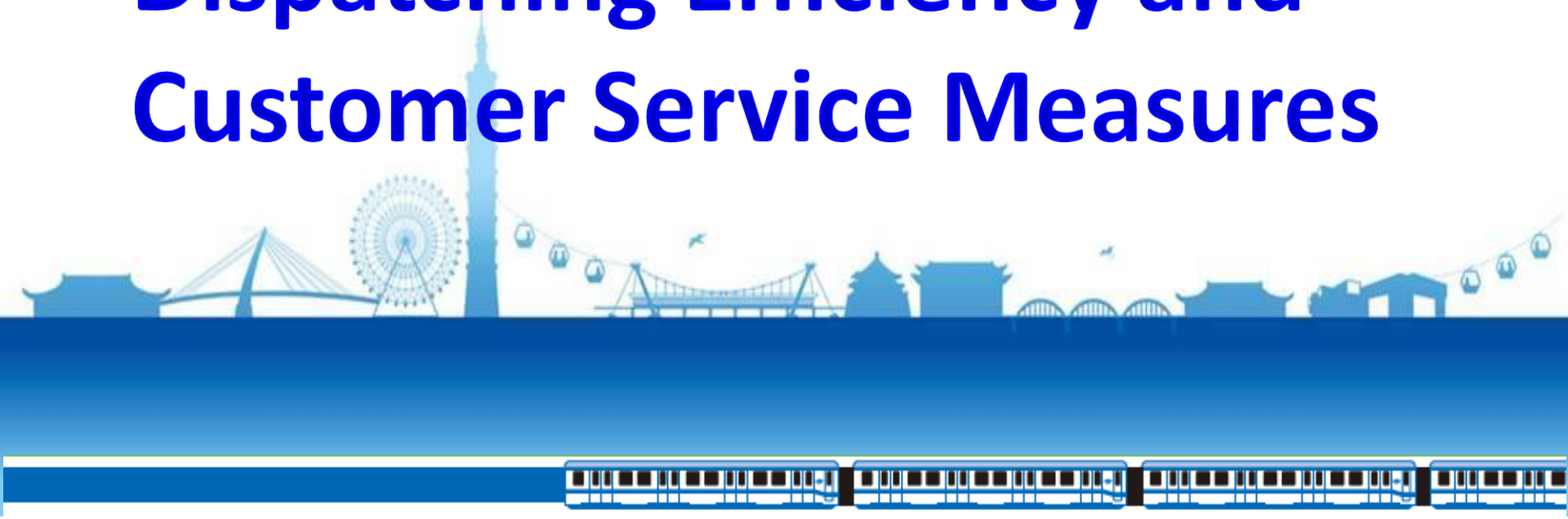
Improvement of Train Dispatching Efficiency and Customer Service Measures



Otis Sheu
Manager of Train Operation Division
Taipei Rapid Transit Corporation, Taiwan

OUTLINE

- **Taipei Metro Operation Overview**
- **Enhance Routine Train Dispatching Measures**
- **Urgent Reaction of Train Dispatching and Customer Services**

1 Taipei Metro Operation Overview

. Network & Operation Mode

. Average Daily Ridership

. Seamless Transfer Platforms

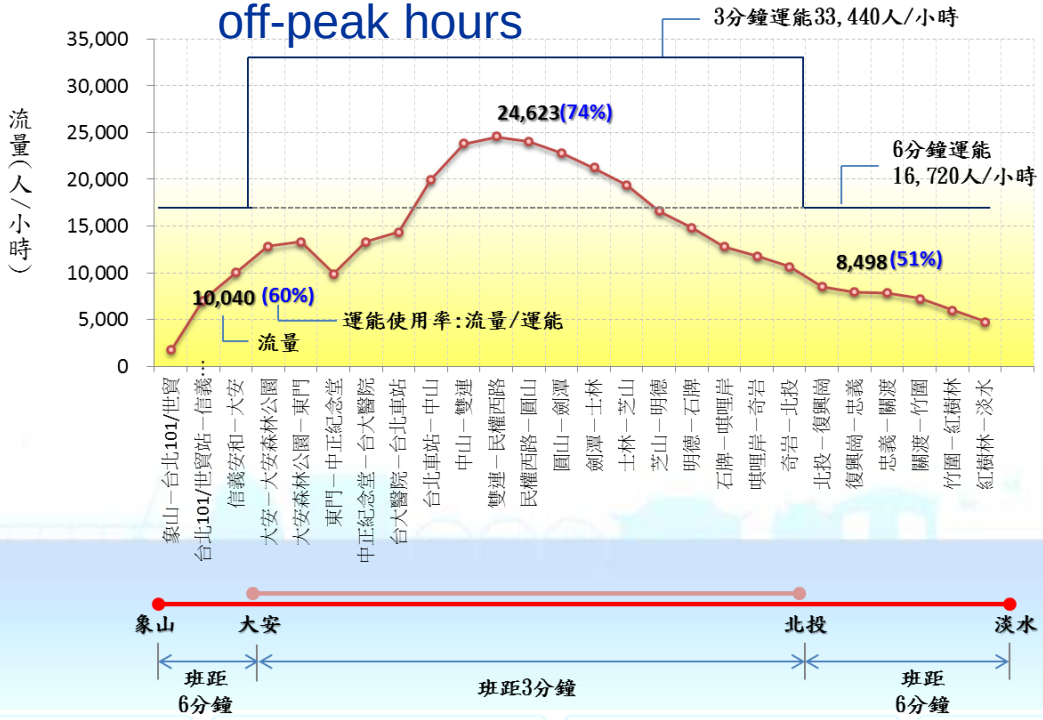
Network

- Number of lines: **5**
  - A transfer-friendly network
  - Some stations are cross-platform interchanges for seamless and easy transfer
- Total length:
  - **131.1 km (Operating)**
    - elevated: 32.6 km
    - ground level: 9.2 km
    - underground: 89.3km
  - 136.6 km (Constructed)
- Station numbers:**117**
- Control Centers: **2**

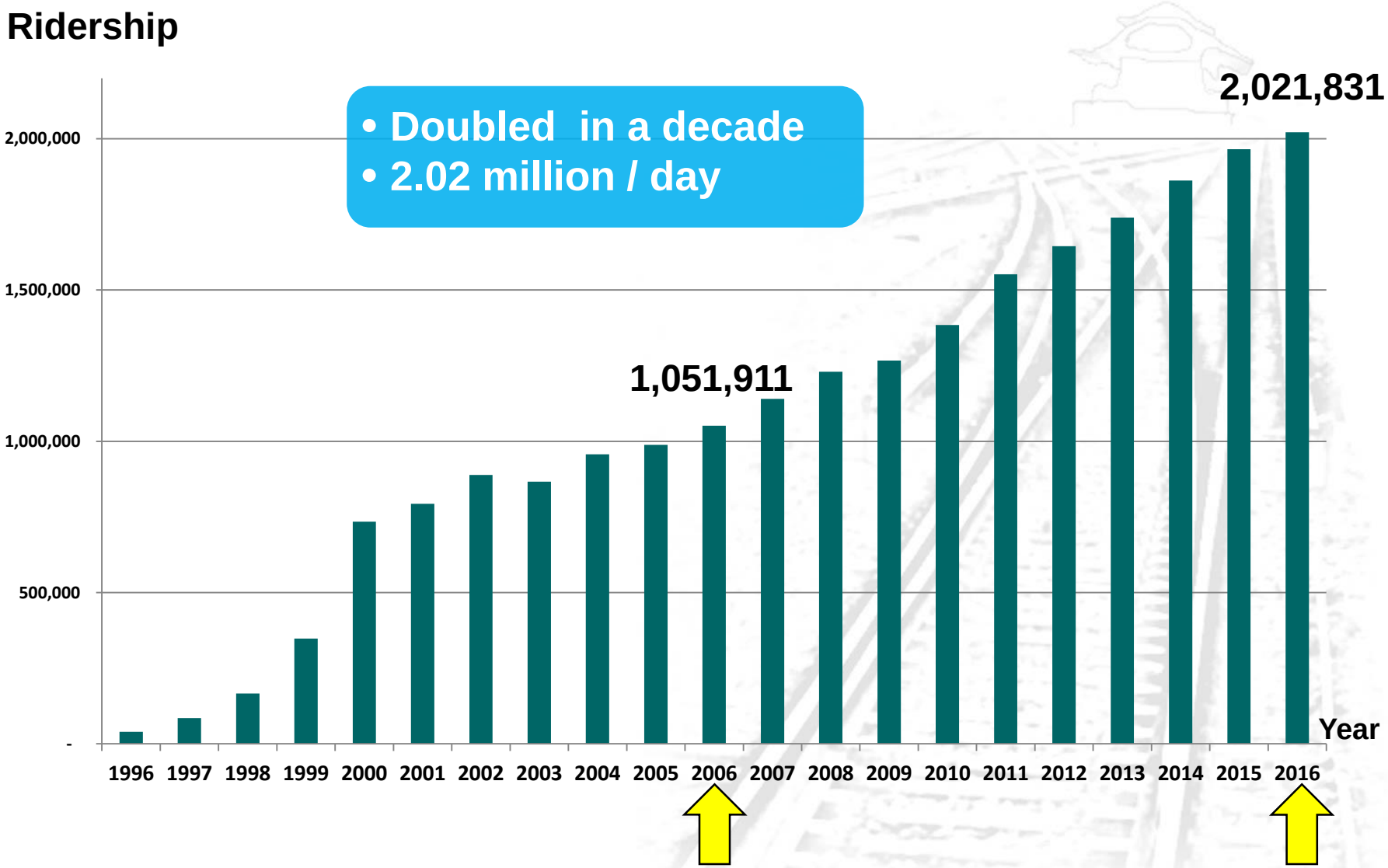
Operation Mode

【Consider both **transport efficiency** and **energy conservation**】

1. Different headway in main direction during peak hours
2. Crucial transfer stations are included in the overlap section
3. Energy conservation planning during off-peak hours



Average Daily Ridership



Seamless Transfer Platforms

G 松山
BL 南港
R 信義
BL10
G18
BR4
BR5
BR6
文山
G 新店
BL9
O13
R9
R O
東門站
R10/O14
G9
R 淡水
O10
G17
R16
R15
R14
R13
R12
BL8
G10/O15
古亭站
G O
中和 O
O9
G11/R11
中正紀念堂站
R G
G16
BL7
O 新莊、蘆洲
BL G
西門站
G12
BL6/G13
G14
板橋、土城 BL

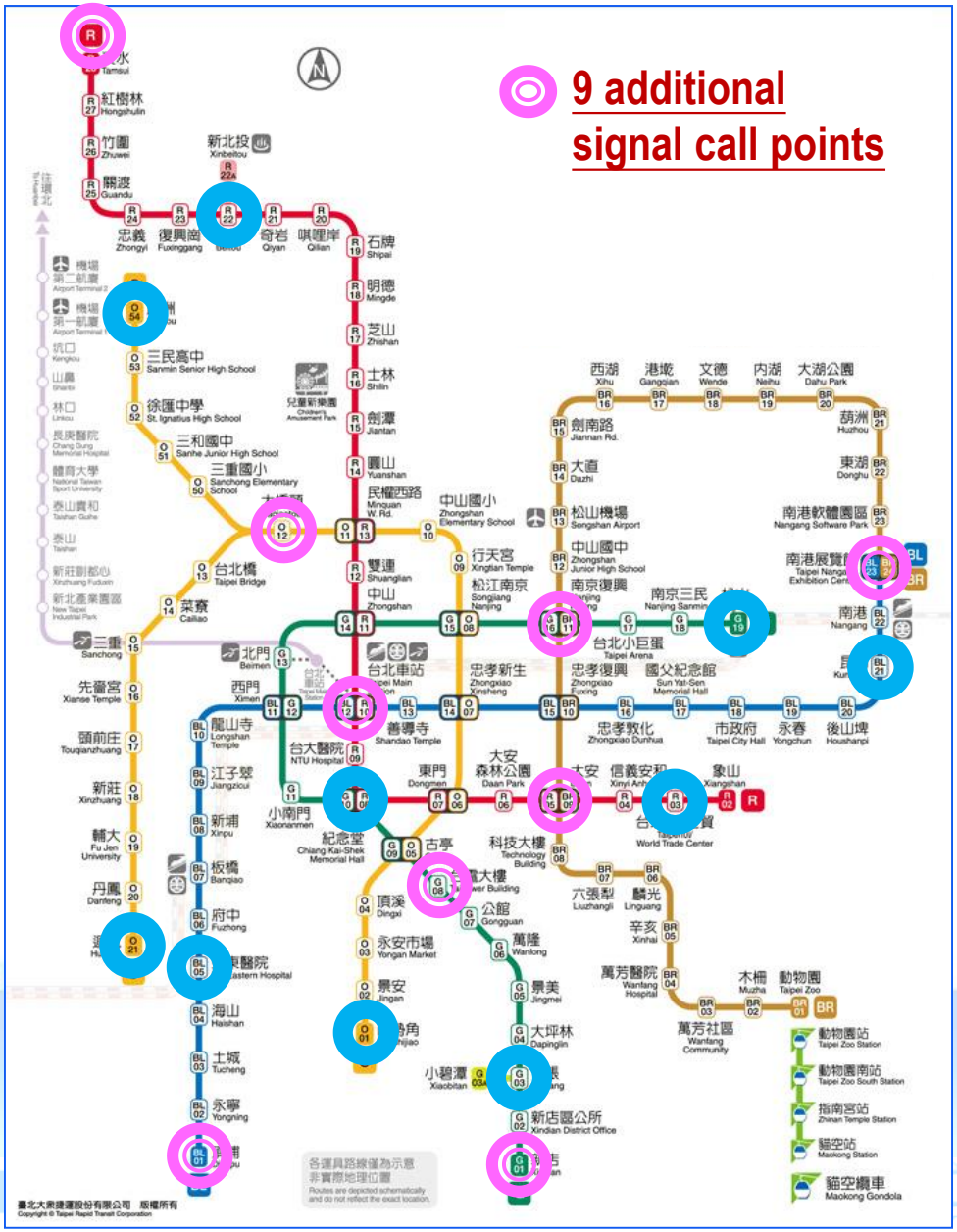
2 Enhance Routine Train Dispatching Measures

. Crew and Train Deployment

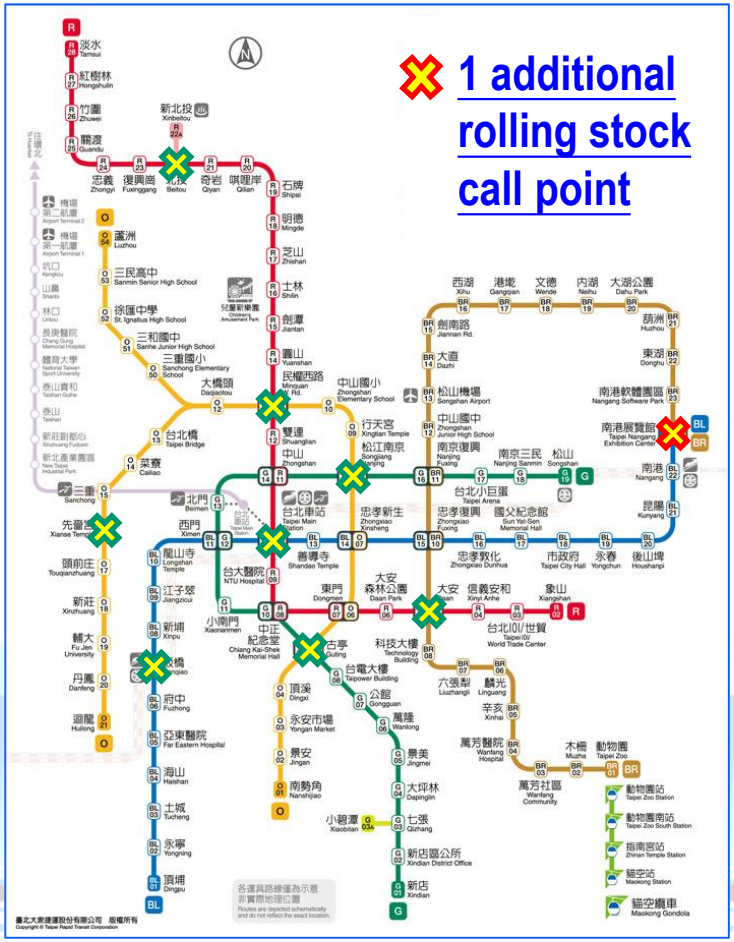
. Train Dispatching in Peak Hours

. High Frequency Train Dispatching

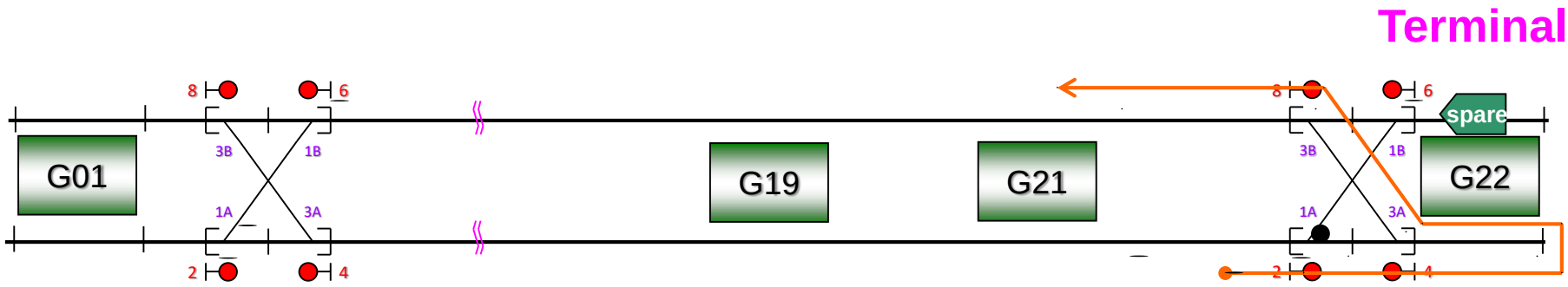
Maintenance Crew Deployment



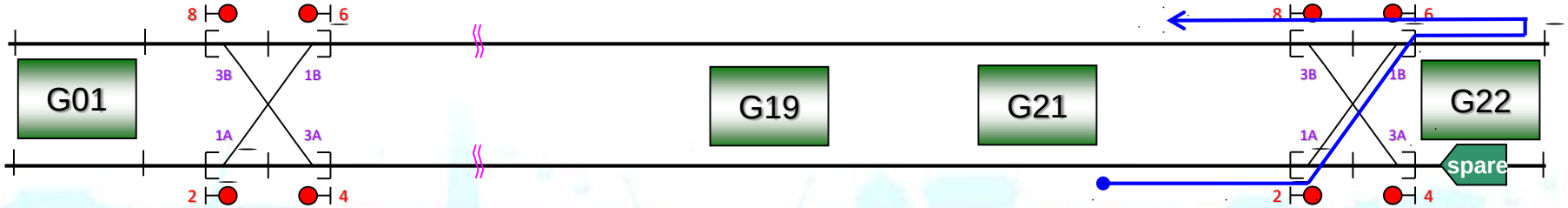
Extra call points at crucial stations during peak hours



Spare Train Deployment

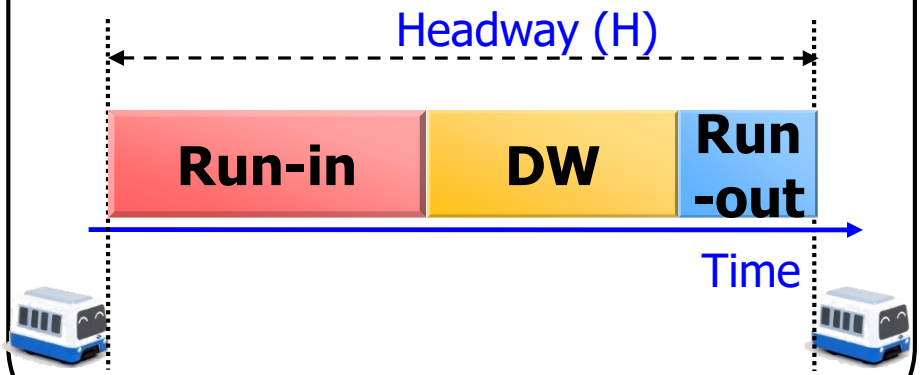


Defective trains can be promptly replaced by spare trains to reduce the impact on passengers



Train Dispatching in Peak Hours

Bottleneck headway



How to decrease the headway?

Min. Headway Control

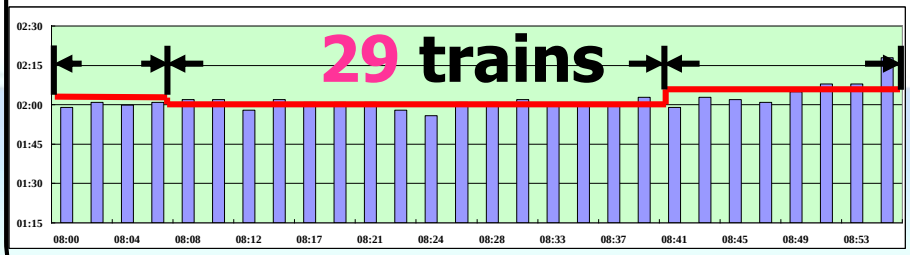
Upstream control + Downstream control = Min. headway control

Control the headway strictly

- Crowd control on platforms
- Staff to assist door closing

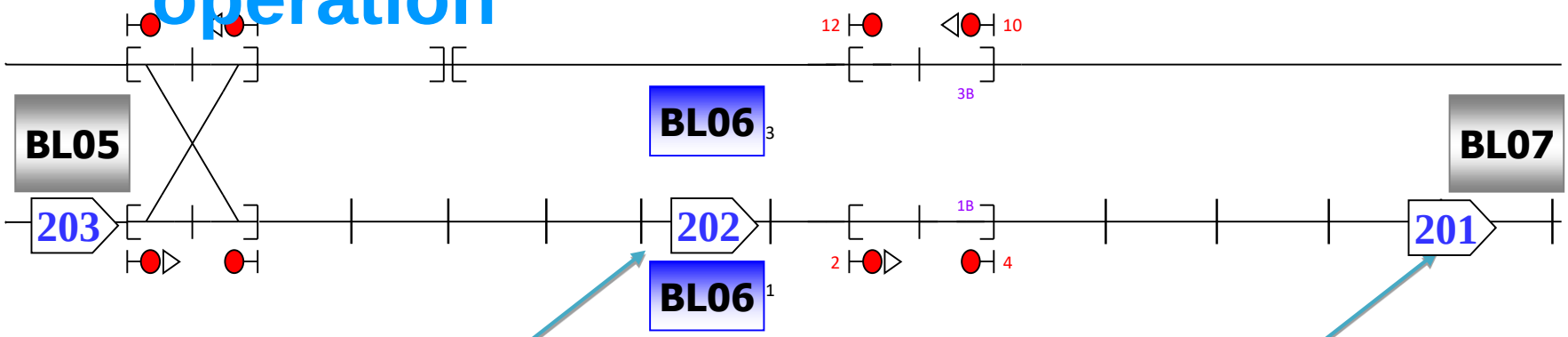
Results and Efficiency

- Min. headway of Blue Line 2'15" → 2'



Programmed Headway Control

Self-developed headway control program ensures smooth operation

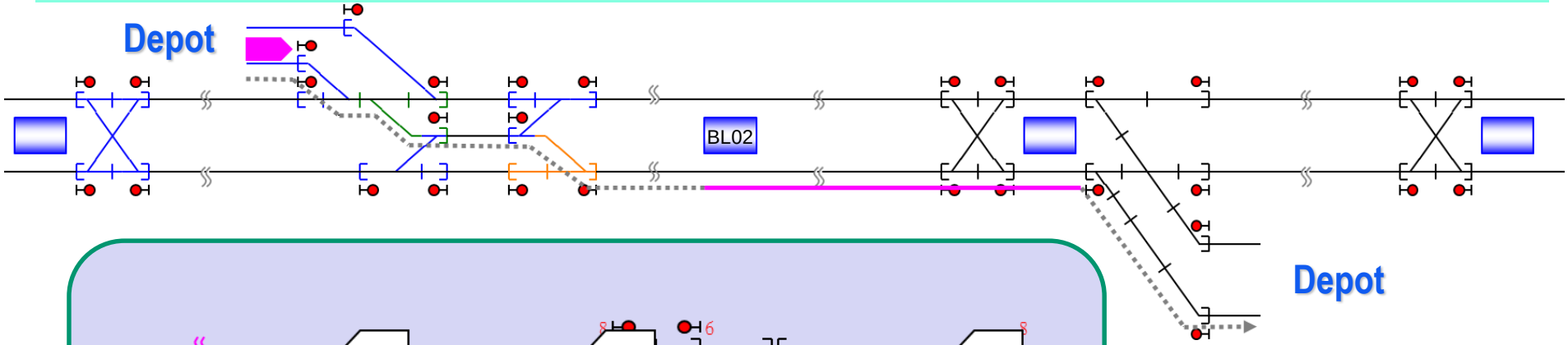


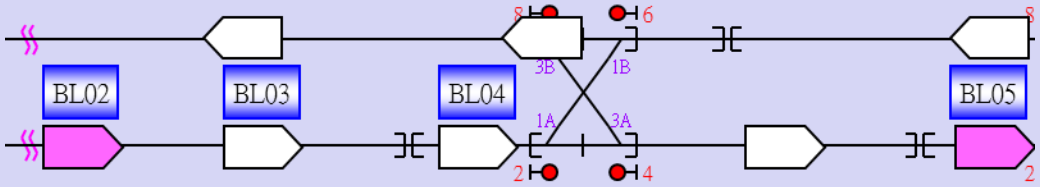
2 T202 berths at platform
T203 departure tone is triggered

1 T201 approaches platform
T202 departure tone is triggered

Add Trains to Run the Min. Headway

Add trains to increase the transport capacity, these trains are allocated to some big transport loading stations.





Add train

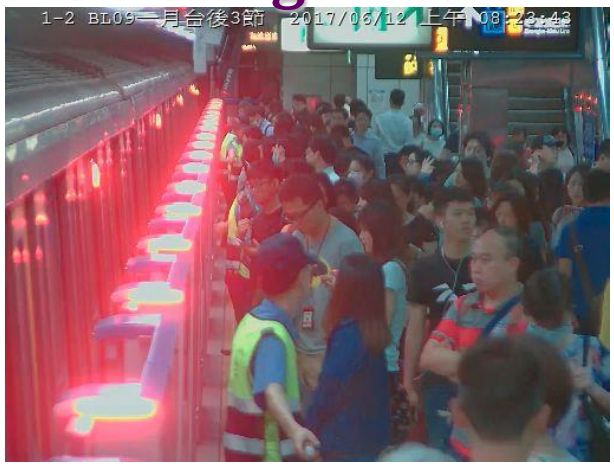
Add train

08:10~08:50
Add 6 trains

For blue line, every adding train is dispatched after 3 regular trains during morning peak hour.

Shorten the Dwell Time

- **Decrease time interval between departure tone and doors closing: Add staff for blocking doors**

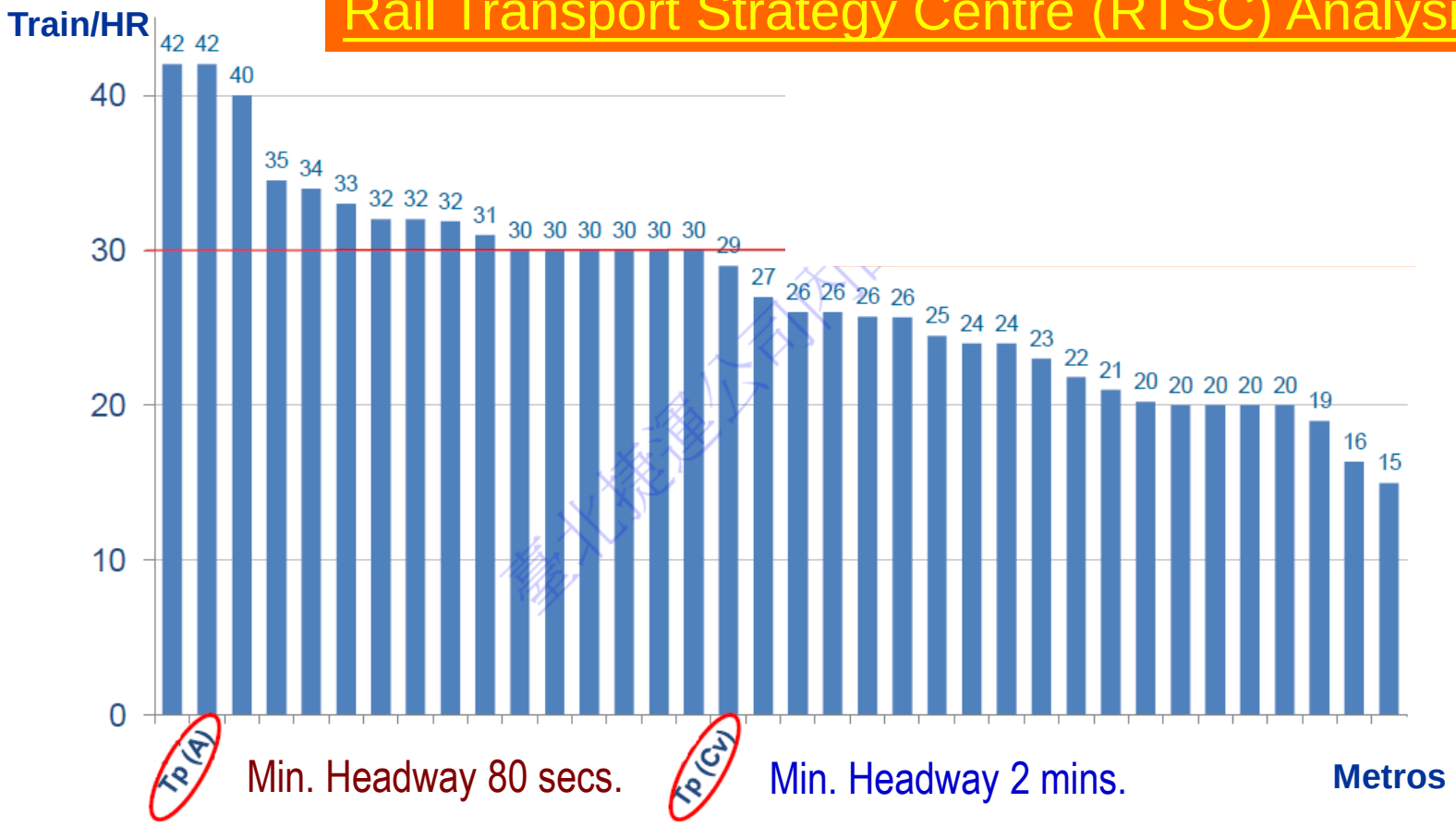


- **Decrease time interval between doors closing and train motion: Add a staff for door closing**

One of the Most Frequent Line in the World

Taipei Brown Line Among the Most Frequent Lines in the World – Many Metros with Experience in Operating High Frequencies

Rail Transport Strategy Centre (RTSC) Analysis



3 Urgent Reaction of Train Dispatching and Customer Services

. Event Category and Response

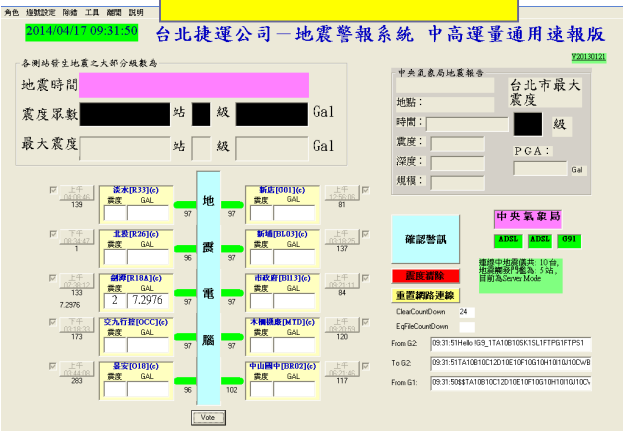
. Optimize the OCC Team Work

. Preparation for Urgent Events

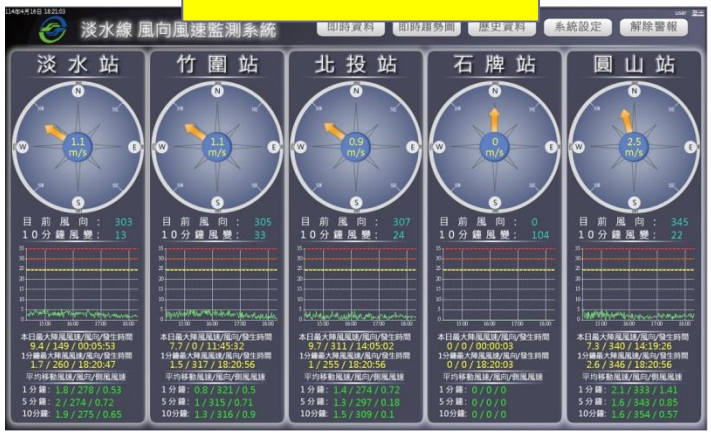
. Maintain High Punctuality and Reliability

Event Category

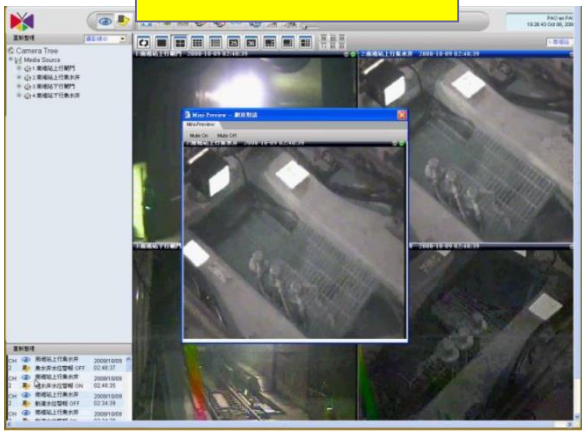
Seismometer



Anemometer



Flood gate



Event Catetories

Earthquake

Typhoon

Extremely heavy rain

Fire

Environmental Factors

Train

Power

Human error

Signal

Civil Engineering

Communication

Electricity

System Factors

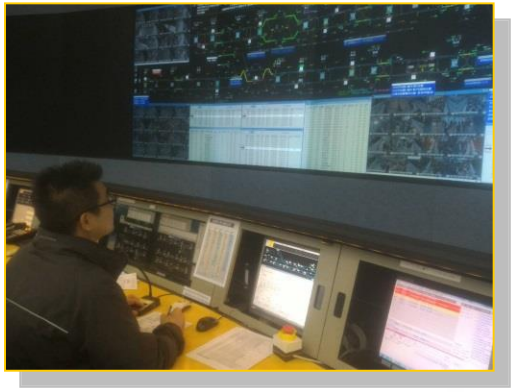
Abnormal behavior

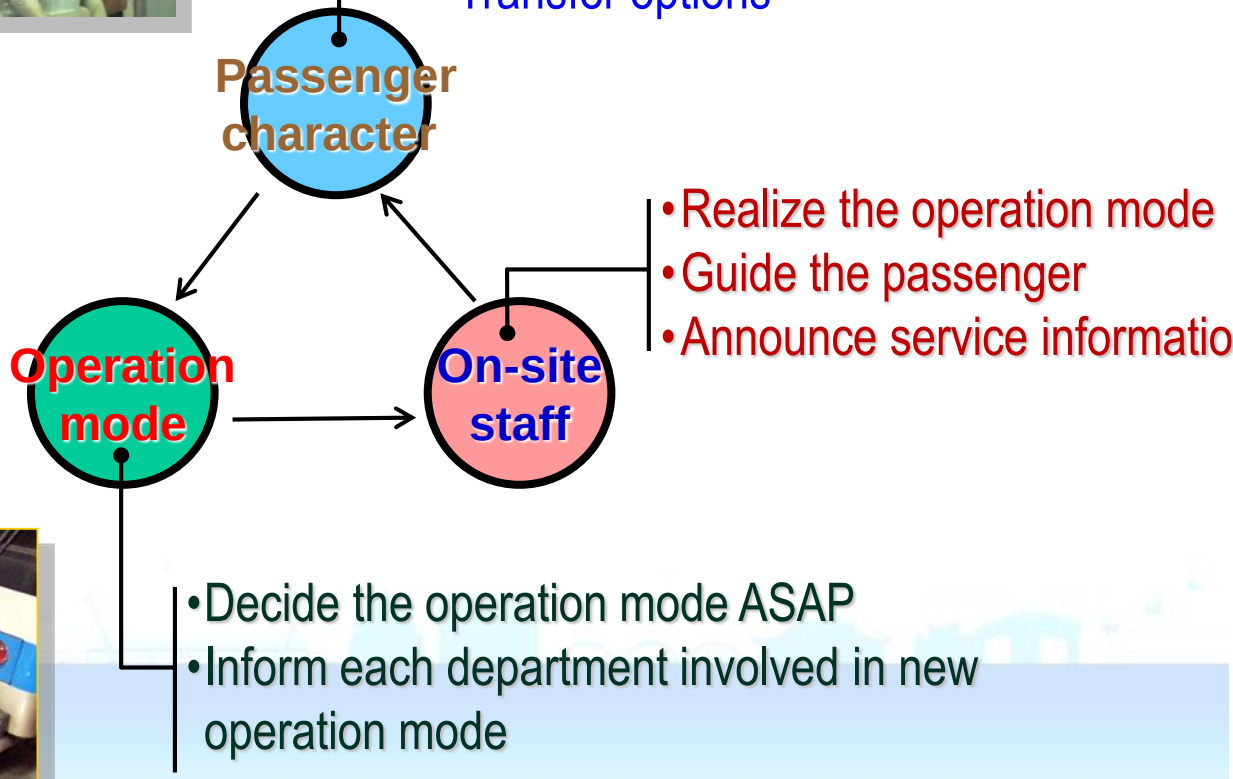
Injuries

Risky events

Passenger Factors

Emergency Response





Optimize the OCC Team Work

Minor event

Urgent event

Major event

Duty TC/LC

Dispatch decisions

Dispatch decision unit

Groups

- Event Section
- Non-Event Section
- Message Transfer
- The Other Support

Handle every aspect simultaneously via teamwork

Optimize the dispatch resources with the highest efficiency

Event occurs — Train service resumed

Confirmation | Dispatch decision | Event treatment

Instant Report and Assistant

Use the Direct Phones to inform the relevant units, like Police office, Fire brigade, Ambulance unit.


City Police Duty Center

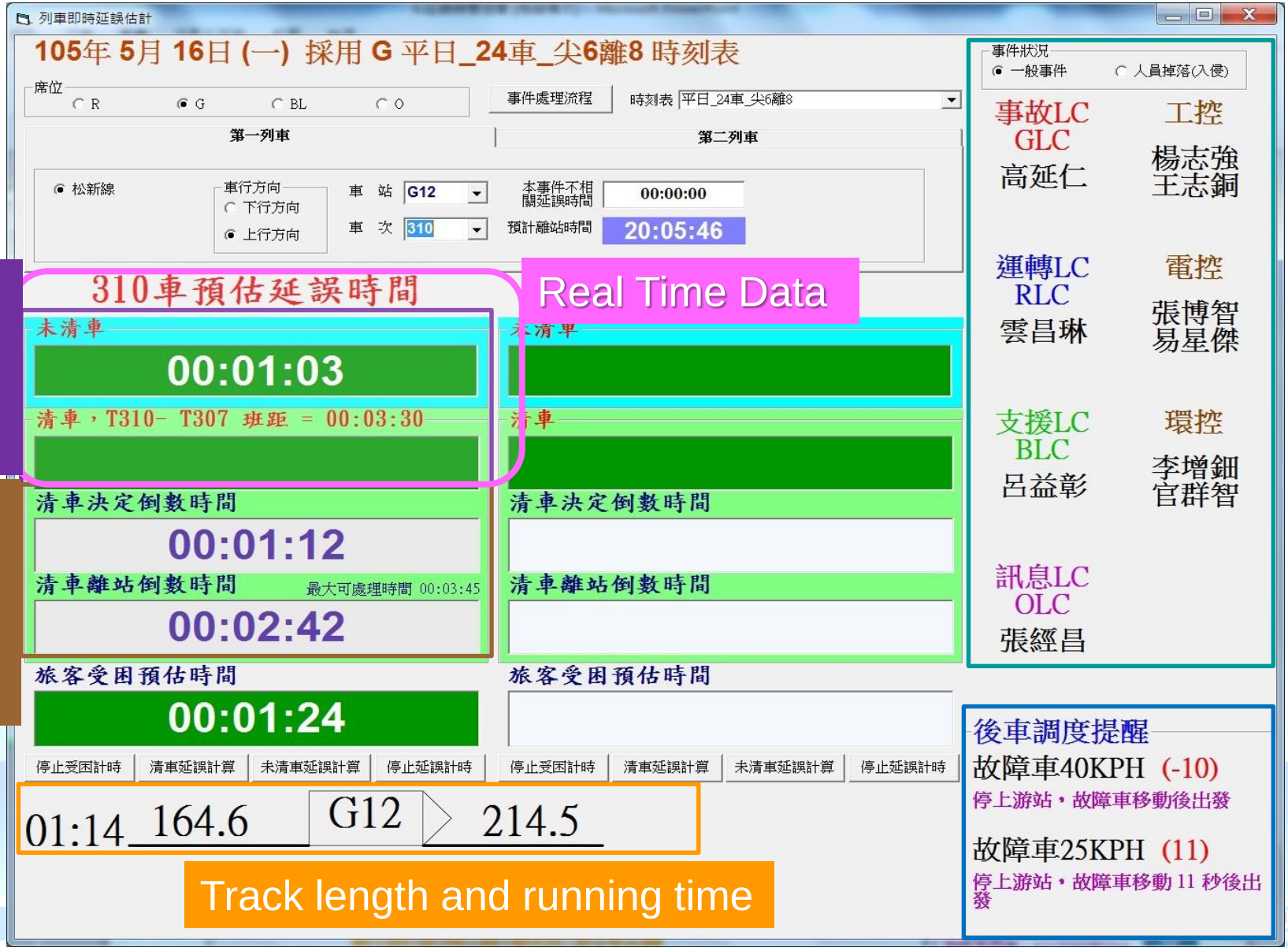

Metro Police Duty Center


Ambulance Unit

Preparation for Urgent Events

- According to operation experiences, keep on reviewing and developing methods to fit the OCC need.

Event Management System



Delay calculation

Detrainment reference

Task Assignment

Subsequent train

Incident Handling Guidelines

Benefits

- Clear Index (9 categories)
- Simplified Key Steps
- Assist and Guide the Crew

Signal Traffic error

VMP：

號誌電腦 HMI畫面	確認是否有交通方向消失
NFSR 強迫激磁	號誌維修於交通方向異常區段最下游車站強迫激磁NFSR。
備援VPI車站	嘗試切換VM(VS)排除
列車持續 RM通過	切換無效或該站無備援VPI，不需安排相鄰連鎖區軌道淨空

異常事件處理程序導覽&VMP重點提醒 3.1版_105.5.9

說明 修改歷程

Signal 號誌

- ◎AC/DC OFF(PS)
- ◎CF ◎VSC異常
- ◎號誌延滯 ◎VPI異常
- ◎交通方向 ◎月台門
- ◎轉轍器異常 ◎轉轍器圖說
- ◎軌道電路誤佔據
- ◎列車接收速度碼異常
- ◎轉轍器電子鎖定故障
- ◎防水隔艙異常 ◎圖說

Power 電力

- ◎三軌跳電投入失敗
- ◎三軌跳電檢視及調度原則
- ◎電纜起火冒煙
- ◎台電限電要求主變電站配合卸載
- ◎主變電站失能運務各席位職責
- ◎TSS異常轉供調度原則
- ◎三軌產生電弧(常閉MDS開啟)
- ◎ETS override ◎斷電不架SCD

R.S. 電聯車

- ◎EB ◎RM ◎越位
- ◎斷路器跳脫 ◎車門
- ◎爆炸撞擊巨響
- ◎火災 ◎火光冒煙焦味
- ◎選擇清車地點原則
- ◎中間站清車折返條件

Comm. 通訊

- ◎無線電異常
- ◎PCM/SDH故障

Nature 天然災害

- ◎下雨天 ◎颱風
- ◎地震2-3級 ◎4級以上
- ◎地震-土板南線晨峰

Train 運轉調度

- ◎迴龍站異常調度原則
- ◎營運期間下軌授權碼發放

Crime 危安事件

- ◎維安通報 ◎殺人事件
- ◎爆炸事件 ◎恐嚇威脅
- ◎可疑行李 ◎車上犯罪
- ◎爆炸事件 ◎可疑氣體
- ◎毒化物 ◎旅客攜帶刀械
- ◎捷運系統員工或旅客遭挾持
- ◎獲知或察覺系統內產生異味

Others 其他異常

- ◎車站火災、煙霧、焦味
- ◎FM200警訊現場確認原則
- ◎軌道異常 ◎軌道障礙物
- ◎軌道失火或煙霧

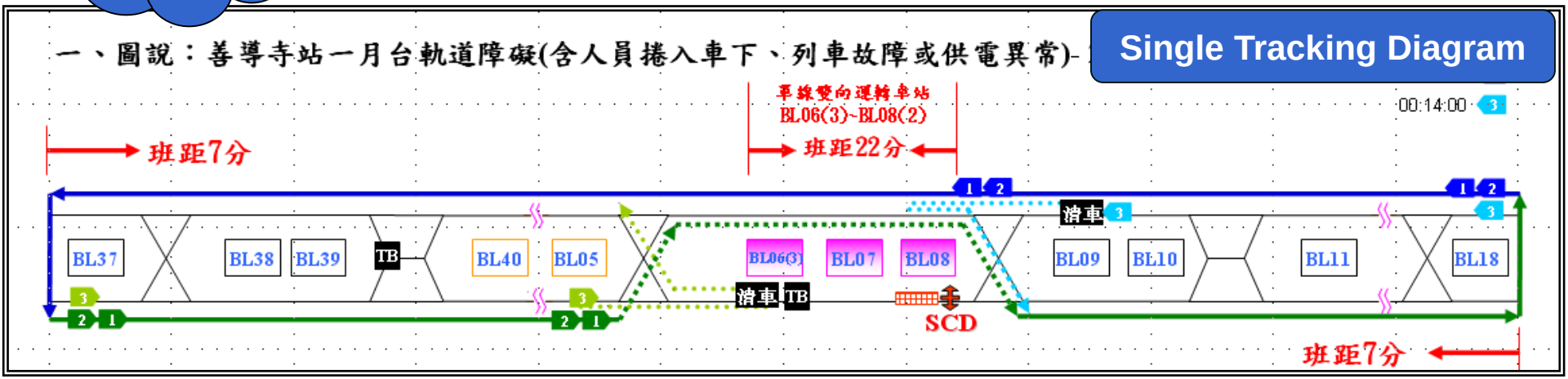
Passenger 人員異常

- ◎人員入侵 ◎動物入侵
- ◎人員掉落軌道
- ◎人員跌落軌道於車下
- ◎月台上旅客行為異常
- ◎月台上旅客與車內親友分開

Operation Diagrams

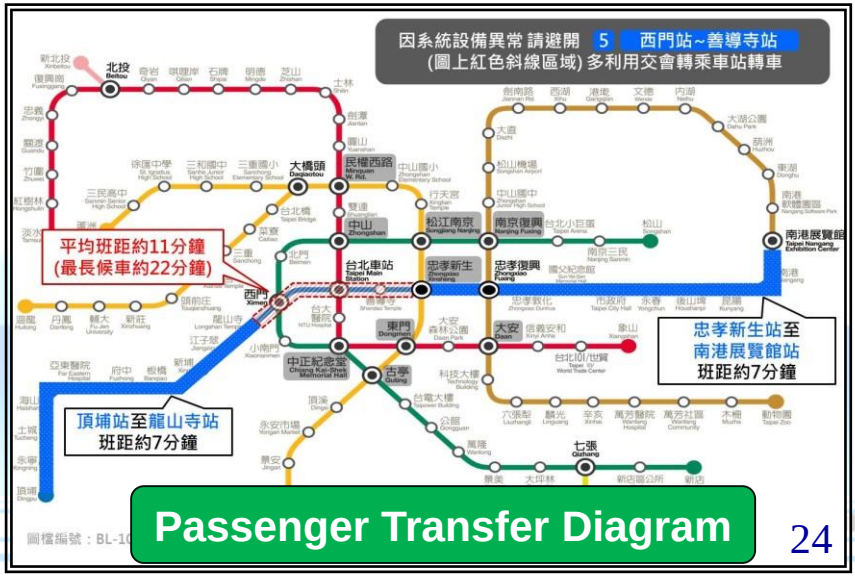
Optimization

- Evaluate best dispatch measures and make readable diagrams
- Shorten the response time of decision



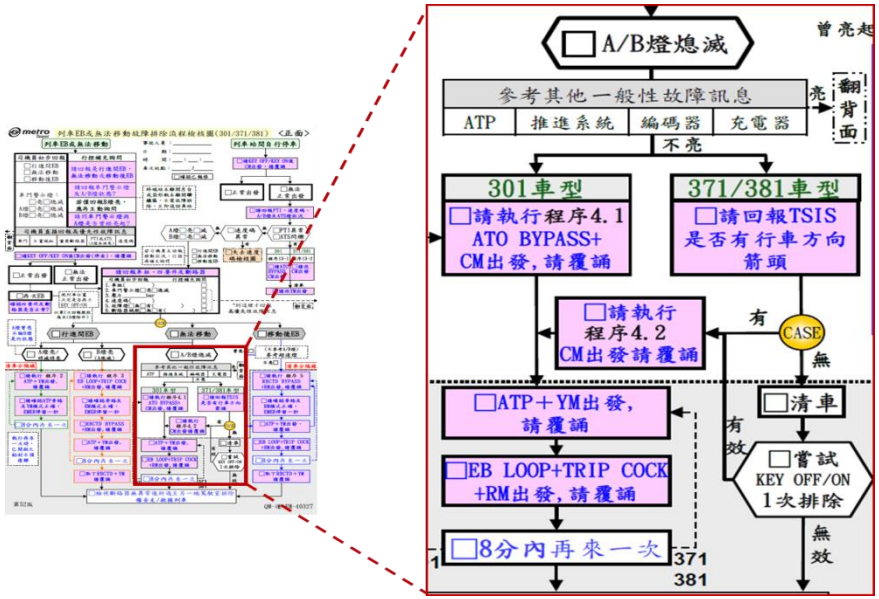
Operation Diagrams:

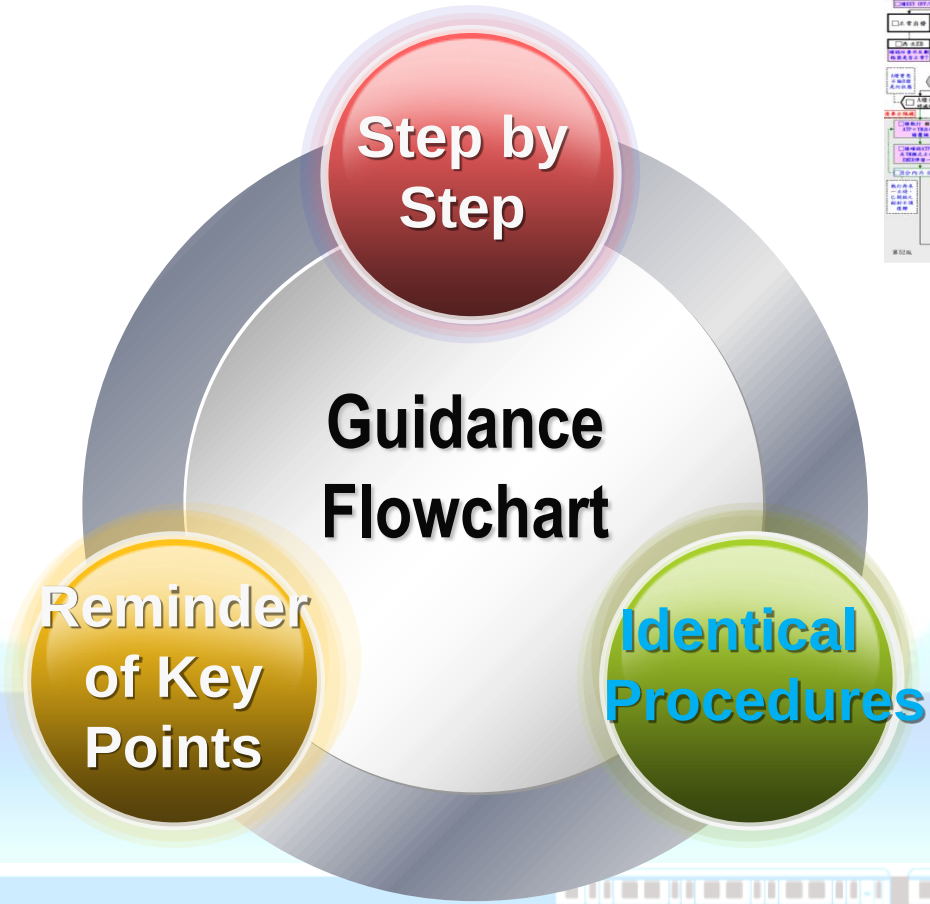
- Single Tracking: 306 sets
- Partial Service: 69 sets
- Passenger Transfer: 136 sets
- Switch Failure: 135 sets
- Track Down: 63 sets



Trouble Shooting Flow Chart

- Complicated procedure guidance
- Follow the flow chart

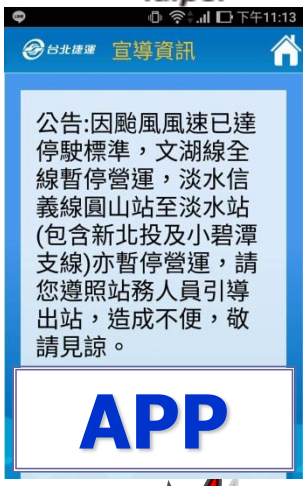


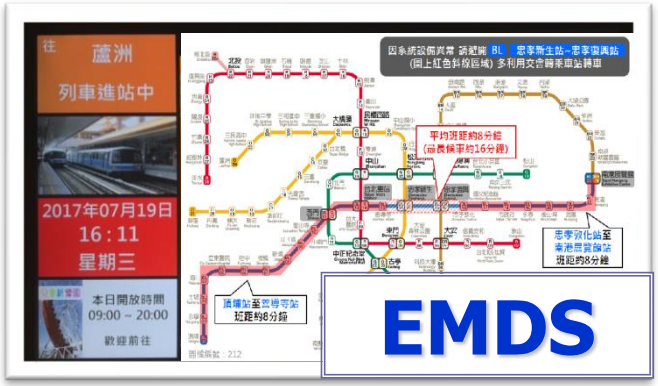


Flow chart categories

- EB or Stalled Train
- Speed Code Lost
- Station or Track Fire

Information Announcement





Event

OCC

SMS
LINE

Related Supervisors

Responsible Departments

Media Relations Section

Customer Service Center

Radio

PA/PIDS
/EMDS

Official Website
/Facebook/APP

Train Operators

Passengers on Trains

Passengers at Stations

Citizens intend to travel in MRT

Information Transmission

Stations/
Section Offices

Crew Sections/
Depots

Customer Service Center

Operation Information Announcement

Release event news & passenger transfer diagram to official website and facebook

➢ **Official Website**

➢ **Facebook Fan Page**

Compensation for Delay

(1) Token Refund

Full refund for single-trip tokens

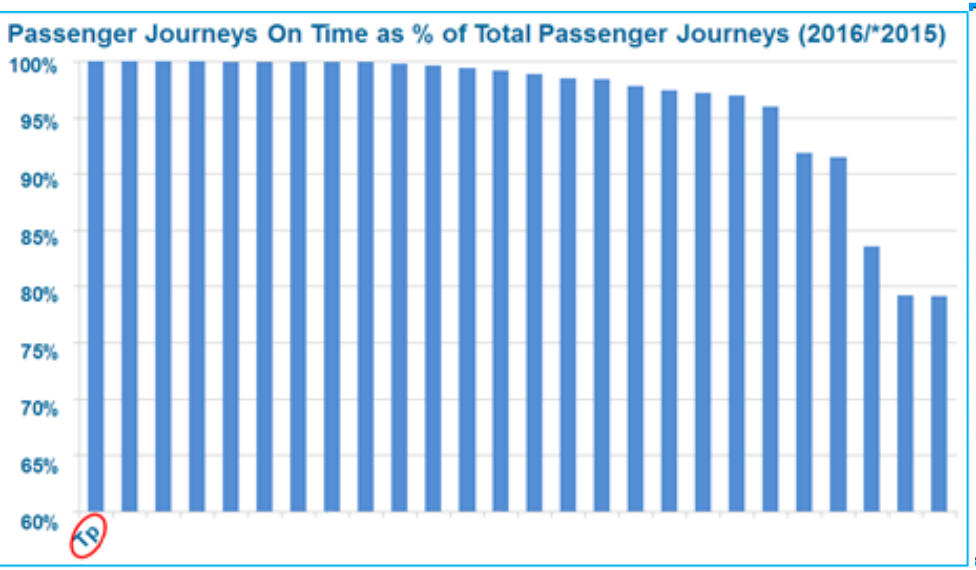
(2) Smartcard Refund

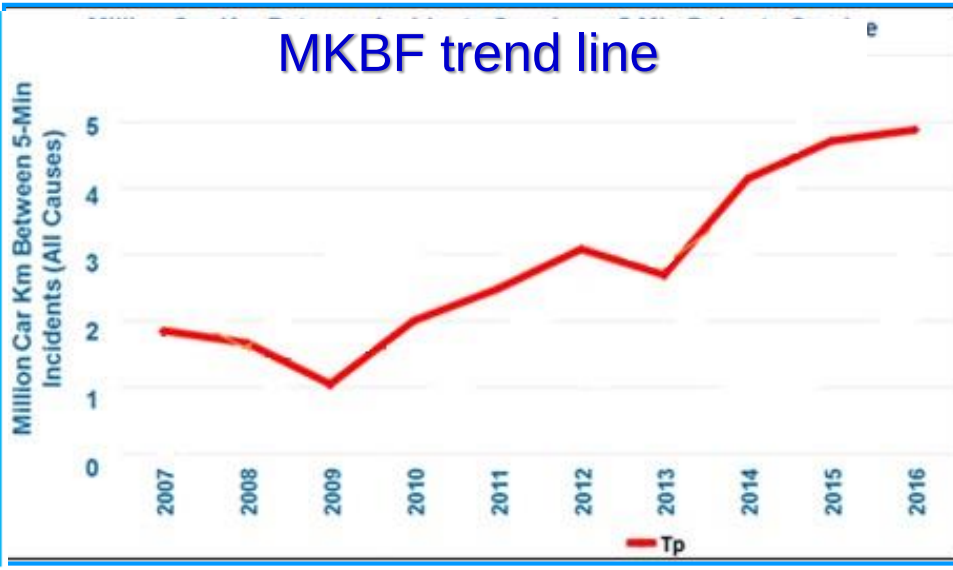
Also full refund for smartcard by modifying records(in upcoming 7 days)

(3) Free Ride Voucher

	Fare Refund	Free ride voucher
10 mins~20 mins	Full price	1 voucher
20 mins~40 mins	Full price	2 vouchers
40mins~60 mins	Full price	5 vouchers
More than 60 mins	Full price	Additional 3 vouchers for every 15 mins

Maintain High Punctuality and Reliability





$$\text{MKBF} = \frac{\text{Total actual Car km operated in revenue service (million)}}{\text{Total number of incidents resulting in a service delay of more than 5 min(s)}}$$

Mean car-**K**ilometers **B**etween service-delay **F**ailure of more than 5 min(s)

Q & A