TAIWAN RAILWAY ADMINISTRATION

3rd December 2008

Presentation to :

Network Rail

Huoo-Nan,Liang
Chief of Electric Power Division

新台鐵・心服務

交 通 部 臺 灣 鐵 路 管 理 局
Taiwan Railways Administration, MOTC

TAIWAN RAILWAY ADMINISTRATION

8th December 2008

Presentation to :

Balfour Beatty

Huoo-Nan,Liang
Chief of Electric Power Division

新台鐵・心服務

TAIWAN RAILWAY ADMINISTRATION
25 kV A.C ELECTRIFICATION
KEELUNG TO KAOHAIUNG

TECHNICAL SPECIFICATION

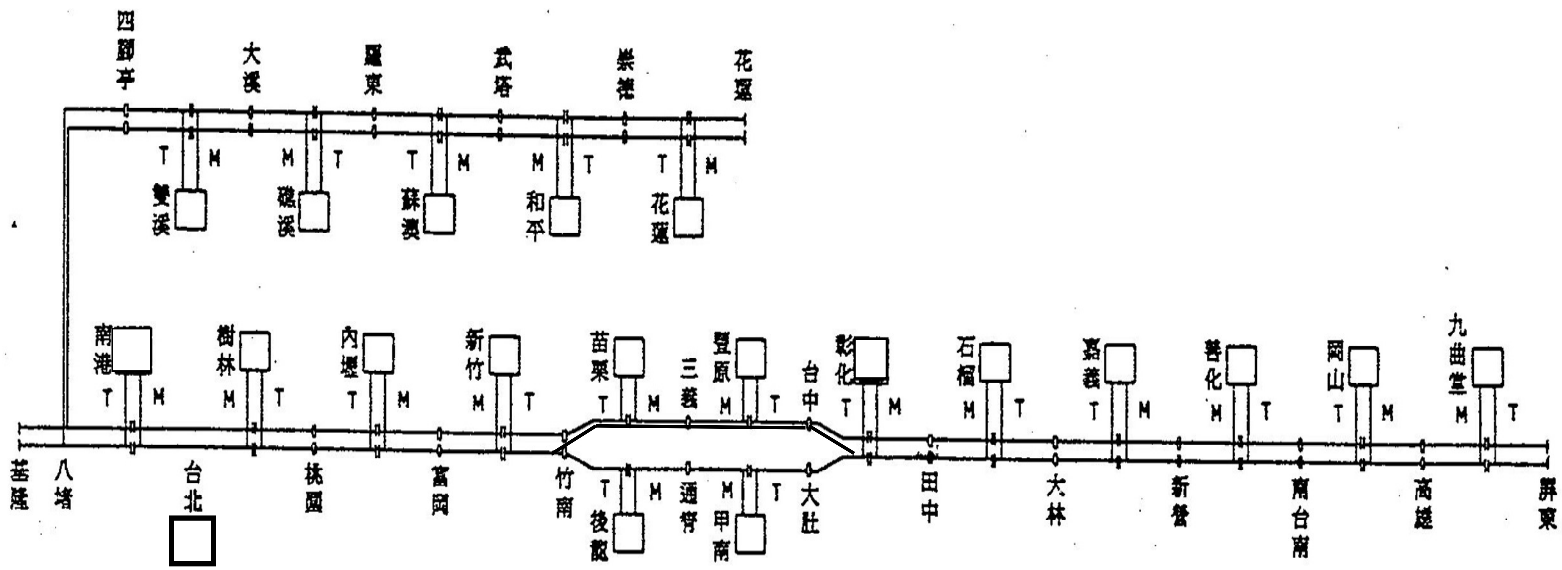
FOR

OVERHEAD CONTACT SYSTEM

新台鐵・心服務

交 通 部 臺 灣 鐵 路 管 理 局
Taiwan Railways Administration, MOTC

Plan of Electric Power supply



Section post

feeders

Substation

Overhead contact wire

Power control center

Neutral section

M T 25KV

GENERAL DESIGN BASIS

1.1 Speed of Train

The catenary system for main lines shall be suitable for a maximum speed of 120 km/h with two pantographs raised. The existing maximum speed is 130km/h.The distance between pantographs shall be a minimum of 5m.

1.2 Track Dimensions

The track gauge is 1.067m .In two track open route areas, the distance between track centres is normally 3.7m.

1.3 Curved Track

The minimum radius of curvature is 274 metres on the main lines with a maximum cant of 105mm.

1.4 Pole Clearance

The minimum clearance from centre line of track to face of pole shall be 2.50m, subject to additional clearances for curves.

2.0 MAIN CHARACTERISTICS OF THE CATENARY SYSTEN

2.1 Main Line Catenary System

On the main lines, the catenary system shall be of simple catenary construction , with a sagged contact wire and shall be automatically tensioned by means of a balance weight termination assembly so that the messenger and contact wires shall be maintained at a substantially constant tension of 1,000 Kp at all temperatures under operating conditions.

2.2 Tension Lengths for Main Lines

The maximum tension length for normal lines shall be 28 spans of the maximum span length for the track curvature concerned, under normal open route conditions. On coast lines, the maximum tension length shall be 32 spans of the maximum span length for the track curvature concerned under open route conditions.

2.3 Spans

The maximum permissible design span length shall be 56m normal lines and 50m coast lines.

2.4 Automatic Tensioning

The tension in the contact and messenger wire will be controlled by a balance weight system having a 3 to 1 ratio.

2.5 Contact Wire Sag

Automatically tensioned catenary systems shall be designed and erected in such a manner that a nominal 60mm sag in the contact wire shall be provided at the mid-point in a span length of 56m.

2.6 Sidings Catenary System

Sidings or subsidiary main tracks, crossing or connecting with main lines shall always be equipped with automatically tensioned catenary system.

2.7 Tension Lengths & Spans for Sidings

The maximum tension length shall normally be limited to 1600m.

The maximum span length shall be 56m normal lines, and 50m coast lines.

2.8 Contact Wire Heights

Open route ---------- 4.75m
Station ---------------- 5.0m
Level Crossings --- 5.4m
Lowest ---------------- 4.42m

2.9 System Height

1.2m on the open line and in station areas.

2.10 Contact Wire Gradient

The contact gradient if a straight line between these support points shall not exceed 1:250（40/00）, relative to track. At the start and finish of a gradient , there must be a transition gradient over the span , which relative to track , must not exceed 1:500 （20/00）.

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Taiwan Railways Administration, MOTC

2.11 Contact Wire Displacement

during wind velocities of 26m/sec measured from the centerline of the static pantograph shall be 350mm.

2.12 Staggers

2.12.1 normal horizontal displacement（known as stagger）of 200mm from the centerline of a static pantograph.

2.12.2 Curved Track

The stagger will not be greater than 200mm and the displacement will be towards the outside of the curve.

2.13 Support and Registration

The contact wire registration assembly shall be of the impact free type .

2.14 Overlap Spans

Insulated------Insulation shall be provided between the two catenary systems, with a distance apart of 460mm.

Uninsulated---The two catenary systems with a distance apart of 350mm shall be connected together with a full copper section jumper to provide electrical continuity.

2.15 Mid-Point Anchor Assembly

On open route ,the mid-point anchor shall normally consist of a cantilever tied to the adjacent masts to prevent along track movement of the messenger wire at this point.

2.16 Overbridges

For Bridge（and Tunnel）approach spans, a maximum of 18m difference in adjacent spans shall be ensured.

2.17 Level Crossings

The minimum height of the contact wire over public road level crossings is normally 5.40m under any conditions.

2.18 Conductors

2.18.1 The contact wire shall be a hard drawn pure copper grooved wire a cross section of 107sq. mm ，No.870 of the International Union of Railways （U.I.C.）

2.18.2 The material for the messenger wire shall be cadmium bronze stranded wire-total cross section 50sq mm （7/3.0mm）.

2.18.3 The hangers of the catenary system shall be made of 3mm dia. Lightly drawn solid stainless steel wire.

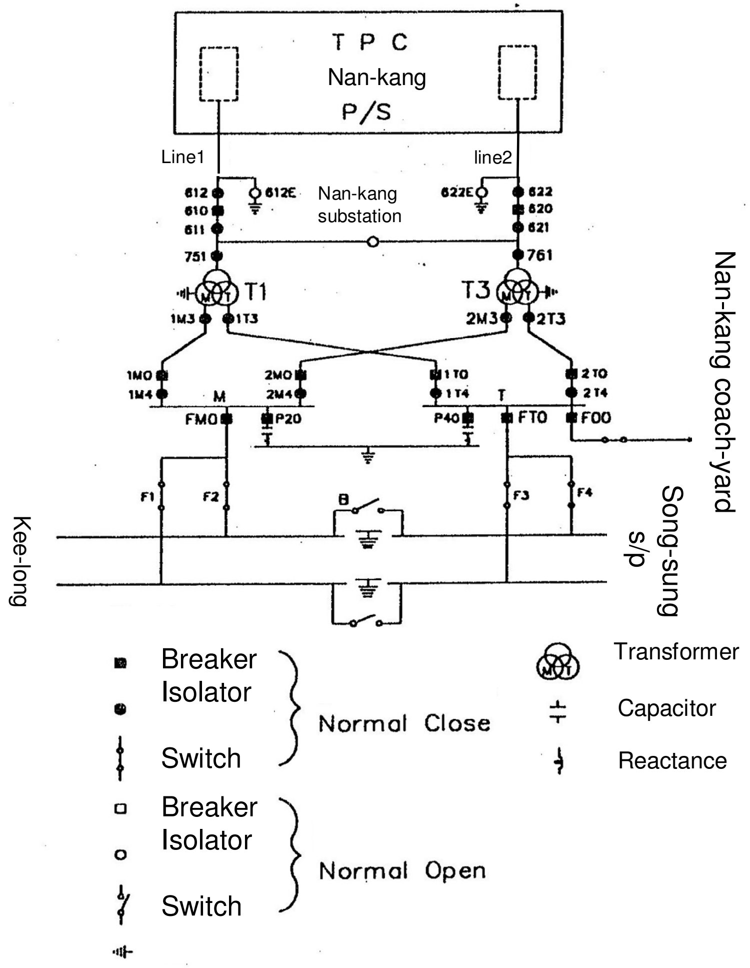
2.18.4 The current connectors in the catenary system i.e. between messenger and contact wire shall be stranded copper wire with a high flexibility and 35 sq. mm cross section（133/0.584mm）.

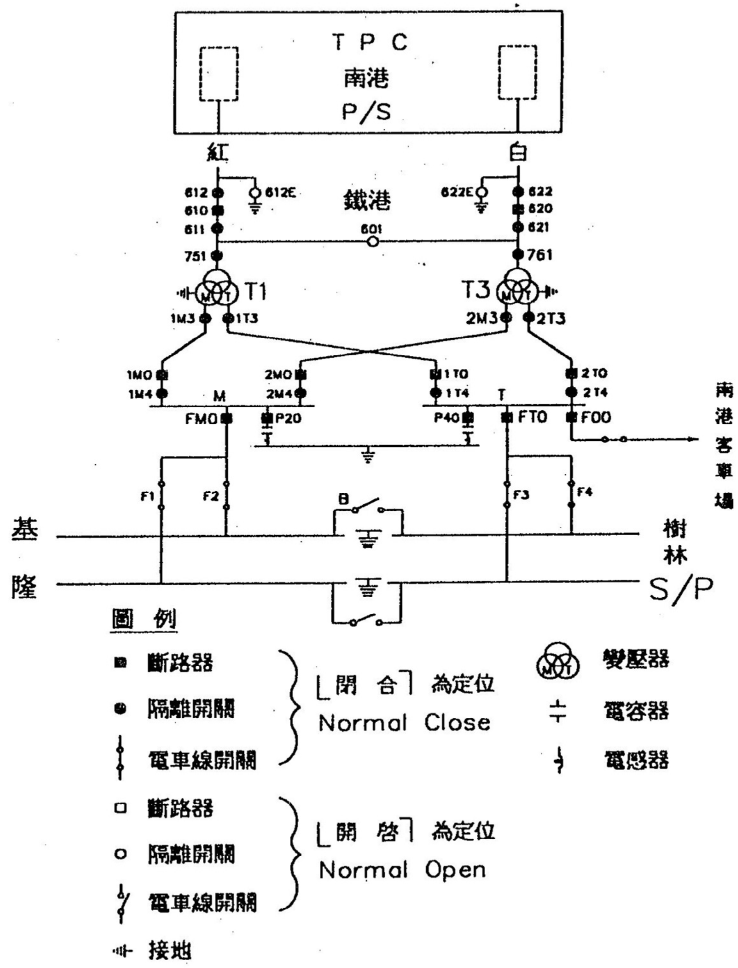
2.18.5 Feeding lines and by-pass feeders Shall be 165sq. mm stranded copper wire（19/3.33m）.

2.18.6 Return feeders（earth wires）shall be 100 sq.mm （7/4.39mm） stranded H.D. aluminum wires,

2.18.7 Rail bonds and rail continuity bonds shall consist of 19/2.77mm 40% conductivity copperply wires.

Single Line Diagram of Substation





TPC
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612E
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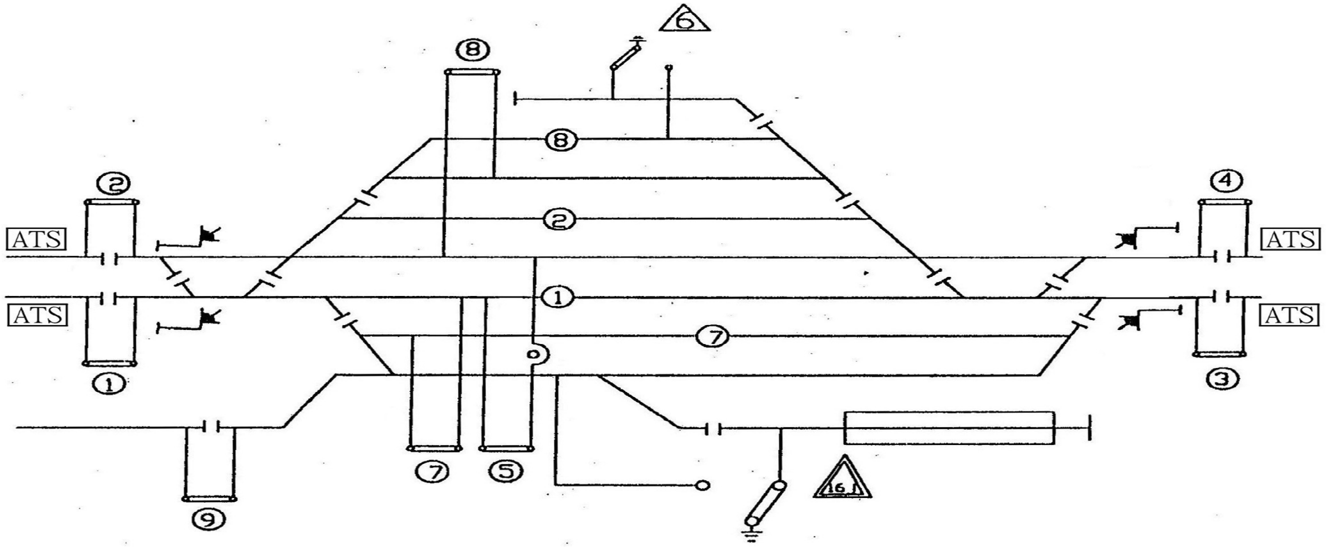
FM0
P20
P40
FT0
F00
南港客車場
F1
F2
B
F3
F4
基隆
樹林
S/P
圖例
斷路器
隔離開關
電車線開關
閉合 為定位
Normal Close
斷路器
隔離開關
電車線開關
開啓 為定位
Normal Open
接地
變壓器
電容器
電感器

變電站單線圖

12



home signal	Hand-operated isolator driving mechanism with lock
Sectioning device	Pole mounted isolator Grounding device
Motor-operated isolator driving mechanism	Pole mounted isolator
Current transformer	

雙軌車站開關配置圖

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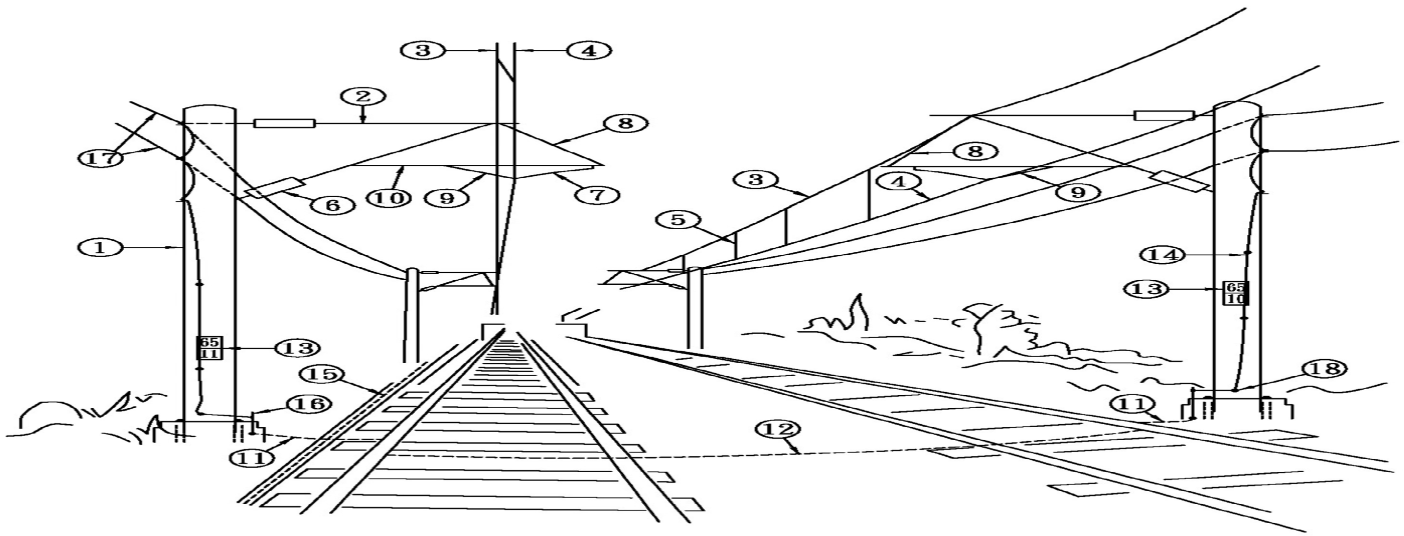
Front view of o.c.s

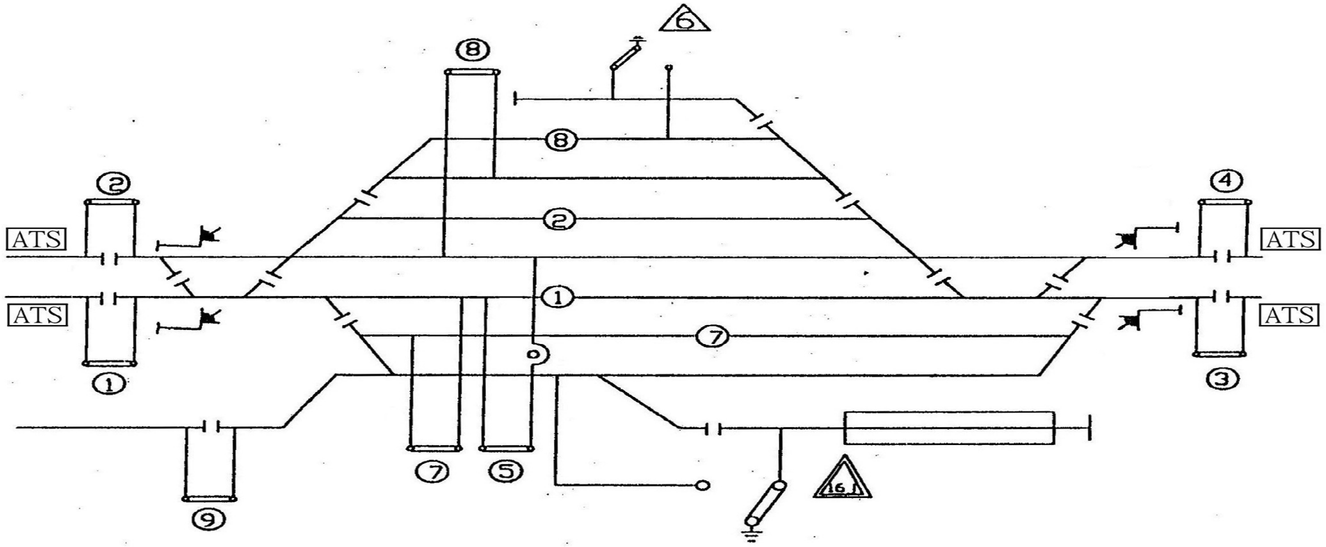


1.300mm DIA P.S.C. Pole
2.Cantilever
3.Messenger Wire
4.Contact Wire
5.Hanger

6.Solid Core Insulator
7.Steady Arm
8.Inclined Hanger
9.Windstay
10.Registration Arm

11.Rail to Rail Bond
12.Inter Track Cross Bond
13.Pole Number
14.Stranded Bond Wire for Earthing
15.Thoughing With Communication
Cables and Buried Earth Wire Below
16.Terminal Earthing Connection to Facilitate Testing
17. Return Feeder
18. Earth Support Bracket

Generalized feeding circuitry for station along double-track lines



home signal

Sectioning device

Motor-operated isolator driving mechanism

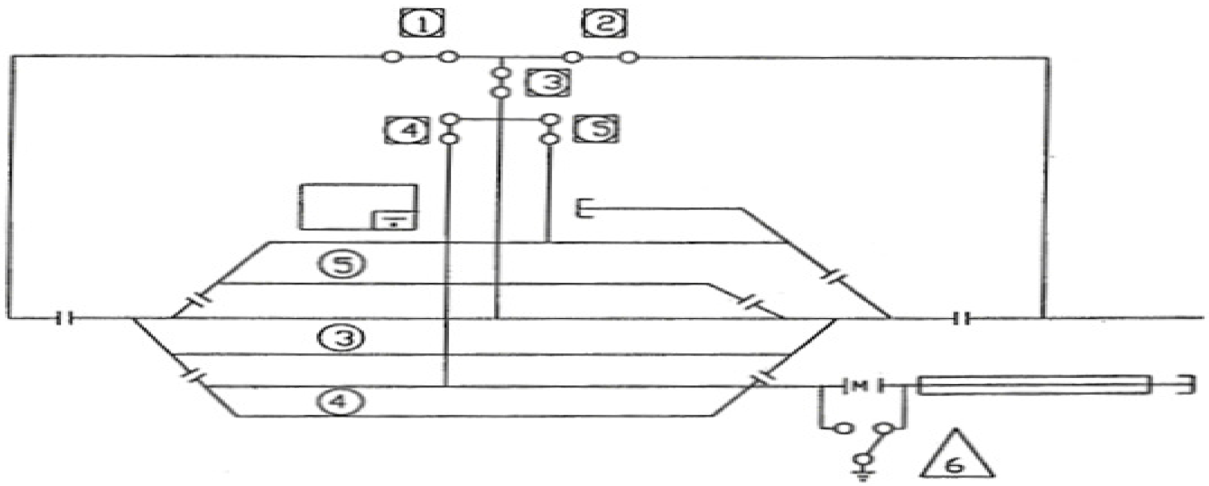
Current transformer

Hand-operated isolator driving mechanism with lock

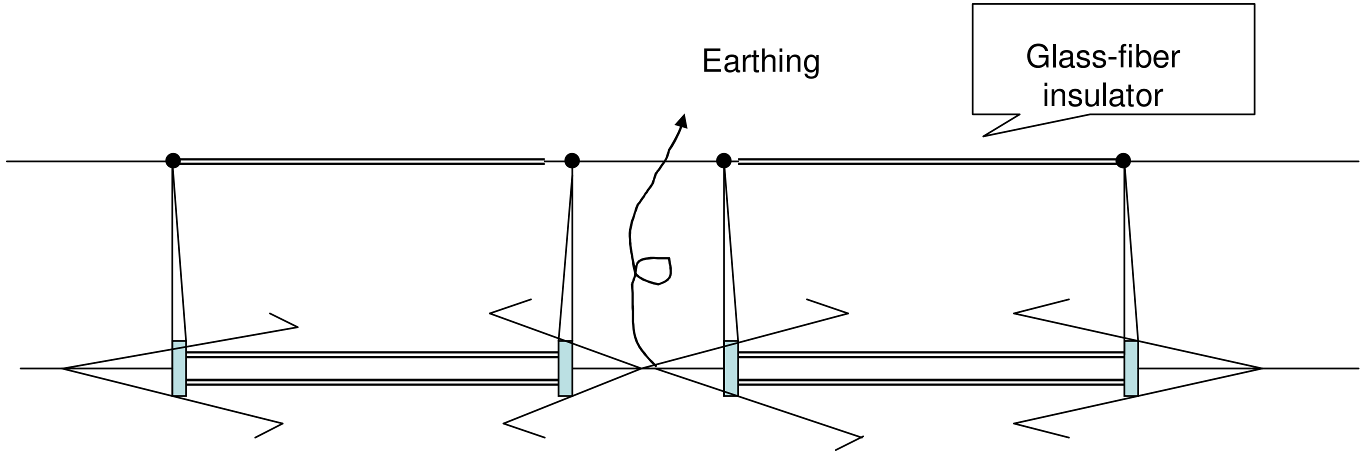
Pole mounted isolator Grounding device

Pole mounted isolator

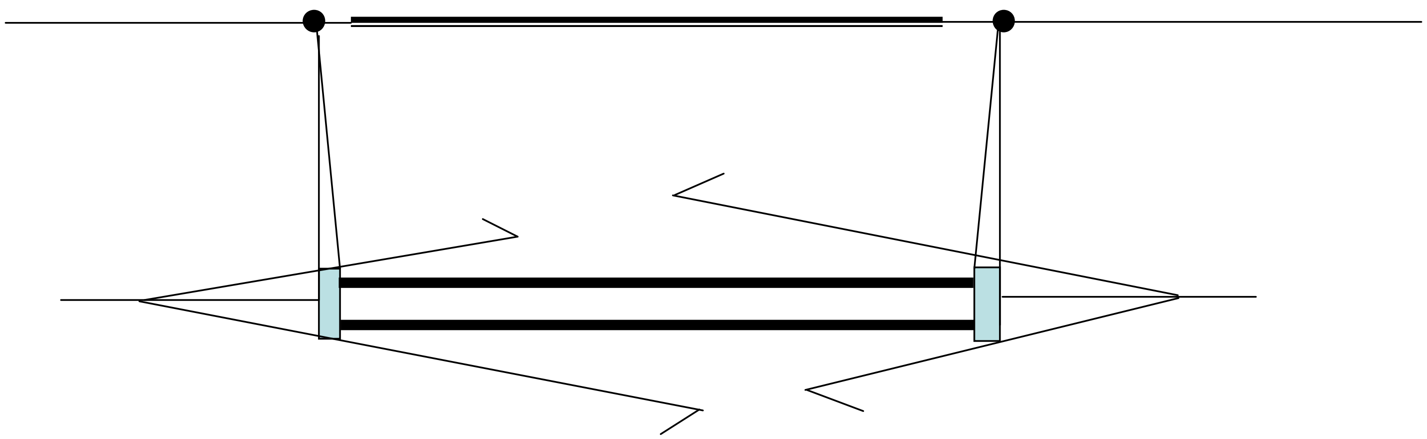
Generalized feeding circuitry for station along single-track lines



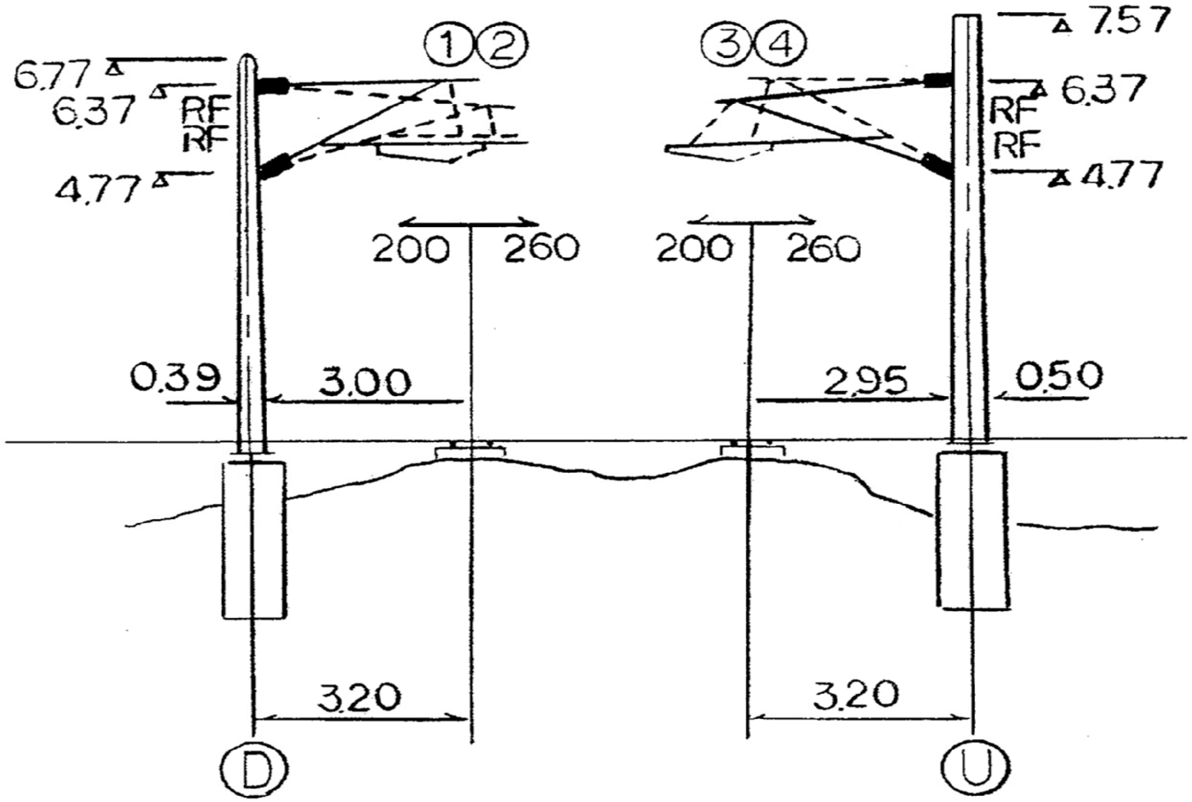
Neutral-section (Arthur Flury AG)

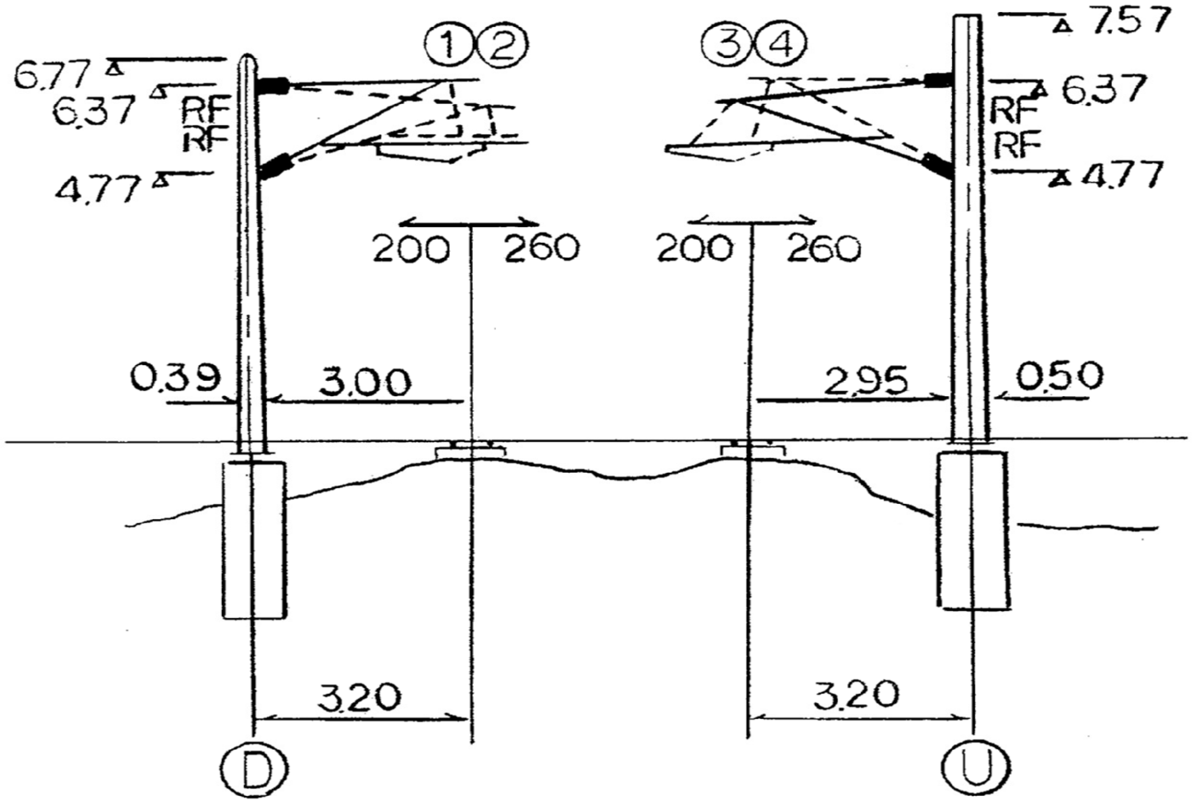


High-Speed Section-Insulator (Arthur Flury AG)



ocs design for single pole





①②
③④
6.77
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RF
RF
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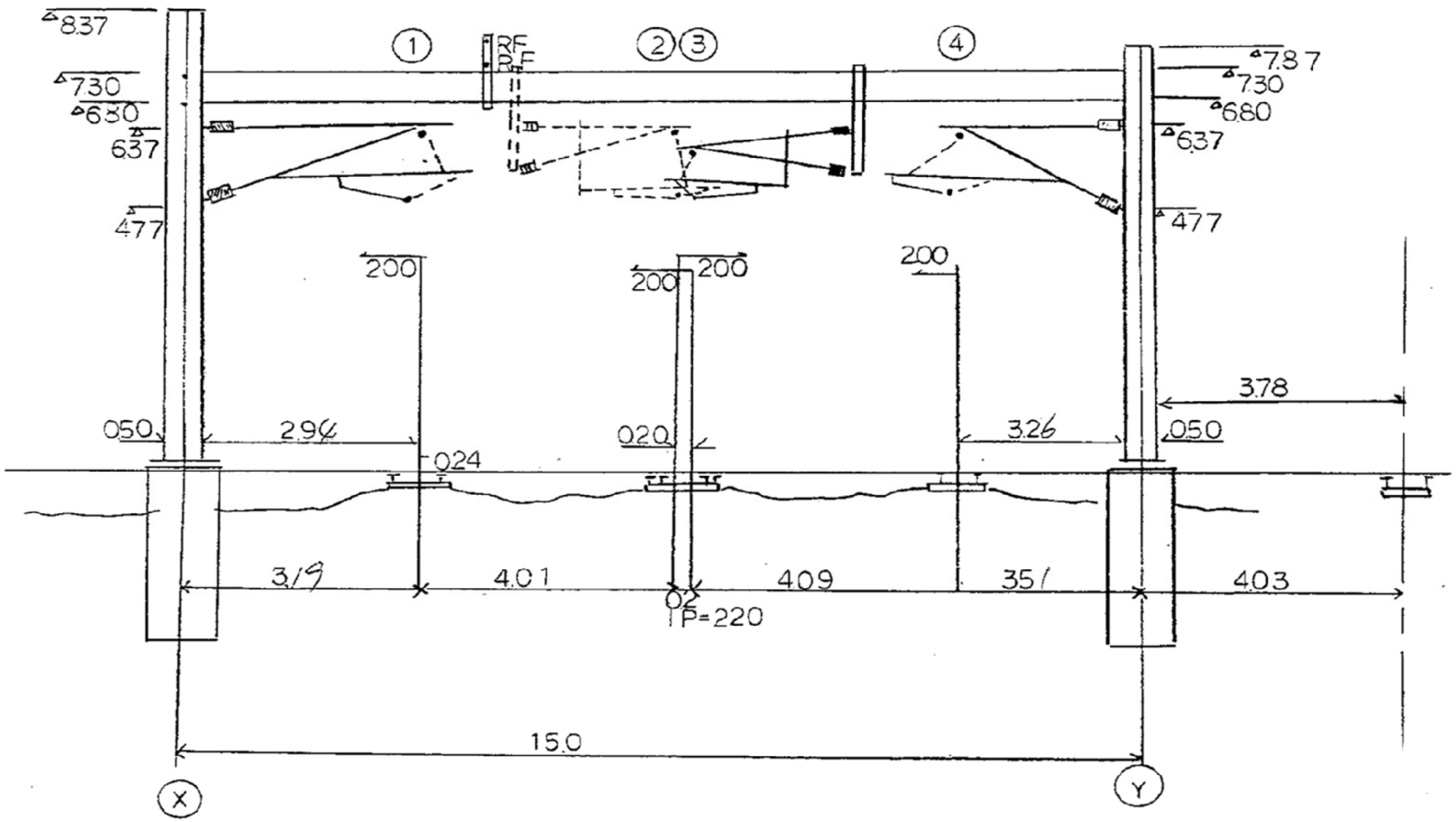
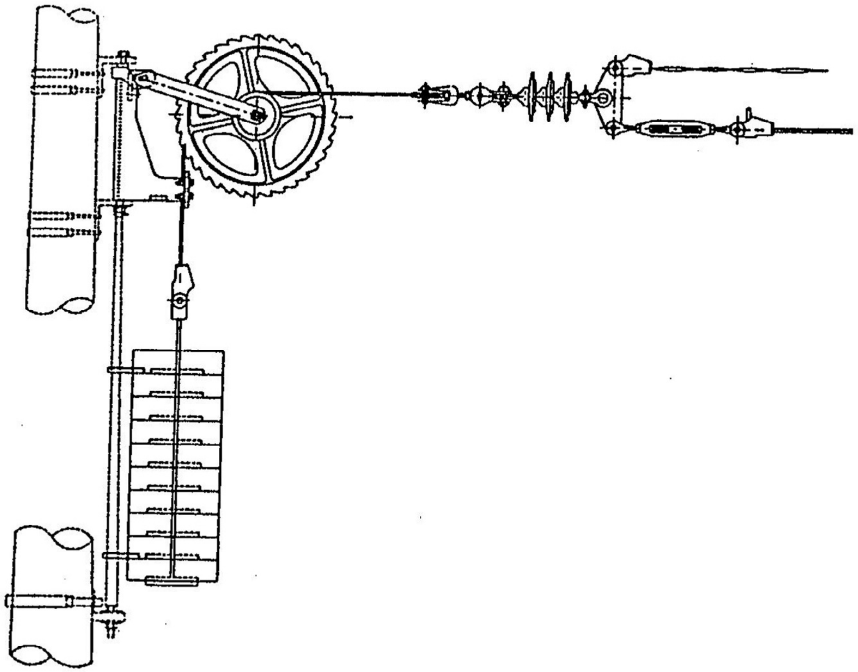
單桿電車線懸臂組

20

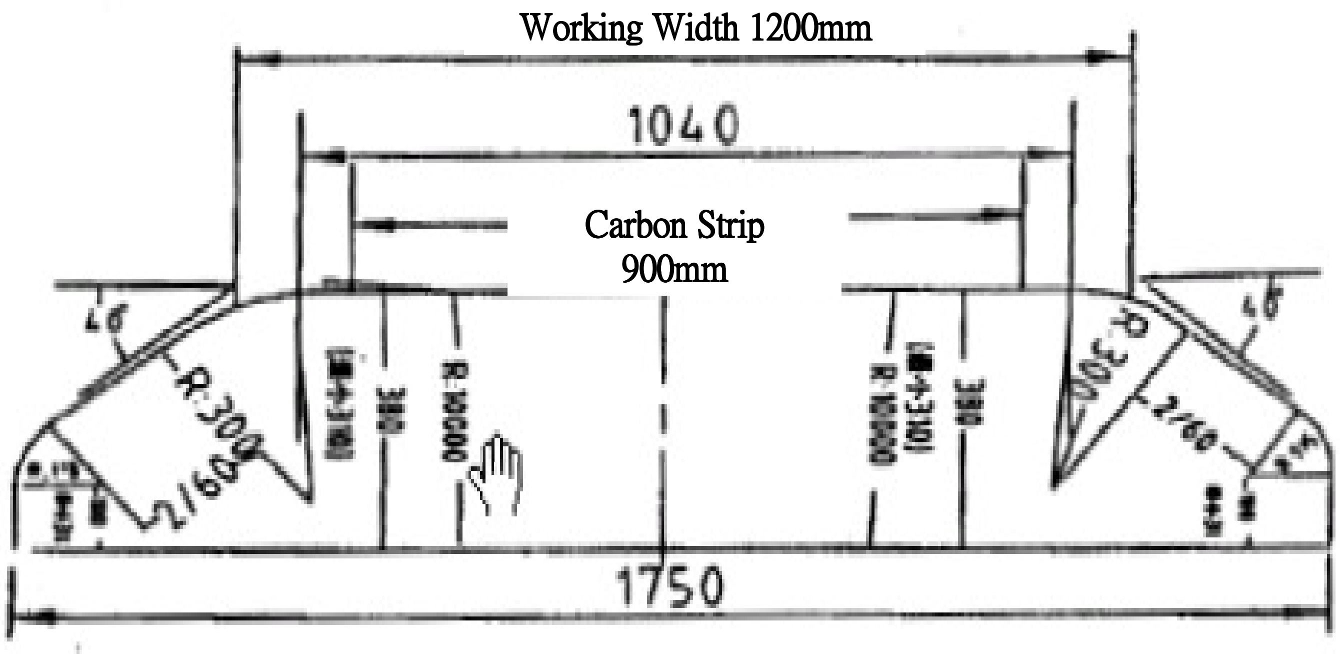
ocs design for portal



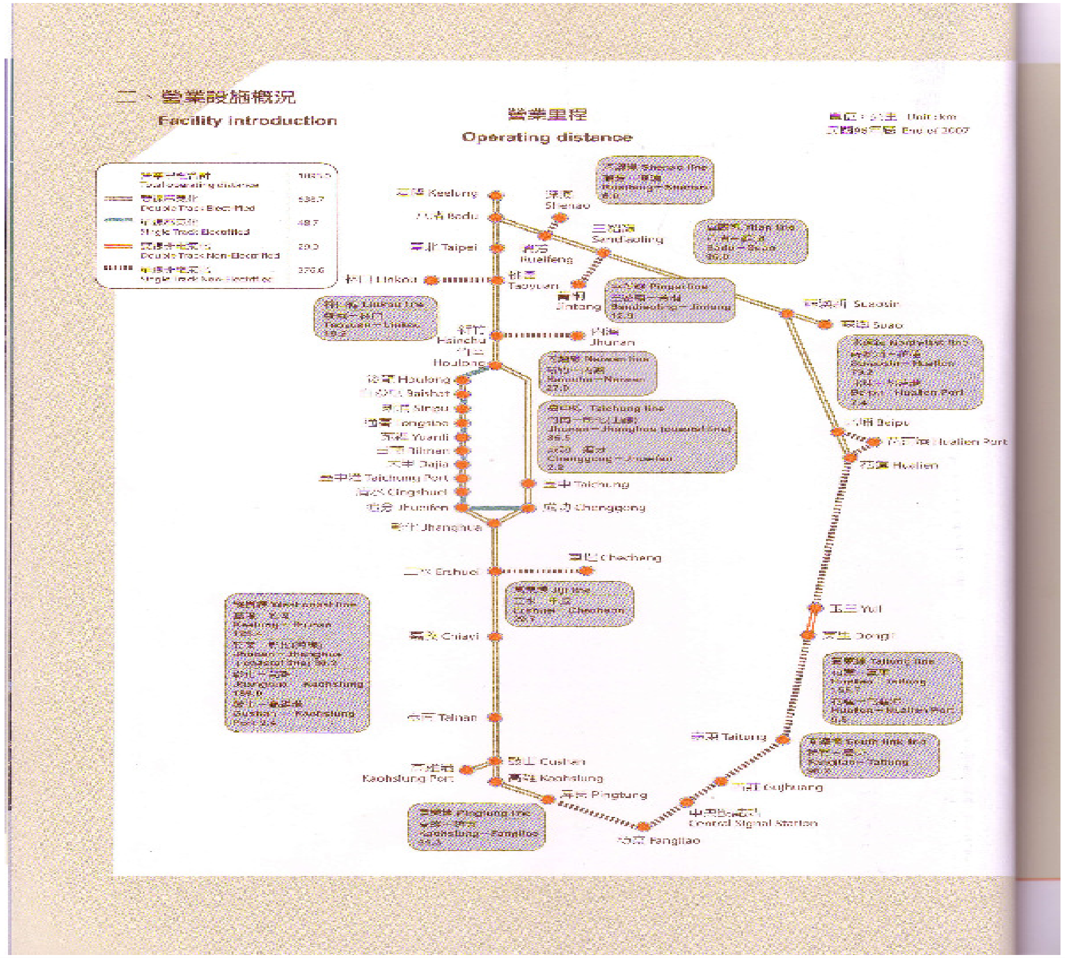
Automatic tensioning Device



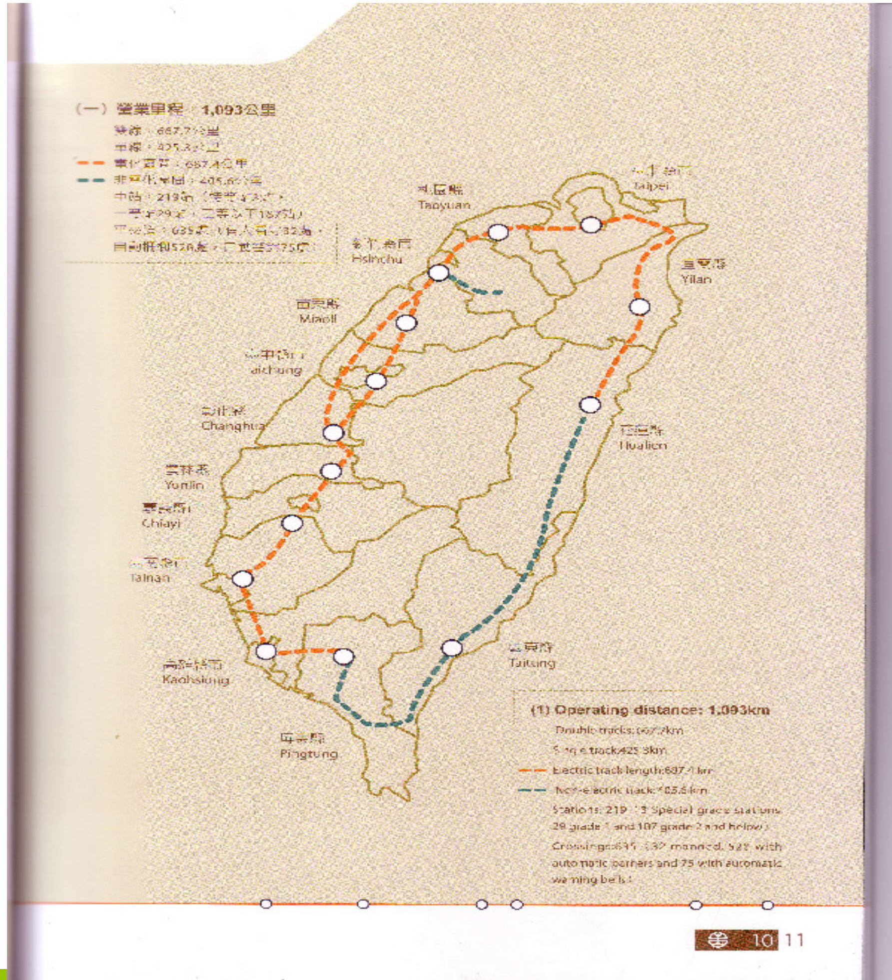
Pantograph's Outline （Faiveley）



Facility introduction



Operating distance



The utilization of railway

四、運輸效率評估
Transport efficiency

（一）客貨列車統計
(1) Passenger and freight train statistics

項目 Item		95年 2006	96年 2007	比較 comparison
列車 Train	列車次數 Train number	383,439	392,180	2.28%
	列車公里 Train kilometers	38,180,000	40,530,000	6.14%
	客車準點率 Passenger train punctuality rate	92%	91.45%	-0.55%
	貨車準點率 Freight train punctuality rate	99.88%	100%	0.12%
客車 Passenger carriage	每日客車公里 Daily passenger train km	811,774	808,485	-0.41%
	每日客座公里 Daily seat-km	40,600,000	40,220,000	-0.96%
	客座利用率 Seat use rate	63.02%	60.89%	-2.13%
貨車 Freight wagon	每日貨車公里 Daily freight train km	215536	194333	-9.84
	每車平均週轉日數 Average turnaround days per train	1.51	1.68	11.26%
	每車平均停站時間 Average length stop at station per train	11.82時 (hours)	10.91時 (hours)	-7.70%
	每列車平均載重噸數 Average train load in tons	206	186	-9.70%

（二）行車事故
1. 事故總件數：本年度共835件，較前一年減少27件，減少3.13%。
2. 事故類別：以電力機車故障182件最多，占21.80%；其次為電車故障144件，占17.25%；再次為受傷件數63件（占7.54%）、列車延誤件數60件（占7.19%），其餘各類件數所占比率均在7%以下。
3. 傷亡人數：本年行車事故死傷人數182人，與上年人數相同。就肇事原因分析，以行走路線死傷51人最多，占28.02%；其次依序為強闖平交道死傷44人（占24.18%）、行車事故22人（占12.09%），其餘各類均在10%以下。

(2) Train operation accidents

A) Total number of accidents: 835 this year, 27 fewer than the previous year, a reduction of 3.13%.

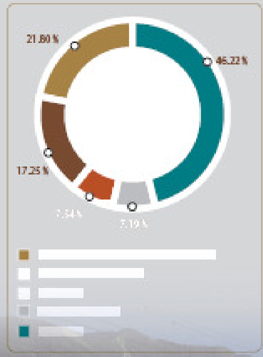
B) Accident type: The most numerous accident was electric locomotive breakdown, with 182 cases accounting for 21.80% of the total. The second most numerous was train accidents, 144 cases accounting for 17.25%, followed by 63 injury cases (7.54%), 60 cases of train delay (7.19%). Other types of accident each accounted for under 7% of the total.

C) Number of injured and dead: This year train operation accidents resulted in 182 cases of injury or death, the same as the year before. The main cause was people walking on the tracks, with 51 people killed or injured, accounting for 22.02%. The other causes, in descending order, were forcibly going through a level crossing which resulted in 44 deaths and injuries (24.18%), train operation accidents which resulted in 22 deaths and injuries (12.09%) and other causes that each accounted for under 10% of the total.

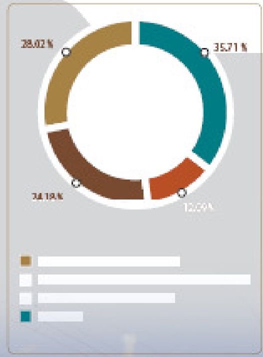
4. 每百萬動力車公里平均事故：本年每百萬動力車行駛公里平均事故件數為11.12件，較上年11.23件，減少0.11件，減少率為0.98%；其中責任事故平均為0.52件，較上年0.51件，增加0.01件，又責任事故占總件數4.67%，較上年之4.52%，增加0.15個百分點。

D) Average accidents per 1 million motive power-kilometers: There was an average of 11.12 accidents per million motive power-kilometers this year, down by 0.11 cases or 0.98% on 11.23 last year. There were 0.52 liability accidents, up by 0.01 cases on the 0.51 cases of last year. Liability accidents accounted for 4.67% of accidents, up by 0.15% on the 4.52% of last year.

事故類別
accident type



傷亡人數
Number of people injured or killed



The statistic the fault of o.c.s.

Faulty condition	2006	2007	2008	sum	percentage
Catenary wire broken down	8	7	8	23	51%
Contact wire broken down	3	1		4	9%
Cantilever fault	2	2	1	5	11%
Breaker failure	1	3	1	5	11%
Glass-fiber flash over	1	1		2	5%
Hanger broken	1			1	2%
Conduct-rail fault			2	2	5%
Isolator flash over			1	1	2%
Section- insulator fault		1		1	2%
Neutral-section fault			1	1	2%
sum	16	15	14	45	100%

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The key factors in decisions to renew is the Catenary wire （49.5mm^2，3.0mm^2× 7 core）broken down reach 51％ of the fault of o.c.s.

TRA planning to substitute 95mm^2（2.5mm^2×19core）H.D copper wire for 49.5mm^2 catenary wire.

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Taiwan Railways Administration, MOTC

THANKS FOR YOUR ATTENTION