STATE RAILWAY OF THAILAND
MINISTRY OF TRANSPORT

กรุงเทพฯ
Bangkok
ฉะเชิงเทรา
Chachoengsao
ชลบุรี
Chon Buri
ระยอง
Rayong

THE HIGH-SPEED RAIL LINKING THREE AIRPORTS PROJECT

REQUEST FOR PROPOSAL

VOLUME 2 : SRT'S REQUIREMENTS

VOLUME 2/1 : THE RAIL-RELATED WORKS OF THE PROJECT

PHASE 2 : OPERATION-MAINTENANCE

PART 2 : OPERATION CONCEPTS

AEC Sasin

Asian Engineering Consultants Corp., Ltd.
TEAM Consulting Engineering and Management Co., Ltd.
Sasin Graduate Institute of Business Administration of Chulalongkorn University

JUNE 2018

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1. GLOSSARY

Accident	A specific form of an incident, which causes damages or/and injuries.
Approval to Proceed	Authorization for a Driver to proceed. This may be given by a signal or verbally by the Controller.
Authorized Staff	An employee of the Private Party permitted to undertake a particular activity.
Course	The performance of one train scheduled for one day. The course may contain service on different lines.
Degraded Operations	An alternative program introduced when Regular Operations are not possible.
Degraded Systems Operation	Malfunctions or failures of one sub-system or of parts hereof degrade the quality of the service. The scheduled performance is provided. Minor delays up to 5 minutes may occur.
De-training	De-training is the ordered transfer of passengers out of a train to the platform.
Dwell Time	Time between arrival (stop) and departure (start of movement) of a train at train stops (includes the time for opening and closing the doors and for passenger change).
Emergency Operations	A (potentially) life threatening situation or danger to large parts of the system or property of the Private Party which may lead to evacuation of passengers and staff. The revenue service is limited or closed in sections of the net.
Emergency Team	Team of Maintenance experts formed according to the specific requirements of an incident.
Evacuation	Transfer of passengers via the infrastructure from an area of danger to one of safety. Evacuation may be controlled or uncontrolled.
Failure	The inability of a System or a Component to fulfill its operational requirements.
Headway	Time interval between a train trip and a subsequent train (of the same service / line), normally scheduled by the timetable.
Incident	An unintended event or sequence of unintended events.
Line	A defined connection between two or more stops that is regularly served by a train for passenger service.

Line Blockage / Blocking	Closure of one or both tracks. This can be planned, e.g., to undertake maintenance works or unplanned as a result of an incident.
Night-hour service	Revenue service during night time (approximately between 01:00 hours and 05:00 hours). The headway is defined by convenience criteria only. This time is mainly defined by operating and maintaining line-side equipment.
Off- peak service	Revenue service time with average or low passenger flow. The headway normally defined by convenience criteria.
Private Party	The company operating and maintaining the PPTA HSR-CITY LINE Railway Systems.
Pulling	The activity of hauling one train or vehicle with another (failed train is at the end in running direction).
Pushing	The activity of propelling one train or vehicle with another (failed train is at the front in running direction). The failed train will be brought to the Depot as soon as possible.
Regular Operations	Regular Operations are operations of the system when scheduled services are possible on the entire Line without impairment and hazard to staff or passengers. Slight delays up to 2 minutes are considered as regular operations.
Revenue Service	Means the operation of the System or any portion thereof, as a means of transport for fare paying passengers.
Reversing Time	Time needed to provide an arrived train for departure; including cab change (if required), change of platform, measured between the time when all arriving passengers have left the train until the train is ready for boarding; In case the arrival and departure platform is identical (platform reversing), the dwell time overlaps with the reversing time.
Reversing Tracks	Tracks designed to enable the trains to return (change the running direction of 180 degrees), located at the end of the Line or other defined terminals.
Route	Signalling item of defined distance that contains different elements (turnouts, track circuits, signals). The route is protected against adverse train runs.
Running Time	Time for train movement between two defined locations.
SA City Line (SAC)	Suburban Rapid Transit Service (Commuter Rail Service) – Rail link with intermediate stations between the SA Airport Terminal station and the Phaya Thai station in the city of Bangkok

Shunting Movement	Intentional movements of trains / rail vehicles mainly in the Depot area. A shunting movement has a defined intention which shall be agreed by all participants before the movement is executed.
Shutting down a train	A procedure to switch off all systems of a train mainly carried out by a driver when stabling a train.
Shuttle Service	In general a degraded mode of operation. Trains operate over a single Line between two defined stations.
Stabling Area / Tracks	Tracks or sections of tracks on the Line, where trains are usually parked and cleaned inside.
System	Means the project as an entire unit consisting of the different subsystems.
Terminal Station	Train stations at the physical end of the Line or defined intermediate train stations, where trains reverse according to the timetable.
Third Parties	External authorities, organizations or companies who may have an interest in the activities of the Private Party (e.g., during an incident) or from whom assistance may be obtained.
Timetable	The planned system of departures, arrivals and train runs between origin and destination (mainly for revenue service) will regulate train movement to the active timetable.
Travel Speed	The average speed of a train from terminal to terminal (or for a section of the Line) determined by the covered distance and the travel time (i.e. including reserve times and dwell times).
Trip	For trains: run between two or more stops without reversing. For passengers: run between stops.
Turnaround Time	Time needed by a train from the departure at one train stop to be ready for the departure at the same location into the same direction; sum of run time for the whole Line in both directions + dwell times + reversing time at both terminals.
Workshop Building	Tracks in and in front of the workshop building, where trains are being maintained. Divided into heavy maintenance hall (crane, no OCS, pits) and light maintenance hall (OCS, elevated tracks).

2. ABBREVIATIONS

AC	Alternative Current
AFC	Automated Fare Collection
AIM	ATP Isolated Mode

AR	Automatic Reversing
ATC	Automatic Train Control
ATO	Automatic Train Operation
ATP	Automatic Train Protection
ATS	Automatic Train Supervision
BCU	Brake Control Unit
BIM	Bulk Initialization Machine
BMR	Bangkok Metropolitan Region
BTS	Bangkok Transit System
CASS	Controlled Access Security System
CAT	City Air Terminal
CCR	Central Control Room
CCS	Central Computer System
CCTV	Closed Circuit Television
CCU	Central Master Clock Unit
COM	Communications
CSP	Correct Stopping Point
DM	Depot Mode
DMB	Driving Motor Baggage
DMOS	Driving Motor Open Standard
DMO1	Driving Motor Open 1
DMO2	Driving Motor Open 2
DRS	Digital Radio System
DTS	Digital Transmission System (= OTN – Open Transport Network)
DVRS	Digital Video Recording System
E&M	Electrical and Mechanical
EB	Eastbound (Track)
ECR	Emergency Control Room
ECS	Environmental Control System

EED	Emergency Escape Door
EMC	Electro-Magnetic Compatibility
EMU	Electrical Multiple Unit
FAM	Fare Adjustment Machine
FIDS	Flight Information Display System
GPS	Global Positioning System
GUI	Graphic User Interface
IT	Information Technology
LAN	Local Area Network
LED	Light Emitting Diode
LCD	Liquid Crystal Display
LZB	Continuous Automatic Train Control System
MAN	Metropolitan Area Network
MEA	Metropolitan Electricity Authority
MMI	Man Machine Interface
Mbps	Mega Byte per second
MRTA	Metropolitan Rapid Transit Authority
NFPA	National Fire Protection Association
NTP	Network Time Protocol
O&M	Operation and Maintenance
OCC	Operation Control Centre
OCS	Overhead Catenary System
OTN	Open Transport Network (= DTS – Digital Transmission System)
PA	Public Address System
PABX	Private Automatic Branch Exchange
PC	Personal Computer
PIS	Passenger Information System
PSD	Platform Screen Doors
PTO	Pantograph Trailer Open

PTOSLW	Pantograph Trailer Open Standard Lavatory Wheelchair
PTZ	Pan Tilt and Zoom
RMM	Restricted Manual Mode
RTU	Remote Control Unit
SAS	Station Accounting System
SC	Station Controller
SCADA	Supervisory Control and Data Acquisition
SCD	Station Control Desk
SCR	Station Control Room
SIG	Signalling
SIL	Safety Integrity Level
SMM	Supervised Manual Mode
SMS	Station Management System
SRT	State Railway of Thailand
TCU	Traction Control Unit
TO	Trailer Open
ToR	Top of Rail
TOS	Trailer Open Standard
TOM	Ticket Office Machines
TPSS	Traction Power Supply Substation
TR	Ticket Reader
TVM	Ticket Vending Machine
UPS	Uninterrupted Power Supply
WB	Westbound (Track)
WM	Wash Mode

3. EXECUTIVE SUMMARY

Introduction

This Operations Plan is based on the Operations Concept, which was part of the initial Airport Rail Link Project from Suvarnabhumi Airport to Phaya Thai Station. This document shall serve as a basis for future Private Party who is not yet appointed. This Operations Plan forms the overall basis of the railway operation of Don Mueang to U-Tapao Railway Line and complies with international standards.

The Operations Plan is important for the Key Element "highest passenger attraction" and balances between competitive initial investment and economic operational and maintenance efforts.

This plan describes the operational provisions to prevent irregularities of the rail service or to limit the consequences to a minimum and to restore regular operations in the shortest time. In general the single failure case will be considered for description of the degraded operations.

The proven design and the performance features of the high-speed trains combined with the updated Passenger Forecast Calculations have been used as a basis for the calculations of headway, running time and fleet size.

4. SERVICE OBJECTIVE

The Private Party (responsible for operations and maintenance) shall be the principal facilitator to put the Revenue Service for the Don Mueang – U-Tapao Railway line into operation.

It will be the objective that from commencement of Revenue Operations of the extension of the Airport Rail Link to Don Mueang and to U-Tapao the services shall operate under reliable, safe, clean and efficient means of transportation and meet the demands of the passengers with an excellent service.

This service objective shall be achieved by a properly organized and proactive management combining the staff of the initial System with additional staff necessary for the extension of the system.

Confident, motivated and well-trained personnel shall be the basis for success in operations and maintenance of the complete system.

5. KEY OPERATION DATA AND PARAMETERS

Key operation data and parameters based on the ridership forecast clause 7

Line Length Total line length Don Mueang – U-Tapao **Extension :** Don Mueang – Suvarnbhumi Suvarnabhumi – U-Tapao	 app. 220 km. app. 49 km. app. 171 km.
Maximum possible gradient Maximum gradient applied	4.0 % 3.5 %
Track gauge (Standard Gauge)	1.435 m
Minimum track radius (Main Line)	1,700 m
Number of stations: High Speed Trains : Don Mueang, Bang Sue, Makkasan, Suvarnabhumi, Chachoengsao, Chon Buri, Si Racha, Pattaya and U-Tapao City Line : Don Mueang, Bang Sue, Phaya Thai, Ratchaprarop, Makkasan, Ramkamhaeng, Hua Mak, Baan Thap Chang, Lat Krabang and Suvarnabhumi	15 9 10
Maximum Operational speed: Main Line (Don Mueang –Phaya Thai - Suvarnabhumi) Main Line (Suvarnabhumi – U-Tapao) Depot Area	 160 km/h 250 km/h 25 km/h
Platform length: Bangsue Station Other Stations	 Not less than 420 m. Not less than 210 m
Daily Operation Times: High Speed Service Don Mueang -U-Tapao City Line	 6:00 –22:00 hours 5:00 – 24.:00 hours
Dwell times: at intermediate stations : City Line Trains at intermediate stations : High Speed Trains Reversing times, minimum (including dwell times): at direction reversal stations (City Line Trains) at direction reversal stations (High Speed Trains)	 30 sec 60 sec 180 sec (3 min) 300 sec (5 min)

Trip Times: City Line (Don Mueang – Suvarnabhumi) High Speed Trains Stop 3 airport : Don Muaeng – Suvarnabhumi - U-Tapao Stop every station : Don Muaeng – Si Racha Don Muaeng – Suvarnabhumi - U-Tapao	 45 min 70 min 75 min 110 min
Traction Power System	2 X 25 kV 50 Hz AC, OCS
Automatic Fare Collection (AFC)	Closed Ticketing System with the capability of upgrading for working with multiple operators and shall comply with Common Ticketing System by Ministry of Transport

6. SYSTEM DESCRIPTIONS

6.1 General System Layout

The High Speed System from Don Mueang to U-Tapao has 3 purposes: First to provide a fast rail link between the central city area and the Airports of Don Mueang, Suvarnabhumi and U-Tapao. The System should serve as connection between the three Airports to deliver a fast and convenient transportation opportunity for Passengers who have to change flights on the different Airports.

Second to provide a suburban rapid transit service for the commuters in the eastern corridor of Bangkok Metropolitan Region (BMR). Furthermore the City Line can be used reaching three further stations to connect to the SRT Red Line.

Third to provide High Speed Rail Service in the south eastern region between Don Mueang and U-Tapao

The High Speed concept consists of two different services:

- High Speed Airport Connection:

The High Speed Train will operate between Don Mueang, Suvanrnabhumi Airport and U-Tapao Airport with the following intermediate stops:

- Bang Sue
- Makkasan
- Chachoengsao
- Chon Buri
- Si Racha

- Pattaya

- City Line:
  The City Line will operate between Phaya Thai station and Suvarnabhumi Airport with 6 intermediate stations with the future Extension from Phaya Thai to Don Mueang with additional intermediate stations at Bang Sue.

The System has a total length of approximately 28.8 km in the initial stage additional 20.2 km will be added for the extension to Don Mueang and further 205 km for the extension to U-Tapao. The station platform length is 210 m except for Bangsue Station, which is appr. 420 m. and enable the use of multiple coupled train-sets. The platform length for the extension should be at least the same as for the existing system. Reversing of trains will be performed at the platform tracks.

There are several interchange stations with the two existing urban mass transit systems, the BTS and the MRTA. Phaya Thai is the interchange station of the City Line with the elevated BTS (Skytrain) and Makkasan interchange station with the underground MRTA system, for both City Line services, the High Speed Line services.

Future interchanges to SRT services will be possible in Bang Sue, Makkasan and Don Mueang as well as for all High Speed Train Stations along the new line from Suvarnabhumi to U-Tapao.

The System is double-tracked using the standard gauge of 1.435 m, which should be used for the extension of the system as it is a prerequisite for a reliable operation at a maximum operational speed of 250 km/h from Suvarnabhumi to U-Tapao and of 160 km/h from Don Mueang to Suvarnabhumi.

Depending on the wideness of the new High Speed Trains the curved track between Lad Krabang and Suvarnabhumi may has to be modified in regards to the distance centre track to centre track (currently 4.00 meter) under the cost and responsibility of the Private Party, this applies to possible the modifications of platforms as well.

The System is equipped with an Overhead Catenary System (OCS) supplying traction power with a voltage of 2 X 25 kV AC and a frequency of 50 Hz. The OCS will is fed from the Traction Power Substation, located next to the railway line approximately at kilometer 8.000 near the Ramkhamhaeng station, separately for each track of the Line. This enables the execution of maintenance works during the nighttime. For the extension of the system adequate principals shall be applied.

The System is controlled by means of a continuous automatic train control system (ATC). Three interlockings are located along the Main Line and will be monitored and controlled from a central Operations Control Centre located in the Depot.

During Regular Operation, the trains run on the left side of the Line. The signaling system will allow bi-directional operations.

Hua Mak station is provided with sidings. The sidings are normally be used only by City Line Trains. These sidings will allow passing of City Line trains by High Speed Trains, if required by the timetable or in case of Degraded Operations. The sidings can also be used to stable trains during the nighttime. Similar principles for degraded operations will be applied for the intermediate stations along the line from Suvarnabhumi to U-Tapao.

The Automatic Fare Collection System is a closed automatic ticketing system, separating paid and unpaid areas, which should be used in the extension of the System to Don Mueang in the same or similar way.

The Automatic Fare Collection System for High Speed Trains will be a Paper Ticketing Systems

6.2 Basic Track Layout

The basic track layout of the System including the extension to Don Mueang and to U-Tapao is shown in Annex 1.

The System has a double track layout. The crossovers will be located in front of the platform tracks of the terminal stations and the stations along the Line from Suvarnabhumi to U-Tapao to enable a reversing of trains at the platform from where the train will depart after the station dwell. This ensures short reversing times.

Generally, the station platforms of the High Speed Trains and the City Line Trains are separated. At the Suvarnabhumi station the island platforms for both services enable the use of both tracks without any difficulties in guiding the passengers.

At the 4-track Makkasan station the platforms for the High Speed Trains are separated but adjacent to the platforms of the City Line trains.

During Regular Operations the eastbound track (EB) at Makkasan Station is intended to be used for arrival and departure of the High Speed Trains.

This operational layout has the following advantages:

The passenger flow for arriving and departing passengers is always constant and does not require any additional information system about the High Speed Train platform, especially for departure of trains.

Hua Mak station is equipped with sidings for passing. This layout, as shown in Annex 1, provides high operational flexibility

In combination with the transition tracks to the depot, whereby one is under passing the main line the track layout provides the opportunities to feed both tracks, each by one of the transition tracks. Opportunities for alternative operation programs are provided by the crossovers.

An additional crossover west of Hua Mak station is recommended to increase operational flexibility during irregularities or in case of blocked track sections due to scheduled maintenance works.

6.3 Stations

The initial stage of the System will comprise a total of 10 stations, each served by the City Line, whereas the High Speed trains are operating non-stop between the airport and the CAT(This service is not provided at the moment). The future extension to the north comprises of two more stations. 1 intermediate Station, Bang Sue and 1 terminal Station Don Mueang at the northern end of the line. The future extension to the southeast comprises of six more stations. 4 intermediate stations, Chachoengsao, Chon Buri, Si Racha and Pattaya. The terminal station is U-Tapao Airport.

The platforms have a length of approximate 210 meters and a width of 6 to 10 meters except Bangsue Station which has a length of approximate 420 meters.

For scheduled and unscheduled passing of trains the following stations are equipped with side tracks (4 track station).

- Hua Mak
- Chachoengsao
- Chon Buri
- Si Racha
- Pattaya

The sidings are located on the left hand side of the running direction.

Each station has a station building providing an area for office rooms with monitoring facilities, ticket office and rooms for technical equipment.

The following table serves as a guideline and gives an overview about the main parameters of the stations.

Station	Chainage	Abbr.	Type of platform	Particularity
Don Mueang	20+672	DMU	Side Platforms	2 tracks
Bang Sue	6+281	BSG	1 Center Platform	Double Length
Beginning of ARL Extension	0+000			
Phaya Thai	0+179	PTH (E1)	side platforms, elevated	2 tracks; future extension to Bang Sue; interchange with BTS
Ratchaprarop	0+982	RPR (E2)	side platforms, elevated	2 tracks

Station	Chainage	Abbr.	Type of platform	Particularity
(City Air Terminal) Makkasan	3+000 (SAE) 3+215 (SAC)	MAS (E3)	separated island platforms for High Speed and City Line, one side used, elevated	4 tracks, interchange with MRTA; interlocking
Ramkhamhaeng	7+399	RKH (E4)	side platforms, elevated	2 tracks
Hua Mak	12+305	HUM (E5)	island platforms, elevated	4 tracks; interlocking
Ban Thap Chang	17+267	BTC (E6)	side platforms, elevated	2 tracks
Lat Krabang	23+498	LKB (E7)	side platforms, elevated	2 tracks, interlocking
SA Terminal (Airport)	28+650	SVB (E8)	island platforms, underground	4 tracks, PSDs
Chachoengsao	64+839	CCS	Island platforms	4 tracks
Chon Buri	113+449	CHB	Side platforms	4 tacks
Si Racha	136+119	SRA	Island platforms	4 tracks
Pattaya	160+929	PAT	Island platforms	4 tracks
U-Tapao	196+410	UTP	Island platforms, underground	4 tracks, PSDs

Table : Stations - Overview of Parameters

6.4 Depot / Workshop

The existing (Khlong Tan) depot, located west of Ramkhamhaeng station, will include the workshops, the stabling yard, Control Centre and the administration offices. The new depot will be located at Chachoengsao Area for supporting only HSR

The depot provides facilities for the operations of the system, maintenance of trains and infrastructure, stabling and cleaning of trains.

Such facilities are:

- OCC with CCR,
- Offices,
- light and heavy maintenance tracks,
- test track,
- stabling tracks,
- washing plant,

- under floor wheel-lathe,
- cranes,
- Depot Main Workshop Building with various maintenance equipment,
- workshop for auxiliary vehicle(s) including workshops for infrastructure,
- Emergency Control Center in the infrastructure workshop building,
- store,
- technical equipment rooms

Shunting movements in the depot area will be carried out guided by local signals under the responsibility of the train driver and will be supervised by the Depot Controller.

Train movements within the depot are limited to a maximum speed of 25 km/h. Designated facilities as the washing plant and the under floor wheel-lathe will be passed with a lower speed (5 km/h or less).

Joining tracks will be marked with fouling points near the turnouts.

The size of the depot area allows the provision of a fully equipped test track with a length of approximately 1,200 meters. This will enable a testing speed of approximately 70 – 80 km/h. The test track will be provided with facilities to test signaling function as well as basic train functions (e.g. brakes). Tests requiring maximum speed will be executed on the main line, especially after revenue service.

The depot has two transition tracks from the main line as shown in "Annex 2 The transition tracks are located at the west side of the depot area.

For the general Depot track layout please refer to Annex 2.

7. RIDERSHIP

The operational layout of the System, including the calculation of operational headways, train configuration and fleet size. The Ridership Forecast shall serve as a guideline for the Private Party to have a common understanding of performances and provisions. The Private Party shall provide an actual Ridership Forecast, which shall result into Train Calculations, Timetables and Headways etc. All documents shall be submitted and approved by SRT before revenue service.

ARL

Station	2566		2576		2586		2596		2606		2616	
	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting
ดอนเมือง	10,080	8,800	12,460	11,360	15,510	14,220	18,030	16,510	18,630	17,640	19,510	18,960
บางซื่อ	13,160	13,550	16,770	16,950	20,360	20,690	23,360	23,600	24,700	24,600	25,860	25,510
พญาไท	19,710	19,960	24,000	25,000	30,380	30,470	36,110	36,630	39,310	39,370	42,200	42,730
ราชปรารภ	7,970	8,010	9,880	10,070	11,770	12,320	14,350	14,010	15,160	15,210	16,530	15,990
มักกะสัน	11,780	11,740	14,950	15,040	18,150	18,230	21,330	21,580	22,620	22,910	22,960	23,150
รามคำแหง	8,110	8,810	10,630	11,090	12,470	12,640	14,980	15,200	16,040	16,330	16,890	16,880
หัวหมาก	9,260	9,250	11,890	11,720	13,990	13,960	17,080	16,430	18,270	17,720	20,050	19,880
บ้านทับช้าง	5,230	5,470	6,620	6,830	7,840	8,120	8,760	9,230	9,430	9,670	9,590	10,320
ลาดกระบัง	9,230	9,460	11,600	11,670	13,520	13,720	15,210	15,830	15,980	16,170	16,560	16,380
สุวรรณภูมิ	11,480	10,960	14,540	13,610	18,430	18,050	20,470	20,660	21,180	21,700	21,820	22,170
Total	106,010	106,010	133,340	133,340	162,420	162,420	189,680	189,680	201,320	201,320	211,970	211,970
Max Line Load (pphpd)		4,670		5,860		7,080		8,310		8,810		9,350
Average Distance (km)		19.3		19.3		19.5		19.2		19.0		18.9

HSR

Station	2566		2576		2586		2596		2606		2616	
	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting
ดอนเมือง	3,960	4,290	5,000	5,440	5,840	6,330	6,340	6,970	6,490	7,200	6,850	7,490
บางซื่อ	6,110	6,160	8,200	8,200	9,720	9,910	10,780	10,940	11,130	11,310	12,050	12,190
มักกะสัน	6,540	6,200	8,190	7,880	9,540	9,090	10,500	10,000	10,810	10,390	11,800	11,150
สุวรรณภูมิ	5,800	5,660	9,310	9,280	12,260	12,070	14,600	14,370	15,740	15,510	17,340	16,920
ฉะเชิงเทรา	6,100	6,190	9,360	9,450	11,450	11,650	14,000	14,180	15,120	15,290	16,990	17,210
ชลบุรี	3,540	3,590	4,610	4,700	5,490	5,630	6,030	6,150	6,240	6,310	6,810	6,940
ศรีราชา	3,800	3,870	4,950	4,970	5,820	5,870	6,400	6,550	6,720	6,760	7,280	7,410
พัทยา	3,420	3,470	4,590	4,610	5,370	5,430	5,920	5,980	6,110	6,180	6,620	6,770
อู่ตะเภา	1,920	1,760	4,320	3,990	6,570	6,080	8,390	7,820	9,260	8,670	10,100	9,760
ระยอง	-	-	-	10	-	-	-	-	-	-	-	-
Total	41,190	41,190	58,530	58,530	72,060	72,060	82,960	82,960	87,620	87,620	95,840	95,840
Max Line Load (pphpd)		1,840		2,670		3,300		3,820		4,050		4,430
Average Distance (km)		109		112		114		114		114		114

8. BASIC OPERATION DATA

8.1 General

The proposed services meet the minimum level of service defined by the required transport capacities and will provide a service attracting passengers in the periods of low traffic demand.

Requirements of the specification, which could be improved, are mentioned in the following chapters accordingly.

8.2 Operation Times

The daily operation times are as follows:

High Speed Service: 06:00 – 22:00 hours (16 hours operation)

City Line Service: 05:00 – 24:00 hours (19.00 hours operation).

Both services will operate each day from Monday to Sunday. Revenue Service will be provided the whole year (365 calendar days).

8.3 Speeds

The maximum operations speed is 250 km/h from Suvarnabhumi to U-Tapao and 160 km/h from Don Mueang to Suvarnabhumi. Appropriate restrictions in curves and through turnouts have to be considered. The Design Speed for the System is 280/176 km/h

For the depot area a speed limit of 25 km/h will be applied.

The following table gives an overview on the speeds to be applied.

Case	Speed (km/h)	Remarks
Maximum Operation Speed	250 160	Suvarnabhumi to U-Tapao, limited in curves Don Mueang to Suvarnabhumi, limited in curves
Restricted Manual Mode (RMM)	25*	Restricted ATP functionality. Driver must obey line side signals.
Dead end sections	40	Valid approximately 200 meters in front of the buffer stop
ATP Isolated Mode (AIM)	25*	All ATP functions have failed or are not available (switched off) for any reason (e.g. pushing of failed train) or train not equipped with ATP.
Depot Area	25	Restricted ATP functionality. Driver must obey lineside signals.
Wash Mode	5	To be applied for coupling, too
* a higher speed can be considered for operational reasons.		

The average trip speed (commercial speed) from station to station includes the boarding/alighting time at intermediate stations along the Line. Reversing and dwell times at the end stations are not included.

8.4 Station Dwell Times and Passing

An average dwell time of 30 seconds will be provided for all intermediate passenger stations of City Line service during peak and non-peak hours. This time will allow alighting and boarding of passengers and includes the time required for the vehicle door operation. The effective dwell time for alighting and boarding will be approximately 25 seconds.

For the High Speed Trains the dwell time in the intermediate stations will be appr. 60 seconds the reversing time at the Terminal and the new stations of the extension Don Mueang and to U-Tapao will last 5 minutes or more depending on the applied headway.

8.5 Trip Times and Turnaround Times

The trip calculations are the result of a computer-based operational simulation. The simulations include a factor of approximately 5% for contingency time.

Existing System

The trip times for the initial stage (8 stations) without passing of both services are as follows:

City Line : Don Muaeng – Suvarnabhumi 45 minutes

High Speed Train :

Stop 3 Airports :

Don Mueang – Suvarnabhumi – U-Tapao 70 minutes

Stop every Stations :

Don Mueang – Si Racha	75 minutes
Don Mueang – Suvarnabhumi – U-Tapao	110 minutes
The total Turnaround Times	
High Speed: Don Mueang – Suvarnabhumi - U-Tapao	225 minutes
City Line: Don Mueang – Suvarnabhumi	93 minutes

8.6 Reversing Time

At the terminals, where the trains will change the running direction (reversing) the reversing time is defined. The reversing time contains the following components:

Time for cab change (walking time of driver and time for deactivation / activation of cabs). This time is assumed with approximately 2 - 3 minutes. In case of a delay or with step-back drivers this can be shortened to 1 minute.

Time allowance to compensate delays. A part of this time can be determined by waiting for the scheduled departure time in order to provide the headway (of e.g. 15 minutes). This time should be kept as low as possible in order to operate the system with a high efficiency.

The following minimum reversing times are assumed:

Terminal	Reversing Time	Remark
City Line Trains Phaya Thai, Bang Sue Station and Suvarnabhumi	3 minutes	Dwell time is included with 1 driver
High Speed Trains Don Mueang, Suvarnabhumi, U-Tapao	5 minutes	Dwell time is included with 1 driver

Table : Reversing Times

Those reversing times will be regularly considered for the elaboration of the timetable.

Deviations will be allowed as follows:

- Shortening of reversing time may be applied in order to minimize the number of trains needed for a defined time (e.g. to save one shift). This can be done by deleting parts of the reserve time. A longer reversing time will be scheduled for the next terminal.
- An extension of the reversing time might be possible to provide the train at a pre-defined departure time.
- The reversing time may be shortened for the City Line Train in general if a step-back driver is used.

8.7 Train Capacities

This Concept for the Airport Link System is based on the existing Siemens Desiro family of Electrical Multiple Units, which are in service in the United Kingdom, Germany, Malaysia and Bangkok.

The train can be provided in different configurations. Train sets consisting of 3- and 4-car units are considered for the City Line services. Up to three train sets can be coupled for operations on the Line. The following table shows the capacities, which can be provided by the different train configurations.

Train Configuration	Seats	Standees (at 6 pers/m2)	Passengers (total)
High Speed Trains:			
8-car train	450 - 600	n/a	450 - 600
City Line Trains:			
3-car train	150	595	745
4-car train	200	810	1,010
4+3-car train	350	1,405	1,755
4 + 3 + 3-car train	500	2,000	2,500

The High Speed trains will not operate with standing passengers.

The standees capacity for the City Line trains is calculated for 6 persons per sqm.

8.8 Operational Headways

The necessary headway depends on the ridership demand (maximum peak load) on one hand and the train capacities and train configuration on the other hand. The following tables show the calculated headways, the required train configuration and the number of trains in operation (O&M reserve not included) for the services based on the ridership demand in the target years. The following tables are calculated for a period 2023 to 2073

However, it is to be noted that the existing system is able to operate with a headway reduced to 7 min

Table : Headways and Train Demands for High Speed Trains

High Speed Train						
Summary Train Configuration from 2023 - 2073						
Year	Peak Hour Passenger per direction	Headway (min)	Train Configuration	Trains in Operations	Capacity of one Train (passengers)	Capacity of Trains in Operations Per Hour
2023	1,840	20	8 - car	12 + 2	600	1800
2033	2,670	13	8 - car	16 + 2	600	2769
2043	3,300	11	8 - car	20 + 2	600	3272
2053	3,820	9	8 – car	22 + 2	600	4000
2063	4,050	9	8 - car	23 + 2	600	4000
2073	4,430	8	8 – car	25 + 2	600	4500

Table : Headways and Train Demands for City Line Trains

City Line Trains						
Summary Train Configuration from 2023 - 2073						
Year	Peak Hour Passenger per direction	Headway (min)	Train Configuration	Trains in Operations	Capacity of one Train (passengers)	Capacity of Trains in Operations per Hour
2023	4,670	13	4 - car	7 + 2	1,010	4,661
2033	5,860	10	4- car	9 + 2	1,010	6,060
2043	7,080	9	4 - car	11 + 2	1,010	6,733
2053	8,310	7	4 - car	12 + 2	1,010	8,657
2063	8,810	7	4 - car	13 + 2	1,010	8,657
2073	9,350	6	4 - car	14 + 2	1,010	10,100

In general, the operational layout needs to be considered with certain tolerance margins, especially at the edge of a level, e.g. the change from 3- to 4-car units,, or in cases when the "used capacity" is negligible higher (<1%) than the defined maximum value.

Furthermore it has to be considered that the proposed operational layout of the System is a result of a "static" calculation based on "forecasted" link loads. In practice the System has to react flexible to changes during a longer service period.

8.9 Fleet Size

The total required fleet size in connection with operational headways during peak hours will accommodate the foregoing operational requirements as well as the demand of operation and maintenance reserve (O&M reserve).

The following table shows the number of trains/cars required and shall serve as a guideline.

The tables are calculated for a period 2023 to 2073

City Line					
Year	Trains in operation	Train Config.	Cars in operation	Train for operational reserve	Cars for operational reserve
2023	7	4 - car	28	2	8
2033	9	4 - car	36	2	8
2043	11	4 - car	44	2	8
2053	12	4 - car	48	2	8
2063	13	4 - car	52	2	8
2073	14	4 - car	56	2	8

High Speed Trains					
Year	Trains in operation	Train Config.	Cars in operation	Train for operational reserve	Cars for operational reserve
2023	12	8 - car	96	2	16
2033	16	8 - car	128	2	16
2043	20	8 - car	160	2	16
2053	22	8 - car	176	2	16
2063	23	8 - car	184	2	16
2073	25	8 - car	200	2	16

O&M reserve will be in general above 10% of the trains required for normal service. The provision of reduced capacity, in case a substitution of a train is necessary during the peak time, is accepted. This is necessary due to the size of the fleet and the necessity to have at least one reserve train for O&M and to remain in an economical reasonable frame.

The above-mentioned fleet size enables a reliable service, however, trains should not be taken out of service for a longer time.

Dependent on the details of the required extensive maintenance activities the additional trains as shown in the tables above have to be ordered earlier than needed on the line.

The additional trains will then already be used to substitute the initial trains on a one by one basis for those undergoing maintenance activities.

Once the initial fleet has gone through the periodical overhauls the number of trains in passenger service can be increased as required.

8.10 Train Procurement

The following Table is based on the above shown tables and serves as an illustration. The actual Train procurement, which are serving the relevant and actual passenger demands, shall be submitted and consented by SRT before revenue service.

8.10.1 High Speed Trains

	2023	2033	2043	2053	2063	2073
	Train Sets					
High Speed Trains	14 8-car	4 8-cars	4 8-car	2 8-car	1 8-car	

8.10.2 City Line Trains

	2017	2023	2033	2043	2053	2063	2073
	Train Sets						
City Line Trains	5 3-car	5 cars	2 4-car	2 4-car	1 4-car	1 4-car	-
	4 4-car						
Remarks	Existing	To be procured					

8.11 Timetable System Methodology

In general the minutes of the departure times will be repeated every hour for the same headway. This can be achieved by headways like 10, 12, 15, 20 minutes. This approach enables the passengers to memorize the departure times. The configuration of the High Speed Railway System has some particularities. In case the ridership requires a shorter frequency of train departures the trains may also depart with irregular departure times in order to enable an efficient operation.

The following timetables are considered:

Timetable		City Line	High Speed	
			U-Tapao	Si Racha
2023	Off Peak	13	30	-
	Peak	13	30	20
2033	Off Peak	10	30	-
	Peak	10	30	13
2043	Off Peak	15	30	-
	Peak	9	30	11
2053	Off Peak	15	20	-
	Peak	7	20	9
2063	Off Peak	15	20	-
	Peak	7	20	9
2073	Off Peak	15	20	-
	Peak	6	20	8

There are two basic kinds of timetables:

8.11.1 Working Timetables

The Working Timetables should be provided for the use of operational staff only. Most of the working timetables should be elaborated in tabular form and contain all necessary information and data of every train run, e.g. number of the course (valid for the daily performance) train number, starting of turnaround, departure and arrival time.

Different kinds of Working Timetables are:

- tabular timetable,
- graphical timetable,
- timetable sheet for drivers,
- train running plans,
- stabling plan,
- servicing and maintenance schedule,
- duty roster.

Train Running Plans are prepared to provide the CCR personnel and the train drivers with all the necessary information on the order of train runs for each train over the whole operating day. In particular, Train Running Plans give information on departure and arrival times at stabling area and terminal stations. Train Running Plans are prepared for each kind of regular service pattern that is to be carried out during a day.

The Depot Controller will prepare schedules for entry to and departure from the stabling sidings, showing the respective berth numbers for each train and the time planned for the

movement. These Stabling Plans may also take the form of tables. All movements of vehicles in the Depot will be controlled by the Depot Controller in co-ordination with the supervisor in charge of maintenance activities.

8.11.2 Public Timetables

The Public Timetables are the commercial offer of the Railway System and prepared for passenger utilization. They should be easy to use and to provide quick reference.

In addition, line diagrams should show the line direction and stations indicating the interchange facilities within the public transit network. These diagrams should be displayed abundantly in station concourse areas, on platforms and inside the trains.

Dwell Time Indicators shall show the time to the next departure of the train.

The driver should receive the countdown second by second.

For the passengers it is recommended to indicate only the minutes in order to prevent rushing on the platform. However, the future Private Party shall decide on this issue.

8.12 Mileage

The requirements of scheduled maintenance for each train mainly depend on the operating performance (mileage = train km) per time period. The exact mileage (per day, per year) for each service can be derived from the actual Working Timetables.

The average mileages per train for the phase from 2023 to 2073 are given in the following tables. The calculation is based on before-mentioned Headways and Fleet size and shall serve a as guideline and illustration.

Mileage High Speed Trains				
Year	Round-trip per Day	Daily Total km	Yearly Total km	Yearly km per Train
2023	46	18,072	6,596,280	549,690
2033	51	19,632	7,165,680	796,187
2043	61	22,752	8,304,480	415,224
2053	61	22,752	8,304,480	377,476
2063	66	24,312	8,873,880	385,820
2073	66	24,312	8,873,880	354,955
Mileage City Line Train				
Year	Round-trip per Day	Daily Total km	Yearly Total km	Yearly km per Train
2023	79	7,753.64	2,830,078.60	404,296.94
2033	85	8,330.97	3,040,804.05	337,867.11
2043	91	8,922.85	3,256,840.25	296,076.38
2053	97	9,519.58	3,474,646.70	289,553.89
2063	100	9,762.16	3,563,188.40	274,091.41
2073	102	10,024.14	3,658,811.11	261,343.65

Table : Average yearly mileage

The calculation of the yearly mileage is based on year factor "365".

Beside regular train operation for passenger service an additional amount of 3% for train operation in "non-service" has been taken into consideration in the calculated figures above.

This percentage includes test runs, feeding of line and the use of the operation reserve.

9. OPERATIONS CONTROL

9.1 General

The Operations Control consists mainly of the following parts:

Operations Control Centre (OCC),

Station Control Rooms (SCR),

- Staff.

Within a public transportation company one has to distinguish between

Operations Staff,

Maintenance Staff and

- Administration Staff

The OCC will be located in the depot and consist of 2 main parts:

technical equipment rooms of which some will be equipped with work desks,

- Central Control Room (CCR).

The Operations Staff is assigned to operate the System on the Line and in the Depot (please refer to 9.3 Organization Chart). Principally the Operations Staff, headed by the Operations Manager, includes the

- Control Staff,
- Station Operations Staff and
- Train Drivers

This concept mainly deals with the operations staff. Maintenance and administration staff is considered as far as it is necessary to describe interfaces between operations and the respective organizational structures.

9.2 Operations Control Centre (OCC)

9.2.1 Technical Rooms

The requirements for the technical equipment rooms, which support the OCC is defined by the relevant subsystem requirements.

9.2.2 Central Control Room

The CCR is manned 24 hours. The reduced train operations during the nighttime will be reflected in the staffing of the CCR. The following staffing is proposed for the CCR for the initial stage of the system:

- Control Superintendent
- Traffic Controller

- Depot Controller
- Engineering Controller

Staffing of the CCR may be reduced during the periods with low workload, if the system operations allows.

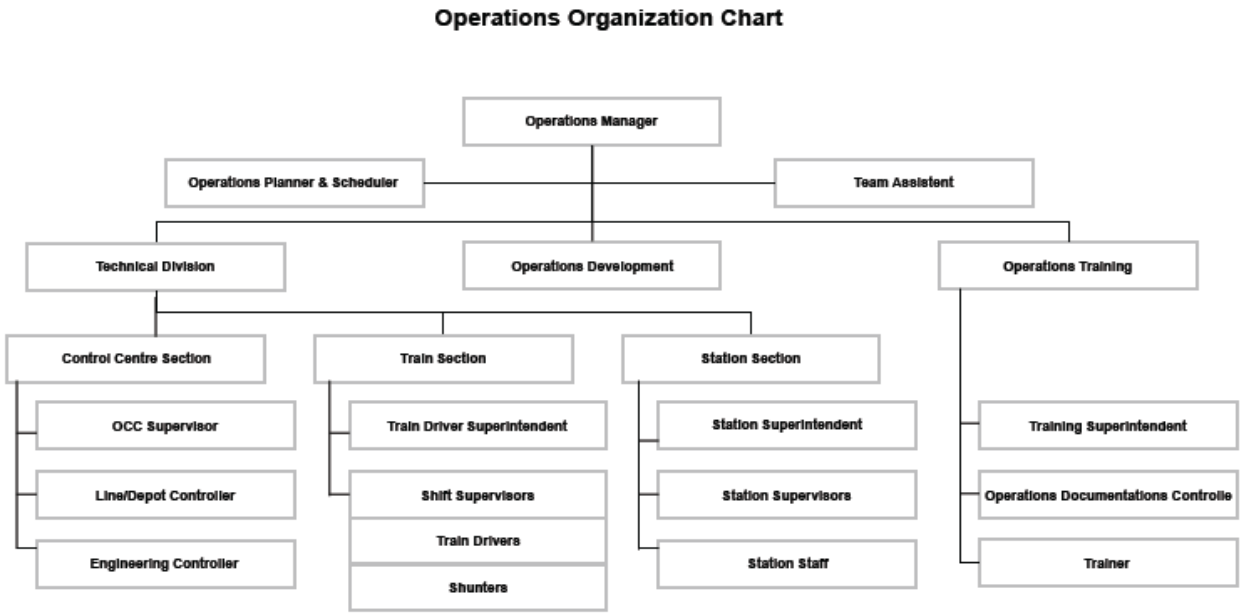
The access to the CCR must be strictly limited to personnel on duty.

The controllers should also obtain a driving license for trains to ensure that decisions in case of train failures are always done on a high level of professionalism and competence.

All essential equipment of the CCR is backed by double Uninterruptable Power Supply (UPS) for total backup time 4 hours in case of power outage.

In order to provide a high availability also in case of Emergencies an ECR (Emergency Control Room) is provided in the building of the Infrastructure Workshop. This ECR will be in a "standby" modus. The active controlling has to be confirmed by log on of the relevant Controllers.

9.3 Operations Organization Chart



9.4 Stations

9.4.1 General

Due to the operational requirements of a closed Ticketing System for the City Line System the station concourse area will be separated by access / exit gates in paid and unpaid areas.

Engineering and layout of the stations are influenced by the track layout, which, in turn, is determined by the operational requirements. Operations as well as passenger requirements

will be taken into consideration. All facilities will be clearly and functionally arranged for passenger convenience as well as for safety and operational purposes.

Doors will not be installed in all main circulation areas and passenger flow routes. Doors may be installed to control the passenger flow as well as special functional areas including the passenger waiting rooms and will not be located adjacent to escalators, passenger conveyors and exits from elevator.

Following rooms are to be provided for the stations:

- Station Control Room (SCR),
- Staff toilets,
- Public toilets at the High Speed stations,
- Staff room in MAS and at the airport station SVB,
- Cash and ticket rooms (special security precautions are required),
- Plant rooms as required by the sub-systems.

9.4.2 Station Control Room (SCR)

All stations shall have a Station Control Room (SCR) from where the station activities can be monitored and the main technical equipment can be controlled. The Station Control Desk (SCD) will enable these controlling and supervising functions.

The SCR shall consist of the following facilities:

- emergency communications system platform – SCR (facility for passengers to request assistance),
- fire alarm control and detection,
- public address system (to be switched group wise for each platform and the concourse level or combined),
- AFC station computer,
- remote control systems for the main technical installations (including the supervision of air conditioning for designated equipment),
- CCTV
- Emergency stop switches for train operation
- Telephone with direct line to the CCR Controller on duty
- Space for 3 persons,
- Workstation for Station Management System
- Locked keyboard with keys for the plant rooms,
- Board for operational documentation,
- First Aid equipment.

The different kinds of alarms indicating faults or failures in the SCR shall be reduced.

At least the following facilities shall be controlled locally in order to minimize hazards (e.g. when switching on an escalator) or increase the efficiency of checks by station staff:

- Escalators,
- Elevators,
- Set back of intrusion alarms,

The following equipment shall be remote controlled:

- CCTV,
- Lighting,
- PA and PIS.

9.4.3 Ticket Office

The stations will have two lines of ticket gates separating the paid from the unpaid area. This requires ticket selling facilities on each side.

The Ticket Offices shall consist of the following main facilities:

- Ticket Office Machine (TOM),
- Telephone.

9.4.4 Platforms

The platforms have a length of approximate 210 meters and a width of 6 to 8 meters except Bang Sue Station which are approximate 420 m. The existing platforms may have to be adjusted according to the requirements of the Rolling Stock

Platforms are equipped with

- firefighting equipment,
- emergency telephones directly linked to the SCR (for passengers to request assistance),
- cameras for CCTV,
- Public Address (PA) system for automatic and manual announcements,
- Emergency Stop Plungers to stop trains in case of emergencies,
- Passenger Information System (PIS),
- clocks,
- a yellow line in one meter distance from the platform edge, except at platforms equipped with PSD,

9.4.5 Platform Screen Doors (PSD)

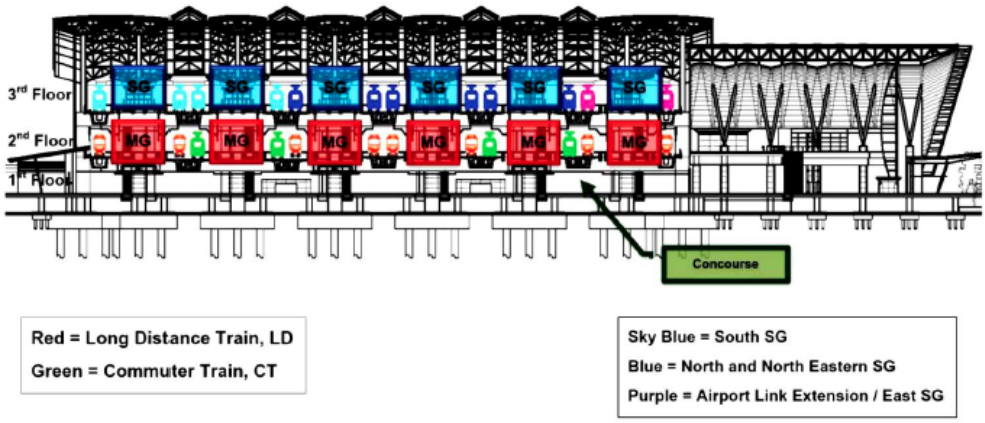
All stations will be equipped at the station platform edges with Platform Screen Doors. The width of the PSD will be determined by the door width of the Rolling Stock and a margin for stopping accuracy. Interfaces between the PSD and Rolling Stock will co-ordinate the operation of the two types of doors (platform and train).

The PSD control has to recognize different train lengths and to operate the related number of PSD's accordingly. The stopping positions will vary according to train length.

Emergency Escape Doors will be provided in order to assure the possibility to evacuate passengers from any train consist at any stopping position.

9.4.6 Extension from Phaya Thai to Don Mueang

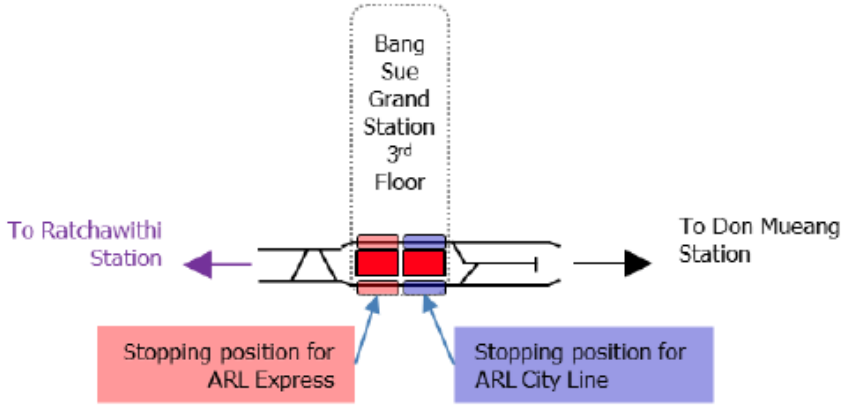
Bangsue Grand Station is currently being constructed by SRT Red Line Project based on Improvement Design. It was determined for improved passenger convenience to combine all metre gauge services on the lower level and allocate all 3rd floor platforms for the use of standard gauge ARL and HSR Service.



Section of Bang Sue Grand Station (Source : SRT Red Line Project, Improvement Designer)

The redesigning of Bangsue Grand Station by this consultancy services will be concerning only the areas relevant to the ARL Extension, i.e. ARL Extension paid area on concourse level, ARL Extension platform area, ARL Extension back to house and ARL Extension equipment rooms.

The platform area will be arranged into a dedicated independent stop positions for the City Line trains and the High Speed trains. A stopping position for the ARL City Line services will be on the North side of the double length platform, nearer to the pocket track. A stopping position for the High Speed trains will be on the South side of the double length platform.



ARL City Line and Express Services Stopping Positions at Bang Sue Grand Station

Don Mueang Station, a pedestrian bridge or "Skywalk" will provide direct connection between Don Mueang Station and Don Mueang Airport, but there will be no BHS to the airport.

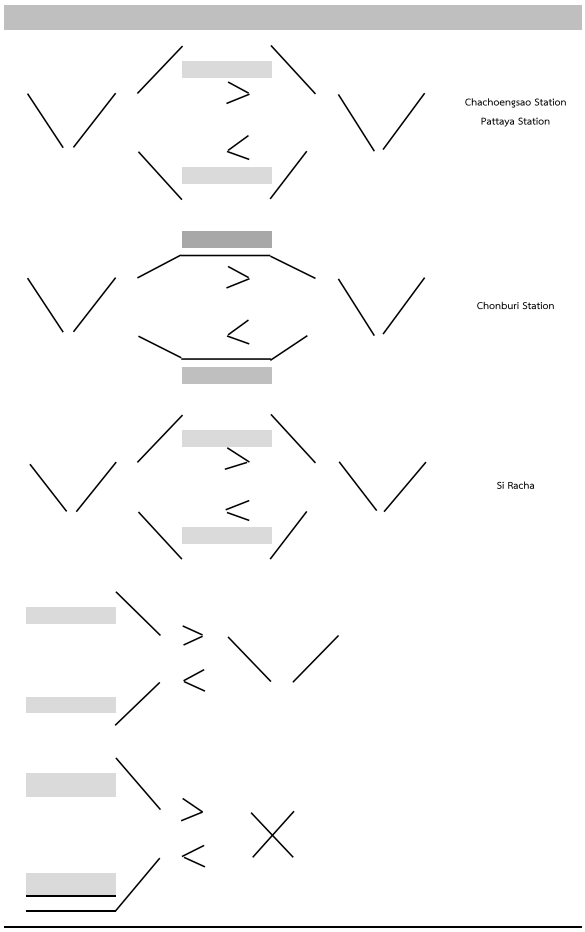
Extension from Suvarnabhumi to U-Tapao

The length of the route is approximate 220 km and serves 6 stations in total including terminal stations. The average kilometer between station to station is approximately 40 km and the platform length will be at least 210 meters.

The station track layout in Suvarnabhumi station has 1 island platform and 2 tracks configuration for the High Speed service. The second island platform will be used by the City Line trains for the Airport Link service between Don Mueang and Suvarnabhumi.

The intermediate stations Chachoengsao, Chon Buri, Si Racha and Pattaya have 2 island platforms with 2 through going tracks and 2 loop tracks. The loop tracks are giving the opportunity for future additional services and passing of other trains.

The station layout and the technical data will be similar to the layout of the existing layout for Makkasan and the design for Bang Sue station.



10. REGULAR OPERATION

10.1 General

At the moment the system cannot be operated with automatic Route Setting. The system is configured by Siemens to run a service with not more than 4 High Speed Trains and not more than 5 City Line Trains. This configuration can only be changed by Siemens with an official source code. Without this Siemens code the system is limited to the amount of trains mentioned before.

To resolve this problem in case of a future extension, a re-signalling of the system to European Train Control System (ETCS) or The Chinese Train Control System(CTCS) or The Japanese Train Control System (Digital ATC) would be necessary.

10.2 Operation Modes

For operations of the services on the Line and in the Depot the following modes of operation are required:

- Supervised Manual Mode (SMM);
- Restricted Manual Mode (RM);
- ATP Isolated Mode (RM2),
- Depot Mode (DM)
- Wash Mode. (WM).

10.2.1 Supervised Manual Mode (SMM)

In this mode the train driver has to operate the train manually following the actual and the recommended train speeds.

The main tasks of the train driver are:

- to close the train doors by means of the relevant button,
- to keep the actual speed close to the recommended one in order to keep the calculated running time,
- to stop the trains at the defined stopping points,
- to open the train doors by means of the relevant button
- to observe the line and the technical functioning of the train during the movement.

The Regular Operation Mode includes the Automatic Train Protection (ATP) system, which controls and prevents the train from safety risks due to driver's inaccurate actions. Dictated by the conditions of the signaling and control system this mode allows a maximum

operations speed of 160 km/h for CITY Line and 250 km/h operations speed for the High Speed Line. In this system trains always run with their spacing determined automatically by the signaling equipment. Section occupation and release will be carried out automatically by route selection, setting, locking and clearing based on track circuit data.

A certain tolerance to the recommended speed limits shall be allowed before an audible and visual warning will call the train driver's attention. If the speed is more than the admissible tolerance above the permitted speed a service brake will be automatically applied to brake the train down to the permitted speed limit.

10.2.2 Restricted Manual Mode (RMM)

This mode shall only be used on the line if the trackside ATP is not functioning and train runs will be performed under manual control according to line-side signals or "approval to proceed" verbally issued by the Traffic Controller. In situations where train runs take place under manual control and without a fully functioning ATP System. The speed for train runs under RMM is required to be restricted according to the specification to a maximum speed of 25 km/h. It is recommended to standardize the restricted mode speeds on the Main Line to achieve a common calculable time to recover from a degraded situation. Due to a maximum operating speed of 160 km/h for CITY Line and 250 km/h for High Speed Line it is suggested that a higher speed (e.g. 35, 40 or 50 km/h) for Restricted Manual Mode is applied.

The driver is responsible for observing line-side signals, regulating the speed of the train and braking the train to a safe standstill within the signalling distance.

To assist in understanding, this mode may also be known as RM1.

10.2.3 ATP Isolated Mode (AIM)

The ATP Isolated Mode will be applied if the trackside ATP functions are not available or cannot be used for any reason (e.g. for pushing a train).

The change to AIM is possible only during the standstill of the train. The driver has (after the respective authorization by the Traffic Controller) to operate the sealed ATP – isolated switch.

To assist in understanding, this mode may also be known as RM2.

10.2.4 Depot Mode (DM)

The Depot Mode (DM) is the regular mode for trains in the Depot area.

The train driver is, in co-ordination with the Depot Controller, responsible for movements in the Depot area. Using the depot mode requires a separate switch to be activated by the train driver.

The speed is limited to 25 km/h and the local signals have to be observed.

10.2.5 Wash Mode (WM)

The Wash Mode (WM) allows a maximum speed of not more than 5 km/h and is the regular mode for:

- trains moving through the washing plant,
- trains passing the under floor wheel-lathe;
- the coupling of train units.

10.3 Train Operations on the Line

Trains will be generally operated from the leading cab.

The train driver, who will be normally the only operational staff member present on the vehicle, will observe the Line in front of his train. He will be fully trained and examined before being qualified.

The Duty Roster based on the relevant timetable will inform the train driver about his shifts and his detailed tasks (e.g. train driving, shunting, reserve etc.).

During operations the train drivers will observe the tracks and the wayside signals.

The train driver will brake the train accurately to a standstill within the relevant stopping window at the platforms. The train driver will open the doors .

10.4 Train Operations in the Depot

10.4.1 General

The Depot is equipped for the required operations and maintenance according to the forecast of the year 2017. Future extensions will be considered on the basis of the forecast for the year 2037.

Train units will be fed into service from stabling yard at the necessary rate to meet the operations timetable.

Besides the stabling and cleaning of vehicles, the Depot will provide facilities for the maintenance of the system. This will include but not be limited to testing, repair by exchange of components, storage of parts and supplies, systems management, control and administration.

10.4.2 Train Movements within the Depot Area

Train movements in the depot are considered as shunting movements. While movements in the Depot area will be under the control, direction and supervision of the Depot Controller only, movements into or out of the Workshop building require the coordination of both the Depot Controller and the respective maintenance supervisor in charge, who is responsible for the possessions of the workshop tracks.

The train driver will be informed prior to a shunting movement about:

- Train number and present location of train,
- Final destination,
- Information about failures or malfunctions of the train.

Train movements along tracks within the workshop are not considered as shunting movement and will be done under the responsibility of maintenance supervisor in charge.

Within the Depot area trains will be driven in Depot Mode (DM) with a maximum speed of 25 km/h. For the test track a higher speed will be defined depending on the final alignment.

10.4.3 Entering and Leaving the Depot

Generally movements into and out of the Depot will be coordinated between the Traffic and the Depot Controllers.

Entering the Depot

The Depot Controller plans the position of the trains in advance, based on:

- Requests for maintenance activities including cleaning (including toilet cleaning works) and washing of trains,
- Planned trips for the next day.

When returning from the main line, the train will enter the transition tracks leading to the Depot area. The usual approach towards the depot takes place in Supervised Manual Mode. The speed of the train will be controlled by the signaling down to the maximum allowed speed of the depot (25 km/h).

Normally, the driver will push the RM1 button on the cab console once the train is below this speed and it is indicated to him on the ATC display that the train is entering the Depot Mode. He does not need to stop in order to do this. The driver will take control of the train by using the power/brake lever and then has sole responsibility to control the train according to the aspects of the depot signals. If the driver does not press the RM1 button, the signaling will bring the train to a stop at the first signal in the depot. The RM1 button can also be pressed at this time and the driver takes control of the train in the normal manner.

The train will then be routed from there to its final destination (e.g. stabling, workshop, etc.).

Leaving the Depot

The Depot Controller assigns the train drivers to the trains based on the duties of the drivers and the assignment of the trains to the trips and services.

The train driver activates the train which includes a series of functional checks of various train-borne equipment. Following the activation of the train, the train driver will check the radio communication. This check will be combined with the report to the Depot Controller

that the train is ready for departure. The driver will get the "Proceed" aspect of the signal and moves via the transition track to the Line according to the line side signals.

While the driver operates the train in the DM the system upgrades the train automatically to the SMM by passing the relevant track circuits. The driver continue under ATP supervision in SMM.

10.4.4 Entering and Leaving the Workshop

For entering and leaving the workshop, particular safety procedures need to be applied.

- When a train requires to enter the workshop, in order to maintain safety of personnel inside the workshop, it is usual practice for the Workshop Supervisor to grant permission to the train before it enters "his" area of supervision. This is normally achieved by use of the radio system.
- On receiving permission to enter the workshop, the train driver provides an audible warning by sounding the horn on the train. Personnel inside the workshop will acknowledge this warning by e.g. raising an arm, which provides a visible confirmation to the train driver that it is safe to proceed.
- Pushing and pulling of trains with another train or service vehicle(s) special procedures shall be applied to be elaborated by the Private Party.
- The under floor wheel-lathe and the washing plant (non washing status) will be passed with a maximum speed of 5 km/h.

11. DEGRADED OPERATION

11.1 General

Degraded Operation may result from the failure of one of the system components, extreme meteorological conditions, or other external influences. The effects of these failures can be very different.

The system and the separate sub-systems will be designed to minimize the effects on services in cases of degraded operation.

The strategy to be adopted in the case of service disruption will depend upon the location of the disruption and the estimation about the duration to be resolved. Minor disruptions will be accommodated within the normal train regulation process. Longer or major disruptions may involve a significant re-casting of the service.

As a basic guideline the Control Superintendent on duty in the CCR shall be overall-in-charge in deciding on Degraded Operation, and the recovery program. The Control Superintendent shall be vested with the appropriate authority. This and the roles of other involved parties shall be explicit and unambiguous defined in the respective plans, procedures and manuals.

During the Trial Run phase, basic alternative programs will be elaborated by the Private Party in close coordination with the SRT.

11.2 Performance Monitoring System Capability

The whole System will be supervised from the CCR. Sufficient and clear data from central control systems will be available for analysis at any time after an incident.

All stations will be under CCTV surveillance. It will be possible to record the events being monitored by cameras.

All systems and sub-systems relevant for the operations of the System will be monitored and managed by the combined SCADA and SMS system from the OCC.

The signalling equipment provides a delay statistic, enabling a performance / availability evaluation.

Delays shall be distinguished in

- Minor delays (between 2 and 5 minutes),
- Major delays (more than 5 minutes).

11.3 Recovery Strategies

The objective is to minimize the impacts of failures to the scheduled revenue service as far as possible. The idea of the provision of safe and convenient service to the passengers shall be part of the training to be provided by the Private Party to their personnel.

After a disruption of service the goal is to get the service back to the scheduled timetable as fast as possible.

Detailed measures have always to be adjusted according to the circumstances.

11.4 Controlled Disembarking of Passengers on Line

Generally, in cases of trains on the Line being unable to proceed, the CCR and the train driver shall try to couple the failed train to another train and to move (pushing or pulling) the train to the next station platform. In the event that such action is not feasible the next option would be to evacuate the passengers over special evacuation gangways to a train stopping beside the faulty train (the gangways are stored in stations and taken by the securing train). If this is also not possible the passengers have to disembark the train to the Line by side door evacuation to the middle of the tracks (at-grade or elevated sections) or to the outer side of the tracks in the tunnel. Since such type of disembarking will be an extreme measure in situations of irregularities, this decision shall be made by the Control Superintendent, in cooperation with the incident Manager

The above mentioned procedure for disembarking may become necessary in the event of loss of traction power supply or in emergency situations, when the train is unable or not allowed to move.

For disembarking following principles shall be applied:

- Determination of door for disembarking and direction (door close to the drivers cab),
- Instruction and support of passengers by the train driver and/or CCR,
- Release of relevant door by the train driver,
- Responsibility of the train driver for safe disembarking of passengers,
- Support of the train driver by other operations personnel (e.g. from the closest station).

11.5 Blocked Line

Should a failure, obstruction, accident or any other exceptional incident cause that both tracks cannot be passed by trains, the Traffic Controller will stop all trains in the relevant section:

Both tracks of the relevant Line section will be locked against route setting. The controller will give the required instructions and inform all operational staff involved accordingly.

In case of blocked Line the Traffic Controller will:

- Initiate alternative operations,
- Organize staff and passenger information accordingly,
- Activate the respective rescue / emergency team(s),
- Organizing bus shuttle if necessary,
- Reporting as determined by the company rules.

11.6 Sub-Systems Failures

11.6.1 General

A selection of typical failures will describe the general approach how to deal with failures. In general the one failure case will be considered only.

Envisaged failures of the sub systems and the respective technical and operational responses will be described in the related operations manuals.

11.6.2 OCS Failures

Failures of the Overhead Catenary System (OCS), e.g. fatigue rupture of Catenary wire, cause short-circuits include short-circuits on the Line and in the Depot which cause the traction power to be cut. Depending on the type of short-circuits, the power can be either restored within a short period of time or the faulty section can be isolated. If only one section of the Line (e.g. one track section) is affected by a traction power failure for a longer period of time, an appropriate alternative operations plan will be implemented.

The sectioning of the OCS supports alternative operations in case of disturbances and scheduled maintenance.

11.6.3 Traction Power Failures

The engineering of the traction power supply system, its distribution to the System and the track feeding and sectioning arrangements will be engineered to minimize the effects of any traction power failure to one track section only.

In the unlikely event that the entire traction power fails (e.g. total MEA/PEA power failure) the Control Superintendent shall assess the situation immediately, contact the MEA/PEA and in case of a predicted longer power outage implement the appropriate operations

11.6.4 SCADA Failures

The SCADA system will allow the CCR to centrally monitor and control the traction power supply and Overhead Catenary System. Certain failures in the SCADA system may remove this capability. Personnel authorized to carry out the control will be sent immediately to the Traction Power Sub-Station to monitor and control the traction power supply locally. If it is necessary to operate OCS switches authorized personnel shall be sent to the location (e.g. by a train stopping at the location) under consideration of safety procedures. All control of traction power and OCS equipment shall be carried out under direction of the Engineering Controller in the CCR. The CCR shall manually document all switching operations in a way that the status of the traction power and OCS system is always correctly displayed.

The procedures to be followed and the back up levels to be implemented will be defined in the relevant rule books and manuals.

11.6.5 Platform Screen Doors Failures

Failures of the Platform Screen Doors (PSD) might have influences on the flows of boarding and alighting passengers.

Such a failure will not directly affect the safety of passengers, because the doors will only open if the relevant location is occupied by a train. Non-operating doors will be taken out of service by manual isolation.

A local control panel will enable the authorized station personnel to assist the train driver in case of an interface failure.

11.6.6 Failures of Automatic Fare Collection Equipment

A failure of the AFC equipment might affect the passenger flows in stations without any influence on safety of passenger service.

For the compensation of failed TVM(s) other TVM(s) and the ticket office will be available.

In case of a connection loss to the AFC central computer the station equipment will function in the stand alone mode. The defined data will be filed for this time and transferred after restoring of connection to the central computer.

In case of power outage of the gates they will be at least opened. The Station Controller (SC) can open the gates in case of emergency with a manual push button.

11.6.7 Signaling Failures

Connection Loss Central Traffic Computer – Interlocking

The interlockings work autonomously. Since the connection of the different interlockings to the OCC and to the MMI in the CCR is a circle at least 2 failures are necessary to cause a connection loss of an interlocking to the CCR. In case the CCR is not available for any reason the Controllers can move to the Emergency Control Room (ECR) where the same functions as in the CCR enable the continuation of regular operations.

Failure of one Interlocking

Basically the operation has to be executed within the borders of the interlocking area in the RM. Points have to be operated manually (by cranking). The approval to proceed has to be issued via radio and will be documented in the relevant operational logs. Details will be defined in the relevant procedures, rule books and plans.

Failure of the ATP System

If the ATP Trackside unit is failed the train can still run in Restricted Manual Mode (RM). The train driver will be responsible for controlling the speed of the train. He will observe the line-side signals and act accordingly with caution.

It is recommended to standardise the restricted mode speeds on the Main Line to achieve a common calculable time to recover from a degraded situation. Due to a maximum operating speed of 160 km/h, 250 km/h, it is suggested that 50 km/h for Restricted Manual Mode is applied.

Critical Commands

Critical Commands are considered to be a tool to handle technical failures as well as response on human errors. Their use is strictly controlled and recorded by the Signaling System.

11.6.8 Telecommunications Failures

The train radio will principally be provided for communication between the Traffic Controller and train drivers. If the train radio fails, the communication can be maintained by mobile phones. The CCR has to ensure that the controllers are using the fixed telephone lines so that the conversations are recorded. As under regular operating conditions, the driver may continue the scheduled turnaround until the train can be properly exchanged without any service disruption.

A failure of the PA systems at stations may be substituted by megaphones.

Telephone failures at the stations will be covered by mobile radios.

11.6.9 Rolling Stock Failures

Stalled Trains

In the case of a train breakdown the Traffic Controller will consult the train driver to determine the cause. The section of the track has to be blocked immediately.

The principal method of recovery will be for the following train to push the stalled train. Therefore the driver of the following train will receive instructions from the Traffic Controller by radio communication.

When the train is unable to move under its own power, the following train will push the stalled train to the nearest station in travel direction where passengers of both trains will be able to disembark. In case the track configuration allows a train approach from the other direction the pulling of the stalled train will be considered, too.

After disembarking the passengers the trains will clear the Line as soon as possible.

After assessing the detailed circumstances the Traffic Controller decides whether to stable the failed train on track at a terminal or pushing / pulling it back to the depot immediately.

The assisting train will resume the service after stabling and decoupling of the failed train. All operations will take place under the permanent co-ordination of the two train drivers and the Traffic Controller.

The detailed procedure will depend on the real failures of the stalled train. Effects on the coupling procedure of both trains caused by the detailed failure and characteristics of Line sections with steep gradients will be defined in the relevant procedures.

The removal of the failed train from a stabling position on the line will be organized as soon as possible by the depot staff.

On-Board ATP Failure

The on-board ATP system fails, the emergency brake will stop the train automatically. On direction of the Traffic Controller the train driver will change into RM and operate the train according to the Line signals or approvals to proceed, issued by the Traffic Controller. This train will be taken out of service as per decision of the CCR.

Door Failures

There are the following main cases of door failures:

a) Single door cannot be opened,

b) Single door cannot be closed,

c) All doors cannot be opened (e.g. no door release),

d) All doors cannot be closed,

e) Door safety loop cannot be closed.

f) Door safety loop opens during train run leading to an Emergency Brake of the train.

Generally the response to a door failure will be to isolate single doors which do not open, or in the event that the entire system has failed, an emergency relax facility is available.

On-Board Communication Failures

If a public address system failure in the train occurs, the train may, however, continue the scheduled service until relieved by a reserve train or instructed otherwise.

Generally a train unit will be equipped with train radios, each one in the two driver cab's.

In case radios in the train have failed, the driver will inform the Traffic Controller using mobile phones or by direct telephone at the next station. The Traffic Controller in conjunction with the driver will then decide what action to take.

Brakes Failures

In Regular Operation, the train speed will be reduced by both the electro-dynamic and the electro-pneumatic operated friction brake up to standstill. The electro-dynamic brake will have priority, which means the electro-dynamic brake will be the first system to operate when the driver applies the brake.

The brake control unit (BCU) of the train will ensure that the train stops when the air pressure drops below a pre-defined value. If this happens or if the brake indicators show any other failure, the train driver will analyze the situation and inform the Traffic Controller.

If the electro-dynamic brake fails, the train can be decelerated and stopped by the electro-pneumatic operated friction brake.

If in case of a brake failure the train driver can restore the brakes to normal, he may continue the scheduled trips. Otherwise the Traffic Controller will instruct the driver accordingly.

The basis for decisions whether the train has to be withdrawn from service immediately or if speed limits have to be applied will be handled according to instructions of the Rolling Stock operating manual. The manual shall describe bypassing and manual release of failed brakes as well as restrictions for the train run depending on the percentage of brake availability.

External Lights

Failures of the train head and taillights will not affect the safety of passenger service. The driver will report the failure to the Traffic Controller, who will decide about the substitution of the train.

Air-Conditioning System

A failure of the air-conditioning system will affect the comfort of the passengers but does not affect the safety of service. Normally the ventilation in the passenger compartment will still be available. Due to the discomfort to the passengers the train will be substituted with a reserve train as soon as possible but may complete the trip to the terminal station.

Pantograph Failure

There may occur different failures of the pantograph. In any case the train shall be taken out of service as soon as possible in order to prevent further damages to the train or the OCS. In most of the pantograph failures the respective train has to be pulled or pushed.

Track Failures

Track failures are normally detected by maintenance during scheduled inspections. In this case the maintenance supervisor in charge defines the required measures (e.g. temporary speed limit, closing of section).

However, track failures may occur suddenly and may be detected by operations personnel.

Following kinds of failures are possible:

- Turnout not operable
- Obstructions within the tracks,
- Lose or broken rail fixings,
- Rail fracture,
- Lateral displacement.

In all cases the operations personnel has to give the initial response until the trackwork maintenance staff arrives at the scene to assess the failure The Control Superintendent will decide according to the information gained. If it cannot be ensured that even with reduced speed safe operation will be possible he shall decide to block the section and shall initiate all related safety and operational measures.

The trackwork maintenance team will be called out to asses the failure. Only the maintenance supervisor shall decide if the track section can be re-opened and the temporary speed limit to be applied.

12. EMERGENCIES

12.1 General

Although emergencies are usually described as current, unforeseen and unplanned events, which have life threatening or extreme property damage implications, they are not unforeseeable.

The standard emergency response to any life-threatening event is to move people away from danger (i.e. an evacuation). Notwithstanding this the exact impact, timing, location, development, etc of an emergency cannot be predicted with any accuracy (e.g. in the event of a fire, the actual chain or speed of propagation of the fire, the actual numbers of persons affected or the behavior of the people involved etc. are all elements of uncertainty).

To the extent that there is an urgent need to evacuate people together with a potential lack of control over both the events themselves and the consequent action of people, an evacuation under such circumstances, may be considered to be uncontrolled.

The objective of the management of emergencies and emergency situations is to always retain or regain as much control as possible.

Despite the different origins of emergency situations and security incidents the likely consequences are similar i.e. death, injury, property damage. It is therefore proposed to utilize a common approach for managing both situations.

As actual emergencies are rare events, personnel only infrequently have to put Emergency Preparedness Measures into effect. However, when these measures are required to be implemented it is because of an actual emergency situation. Unfortunately, the least practiced skills are those which personnel are the least likely to retain. It is therefore essential that emergency procedures are:

- Simple and easy to apply,
- Consistent throughout the system; and
- Built upon procedures, which personnel apply on a more regular basis.

All emergencies will require the application of Emergency Preparedness Measures and may also require specific incident response. Such a situation may effectively place the remaining parts of the system into alternative mode operations, although such a decision will be taken based upon the ability to operate any of the system away from the incident itself (e.g. a fire in the Depot may not preclude trains running on the Line) and hence a near normal service may be possible on the rest of the system.

12.2 Internal Emergency Response

Priority is given to preventative measures in order to limit the effects of any incident. This goal is achieved by precise procedures.

The initial response on an emergency is important to:

- Maintain the safety of passengers and staff,
- Limit damage to the premises,
- Facilitate immediate repair of damage or removal of obstacles blocking the Line,
- Facilitate the return to Regular Operations as soon as possible.

The different supervision systems (e.g. SCADA) are monitoring the equipment and system facilities. In case of irregularities, alarms will be initiated in the CCR or SCR's. Controllers and station staff will respond according to the defined procedures and inform the Control Superintendent. The Control Superintendent will then give further instructions to the operations staff and initiate internal and external responses, if required.

The "stop" command and the group call facility enable the Traffic Controller to stop all trains immediately if the circumstances require.

The fire detection systems will warn the staff concerned of an outbreak of fire. Defined procedures ensure that immediate information will be available to the CCR. The staff will fight any fire immediately by the use of locally available equipment in order to control the spread of fire and limit the extent.

In case of an emergency the main task of the operations staff is to avoid panic. Trained personnel can also reduce the impact of an incident by appropriate actions such as administering First Aid correctly.

12.3 Liaison with External Emergency Services

Liaison will be carried out with external emergency services that may provide a response in emergency situations to ensure that practical, common and appropriate overall responses can be made. Appropriate emergency equipment will be available at strategic locations in the depot.

The Control Superintendent will inform the external emergency services by telephone. He co-ordinates all activities on behalf of the Private Party and must therefore be made aware of all relevant facts.

Updated lists in the CCR containing addresses and telephone numbers are to be made available for the following services:

- Police stations,
- Hospitals,
- Specialist hospitals,
- Ambulance,

- Fire department.

An Incident Manager will always be appointed when coordination with Emergency Services and Third Parties are required on site. He will be the person who keeps close contact to the CCR and is therefore the interface between CCR and Incident scene.

If required the OCS has to be de-energized. The commands for switching the power supply are to be defined in procedures. Besides the confirmation of Engineering Controller that the relevant section is de-energized the respective OCS section has to be properly earthed.

In case of emergency in the depot the emergency services have to be picked up at the main entrance and to be guided to the location of the incident.

A meeting point shall be agreed for 3rd Parties' as access point to the stations. Station staff will wait there in order to guide the services as quick as possible to the location of the incident.

Non-authorized persons will not have access to the scene of an incident as far as this can be realized in public areas. Recovery of bodies will be in accordance with defined procedures.

12.4 Safety Audits

Already at the stage of the engineering Safety Audits shall be arranged ensuring a successful and efficient cooperation of the railway personnel as well as third parties involved. Considering the planned arrangements these audits will ensure the implementation of procedures, which are suitable and effective to achieve the specific objective of the assistant rescue.

12.5 Emergency Team

The Emergency Team is part of the maintenance organization, which gives technical response to emergencies. The response is coordinated on site by the Emergency Team Leader. The members of the Emergency Team will be nominated.

The Emergency Team will access the incident site with the permission of the Incident Manager. The Incident Manager instructs the Emergency Team about their duties and cooperation with other parties.

12.6 Emergencies On-Board of Trains

In case of on-board emergencies notified to the drivers, the train driver will inform the CCR as soon as possible about the details. For an initial emergency response on-board facilities will be provided.

In the event of arising of smoke the train driver will shut the flaps for incoming fresh air. He will not be allowed to pass the next station platform until clarification of the incident. In the meantime the Traffic Controller will alert the station staff of the next station about the initial information. While the station staff will check the platform area via CCTV for being

prepared on an evacuation of passengers at the platform, the Traffic Controller will ensure access to the platform of the next station.

12.7 Emergencies at Stations

For the procedures related to emergency conditions and situations at stations or buildings principally the local fire rules and regulations will be adopted. Referring to the station engineering the technical facilities as well as emergency egress capacities have been provided to cope with such situations.

The station personnel have to initiate the appropriate measures. After alerting the external emergency services the Station Supervisor immediately will inform the Traffic Controller about the situation and the effects on the general train operation.

Assuming that the station platform area is affected, the emergency situation could affect the safety of passengers on-board of trains or the track area will be required for emergency egress of passengers on the platforms, trains principally will not be allowed to proceed. In the event that a movement of a train backward to the next station is not feasible, passengers will be detrained on the Line as described above.

In situations that the platform area is not affected the impacts of further train movement on emergency situations at stations, especially the impacts on fire conditions and the station ventilation system, have to be considered.

The same procedure will be handled for other trains until a statement of the emergency services, that the operation of trains will not affect the conditions in the station area.

13 SAFETY SYSTEM

13.1 General Safety Requirements & Safety Criteria

The System will be engineered on the basis of the relevant Thai or international standards. The details of the safety requirements will be described within the engineering phase of the sub-systems. Operational Safety will be described in the operations safety plan.

14 FAILURE MANAGEMENT

The system failure management will allow alternative operations which can be implemented without risk for the safety for passengers, personnel, other people and equipment. The System will be engineered to support the use of alternative operations, including the reversal of operating direction at the locations of the crossovers on the Line.

15 INCIDENT MANAGEMENT

The Incident Management will be organized, implemented and carried out by the Private Party. The Incident Management of the Private Party with qualified and well trained personnel will be able to handle any kind of incidents.

16 TRAINING

The training is an important part of the work that must be completed by the different parties involved, in order to operate and maintain the system in a safe manner.

Generally speaking the Private Party's staffs require the following types of training:

- Company rules and policies provided by the Private Party.
- Railway safety rules training to be provided by the Private Party based upon the Private Party safety rules.
- Railway procedure training to be provided by the Private Party based upon the Private Party's railway procedure manuals.
- Equipment training to the Private Party's Training Instructors provided by the Private Party as defined in the Contracts.

Prior to the definition of the scope of the training it is necessary to define the required training. The training required is determined by:

- Organization of the Private Party,
- Job descriptions,
- Qualification of personnel,
- Operations Procedures, Rulebooks and Manuals,
- Equipment Operation and Maintenance Documents,
- Incident Management.

The required training will need to be planned very carefully and the methodology will also need to be decided by the Private Party at an early stage. The Private Party shall provide a training schedule which Private Party shall include first aid and firefighting training.

The documentation for training will be elaborated. Besides the training documents, the documentation for operations and maintenance is an essential part for the training. This documentation will be developed step by step. The documentation will be completed during the System Integration Tests phase. All documentation as required by the contract will be provided.

The following general methods of training will be applied:

- Theoretical Training – (such as class room lessons; Work Group Training / Workshops / Discussion; Video Presentation / Evaluation etc.) by all parties carrying out training.
- Practical Equipment Training – (such as driving trains, operating CCR workstations; by the Consortium in accordance with the Contracts.
- Practical Operations Rulebook and Procedure Training under normal, degraded and emergency modes carried out by the Private Party.

- "On the Job Training" as a specific form of practical training provided by the Private Party with support from the Consortium.

The Private Party shall provide training certificates for its part of the training in accordance with the Contracts. It is the Private Party's responsibility to certify that the staff can operate and maintain the system under the valid Railway Operations Rules and Procedures and issue the necessary licenses and certificates to the Operations staff. The Private Party will define the scope of tests and examinations for such licenses and certificates.

The content of the training, the attendance records and the results of all tests and examinations need to be collected by the Private Party so that the Private Party can issue the licenses and certificates.

Training of personnel is a continuous process, in order to keep and improve the level of operations and maintenance. Training after start of revenue service is as follows:

- Regular refresher training (to keep the knowledge of personnel),
- Training after incidents and violation of rules by personnel,
- Training for newly recruited personnel,
- Training in case of technical modifications,
- Training in case of changes of procedures, rulebook and/or manuals.

Safety criteria and information will be included in the documents for the training of operations and maintenance personnel. Protective devices and emergency equipment and their application will be identified and considered in the training program.

Support and joint training programs from the local emergency services will be integrated as part of the Private Party's safety-training program. Appropriate training will need to be given to staff of those services by the Private Party in case such services need to enter the System to attend to the scene of an emergency.

17. SECURITY

17.1 Security System

The Security System is used to manage the access of persons to the premises of the System. It allows only authorized staff controlled access to different levels of security areas within the System.

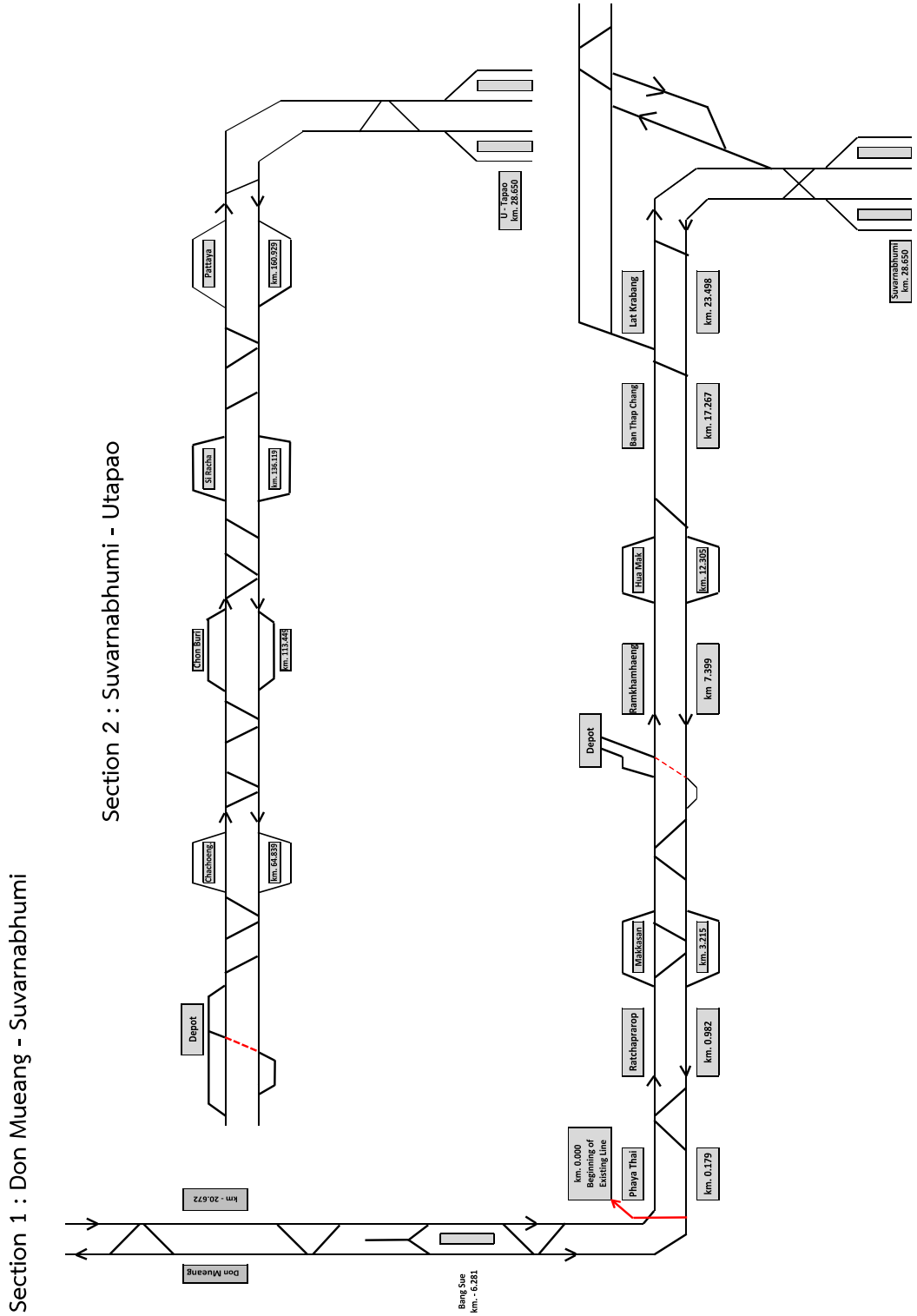
The Security System manages also the access of 3rd Parties to premises others than used for passenger operations.

17.2 Security Policies

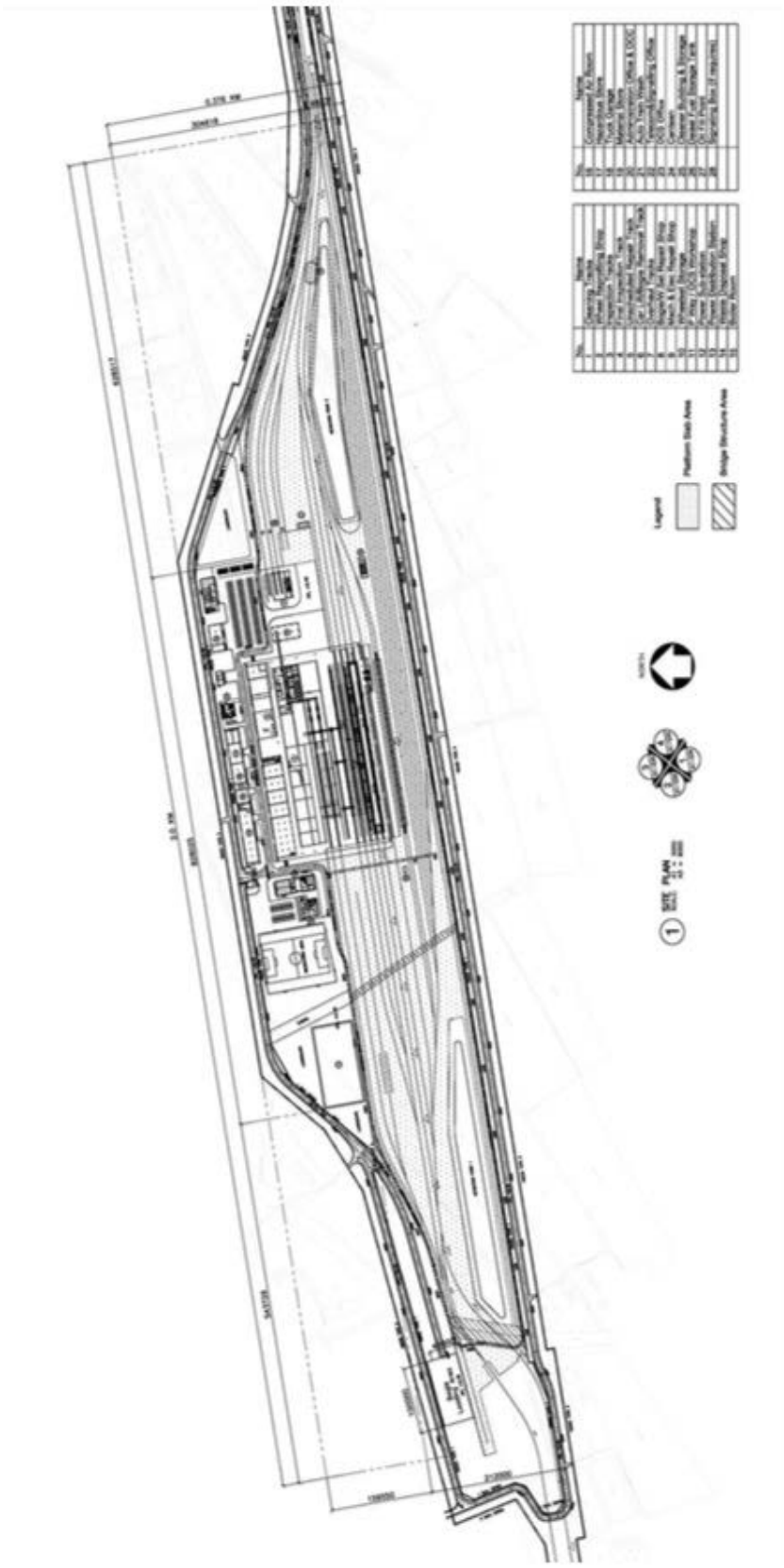
Security policies are elaborated by the Private Party and shall deals with following subjects (not exhaustive!)

- Vandalism
- Bomb threats
- Hostage taking
- Trespassing
- Theft
- Riots
- Disorderly Conduct
- Etc

- ANNEX 1: SCHEMATIC TRACK LAYOUT MAINLINE

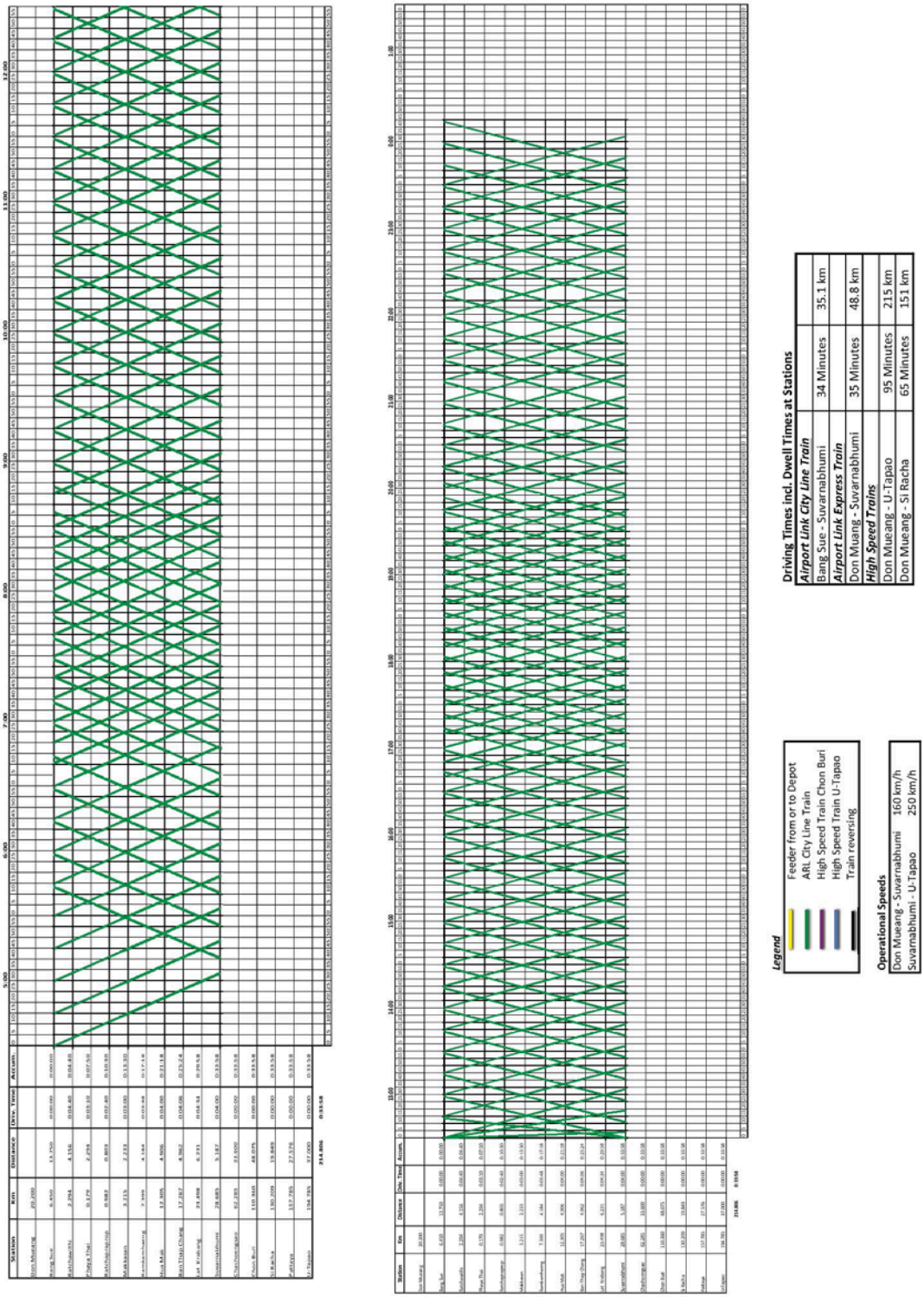


ANNEX 2: SCHEMATIC TRACK LAYOUT DEPOT / TRACK NUMBERING

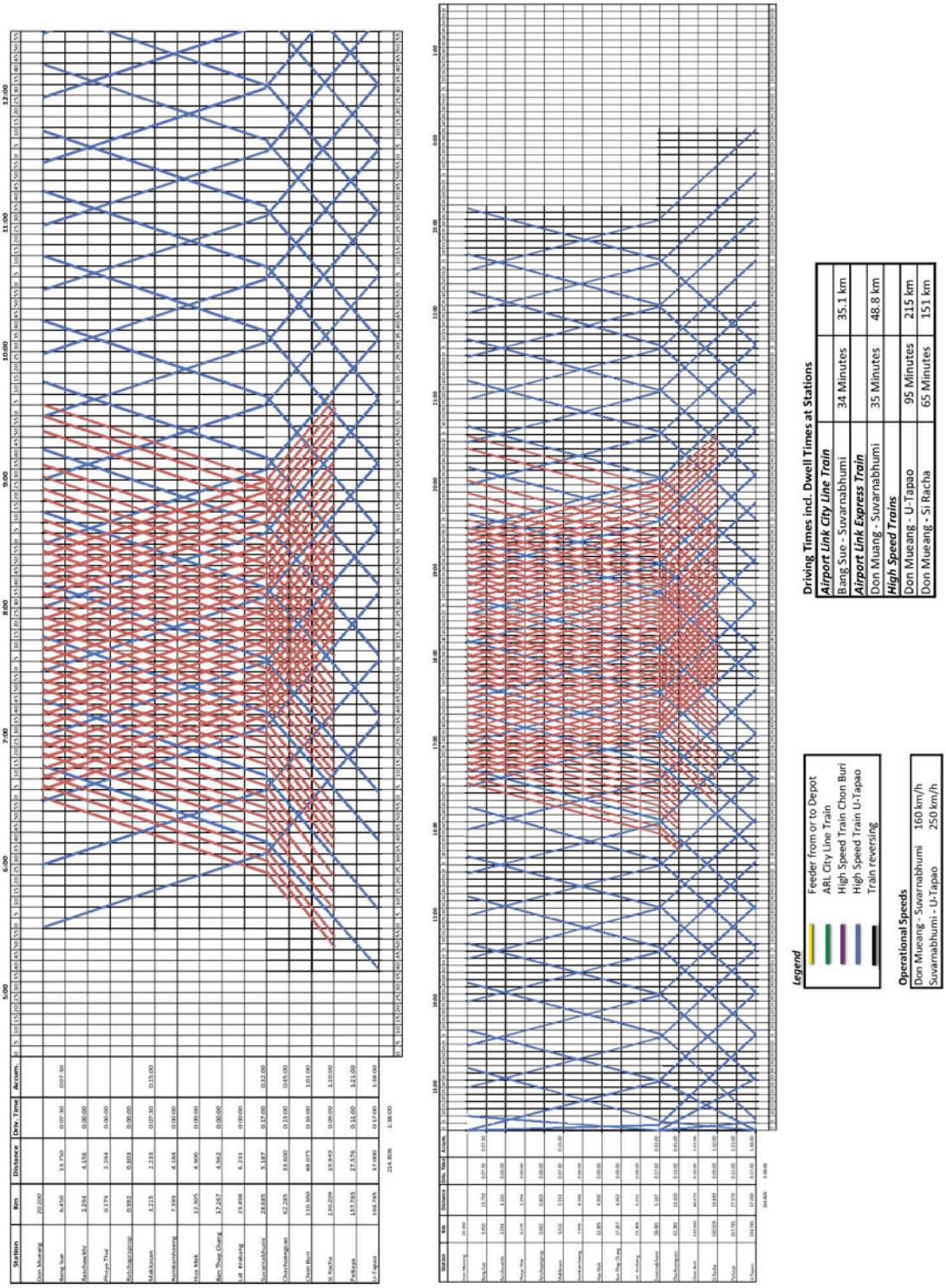


ANNEX 3: GRAPHICAL TIME TABLE

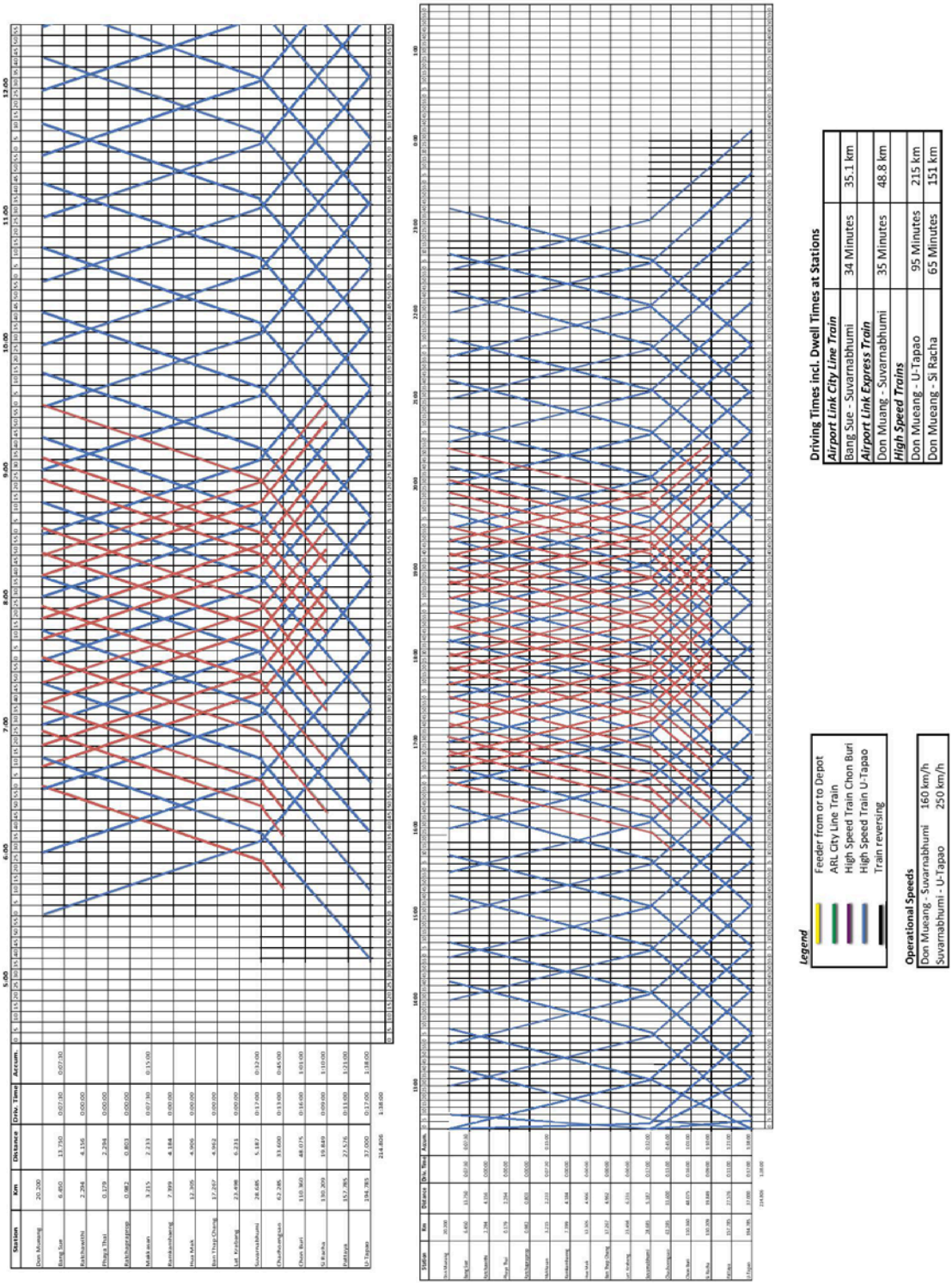
A3-1: Don Mueang – Suvarnabhumi City Line:
10 Minutes Headway (Peak) and 15 Minutes (Off Peak)



A3-2: Don Mueang – U-Tapao :
5 Minutes Headway (Peak) and 30 Minutes (Off Peak)



A3-3: Don Mueang – U-Tapao :
10 Minutes Headway (Peak) and 30 Minutes (Off Peak)



A3-4: Don Mueang – U-Tapao :
20 Minutes Headway (Peak) and 30 Minutes (Off Peak)