	2.10	2.50	2.60	2.75									
	Medium 31mm - 60mm							1.00		1.25	1.55	2.00	2.20	2.30	2.40	2.50	2.60						
	High 61mm - 100mm							0.70		0.85	0.95	1.20	1.65	1.85	1.95	2.10	2.20	2.30	2.45	2.75	3.15	3.65	4.45
	Extra Strength 100mm >							0.50		0.60	0.70	0.80	0.90	1.00	1.10	1.15	1.20	1.25	1.33	1.48	1.68	1.93	2.33
	CONCRETE Concrete (20cms)							0.50		0.60	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.23	1.38	1.58	1.83	2.23

Width Factors

PAVED (Concrete or Asphalt)					
< = 7.50m	=	1.00	30.00m < = 32.50m	=	2.50
7.50m < = 10.00m	=	1.15	32.50m < = 35.00m	=	2.65
10.00m < = 12.50m	=	1.30	35.00m < = 37.50m	=	2.80
12.50m < = 15.00m	=	1.45	37.50m < = 40.00m	=	2.95
15.00m < = 17.50m	=	1.60	40.00m < = 42.50m	=	3.10
17.50m < = 20.00m	=	1.75	42.50m < = 45.00m	=	3.25
20.00m < = 22.50m	=	1.90	45.00m < = 47.50m	=	3.40
22.50m < = 25.00m	=	2.05	47.50m < = 50.00m	=	3.55
25.00m < = 27.50m	=	2.20	50.00m = >	=	3.70
27.50m < = 30.00m	=	2.35			

UNPAVED (Gravel or Earth)		
< = 5.00m	=	0.80
5.00m < = 7.50m	=	1.00
7.50m < = 10.00m	=	1.20
10.00m < = 12.50m	=	1.40
12.50m < = 15.00m	=	1.60
15.00m = >	=	1.80

Estimating Cost of Road Maintenance

For *ROADS:* ₱ = L x EMK x sf x wf

For *BRIDGES:* ₱ = BL x EMK x bf

where: L = road length
sf = surface factor of road
wf = width factor of road
EMK = equivalent maintenance kilometer range

Bridge Factors

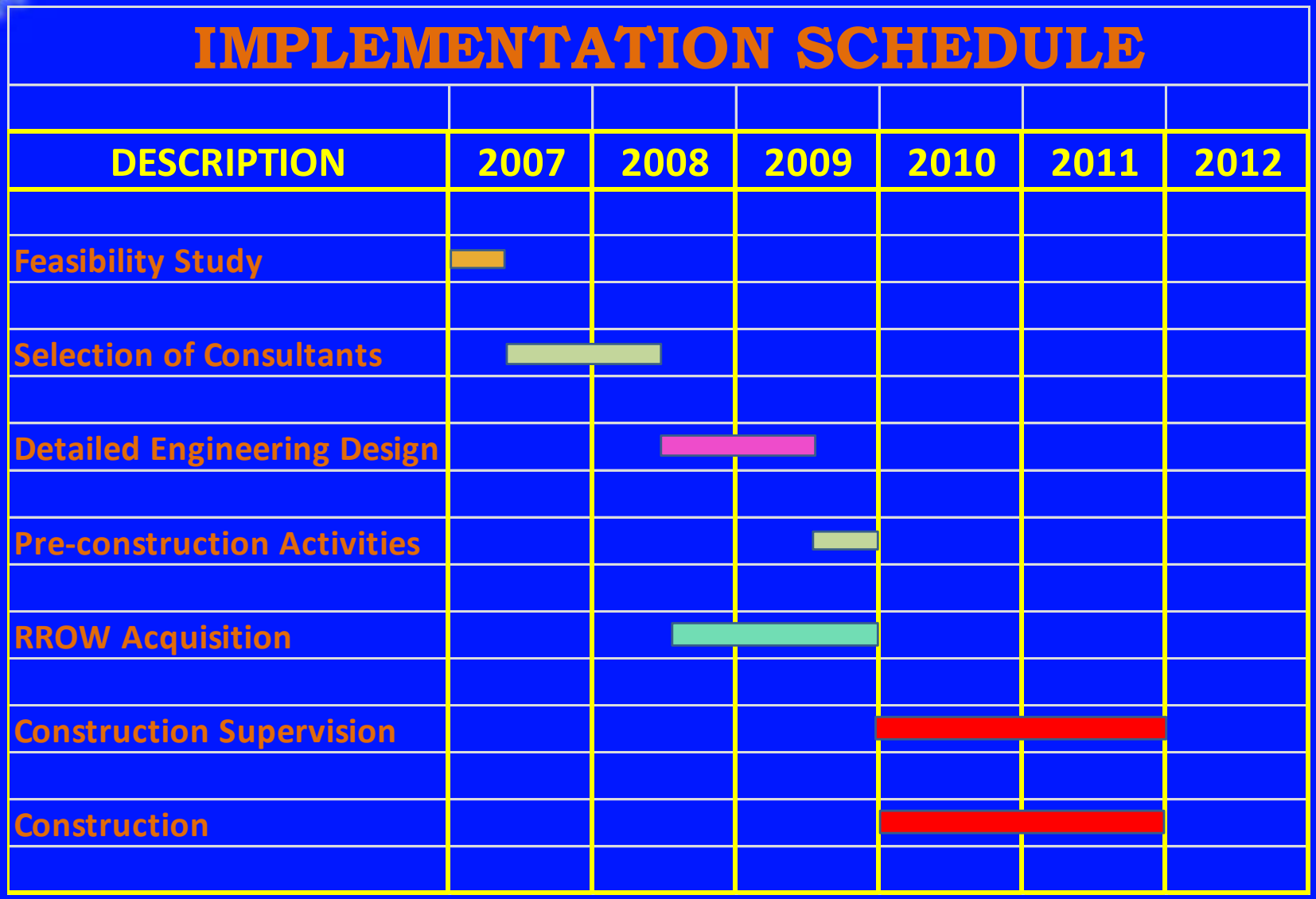
Concrete =	0.010
Steel =	0.035
Bailey / Timber =	0.100

Implementation Schedule

Consists of:

- project appraisal,
- pledging
- exchange of notes
- loan negotiation/signing
- selection/procurement of consultants
- detailed engineering design
- pre-construction activities
- RROW acquisition
- construction period

IMPLEMENTATION SCHEDULE

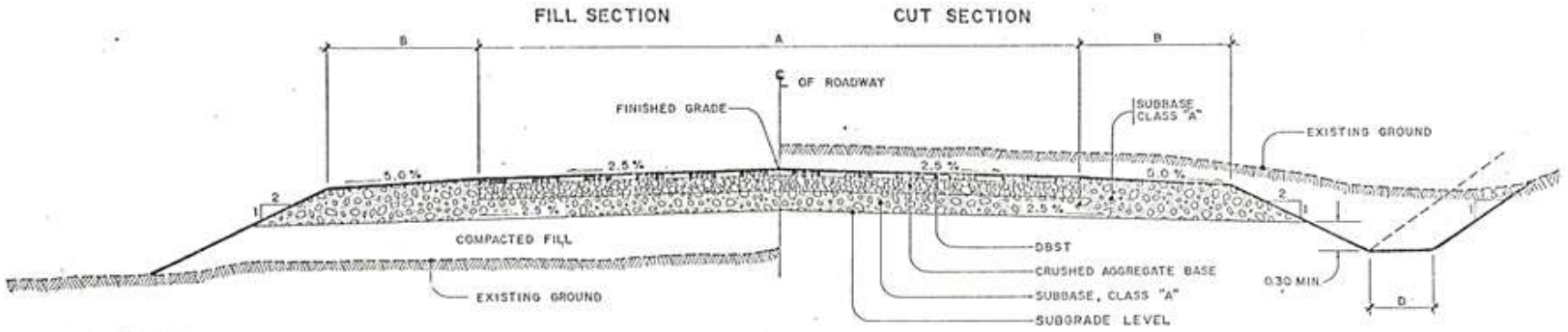


Investment Schedule and Cash Flow

INVESTMENT SCHEDULE						
DESCRIPTION	2007	2008	2009	2010	2011	2012
Detailed Engineering Design						
RROW Acquisition						
Construction Supervision						
Construction						

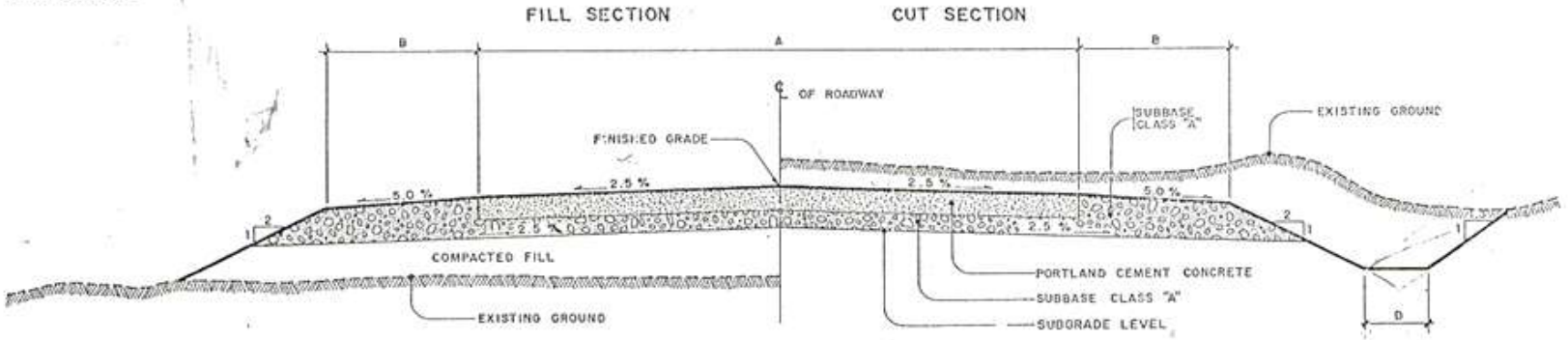
CASH FLOW (in Million Pesos)						
DESCRIPTION	2007	2008	2009	2010	2011	TOTAL
Detailed Engineering Design		6.00	4.00			10.00
RROW Acquisition		9.00	12.00			21.00
Construction Supervision				10.00	10.00	20.00
Construction				125.00	125.00	250.00
Grand Total		15.00	16.00	135.00	135.00	301.00

Sample Drawings



A - CARRIAGEWAY WIDTH
B - SHOULDER WIDTH
D - DITCH WIDTH

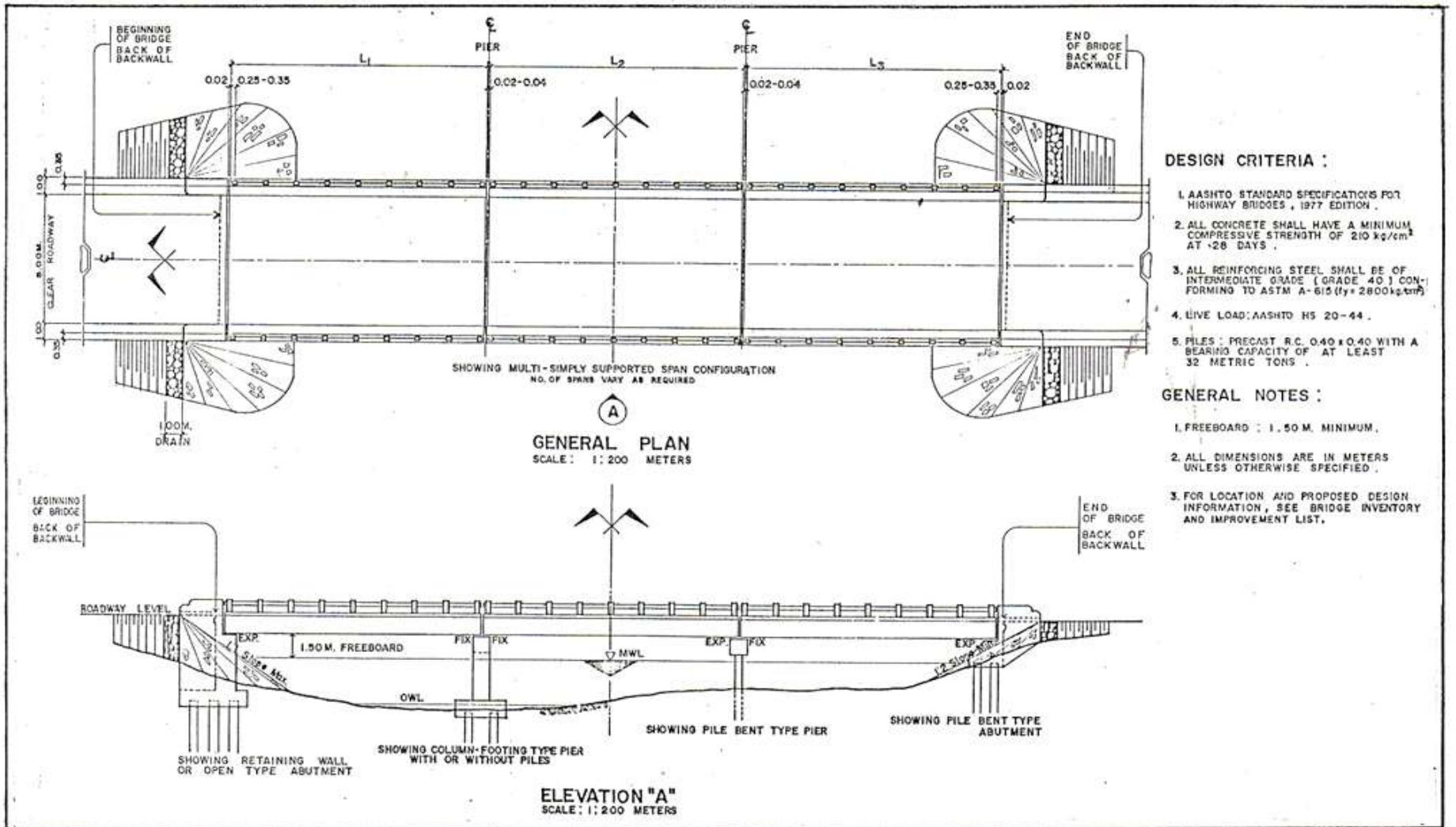
DOUBLE BITUMINOUS SURFACE TREATMENT PAVEMENT (NEW CONSTRUCTION OR RECONSTRUCTION)



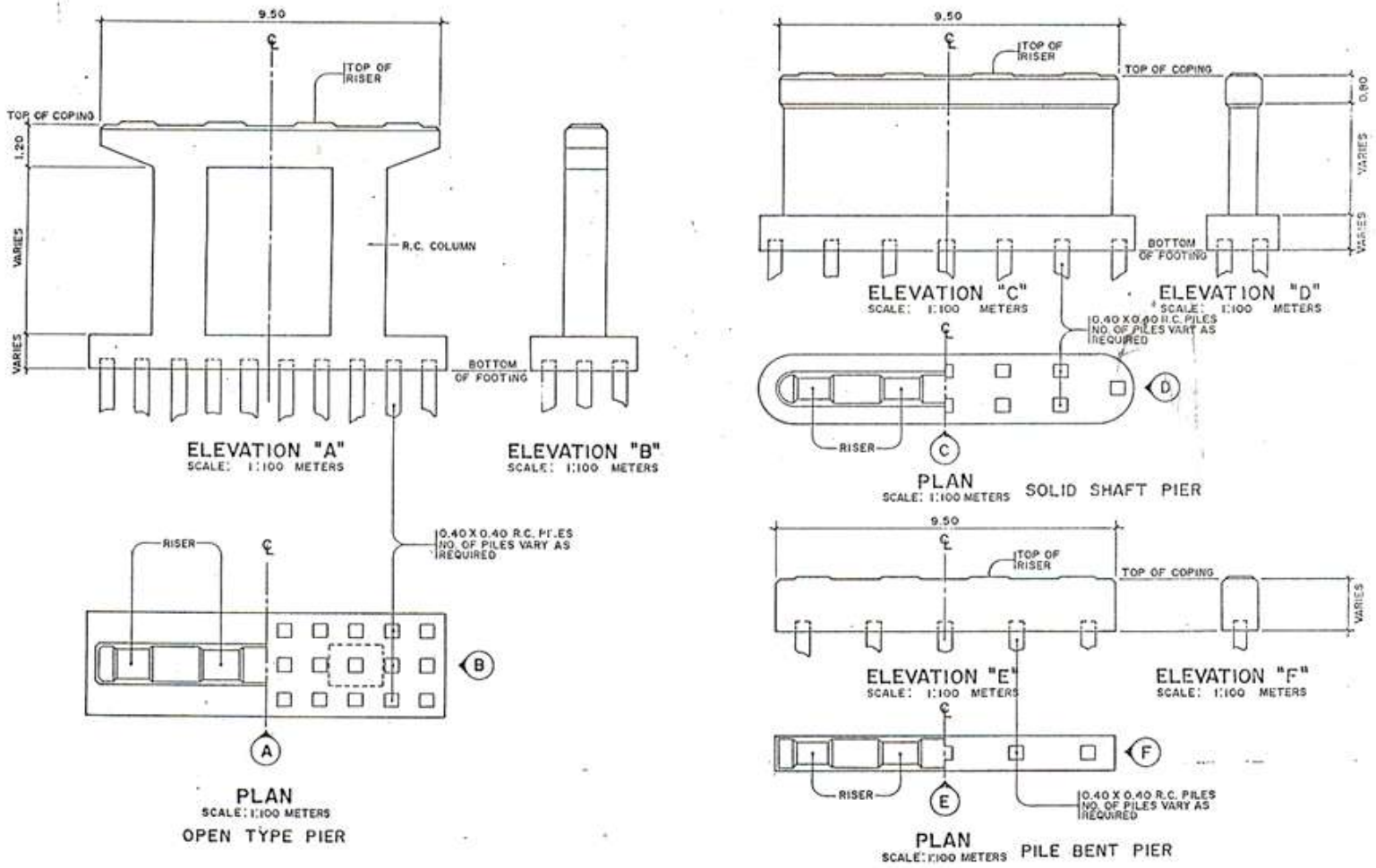
PORTLAND CEMENT CONCRETE PAVEMENT (NEW CONSTRUCTION OR RECONSTRUCTION)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PMO - FEASIBILITY STUDIES	PROJECT	SHEET CONTENTS	DRAWING NO.
		TYPICAL ROAD SECTIONS DBST & PCC	

Sample Drawings

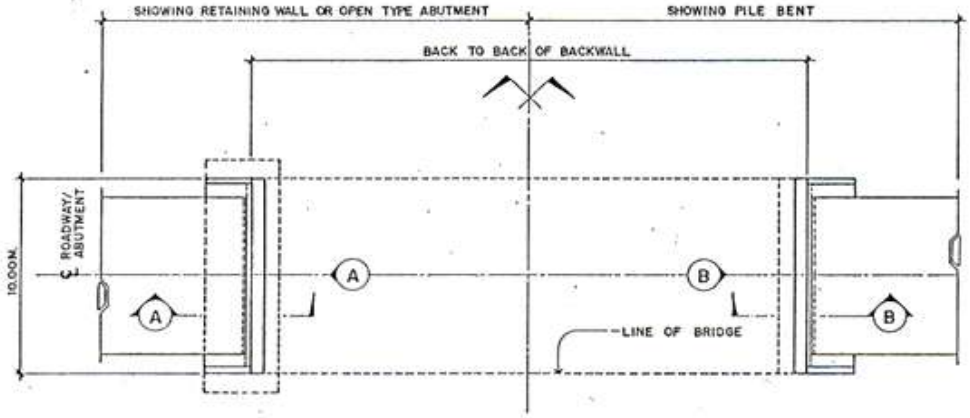


Sample Drawings



DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PMO – FEASIBILITY STUDIES	PROJECT	SHEET CONTENTS	DRAWING NO.
		TYPICAL PIER DETAILS	

Sample Drawings



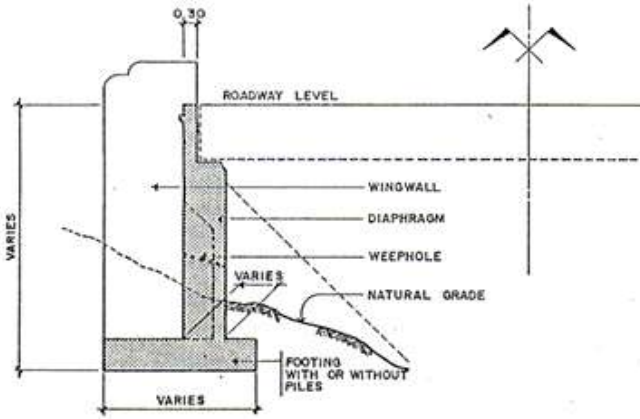
GENERAL PLAN
SCALE: 1 : 200 METERS

DESIGN CRITERIA :

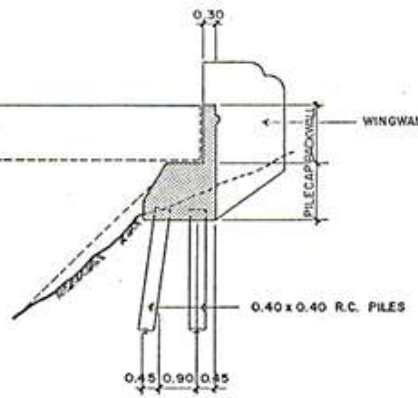
1. AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1977 EDITION.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 210 kg/cm² AT 28 DAYS.
3. ALL REINFORCING STEEL SHALL BE OF INTERMEDIATE GRADE (GRADE 40) CONFORMING TO ASTM A-615 (fy = 2800 kg/cm²).
4. LIVE LOAD AASHTO HS 20-44.
5. PILES: PRECAST R.C. 0.40 x 0.40 WITH A BEARING CAPACITY OF AT LEAST 32 METRIC TONS.

GENERAL NOTES :

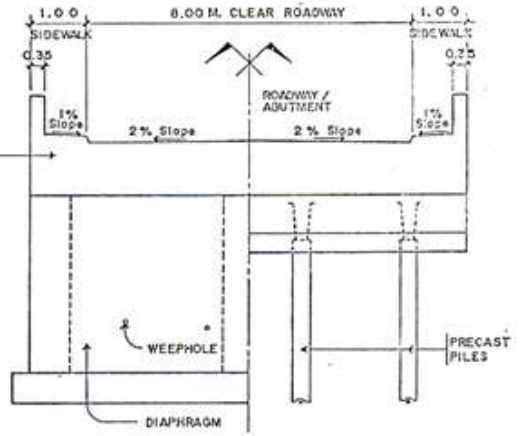
1. FREEBOARD : 1.50 M. MINIMUM.
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
3. FOR LOCATION AND PROPOSED DESIGN INFORMATION, SEE BRIDGE INVENTORY AND IMPROVEMENT LIST.



SECTION "A"
SCALE: 1:100 METERS



SECTION "B"
SCALE: 1:100 METERS



ELEVATION "A"
SCALE: 1 : 100 METERS

ELEVATION "B"
SCALE: 1 : 100 METERS

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PMO – FEASIBILITY STUDIES

PROJECT	SHEET CONTENTS	DRAWING NO.
	TYPICAL ABUTMENT DETAILS	


Thank You !!!