PROCUREMENT OF NEW ROLLING STOCK NETWORK INFORMATION AND INFRASTRUCTURE INTERFACE

18 March 2011

Contents

ABBREVIATIONS

A:	Ampere
AC:	Alternating Current
ATC:	Automatic Train Control
ATP:	Automatic Train Protection
DC:	Direct Current
Eskom:	State-owned enterprise generating, transmitting and distributing electricity to industrial, mining, commercial, agricultural and residential customers and redistributors.
Hz:	Hertz
kA:	Kilo ampere
km:	Kilometer
kV:	Kilovolt
mH:	Millihenry
mm:	Millimeter
ms:	Millisecond
MVA:	Mega volt ampere
MW:	Megawatt
PRASA:	Passenger Rail Agency of South Africa, previously SARCC
RSR:	Railway Safety Regulator
SARCC:	South African Rail Commuter Corporation of South Africa, now known as PRASA
Spoornet:	State-owned logistics provider, now known as TFR
TFR:	Transnet Freight Rail, a division of Transnet, previously known as Spoornet
V:	Volt

1. BACKGROUND

1.1 Introduction

Following the proclamation of the Legal Succession to S.A. Transport Services Act 1989, (Act No.9 of 1989) (as amended by Act No. 52 of 1991), immovable rail infrastructure (network) assets were divided between the Passenger Rail Agency of South Africa (PRASA), previously known as the South African Rail Commuter Corporation Limited (SARCC), and Transnet Limited, trading as TFR.

Commuter networks became the property of PRASA. All other networks became the property of TFR.

For the purpose of fulfilling its mandate, PRASA and TFR entered into an agreement for the mutual use of each others networks, known as the “Agreement for the Use of Assets and Related Services [i]. This agreement prescribes restrictions, clearances and circumscriptions of rolling stock operating on each others networks. If any restrictions, clearances or circumscriptions are exceeded, the owner of the network has the right to refuse access by the relevant rolling stock.

Furthermore, the National Safety Regulator Act, No. 16 of 2002 (as amended) [ii], requires network owners to ensure that rolling stock operating on their network meet all required standards of that network.

1.2 Purpose of Document

Rolling stock proposed for this project shall be able to operate on all commuter networks in South Africa.

To this effect, Metrorail train service information, network information, clearances and restrictions and other related information is given in this document and is also generally applicable for Shosholoza Meyl mainline services.

2. PRASA COMMUTER SERVICES

This section gives an overview of commuter train services per region [iii].

2.1 Gauteng North

Table 2.1: Gauteng North Commuter Services

Name of train service	Start station	End station	Distance of one way journey (km)	Time duration of one way journey (minutes)	Track Gauge (m)	Max Axle Load (tone)	Maximum Section Speed (km/h)	Train Control System	Maximum Train Length (m)	Motive Power
Mabopane	Pretoria	Mabopane	39	60	1.067	20	100/90	Colour Light	275	3 kV DC / Diesel
Pretoria - Johannesburg	Pretoria	Johannesburg	69	103	1.067	20	100/90	Colour Light	275	3 kV DC / Diesel
Pienaarspoort	Pretoria	Pienaarspoort	27	44	1.067	20	90	Colour Light	250	3 kV DC / Diesel
Saulsville	Pretoria	Saulsville	14	20	1.067	20	90 / 75	Colour Light	275	3 kV DC / Diesel
De Wildt	Pretoria	De Wildt	36	60	1.067	20	100/90	Colour Light	275	3 kV DC / Diesel
Mabopane - Eerste Fabrieke	Mabopane	Eerste Fabrieke	39	77	1.067	20	100/90	Colour Light	275	3 kV DC / Diesel
Saulsville - Eerste Fabrieke	Saulsville	Eerste Fabrieke	35	58	1.067	20	90/75	Colour Light	275	3 kV DC / Diesel
Total route kilomet			**260**							

All lines are PRASA property except for the following TFR-owned lines / sections (see Section 3.1):

- Mamelodi Gardens (excluded) to Rayton

2.2 Gauteng South

Table 2.2: Gauteng South Commuter Services

Name of train service	Start station	End station	Distance of journey (km)	Time duration of journey (minutes)	Track Gauge (m)	Max Axle Load (tone)	Maximum Section Speed (km/h)	Train Control System	Maximum Train Length (m)	Motive Power
Naledi	Johannesburg	Naledi	28	52	1.067	20	90/60	Colour Light	275	3kV DC / Diesel
Naledi (via Crown)	George Goch	Naledi	35	54	1.067	20	90/50	Colour Light	275	3kV DC / Diesel
Leralla	Germiston	Leralla	33	46	1.067	20	100/90	Colour Light	210	3kV DC / Diesel
Daveyton	Dunswart	Daveyton	45	21	1.067	20	90	Colour Light	210	3kV DC / Diesel
Houtheuwel	George Goch	Houtheuwel	66	98	1.067	20	90/60	Colour Light / Semaphore	275	3kV DC / Diesel
Houtheuwel (via Crown)	George Goch	Houtheuwel	73	87	1.067	20	90/50	Colour Light / Semaphore	275	3kV DC / Diesel
Residensia - Vereeeniging	Residensia	Vereenigng	11	26	1.067	20	90/75	Colour Light / Semaphore	235	3kV DC / Diesel
Pretoria	Johannesburg	Pretoria	69	102	1.067	20	100/90	Colour Light	275	3kV DC / Diesel
Randfontein	Johannesburg	Randfontein	44	76	1.067	20	90/60	Colour Light	275	3kV DC / Diesel
Springs	Johannesburg	Springs	47	81	1.067	20	90/60	Colour Light	275	3kV DC / Diesel
Nigel	Springs	Nigel	24	34	1.067	20	90	Colour Light	275	3kV DC / Diesel
Kwesini	Germiston	Kwesini	21	35	1.067	20	90	Colour Light	275	3kV DC / Diesel
Germiston - Vereeniging	Germiston	Vereeniging	61	83	1.067	20	90	Colour Light	235	3kV DC / Diesel
Germiston - New Canada	Germiston	New Canada	22	37	1.067	20	90	Colour Light	275	3kV DC / Diesel
Oberholzer	Johannesburg	Oberholzer	82	96	1.067	20	90	Van Schoor / Colour Light	235	3kV DC / Diesel
Total route kilometres			661							

All lines are PRASA property except for the following TFR-owned lines / sections (see Section 3.2):

- Midway (excluded) – Bank (via Suurbekom) – Oberholdzer
- Houthewel (excluded) – Vereeniging
- Germiston (excluded) – Vereeniging
- India (excluded) – Elsburg
- Germiston West – Jupiter
- Springs (excluded) – Nigel

2.3 Western Cape

Table 2.3: Western Cape Commuter Services

Name of train service	Start station	End station	Distance of journey (km)	Time duration of journey (minutes)	Track Gauge (m)	Max Axle Load (tone)	Maximum Section Speed (km/h)	Train Control System	Maximum Train Length (m)	Motive Power
Simonstown	Cape Town	Simonstown	36	70	1.067	20	75/60	Colour Light	160	3kV DC / Diesel
Retreat	Cape Town	Retreat	19	36	1.067	20	75	Colour Light	160	3kV DC / Diesel
Kapteinsklip	Cape Town	Kapteinsklip	32	51	1.067	20	90/75	Colour Light	275	3kV DC / Diesel
Khayalitsha	Cape Town	Khayalitsha	29	56	1.067	20	90/75	Colour Light	275	3kV DC / Diesel
Lavistown	Cape Town	Bellville	19	29	1.067	20	90/75	Colour Light	235	3kV DC / Diesel
Kraaifontein	Cape Town	Kraaifontein	31	73	1.067	20	90/75	Colour Light	195	3kV DC / Diesel
Bellville	Cape Town	Bellville	29	33	1.067	20	90/75	Colour Light	215	3kV DC / Diesel
Wellington	Cape Town	Wellington	47	96	1.067	20	90	Colour Light / Semaphore	195	3kV DC / Diesel
Strand	Cape Town	Strand	54	88	1.067	20	90	Colour Light / Semaphore	235	3kV DC / Diesel
Eersterivier	Cape Town	Eersterivier	34	63	1.067	20	90	Colour Light	235	3kV DC / Diesel
Muldervlei	Cape Town	Muldervlei	41	95	1.067	20	90	Colour Light	235	3kV DC / Diesel
Malmesbury	Cape Town	Malmesbury	78	140	1.067	20	90	Colour Light / Semaphore	140	Diesel
Total route kilometres			448							

All lines are PRASA property except for the following TFR-owned lines / sections (see Section 3.3):

- Kentemade – Monta Vista – Bellville (Bellville excluded)
- Bellville (Bellville excluded) – Wolseley
- Kraaifontein – Malmesbury

2.4 Durban

Table 2.4: Durban Commuter Services

Name of train service	Start station	End station	Distance of one way journey (km)	Time duration of one way journey (minutes)	Track Gauge (m)	Max Axle Load (tone)	Maximum Section Speed (km/h)	Train Control System	Maximum Train Length (m)	Motive Power
Umlazi	Durban	Umlazi	26	47	1.067	20	90/75	Colour Light	275	3kV DC / Diesel
Kwa-Mashu	Durban	Kwa Mashu	19	33	1.067	20	75/60	Colour Light	210	3kV DC / Diesel
South Coast	Durban	Kelso	67	118	1.067	20	90	Colour Light	275	3kV DC / Diesel
North Coast	Berea Road	Stanger	77	125	1.067	20	75	Colour Light	210	3kV DC / Diesel
Pinetown	Durban	Pinetown	27	58	1.067	20	90/75	Colour Light	275	3kV DC / Diesel
Chatsworth	Durban	Crossmoor	26	45	1.067	20	90	Colour Light	230	3kV DC / Diesel
NEW LINE	Durban	Cato Ridge	71	126	1.067	20	90	Colour Light	210	3kV DC / Diesel
Bluff	Durban	Wests	20	41	1.067	20	90	Colour Light	275	3kV DC / Diesel
Total route kilometres			**333**							

All lines are PRASA property except for the following TFR-owned lines / sections (see Section 3.4):

- Rossburgh (excluded) – Cato Ridge (New main line)
- Clairwood (excluded) – Wests
- Umgeni (excluded) – Stanger

2.5 East London

Table 2.5: East London Commuter Services

Name of train service	Start station	End station	Distance of one way journey (km)	Time duration of one way journey (minutes)	Track Gauge (m)	Max Axle Load (tone)	Maximum Section Speed (km/h)	Train Control System	Maximum Train Length (m)	Motive Power
Blaney	East London	Blaney	23		1.067	20	75	Colour Light	210	25kV AC / Diesel
Total route kilometres			**23**							

All infrastructure assets are owned by TFR.

2.6 Port Elizabeth

Table 2.6: Port Elizabeth Commuter Services

Name of train service	Start station	End station	Distance of one way journey (km)	Time duration of one way journey (minutes)	Track Gauge (m)	Max Axle Load (tone)	Maximum Section Speed (km/h)	Train Control System	Maximum Train Length (m)	Motive Power
Swartkops	Port Elizabeth	Swartkops	9		1.067	20	75	Colour Light	210	25kV AC / Diesel
Uitenhage	Swartkops	Uitenhage	16		1.067	18.5	75	Semaphore	210	Diesel
Total route kilometres			**25**							

All infrastructure assets are owned by TFR.

3. PRASA NETWORK DIAGRAMS

PRASA network diagrams are shown in this section.

Network diagrams indicate the following information:

- PRASA rail networks (indicated in red)
- TFR rail networks (indicated in blue)

Networks in East London and Port Elizabeth belong to TFR.

3.1 Gauteng North Network Diagram

LEGEND:

PRASA LINES

TFR LINES

BEESTEKRAAL

RUSTENBURG

END OF METRO RAIL SERVICE

DE WILDT

TAILLARDSHOOP

GARANKUWA

MEDUNSA

MABOPANE

SOSHANGUVE

LEBALENG

HALTE 2

AKASIABOOM

SPHINX

PYRAMID

PYRAMID-SOUTH

VASFONTEIN

PETRONALLA

SPYKERRAS

HAMMANSKRAAL

BABELEGI SYLYN

KEKANA

BOSPLAAS

MAUBANE

PIETERSBURG

PIENAARSRIVIER

BON ACCORD

MEERSIG

LINE NOT USED BY METRORAIL

OORSTAANTERREIN

LINE NOT USED BY METRORAIL

PRETORIA NOORD

BRITS

PENDORING

STEPHANUS

LINE NOT USED MY METRORAIL

HORNSNEK

LYNROSS

ROSSLYN

WINTERSNEST

WOLMERTON

WONDERBOOM

MOUNTAIN VIEW

DASPOORT

MEERHOF

XANADU

SAARJIESNEK

LONGMEADOW

ISWIN

SWARTSPRUIT

SUNSET VIEW

FORTSIG

MOOKA

GOMSAND

SANDPITS

KAMPSTRAAT

RIEKERT

MACHIELSNEK

MAGALIESBURG

(LINE NOT USED BY METRORAIL)

HERCULES

GOODS DEPOT

GEZINA

DEERNESS

VILLIERIA

PIERNEEFSRUS

QUEENSWOOD

GREENVIEW

PIENAARSPOORT

PANPOORT

VAN DE MERWE (NOT USED BY METRORAIL)

RAYTON

CULLINAN

WITBANK

CAPITAL PARK

GOLF

BELLE OMBRE

SCHUTTESTRAAT

MITCHELLSTRAAT

REBECCA

ELEKTRO

RISSIK

HARTBEESTSPRUIT

KOEDOEPOORT

SILVERTON

EERSTERUS

WATLOO

DENNEBOOM

EERSTE FABRIEKE

MAMELODI GARDENS

SENTRARAND

LOFTUS VERSFELDPARK

WALKER STREET

DEVENISH STREET

MEARS STREET

PRETORIA

PRETORIA-WEST

BARRACKS

BOSMANSTRAAT

ATTERIDGVILLE

SAULSVILLE

KALAFONG

COR DELFOS

FONTEINE

KLOOFSIG SPORTPARK

CENTURION

IRENE

PINEDENE

JOHANNESBURG

3.2 Gauteng South Network Diagram

LEGEND:

PRASA LINES

TRANSNET FREIGHT RAIL(TFR) LINES

MAFIKENG
WESRAND
MILLSITE
CENTRAL
ROBINSON
HOMELAKE
RANDFONTEIN
MIDDELVLEI
MIDPOINT
VLEIKOP
BANK
MAIZELANDS
OBERHOLZER
WELVERDIEND
POTCHEFSTROOM
CRESCENT
NEW MACHAVIE
KOEKEMOER
KLERKSDORP
KRUGERSDORP
WINDSOR MINE
LANWEN
LUIPAARDSVLEI
WITPOORTJIE
PRINCESS
HORISON
ROODEPOORT
GEORGINIA
HAMBERG
FLORIDA
UNIFIED
MARAISBURG
BOSMONT
NEWCLARE
WESTBURY
INDUSTRIA
LANGLAAGTE
GROSVENOR
MAYFAIR
BRAAMFONTEIN
JOHANNESBURG
DOORNFONTEIN
ELLIS PARK
JEPPE
GEORGE GOCH
DENVER
TOORONGA
CLEVELAND
GELDENHUYS
DRIEHOEK
PRESIDENT
GERMISTON
BENROSE
REFINERY
INDIA
GERMISTON SOUTH
GERMISTON LAKE
WEBBER PARKHILL
KUTALO
ELSBURG
DELMORE
ANGELO
EAST RAND
RAVENSKLIP
KNIGHTS
ELANDSFONTEIN
BOKSBURG EAST
BOKSBURG
DUNSWART
AVENUE
BENONI
APEX
ANZAC
NORTHMEAD
VAN RYN
ALLIANCE
DAVEYTON
DEEP LEVELS
MODREA
NORTH SHAFT
DERSLEY
GEDULD
BRAKPAN
SCHAPENRUST
AURUM
WITHOK
SELPARK
DAGGAFONTEIN
STRUISBULT
ROADBEND
DUNNOTTAR
SUB-NIGEL
SERVAAS
NIGEL
JAMESON PARK
TO KAYDALE
WELGEDAG
PAYNEVILLE
TO ENDICOTT
SPRINGS
HARTEBEEST
SENTRAAL
NO: 2 MODULE
BAPSFONTEIN
KNOPPIES
MODDER
PERSIDA
TO VOELFONTEIN
TO GLENROY
TO PRETORIA
PINEDENE
OLIFANTSFONTEIN
SENTRARAND
KAALFONTEIN
LERALLA
LIMINDLELA
TEMBISA
BIRCHLEIGH
VAN RIEBEECKPARK
KEMPTON PARK
RHODESFIELD
ISANDO
NALEDI
INHLAZANE
DUBE
PFEFENI
MZIMHLOPE
MLAMLANKUNZI
ORLANDO
NANCEFIELD
KLIPTOWN
TSHIAWELO
MIDWAY
LENZ
LAWLEY
ANGLERS
MIDANNADALE
GRASMERE
STRETFORD
RESIDENSIA
EATONSIDE
KWAGGASTROOM
HOUTHEUWEL
LEEUHOF
KLEIGROND
YSKOR
NEW CANADA
CROESUS
LONGDALE
NASREC NORTH
WESTGATE
FARADAY
VILLAGE MAIN
CROWN
BOOYSENS
NASREC
KASERNE WEST
KASERNE
JUPITER
DUNCANVILLE
VEREENIGING
VILJOENSDRIF
GOUDRYK
WESTONARIA
SUURBEKOM
GOUDEON
WATERWORKS
ENSELSPRUIT
FOCHVILLE
VAN DER BIJL
BOOYSENS
DALLAS
WATTLES
UNION
NATALSPRUIT
MPILISWENI
RANDWATER
KLIPRIVIER
SKANSDAM
DALESIDE
HENLEY-ON-KLIP
MEYERTON
KOOKRUS
KRAGSTASIE
TO GROOTVLEI
REDAN
ALLOY
ROOIKOP
ANGUS
NATAL
SUIDRAND
TO SPRINGS
MAPLETON
VALLEY
PLAATS
GLENROY
DRIEMANSKAP
KAYDALE
HEIDELBERG
TO VOLKSRUST
WADEVILLE
KATLEHONG
LINDELA
PILOT
KWESINE

3.3 Western Cape Network Diagram

LEGEND

PRASA

TRANSNET FREIGHT RAIL

TO WORCESTER
WOLSELEY
ARTOIS
TULBACHWEG
GOUDA
VOELVLEI
HERMON
SOETENDAL
MALAN
WELLINGTON
M'BEKWENI
DAL JOSEFAT
HUGUENOT
PAARL
KLAPMUTS
MULDERSVLEI
KOELENHOF
STELLENBOSCH
VLOTTENBURG
LYNEDOCH
EERSTERIVIER
FAURE
FIRGROVE
SOMERSET WEST
VAN DER STEL
SIR LOWRY'S PASS
TO BREDASDORP
STRAND
TO BITTERFONTEIN
MALMESBURY
ABBOTSDALE
KALBASKRAAL
WINTERVOGEL
NA SALDANHA
KLIPHEUWEL
MIKPUNT
MELLISH
FISANTKRAAL
KRAAIFONTEIN
EIKENFONTEIN
BRACKENFELL
STIKLAND
BELLVILLE
BELLVILLE YARD
TO HARBOUR
WINDERMERE
CTC
TO ATLANTIS
KENSINGTON
KENTEMADE
AKASIAPARK
MONTE VISTA
DE GRENDEL
AVONDALE
OOSTERZEE
TYGERBERG
PAROW
ELSIESRIVIER
VASCO
GOODWOOD
THORNTON
MUTUAL
MUTUAL YARD
CENTURY CITY
WOLTEMADE
YSTERPLAAT
PAARDENEILAND
ESPLANADE
CAPE TOWN
YARD
ERS
WOODSTOCK
SOUTRIVIER
KOEBERGWEG
MAITLAND
MAITLAND WERF
NDABENI
PINELANDS
OBSERVATORY
MOWBRAY
ROSEBANK
RONDEBOSCH
NUWELAND
CLAREMONT
HARFIELD ROAD
KENILWORTH
WYNBERG
WITTEBOME
PLUMSTEAD
STEURHOF
DIEPRIVIER
HEATHFIELD
HAZENDAL
ATHLONE
CRAWFORD
LANSDOWNE
WETTON
OTTERY
SOUTHFIELD
RETREAT
STEENBERG
LAKESIDE
VALSBAAI
MUIZENBERG
ST.JAMES
KALKBAAI
SUNNY COVE
VISHOEK
SIMONSTOWN
GLENCAIRN
LANGA
BONTHEUWEL
LAVISTOWN
BELHAR
UNIBELL
PENTECH
SAREPTA
NETREG
HEIDEVELD
NYANGA
PHILLIPI
STOCK ROAD
MANDALAY
NOLUNGILE
LENTEGEUR
MITCHELL'S PLAIN
KAPTEINSKLIP
NONQUBELA
KHAYELITSHA
KUYASA
CHRIS HANI
KUILSRIVIER
BLACKHEATH
MELTONROSE

3.4 Durban Network Diagram

LEGEND:

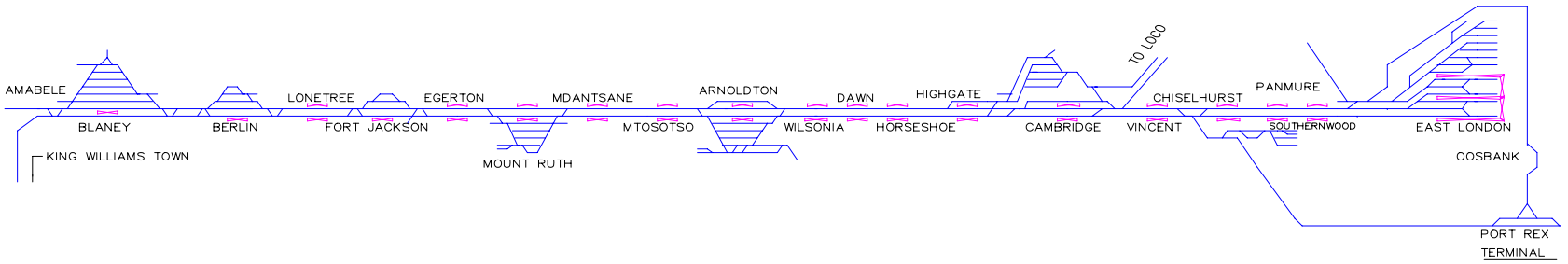
PRASA LINES

TRANSNET FREIGHT RAIL(TFR) LINES

END OF METRO SERVICE
PIETERMARITZBURG
CATO RIDGE
HARRISON
INCHANGA
DRUMMOND
BOTHAS HILL
PADLEY
HILLCREST
GILLITS
KLOOF
GEORGEDALE
KWA TANDAZA
HAMMERSDALE
CLIFFDALE
NSHONGWENI
DELVILLE WOOD
KWA NDENGEZI
DASSENHOEK
SITUNDU HILLS
THORNWOOD
MARRIANHILL
KLAARWATER
SHALLCROSS
BURLINGTON
CAVENDISH
MOUNT VERNON
WYEBANK
END OF METRO SERVICE
PINETOWN
SARNIA
GLEN PARK
MOSELEY
NORTHDENE
ESCOMBE
MALVERN
POET'S CORNER
HILLARY
BELLAIR
SEA VIEW
CROSSMOOR
CHATSGLEN
WESTCLIFF
BAYVIEW
HAVENSIDE
UMLAZI
LINDOKUHLE
KWA-MNYANDU
ZWELETHU
AMANZIMTOTI
PAHLA
DOONSIDE
WARNER BEACH
UMBOGINTWINI
ISIPINGO
PELGRIM
REUNION
MEREBANK
MONTCLAIR
CLAIRWOOD
BOOTH
JACOBS
FUEL FLOW
BAYHEAD
ROSSBURGH
UMBILO
CONGELLA
MAYDON WHARF
SYLYNE
CATO CREEK
DALBRIDGE
BEREA ROAD
MOSES MABHIDA
DURBAN STN.
UMGENI
SPRINGFIELD FLATS STAGING
TEMPLE
KENVILLE
EFFINGHAM
BRIARDENE
GREENWOOD PARK
RED HILL
AVOCA
DUFF's ROAD
KWA-MASHU
TEMBALIHLE
NEW BRIDGE CITY LINE
PHOENIX
MOUNT EDGECOMBE
END OF METRO SERVICE
STANGER
GLEDHOW
CHARLOTTEDALE
GROUTVILLE
TINLEY MANOR
SHAKASKRAAL
UMHLALI
COMPENSATION
FRASER
TONGAAT
TONGAAT CENTRAL
FLAMINGO HEIGHTS
NYANINGA (NOT USED BY METRO)
CANELANDS
VERULAM
OTTAWA
WINKLESPRUIT
ILLOVO BEACH
KARRIDENE
UMGABABA
ILFRACOMBE
UMKOMAAS
CLAUSTAL
UMZINTO
END OF METRO SERVICE
KELSO
PARK RYNIE
SCOTTBURGH
RENISHAW
PORT SHEPSTONE
WENTWORTH
KINGS REST
FYNNLANDS
ISLAND VIEW
WESTS

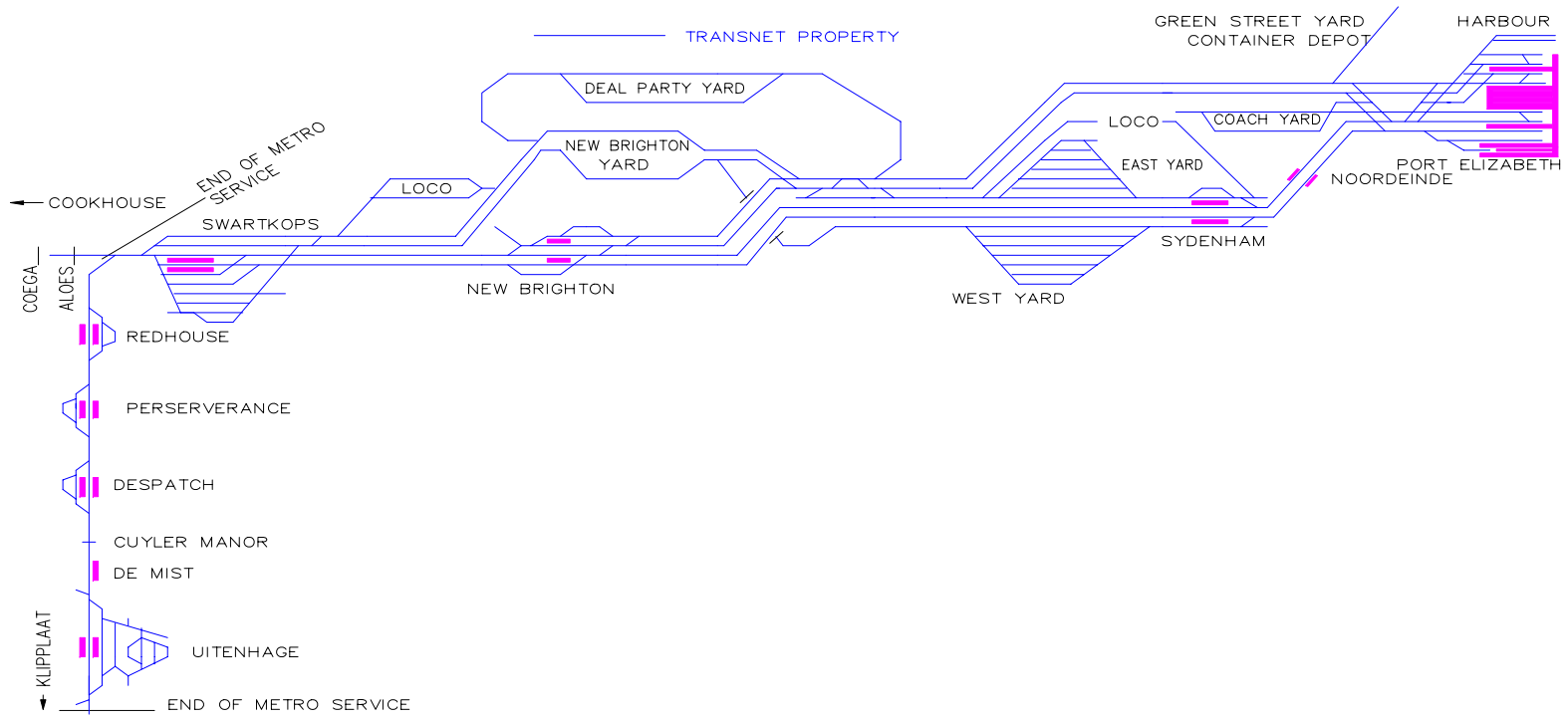
3.5 East London Network Diagram

EASTERN CAPE METRORAIL REGION – EAST LONDON



3.6 Port Elizabeth Network Diagram

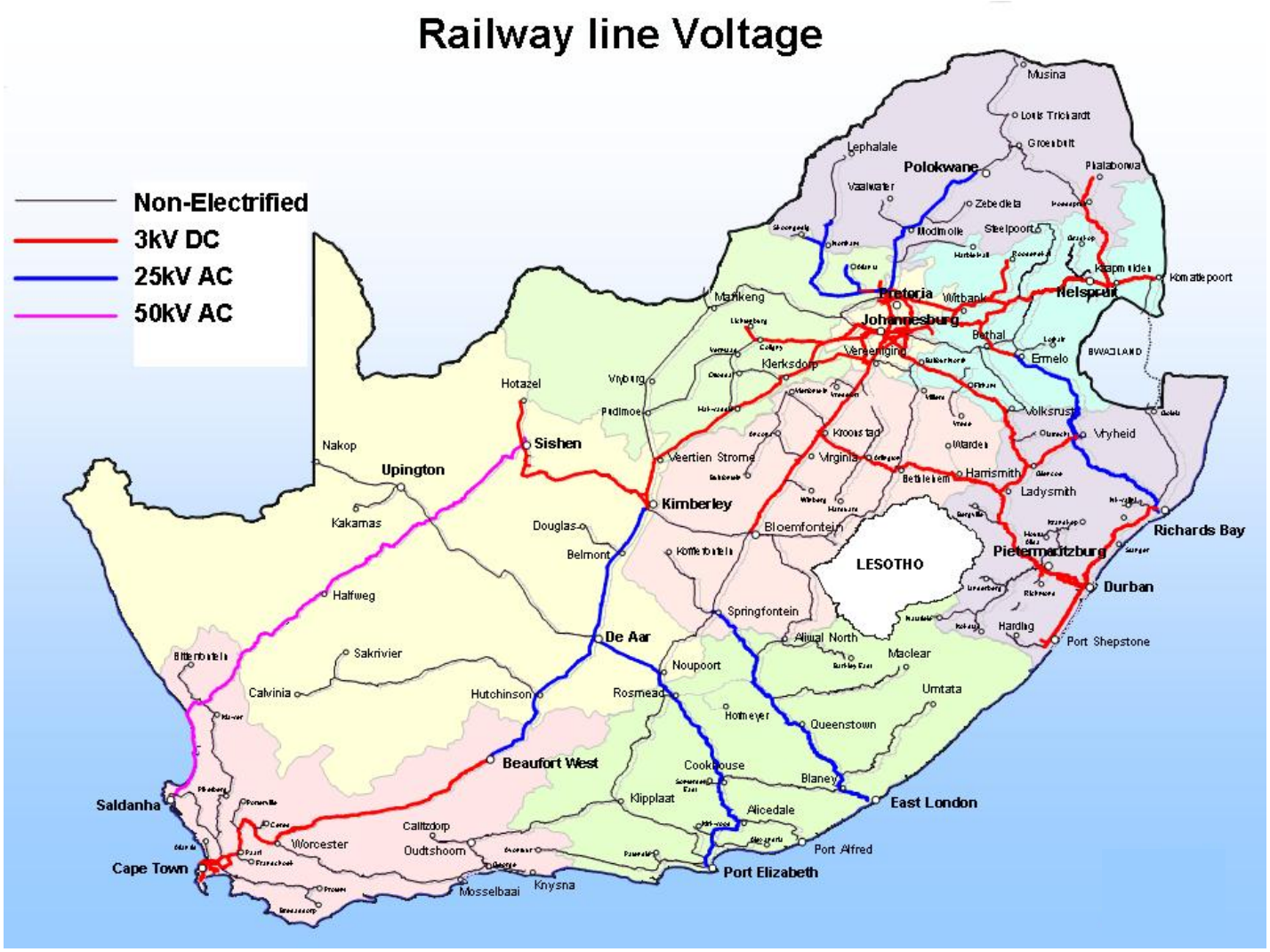
EASTERN CAPE METRORAIL REGION — PORT ELIZABETH



4. TFR NETWORK DIAGRAM

Because Shosholoza Meyl operates extensively on the TFR network, the TFR network is shown in this section. The network diagram shows both electrified lines (25kV AC and 3kV DC) as well as non-electrified lines.

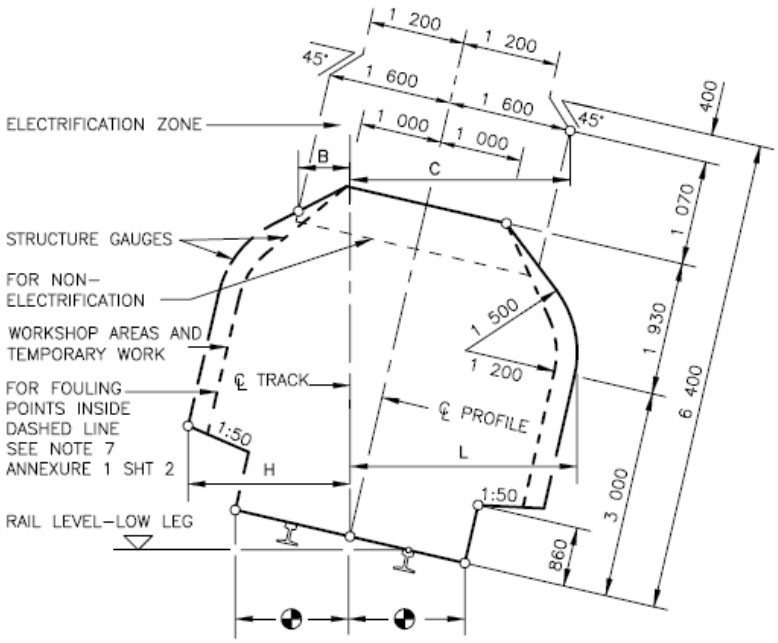
Railway line Voltage



5. CLEARANCES AND RESTRICTIONS

5.1 Horizontal Clearances

RADIUS	WITH CANT		NO CANT	WITH CANT	
(m)	H (mm)	L (mm)	H & L	B (mm)	C (mm)
90	2 730	3 090	2 780	1 130	2 100
100	2 700	3 030	2 750	1 140	2 050
120	2 650	2 970	2 700	1 160	2 010
140	2 620	2 920	2 660	1 175	1 990
170	2 590	2 870	2 630	1 190	1 970
200	2 570	2 820	2 600	1 205	1 950
250	2 550	2 790	2 580	1 230	1 920
300	2 540	2 760	2 560	1 250	1 900
350	2 530	2 730	2 540	1 270	1 890
400	2 520	2 710	2 530	1 290	1 875
500	2 510	2 680	2 520	1 320	1 850
600	2 500	2 660	2 510	1 340	1 830
800	2 490	2 620	2 500	1 365	1 790
1 000	2 480	2 600	2 490	1 380	1 760
1 200	2 480	2 580	2 490	1 200	1 730
1 500	2 480	2 550	2 480	1 415	1 700
2 000	2 480	2 500	2 480	1 440	1 660
3 000	2 470	2 470	2 470	1 500	1 600
>5 000	2 460	2 460	2 460	1 600	1 600



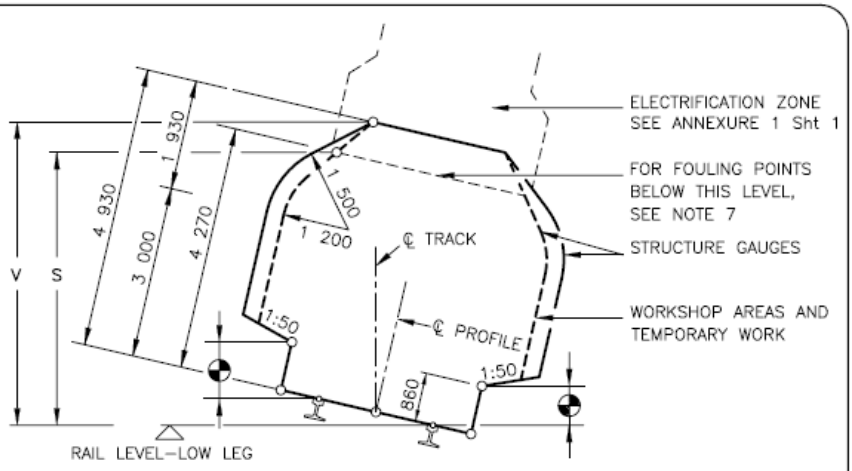
REMARKS:

1. H AND B IS THE REQUIRED HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. L AND C IS THE REQUIRED HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR WORKSHOP AREAS AND TEMPORARY WORK, CLEARANCES H AND L MAY BE REDUCED BY 300mm.
5. ⊕ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.
6. ALSO REFER TO REMARKS 4 TO 8 OF ANNEXURE 1 SHEET 2.

Figure 5.1: Horizontal Clearances [iv]

5.2 Vertical Clearances

LOCATION		NOT ELECTRIFIED	ELECTRIFIED (PRESENT OR FUTURE)	
			3kV & 25kV	50kV
	RADIUS (mm)	S (mm)	V (mm)	V (mm)
ALL AREAS OTHER THAN THOSE INDICATED BY * BELOW	100	4 470	5 050	5 400
	300	4 410	5 020	5 370
	600	4 370	5 000	5 350
	1 000	4 350	4 990	5 340
	1 500	4 310	4 960	5 310
	2 000	4 290	4 940	5 290
	>3 000	4 270	4 930	5 280
* OVER OR NEAR POINTS AND CROSSING IF REQUIRED BY ELECTRICAL IRRESPECTIVE OF RADIUS			5 650	6 000



REMARKS:

1. V IS THE REQUIRED VERTICAL CLEARANCE EXCEPT WHERE REDUCED CLEARANCE S APPLIES.
2. S IS THE MINIMUM VERTICAL CLEARANCE FOR STRUCTURES AND TEMPORARY WORK OVER NON–ELECTRIFIED LINES.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR APPLICATION AT CURVES
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 3m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON–TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 15m ALONG STRAIGHTS.
5. NEW STRUCTURES: SEE BRIDGE CODE.
6. TUNNELS: SEE DRAWING BE 82–35.
7. FOULING POINTS: SEE CLAUSE 8.1.
8. CLEARANCES ARE BASED ON 15m BOGIE CENTRES AND 21,2m VECHILE BODY LENGTH.
9. ⊕ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.

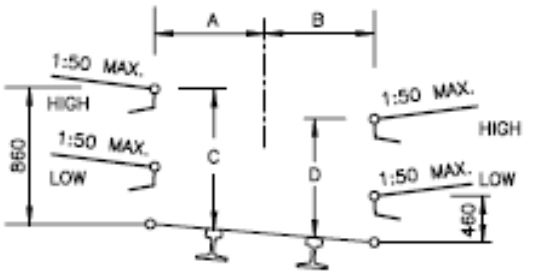
Figure 5.2: Vertical Clearances [iv]

5.3 Platform Clearances

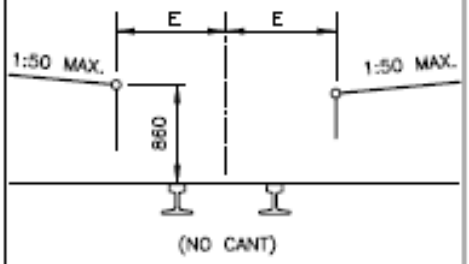
Platform clearances indicated below are applicable to ballasted track.

PLATFORMS : TRACK GAUGE 1 065mm

PASSENGERS



GOODS



(NO CANT)

RADIUS (m)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
90	1 690	1 820	890	810	1 840
100	1 650	1 790	890	810	1 810
120	1 610	1 740	890	810	1 760
140	1 580	1 700	890	810	1 720
170	1 550	1 660	890	810	1 690
200	1 530	1 630	890	820	1 670
250	1 520	1 600	890	820	1 640
300	1 520	1 580	890	830	1 620
350	1 520	1 560	880	830	1 600
400	1 520	1 550	880	840	1 590
500	1 520	1 540	880	850	1 580
600	1 520	1 530	870	850	1 570
800	1 520	1 520	860	860	1 560
1 200	1 520	1 520	860	860	1 550
2 000	1 520	1 520	860	860	1 540
3 000	1 520	1 520	860	860	1 530
STRAIGHT	1 520	1 520	860	860	1 520

REMARKS:

1. NO CANT TO BE APPLIED EXCEPT WHEN THE GOODS PLATFORM IS ON A RUNNING LINE.
2. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
3. ⊕ 8m TO MAIN STATION-BUILDINGS AND 3m TO ALL OTHER STRUCTURES.
4. TOLERANCES : SEE CLAUSE 8.0.10.

STRUCTURES ON PLATFORMS : 1 065mm AND 610mm TRACK GAUGE

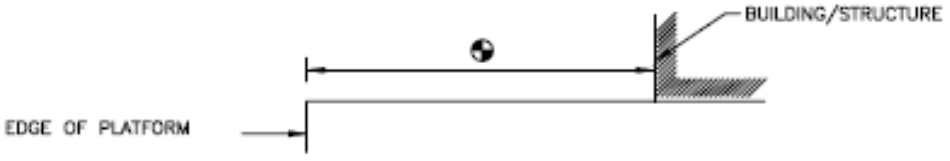


Figure 5.3.: Platform Clearances [iv]

Horizontal and vertical platform clearances applicable to track slab is given below [v].

Table 5.1: Platform Clearances for Track Slab

Curve Radius	Super-Elevation	Outside Horizontal	Outside Vertical	Inside Horizontal	Inside Vertical
400m	60mm	1580mm	1130mm	1695mm	1015mm
450m	50mm	1580mm	1120mm	1680mm	1025mm
500m	50mm	1575mm	1120mm	1670mm	1025mm
550m	40mm	1575mm	1110mm	1660mm	1035mm
600m	40mm	1575mm	1110mm	1655mm	1035mm
700m	30mm	1575mm	1100mm	1635mm	1045mm
800m	30mm	1575mm	1100mm	1630mm	1045mm
1000m	20mm	1575mm	1090mm	1615mm	1055mm
2000m	10mm	1575mm	1080mm	1590mm	1065mm
3000m	0mm	1575mm	1070mm	1575mm	1070mm
Tangent	0mm	1565mm	1070mm	1565mm	1070mm

5.4 Vehicle Gauge

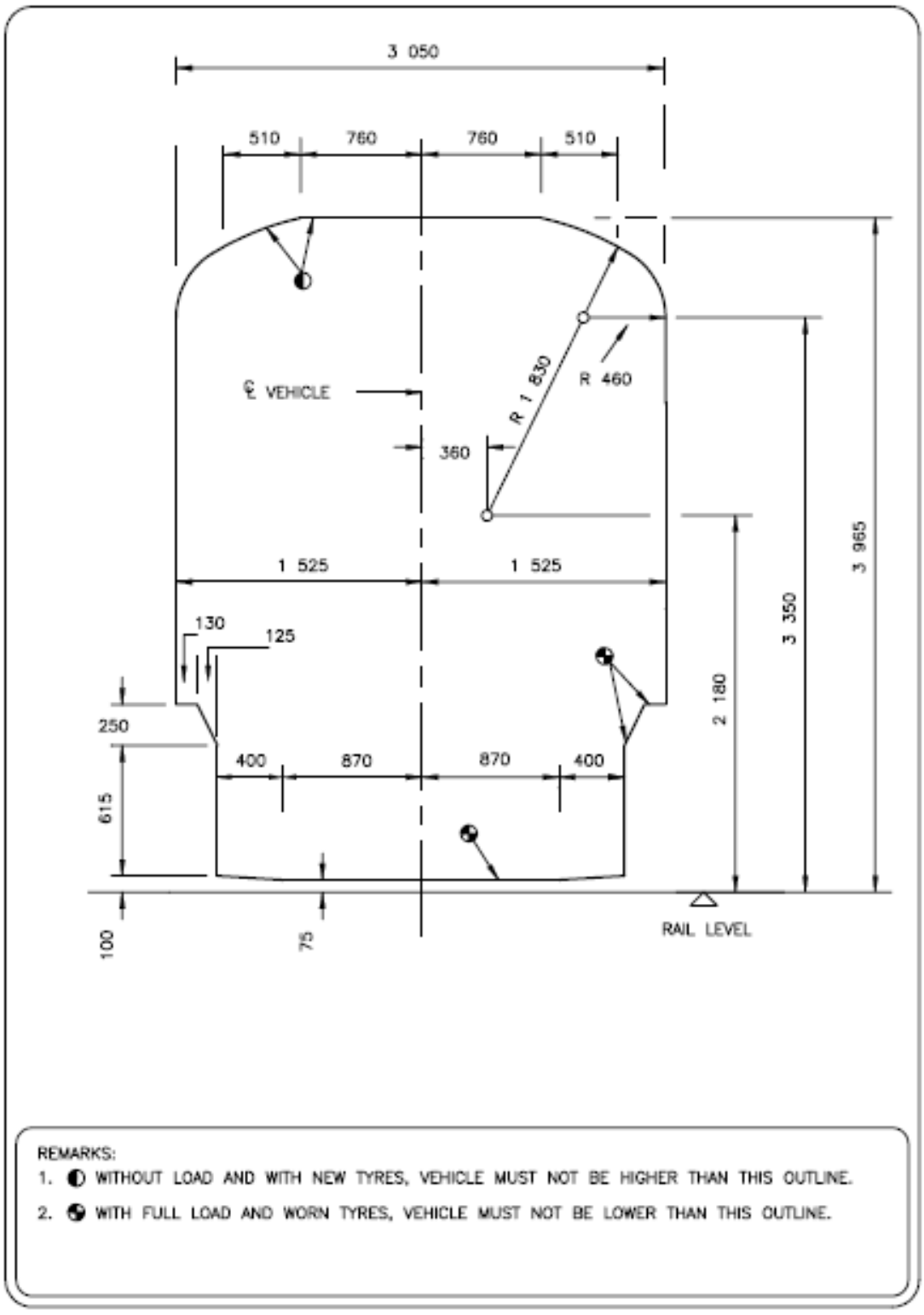


Figure 5.4.: Vehicle Gauge [iv]

5.5 Speed Restrictions

Permissible speed in curves is shown in Table 6.1.5 below [v].

Table 5.2: Permissible speed in Curves

Section speed	90 km/h		80 km/h		70 km/h		60 km/h		50 km/h		40 km/h		30 km/h	
Radius	Speed	Cant	Speed	Cant	Speed	Cant	Speed	Cant	Speed	Cant	Speed	Cant	Speed	Cant
100m/ 109m	30	100	30	100	30	100	30	100	30	70	30	60	30	30
110m/ 119m	40	90	40	90	40	90	40	90	30	60	30	60	30	30
120m/ 139m	40	90	40	90	40	90	40	90	30	60	30	60	30	30
140m/ 159m	40	90	40	80	40	90	40	80	40	60	40	50	30	30
160m/ 199m	50	80	50	70	40	80	40	70	40	50	40	50	30	30
200m/ 250m	50	80	50	70	50	70	50	70	40	50	40	40	30	30
250m/ 300m	60	70	50	60	50	60	50	60	50	40	40	30	30	20
300m/ 400m	60	60	60	60	60	60	60	50	50	30	40	30	30	20
400m/ 500m	70	60	70	50	60	50	60	40	50	30	40	20	30	10
500m/ 600m	70	60	70	50	60	40	60	30	50	20	40	20	30	10
600m/ 700m	80	50	80	40	70	40	60	30	50	20	40	10	30	10
700m/ 800m	90	50	90	40	70	30	60	20	50	10	40	10	30	10
800m/ 900m	90	40	90	30	70	30	60	20	50	10	40	10	30	0
900m/ 1000m	90	40	90	30	70	30	60	20	50	10	40	10	30	0
1000m/ 1500m	90	30	90	30	70	20	60	20	50	10	40	10	30	0
1500m/ 2000m	90	20	90	20	70	10	60	10	50	10	40	0	30	0
2000m/ 3000m	90	10	90	10	70	10	60	10	50	0	40	0	30	0
>3000m	90	0	90	0	70	0	60	0	50	0	40	0	30	0

- The maximum permissible speed of passenger trains passing through stations is 75 km/h or the speed pertaining to the section, whichever is the lowest.

6. 3 kV DC ELECTRICAL POWER SUPPLY

Parameters in this section are under review and changes shall be communicated as soon as the review is completed.

6.1 Traction Sub-Stations

Power is taken from three phase high voltage transmission lines at 50 Hz and converted at silicon rectifier sub-stations to 3.3 kV D.C.

- Both six and twelve pulse rectifiers are used but the present standard is to provide only 12-pulse rectification.
- The traction sub-stations are spaced 3.88 to 7.88 km apart depending on the number of tracks, overhead conductor sizes, terrain and traffic conditions and have a nominal open circuit voltage of 3,450 V which reduces by approximately 15 V per 100 A of loading.
    - For the purposes of I.E.C. Publications the rated supply system voltage (U) shall be taken as 3 300 V.
- The continuous rating of the different types of traction substations varies from 3 MW to 6 MW.

The overload ratings of the existing substations are as follows:

- ½ x full load for two hours
- 2 x full load for thirty minutes
- 3 x full load for one minute
- 3½ x full load for ten seconds

- The MVA back-up of the traction sub-stations varies between 600 MVA and 1 200 MVA.
- Traction sub-stations are provided with under voltage protection relays which may be set between 1,5 kV and 2,7 kV.
- L.C. filters are provided at traction substations for the 600 Hz and 1 200 Hz harmonics, the relevant L and C values being 60 µF and 1,173 mH (600 Hz) and 10 µF and 1,759 mH (1 200 Hz).

- A 0.9 mH series reactor is provided at each traction sub-station on the DC supply side.

6.2 Traction Sub-Station High-Speed Circuit Breakers

Overhead track sections are fed from each end from common sub-station bus bars, via individual high speed circuit breakers with a minimum continuous rating of 2 000 A, the calibration of which may vary up to 5 000 A.

- The high-speed circuit breaker tripping times are of the order of 40 to 100 ms for local and remote faults, depending on the magnitude and rate of rise of the fault current and automatic re-closure features provided.
- The high speed circuit breakers are provided with a rate of rise of current trip feature which initiates tripping at a rate of rise of current of 200 to 1 500 A/ms.

6.3 Overhead Track Equipment

- The nominal overhead supply voltage shall be taken as 3.3 kV, which under normal working conditions may vary between 2.7 kV and 3.9 kV and under abnormal conditions may vary between 2.0 kV and 4.0 kV.
- The overhead system is designed to accept regenerative braking energy where absorption resistors are provided at traction sub-stations with capacities of 1 000 to 2 000 A (this is only applicable to certain routes in South Africa.)
- The overhead system comprises a copper catenary; copper contact wire and aluminium feeder with cross sectional areas of 80 mm², 161 mm² and 800 mm², respectively.
    - The normal working height of the contact wire is 5 000 mm but this may vary between 4 500 mm and 6 000 mm. The absolute minimum is 4 220 mm.
    - The maximum contact wire stagger is 300 mm on either side of track centre line.
    - The overhead contact wire is of 161 mm² cross-sectional area in accordance with BS 23/1970 or appropriately as superceded.
- The ordinary running rail, which is not earthed, constitutes the negative return of the system and one (normally) or both rails may be used for this purpose.
- The resistance values of the overhead supply equipment and the rail system are given in drawing CEE-TA-111 (attached).
- The overhead system has an impulse withstand level (1,2/50 µs impulse) of +130 / -140 kV, a power frequency withstand level of 40 kV, a minimum dry flashover level 128 kV, a minimum wet flashover level (vertical) of 90 kV and a minimum creepage distance of 530 mm.
    - Surge arrestors between overhead supply and earth are provided at supply feed points and have a DC Spark-over rating of 10 kV and a discharge voltage of 9.5 kV at 10 kA.

  - Arc horns with 20 mm gaps are provided on the overhead supply at 0.8 km spacing.
- Details of the amplitudes and frequencies of lightning and switching over-voltages that are superimposed on the supply system are given in drawing CEE-THY-64 (attached).

7. TRAIN CONTROL AND SIGNALLING SYSTEMS

Under normal operating conditions the electrical / electronic interference profile of train sets shall fit the existing susceptibility limits of the signal equipment currently installed on Metro lines.

Interference of the signal system by the modules and or train sets is not permitted.

Train control is optimised around commuter train lengths not exceeding 275m overall length.

7.1 Train detection circuits

Two types of train detection circuitry are currently in use across the rail network in South Africa that rolling stock must comply with, namely:

- Track circuits
- Axle counters

Track circuits

Several types of track circuits are being used. The first three types listed below are widely used while the rest have limited use and are being phased out.

- TI 21 Audio Frequency Track circuits
  - 8 sets of frequencies are approved (from A = 1699 Hz to H = 2445Hz)
  - Authorized for all traction areas
  - Used in jointed or jointless configurations
  - Locally known as ML track circuits

- Jeumont track circuits
  - Asymmetric impulse
  - 2 types: 83 1/3 Hz and 16 Hz
  - Authorised for use in diesel and dc traction areas

- 50Hz AC Track circuits

  Authorised for use in diesel and DC traction areas

- D.C Track Circuits

  Authorised for use in diesel and AC traction areas

- Reed Track Circuits

  6 sets of frequencies are approved (from 363 Hz to 408 Hz)

  Authorized for all traction areas

- Aster track circuits

  2 types- U type and the Z type (presumed phased out)

Axle counters

The following axle counter equipment is in use:

- Siemens: AzSM(R), AzS350U with ZP43 Wheel detector
- Alcatel: AzLM with ZP30 Wheel detector
- Frauscher ACS2000 axle counter systems

7.2 Signalling Systems

Only conventional signalling systems are being used on Prasa and TFR networks, with line side signals conveying aspect and route information to the driver. In some remote areas paper-based authorisations are issued to the driver by hand or via radio.

Currently no form of automatic train protection (ATP), train stop (ATS) or warning systems (AWS) are in use anywhere on the network.

PRASA are considering the implementation of protection systems in the near future, but details have not yet been finalised. Consideration shall also be given to upgrading to cab-signalling and other forms of Communication Based Authorisation.

7.3 Trunking Radio System

- MPT 1327 is the trunked radio communications network used by Metrorail.
- TFR Telecom, previously Transtel, owns the network inclusive of customised software with features such as entry of a train number linked to a radio.
- All radios, portable or train-based, are owned by PRASA. Radios were procured from various suppliers including Motorola, Kavicom and Tate.

8. CIVIL AND TRACK

8.1 General Description

The following is a general description of the track on which the train sets shall operate:

- Track gauge is 1065 mm. + 5mm - 3mm.
- Nominal radius of the sharpest curve is 98 metres.
- The sharpest turnout is 1 in 6.
- On the sharpest parabolic vertical curve the grade changes at a rate of 240 mm/ 20m/ 20m in depots and 150mm/20m/20m for yards and 40mm/20m/20m in running lines.
- The super-elevation of the outer rail on a curve of 120 metres radius is 90mm at a speed limit of 50 km/h.
- The maximum rate of change of super elevation entering and leaving such a curve is 1 in 500.
- The gauge widening on a curve of 120 metres is 20 mm.
- The vehicles must negotiate both a 1 in 9 reverse turnout with 4877 mm semi-curved switches, and a 1 in 9 crossover road with 4877 mm semi-curved switches.
- The nominal length of platforms is 270 metres long.
- The existing standard is that platforms are 1520 mm from the centre of the track.
- The present nominal platform height from rail is 860 mm.

In the event of vehicles exceeding the vehicle gauge depicted on drawing no. BE 83-252, sheet 13 (attached) due to dynamic displacement, such displacement shall at all times remain with the minimum structure gauges stated in Section 6.

8.2 Track Structure

Table 8.1: Track Structure [v]

CURVE RADIUS	SLEEPER TYPE	SLEEPER SPACING	RAIL PROFILE	BALLAST PROFILE
>600m	P2 or F4	700mm	48/57/60kg/m	1200m^3/km
400m – 600m	P2 or F4	700mm	48/57/60kg/m	1500m^3/km
300m – 400m	PY or FY	650mm	48kg/m	1500m^3/km
200m – 300m	PY or FY	600mm	48kg/m	1500m^3/km
<200m	PY or FY	500mm	48kg/m	1500m^3/km

9. RAIL AND WHEEL PROFILES

9.1 Rail Profiles

Typical rail profiles for curved track for bogie performance calculations are shown in **Figure 9.1**.

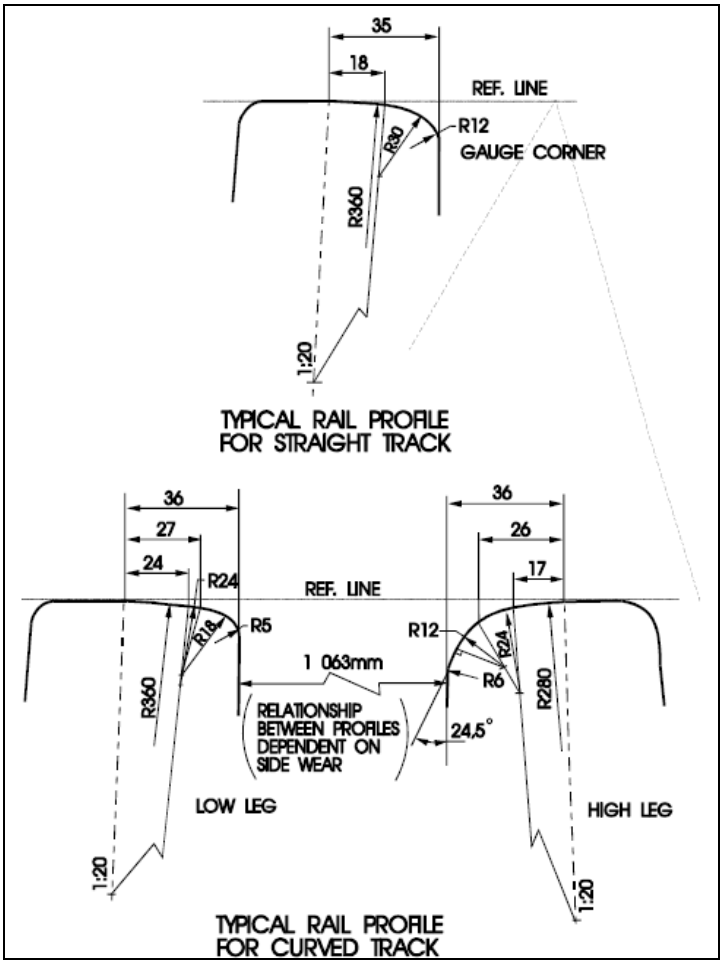


Figure 9.1: Typical Rail Profile for Curved Track

9.2 Wheel Tread Profile

Wheel tread profile used by Metrorail is Profile 22.

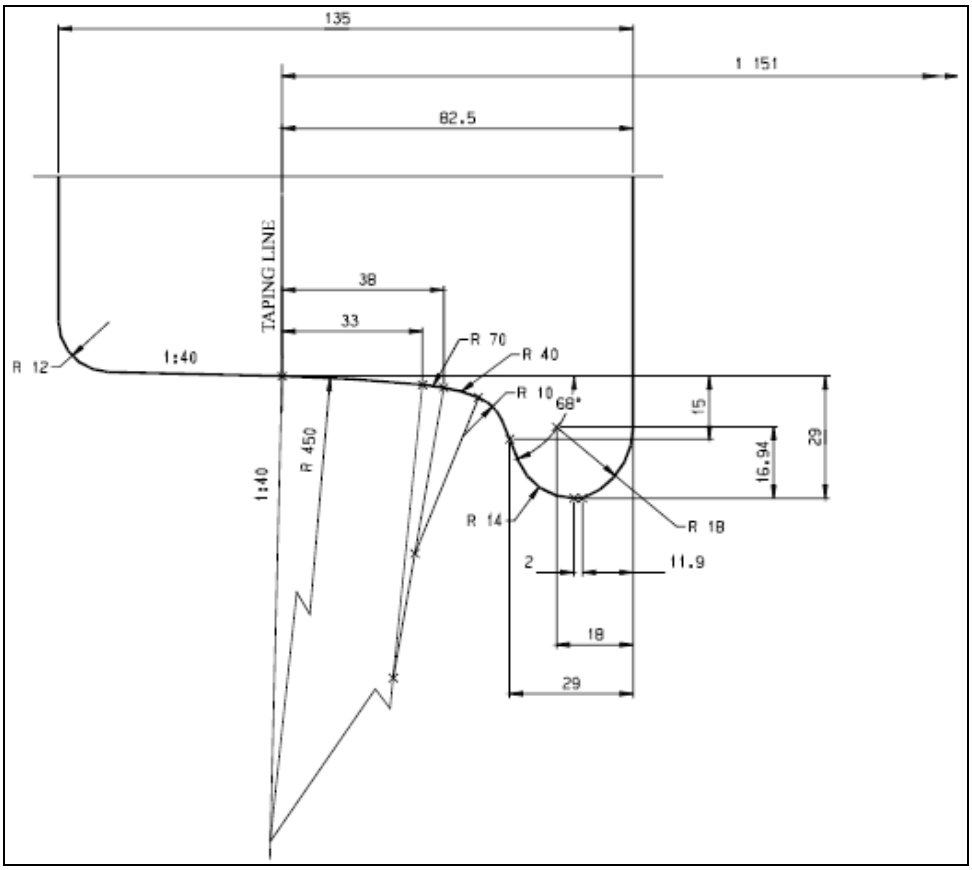


Figure 9.2: Wheel Tread Profile

10. LOCOMOTIVE COUPLERS

Couplers on existing locomotives are to drawing no. CME 68/10719/478.

11. CLIMATIC CONDITIONS

- Salt, ice, severe dust and iron particle laden wind conditions, with severe lightning storms and driving rain occur in the areas in which trains shall operate.
- The altitude at which the trains shall operate is between sea level and 1 800 m above sea level.
- Trains shall operate continuously in a relative humidity as high as 80 %.
- The maximum air temperature is 48°C (in the shade) and the minimum air temperature is minus 10°C in the areas in which tr ains shall operate.
- Snow conditions occur but this is infrequent.
- The environment in which the trains operate is highly industrialised and therefore air pollution will be very high.
- Extremely severe electric storms are frequent in the summer months.
- The design of the air intake components for ventilation or forced cooling shall prevent ingress of water due to severe wind driven rainfall as well as plastic bags, etc.

12. STANDARDS AND SPECIFICATIONS

12.1 Perway Standards and Specifications

1. Perway & Structures Standards for the Design and Construction of New Infrastructure, S.I. Grobler, 2010-08-05

2. Manual for Track Maintenance, Spoornet, 2000

3. Railway Station – Passenger Platforms, Part 1: Clearances on Ballastless Track (1065 mm track gauge), ARP 084-1:2009

4. Design Guidelines to Improve Accessibility of Commuter Rail in South Africa, SARCC, 07 April 2008

12.2 Electrical Standards and Specifications

1. Specification No. BBB-2856, 3kV Regenerative Energy Absorption Control Equipment
2. Specification No. CEE-0041, 25kV AC Electrification (OHTE)
3. Specification No. CEE-0047, 3kV DC Traction Sub Equipment (OHTE)
4. Specification No. CEE-0054, Section Insulators for 3kV DC OHTE for both High and Low Speed Traffic
5. Specification No.CEE-0055, Section Insulators for 25kV AC OHTE for both High and Low Speed Traffic
6. Specification No. CEE-0111, 25kV AC Traction Subs
7. Specification No. CEE-0201, Regenerative Braking and Loading Equipment at 3000V DC Traction Subs
8. Specification No. CEE-0220, The Manufacture of Regenerative Braking Power Control Equipment for use in 3kV Traction Subs
9. Specification No. T-T6E-0004, 3kV DC Electrification Overhead Track Equipment

12.3 Signalling Standards and Specifications

1. Specification No. CSE-1174-008, Category E42 / Issue 2, dated 6 March 1996

12.4 Mechanical Standards and Specifications

While PRASA are looking at international standards in the area of rolling stock mechanical standards and specifications, it is relevant that the standards and specifications listed below are taken into account as minimum standards and specifications.

1. Code of Practise No. 2: Workshop Wheel and Axle Manual No. 2
2. RS/ME/SP/002: Specification for the Supply of Axles for Tractive and Trailing Stock
3. CME 19: Steel Castings for Rolling Stock

4. CME 85: The Testing and Inspection of Welding (1971)

5. RTS-SPC-0023: Paint and Cleaning of Metro Rolling Stock

13. REFERENCES

i Agreement for the Uase of Assets and Related Services entered into between SARCC Ltd. and Transnet Ltd., June 2000

ii National Safety Regulator Act, No. 16 of 2002 (as amended)

iii Re-Signalling Implementation Master Plan for the SARCC, HERA Infrastructure Limited, 31 March 2009

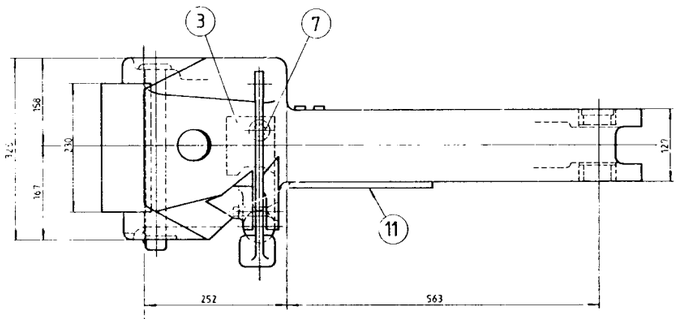
iv Manual for Track Maintenance, Spoornet, 2000

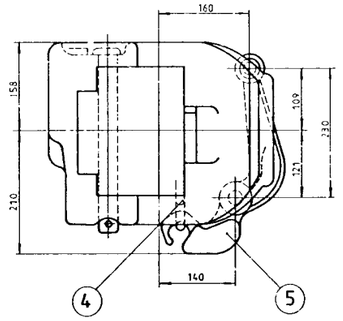
v Perway & Structures Standards for the Design and Construction of New Infrastructure, S.I. Grobler, 2010-08-05

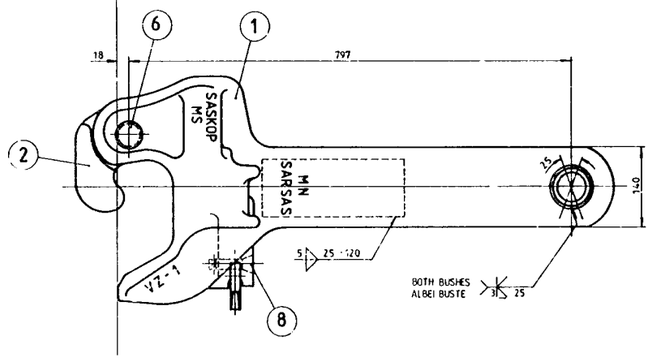
CME 68
10719 - 478/

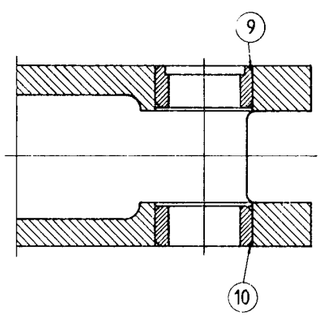
PROJECTION
PROJEKSIE

FOR LIMITS ON UNTOLERANCED DIMENSIONS SEE DRG. No. CME 4097/0-000 (LATEST)
VIR LIMIETE OP AFMETINGS WAT NIE 'N TOLERANSIE BEVAT NIE, KYK TEK. No. CME 4092/0-000 (JONGSTE)









ENLARGED VIEW OF SHANK END
VERGROTE AANSIG VAN SKAGEND

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@2 ALTERNATIVE MATERIAL: SILICON-MANGANESE, SPEC BS 24 PART 3B SECT. 1 (EN 45) HARDNESS, 42 TO 46 HRC.
ALTERNATIEWE MATERIAAL: SILIKON MANGAAN, SPES BS 24 DEEL 3B AFDELING 1 (EN 45) HARGHEID, 42 TOT 46 HRC.

ALTERNATIVE MATERIAL: SPRING STEEL, SPEC. CME 140/-; HARDNESS 45 TO 49 HRC.
ALTERNATIEWE MATERIAAL: VEERSTAAL, SPES. CME 140/-; HARDHEID 45 TOT 49 HRC.

FOR TYPE MS COUPLER WITH TAILPIN RETAINING PLATE SEE DRG. No CME 68/10720-478
VIR TIPE MS KOPPELAAR MET STAARTSPENKEERPLAAT KYK TEK.

ITEM	NAME / NAAM	NUMBER PER ASSEMBLY / GETAL PER SAMESTEL	MATERIAL / MATERIAAL	SPEC / SPES	SYM / SIM	DESCRIPTION/SIZE / BESKRYWING/GROOTTE	STORES IT No. OR DRG No. MAG. IT No. OF TEK. No.	QUANTITY/SIZE / HOEVEELHEID/GROOTTE	MASS PER ARTICLE / MASSA PER ARTIKEL kg	REMARKS / OPMERKINGS
			DESCRIPTION OF MATERIAL PER ARTICLE / BESKRYWING VAN MATERIAAL PER ARTIKEL							
13	SPLITPIN FOR IT.8 / SPLITPEN VIR	1	MILD STEEL / SAGTE STAAL			ϕ 6·3		32		
12	SPLITPIN FOR IT.6 / SPLITPEN VIR	1	MILD STEEL / SAGTE STAAL			ϕ 10		63		
11	PLATE, WEARING / SLYTPLAAT	1	STEEL @2 / STAAL	*		200×6 OR OF 4"×1/4"	11/008837	267		* ROQ LAST AD 321 @1
10	BUSH / BUS	1					CME 68 07422-433		0·34	
9	BUSH / BUS	1					CME 68 07423-433		0·34	
8	PIN / PEN	1					CME 68 19791-431		0·23	
7	PIN / PEN	1					CME 68 19866-431		0·23	
6	PIN / PEN	1					CME 68 19793-431		3·6	
5	LEVER / HEFBOOM	1					CME 68 16509-362		3·4	
4	LIFTER / OPLIGTER	1					CME 68 16595-717		0·7	
3	LOCK / SLOT	1					CME 68 17708-751		3·2	
2	KNUCKLE / KNEUKEL	1					CME 68 16194-641		38	
1	COUPLER HEAD (HEAD AND SHANK) / KOPPELAARKOP (KOPSTUK EN SKAG)	1					CME 104 12-993		116	

@1 STORES MAG IT No 68/046651 ALLOCATED TO IT No 68/23028 TOEGEKEN AAN IT. 11.

NATIONAL STOCK No. (N.S. No.) / NASIONALE VOORRAAD No. (N.V. No.)
STORES ITEM No. MAGASYN 68/006994

RETRACED / HERNAGETREK L.P.K.
RECHECKED / HERNAGESIEN B.J.M.
AMENDMENTS / WYSIGINGS
MASS / MASSA 166 kg
MATERIAL - MATERIAAL

ASSEMBLY DRG. No. / SAMESTELTEK. No.	LL 82-16025 IT. 13	LL82-16024 IT. 17	LL 82-16020 IT. 17	LL 82-16028 IT. 16	CME 2158 12-990 IT.1	DRN - GET	E.N.
SUPERSEDES/REPLACES DRG. No. / VERVANG TEK. No.	CME 68 10717-478	CME 68 10719-478				TCD - NGT	E.N.
						CKD - NGS	L.O.
						APPROVED / GOEDGEK.	P.v.G. 8'69
CLASS OR TYPE / KLAS OF TIPE: SASKOP — AUTOMATIC COUPLER / OUTOMATIESE KOPPELAAR						REF / VERW 11480	
						DATE / DATUM 1969-07-28	
SEPIA TO M.E. / SEPIA NA W.I. KDS. UTH.						SCALE / SKAAL 1:2, 1:5	

CARRIAGE / RYTUIG

S.A.R. — S.A.S.

PRETORIA

COUPLER - KOPPELAAR

AUTOMATIC COUPLER, TYPE / OUTOMATIESE KOPPELAAR, TIPE MS (127mm × 140mm)

DIMENSIONS IN mm EXCEPT WHERE OTHERWISE INDICATED / AFMETINGS IN mm BEHALWE WAAR ANDERS AANGEGEE

SEE TABLE / KYK TABEL

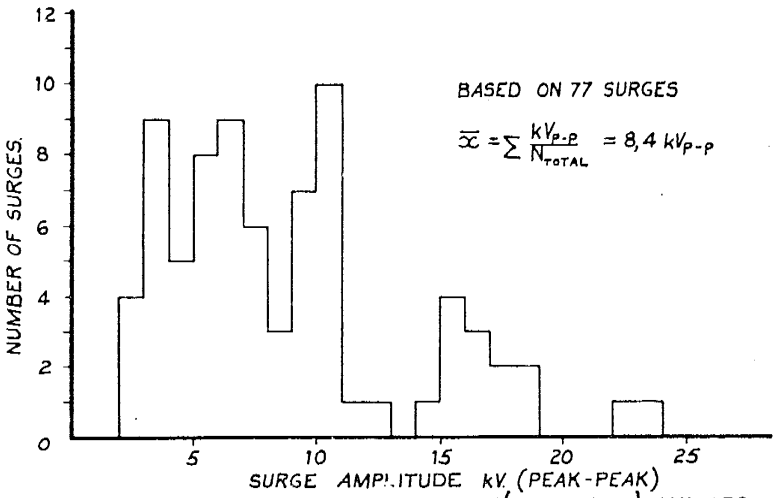
STORES MAG. IT. No.

No. CME 68 / 10719-478/

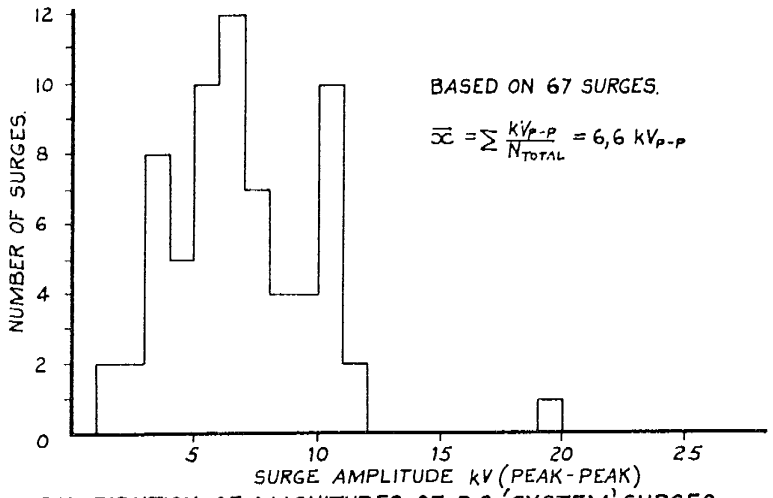
AMENDMENT / WYSIGING 0

A1

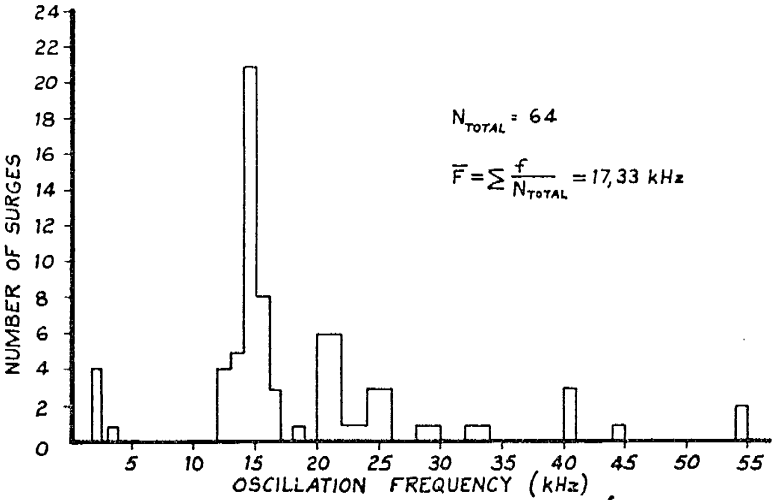
ORIGINAL FRAME SIZE
OORSPRONKLIKE RAAMGROOTTE 390x267



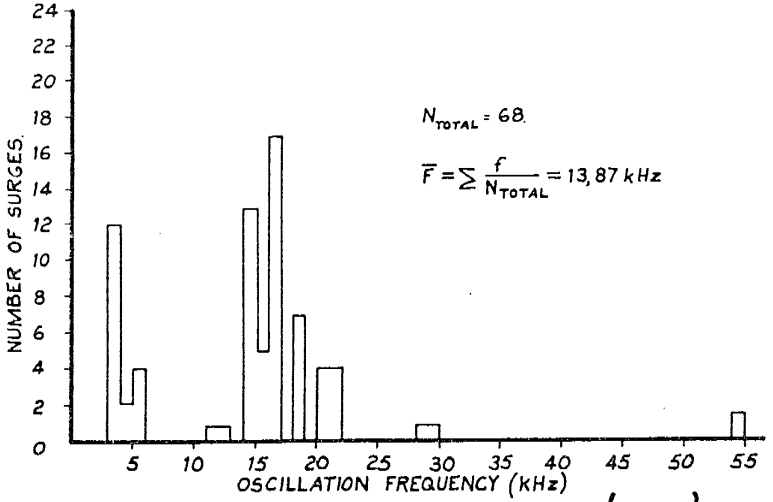
DISTRIBUTION OF MAGNITUDES OF DC 'LIGHTNING' SURGES.



DISTRIBUTION OF MAGNITUDES OF DC 'SYSTEM' SURGES.



DISTRIBUTION OF THE OSCILLATION FREQUENCIES OF DC 'LIGHTNING SURGES.



DISTRIBUTION OF THE OSCILLATION FREQUENCIES OF DC 'SYSTEM' SURGES

AMENDMENTS.
WYSIGINGS.

NO.	NAME. NAAM.	DATE. DATUM.

DRN. GET. H.v. VUUREN.	GEN. TOLERANCES: LIN. ALG. TOLERANSIES: ANG./HOEK	
TRCD. NGT. H. v. VUUREN.	D.O. REF. TK-VERW. M80/203	ENG. IR.
CKD. NGS. F. HEYL.	DATE. DATUM. 80-07-29	
CHIEF ELECTRICAL ENGINEER SARS ELEKTRIESE HOOFINGENIEUR SAS JOHANNESBURG.		

SURGE AMPLITUDE DISTRIBUTION GRAPHS.

DISTRIBUSIEGRAFIEKE VIR STUWINGAMPLITUDE.

DRAWING NO. TEKENING NO. CEE-
THY-64

A3
A4

RESISTANCES OF RAILS / WEERSTANDE VAN SPORE

TYPE OF RAIL / TIPE SPOOR	RESISTANCE AT 20 °C / WEERSTAND TEEN
H.C.O.B. 48 kg/m	0,0309 Ω km^{-1}
H.C.O.B. 57 "	0,0250 "
UIC A 48 "	0,0320 "
UIC A 57 "	0,0285 "
UIC B 48 "	0,0356 "
UIC B 57 "	0,0301 "
UIC C 48 "	0,0396 "
CHROME MANGANESE / CHROOMMANGAAN 60 kg/m	0,0409 "

RESISTANCE OF OVERHEAD WIRES / WEERSTANDE VAN BOGRONDSE DRADE.

RESISTANCE OF / WEERSTAND VAN 1 mm² HARD DRAWN / HARDGETROKKE Cu CONDUCTOR / GELEIER = 17,77 Ω km^{-1} AT / TEEN 20 °C

RESISTANCE / WEERSTAND VAN 1 mm² ALUMINIUM CONDUCTOR / GELEIER = 27,2 Ω km^{-1} AT / TEEN 20 °C

RESISTANCE OF / WEERSTAND VAN Cu CONTACT WIRE, / HYDRAAD, 161 mm² = 0,1125 Ω km^{-1} AT / TEEN 20 °C

SIZE OF CATENARY / GROOTTE VAN DRAKABEL	RESISTANCE OF CATENARY AT 20 °C / WEERSTAND VAN DRAKABEL TEEN
80 mm²	0,2360 Ω km^{-1}
100 mm²	0,1750 "
160 mm²	0,1140 "
250 mm²	0,0705 "

SIZE OF Al. FEEDER / GROOTTE VAN Al. VOERDER	RESISTANCE OF Al. FEEDER AT 20 °C / WEERSTAND VAN Al. VOERDER TEEN	CONTINUOUS RATING / DEURLOPENDE AANSLAG	5 MIN	1 MIN
250 mm²	0,1089 Ω km^{-1}			
500 mm²	0,0560 "	800	1 846	3 926
800 mm²	0,0341 "	1 167	2 990	6 470

SIZE OF CONDUCTORS / GROOTTE VAN GELEIERS						TOTAL RESISTANCE OF CONDUCTORS AT 20 °C / TOTALE WEERSTAND VAN GELEIERS TEEN 20 °C	CONTINUOUS RATING / DEURLOPENDE AANSLAG	5 MIN	1 MIN
CATENARY / DRAKABEL		Al. FEEDERS / Al. VOERDERS		CONTACT WIRE / HYDRAAD					
80 mm²	+	500 mm²	+	161 mm²	=	0,0323 Ω km^{-1}	1 420	2 950	5 840
80 mm²	+	800 mm²	+	161 mm²	=	0,0236 "	1 600	4 100	8 180
100 mm²	+	500 mm²	+	161 mm²	=	0,0308 "			
100 mm²	+	800 mm²	+	161 mm²	=	0,0228 "			
160 mm²	+	800 mm²	+	161 mm²	=	0,0213 "			
250 mm²	+	500 mm²	+	161 mm²	=	0,0244 "			
250 mm²	+	800 mm²	+	161 mm²	=	0,0191 "			

SIZE OF / GROOTTE VAN			RESISTANCE AT 20 °C / WEERSTAND TEEN	CONTINUOUS / DEURLOPENDE	RATING AANSLAG (Δt=65 °C) 30 MIN	1 MIN	1 SEK.
XLPE	CABLE (SINGLE CORE) / KABEL (ENKEL KERN)	500 mm²	0,0352 Ω/km^{-1}	710	1 630	7 760	19 000

NOTE / OPMERKING
FOR IMPERIAL VALUES SEE DRG / VIR IMPERIALE WAARDES KYK TEK. NO. CEE-TA-80

AMENDMENTS / WYSIGINGS		
NO	NAME / NAAM	DATE / DATUM
3.	A.VORSTER	83-09-26

REDRAWN & REVISED / OORGETEKEN EN HERSIEN
DO. REF / TK. VERW. T2/33/85

DRN / GET A.ZAZWORKA.	GEN TOLERANCES LIN —— / ALG. TOLERANSIES ANG./HOEK ——		
TRCD / NGT A.MICHAU.	DO REF / TK-VERW Y78/25	ENG / IR ——	
CKD / NGS W.R.GRANT.	DATE / DATUM 78/02/24	R.C.THURGOOD.	
CHIEF ELECTRICAL ENGINEER / ELEKTRIESE HOOFINGENIEUR	JOHANNESBURG.	for / ns	
SOUTH AFRICAN TRANSPORT SERVICES / SUID-AFRIKAANSE VERVOERDIENSTE			

RAIL AND OVERHEAD WIRE RESISTANCES
WEERSTAND VAN SPOORSTAAF EN BOGRONDSE DRADE

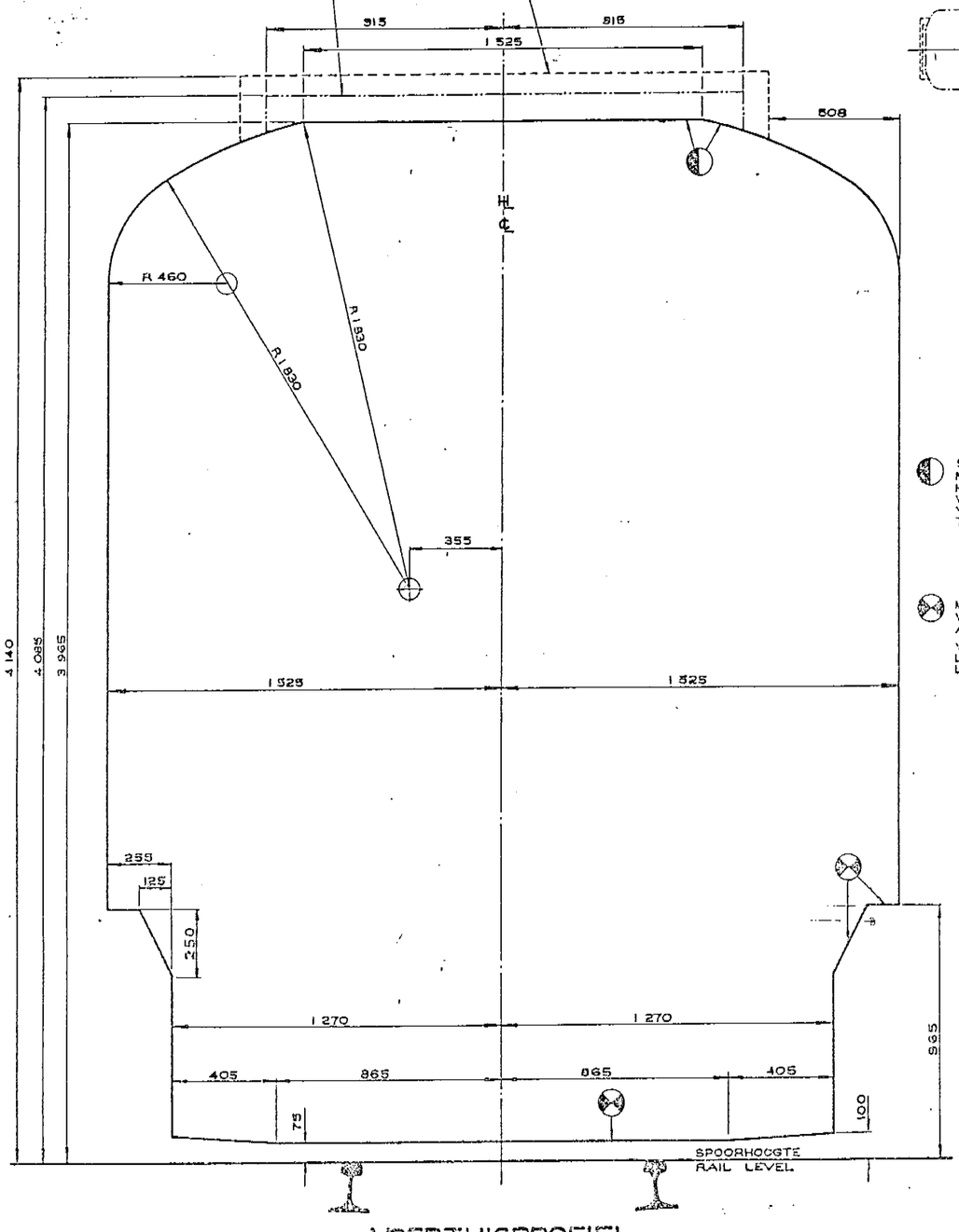
ASSY. DRG. / SAMEST-TEK.

DRAWING / TEKENING NO. CEE-TA-111

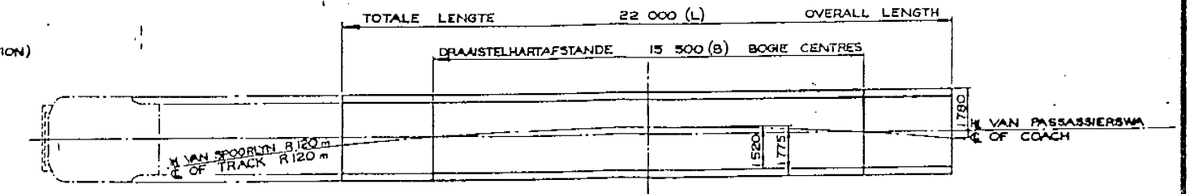
A3

SPESIALE TOELATING VIR TOEBEHORE OP MOTORWAENS.
SPECIAL ALLOWANCE FOR FITTINGS ON MOTOR COACHES.

SPESIALE TOELATING VIR PANTOGRAAF OP MOTORWAENS. (PANTOGRAAF IN AF STAND)
SPECIAL ALLOWANCE FOR PANTOGRAPH ON MOTOR COACHES (PANTOGRAPH IN DOWN POSITION)



VOERTUIGPROFIEL
VEHICLE GAUGE



POSISIE VAN NUWEGESLAGTREINSTEL TOT ℄ VAN SPOORLYN (ERGSTE GEVAL)
RELATIVE POSITION OF NEW GENERATION TRAIN SET TO ℄ OF TRACK (WORST CASE)

SONDER VRAG EN MET NUWE WIELBANDE MOET VOERTUIG NIE HOËR AS HIERDIE BUITELYN WEES NIE.
WHEN UNLOADED AND WITH NEW TYRES, VEHICLE MUST NOT BE HIGHER THAN THIS OUTLINE.

MET VOLLE VRAG EN GESLYTE WIELBANDE MOET VOERTUIG NIE LAER AS HIERDIE BUITELYN WEES NIE.
WITH WORN TYRES AND FULLY LOADED, VEHICLE MUST NOT BE LOWER THAN THIS OUTLINE.

OPMERKINGS

1. GOEDKEURING MOET VOORAF VAN DIE SIVIELE HOOFINGENIEUR VERKRY WORD VIR ENIGE AFWYKING VAN HIERDIE VOERTUIGPROFIEL.
2. OP 'N DRAAI MET 'N STRAAL VAN 120m MOET DIE AFSTAND VANAF HARTLYN VAN SPOORLYN NA ENIGE GEDEELTE VAN DIE PASSASIERSWA NIE DIE AFMETINGS VIR DIE ERGSTE GEVAL, SOOS IN DIE SKETS HIERBO AANGETOON, OORSKRY NIE EN WORD BEPERK OM OP SPOORLYNE MAAR DRAAIE 120m OF STOMPER IS TE WERK.
3. IN DIE GEVAL VAN MOTORWAENS, MOET DIE PANTOGRAAF, WANNEER DIT IN DIE AF STAND IS, NIE DIE AFMETINGS VAN DIE STIPPELGEDEELTE WAT BO-OP DIE VOERTUIGPROFIEL AANGETOON IS, OORSKRY NIE.
4. TOEBEHORES VIR MOTORWAENS MAG TOT BINNE DIE KETTINGSTIPPELLYNGEDEELTE BO-AAN DIE VOERTUIGPROFIEL STREK. DIE BAK VAN DIE VOERTUIG MOET EGTER VOLDOEN AAN DIE STANDAARDPROFIEL. (VOLLEDIG AANGETOON)
5. DIE EERSTE TREINSTELLE SAL NET AAN DIE RANDSE EN WES-KAAPLANDSE VOORSTEDELIKE STELSELS WERK OP ALLE ANDER LYNE SAL DIT AS 'N ABNORMALE VRAG BEHANDEL WORD.

NOTES

1. PRIOR APPROVAL MUST BE OBTAINED FROM THE CHIEF CIVIL ENGINEER FOR ANY DEPARTURE FROM THIS GAUGE.
2. ON A 120m RADIUS CURVE THE DISTANCE FROM THE CENTRE LINE OF TRACK TO ANY PORTION OF THE COACH SHALL NOT EXCEED THE DIMENSIONS FOR THE WORST CASE, AS SHOWN IN THE ABOVE SKETCH, AND IS RESTRICTED TO OPERATE ON LINES WHERE CURVES ARE 120m OR FLATTER.
3. IN THE CASE OF MOTOR COACHES, THE PANTOGRAPH, WHEN IN THE DOWN POSITION, MUST NOT EXCEED THE DIMENSIONS OF THE DOTTED PORTION SHOWN AT THE TOP OF THE VEHICLE GAUGE.
4. FITTINGS FOR MOTOR COACHES MAY EXTEND INTO THE CHAIN-DOTTED PORTION AT THE TOP OF THE VEHICLE GAUGE. THE BODY OF THE VEHICLE MUST HOWEVER CONFORM TO THE STANDARD GAUGE. (SHOWN IN FULL)
5. THE FIRST TRAIN SETS WILL OPERATE EXCLUSIVELY ON THE REEF AND CAPE WESTERN SUBURBAN SYSTEMS ON ALL OTHER LINES IT SHALL BE TREATED AS AN ABNORMAL LOAD.

WYSIGINGS

1. AFSKUINSING OP DIE ONDERKANT VAN PROFIEL VERANDER VAN 125 x 125 mm NA 250 x 125 mm. 23-4-80

AMENDMENTS

1. SLOPE ON UNDERSIDE OF PROFILE CHANGED FROM 125 x 125 mm TO 250 x 125 mm

SAS SPOORBAANONTWERP — 1 065mm SPOORWYDTE GAUGE — TRACK DESIGN SAR

VOERTUIGPROFIEL VIR NUWEGESLAGTREINSTEL WAT MAKSIMUM TOELAATBARE AFMETINGS IN DIE VERVAARDIGING VAN PASSASSIERSWAENS AANTOON

VEHICLE GAUGE FOR NEW GENERATION TRAIN SET SHOWING MAXIMUM DIMENSIONS PERMISSIBLE IN THE MANUFACTURE OF COACHES

SKAAL 1:10 — SCALE 1:10

GETEKEN DRAWN			
NAGETREK TRACED			
NAGESIEN CHECKED		TEKENKANTOORGOEDKEURING DRAWING OFFICE APPROVAL	SPOORBAANINGENIEUR TRACK ENGINEER DATUM: 71-09-22 DATE
LÊER NR — FILE NO W 47/15		Ir (SPOORBAAN) IE (TRACK) DATUM: 27 Sept 1979 DATE	SIVIELE HOOFINGENIEUR CHIEF CIVIL ENGINEER DATUM: 27 Sept 1979 DATE

TYPE/TYPE D 250M SHT 2

WYSIGINGS AMENDMENTS 1

BE 83-252 SH.13

707