Ministry of Transportation
Directorate General of Railway

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DIGITAL TRANSFORMATION IN RAILWAYS

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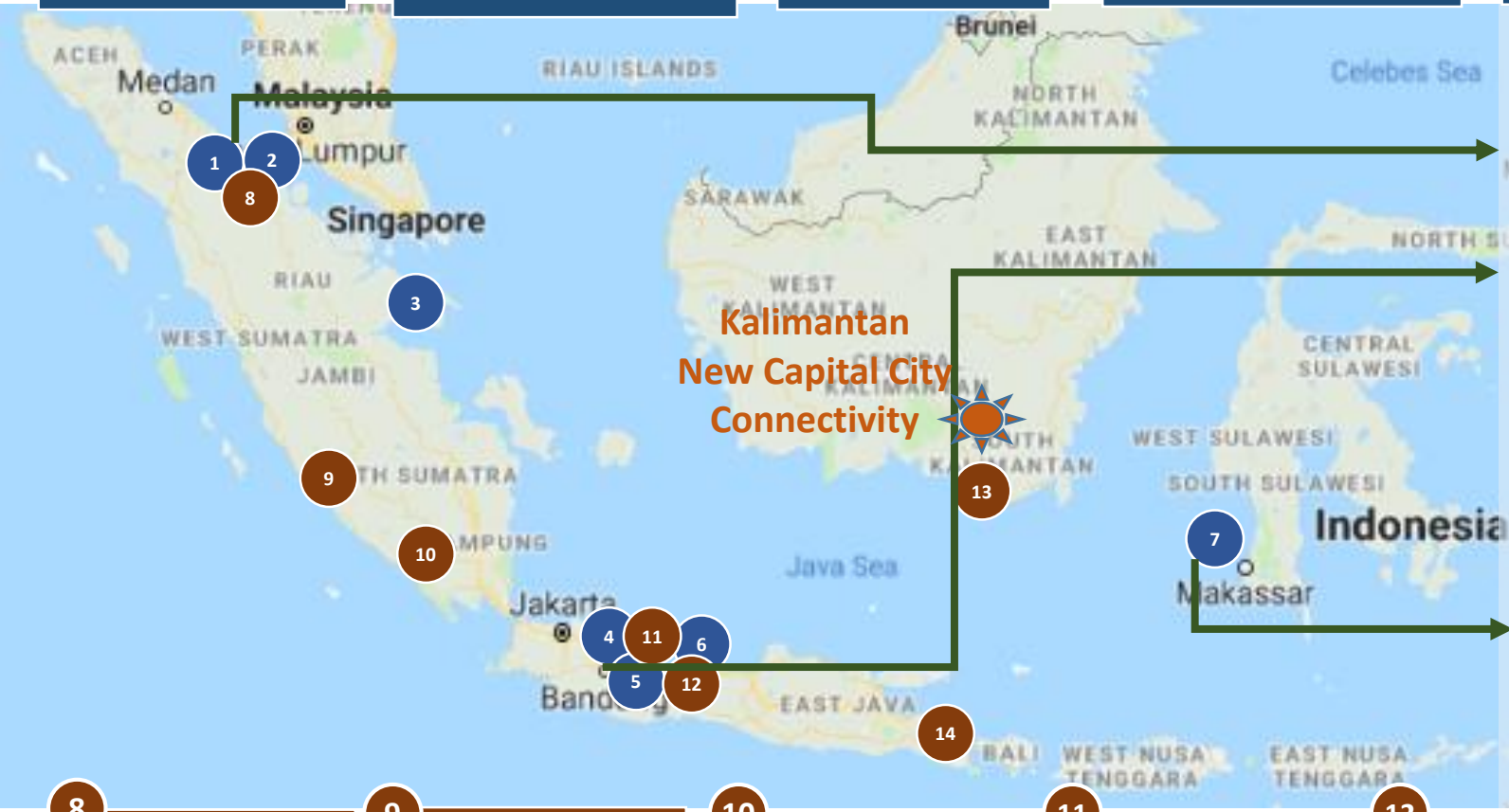
AFEO
ASEAN Federation of Engineering Organisations

PERSATUAN INSINYUR INDONESIA
PII

POTENTIAL RAILWAY DEVELOPMENT IN INDONESIA 2030

- *Special new development Urban Transport by new Capital city*
- *6 Metropolitan Cities prioritized for the development of rail-based urban mass public transport in 2020-2024, that is :*

1. LRT Medan (22,74 Km)
2. Medan – Binjai – Deli Serdang (Mebidang) (61,59 Km)
3. LRT Batam (55,47 Km)
4. LRT Cibubur – Bogor (26,4 Km)
5. Bandung Urban (15,6 Km)
6. Semarang Urban (78,4 Km)
7. Makassar Urban (MAMINASATA) (62,73 Km)



By cities Prioritized 2020-2024

Sumatera

1) Metropolitan Medan) (Mebidangro

Java

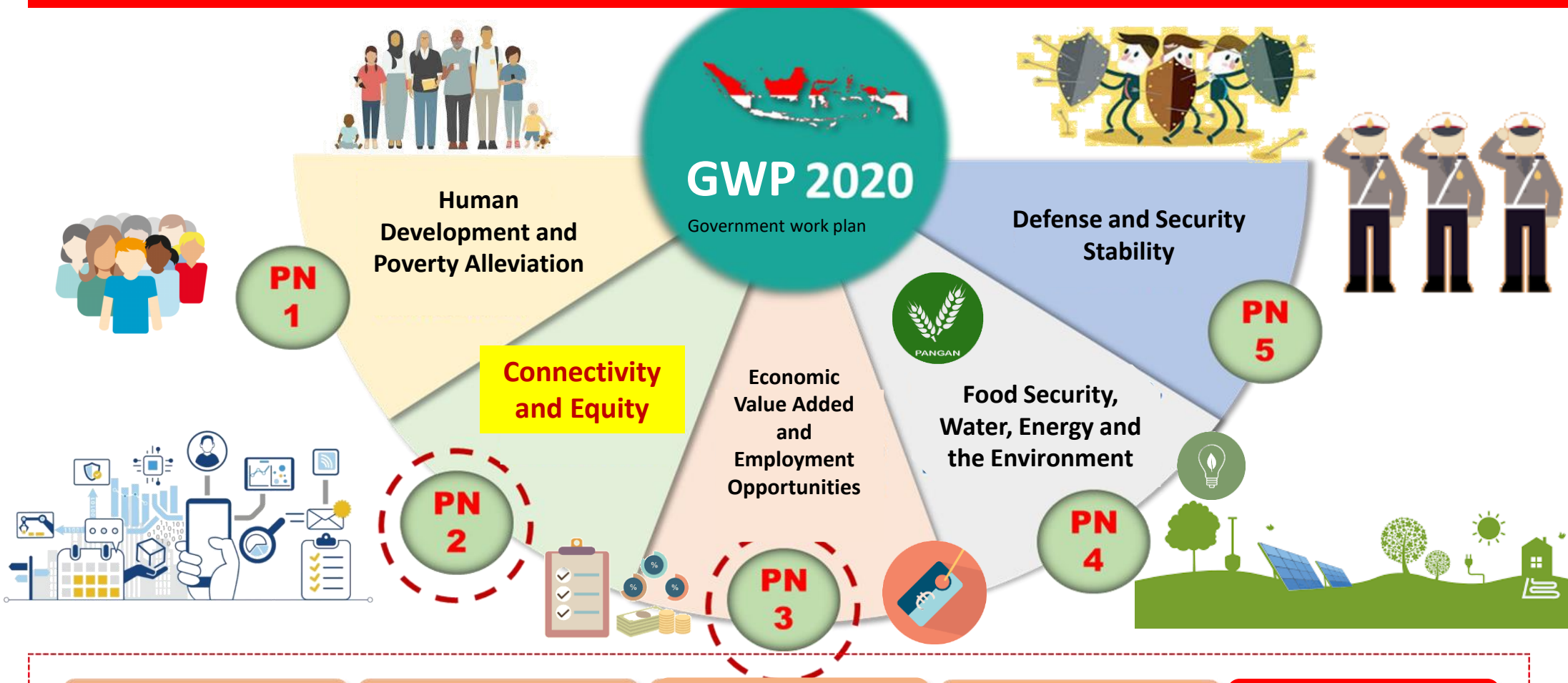
2) Metropolitan Surabaya (Gerbangkertosusilo)
3) Metropolitan Jakarta (Jabodetabek)
4) Metropolitan Bandung (Bandung Raya)
5) Metropolitan Semarang (Kedungsepur)

Sulawesi

6) Metropolitan Makassar (Mamminasata)

8. Siantar – Parapat (64,7 Km)
9. Kota Padang – Pulau Baai (168,2 Km)
10. Lahat – Tarahan (249,78 Km)
11. Shortcut of Cibungur – Tanjung Rasa (10,62 Km)
12. Kertajati Airport Railway (90 Km)
13. Tanjung – Banjarmasin (213,93 Km)
14. Mengwitani - Singaraja (Bali) (95,520 Km)

OUTLOOK FORWARD KABINET INDONESIA MAJU



How to get there?

Development paths to complete urban mobility by Integrated city management

* PN : Priority National

LONGSPAN Kuningan 351m LRT JABODEBEK

HOW

TO CONTROL NETWORK INFRASTRUCTURE AND ROLLINGSTOCK

Source : Photo Drone PT. Adhi Karya (Persero)

HUMAN CAPITAL : Workforce Must Have The Relevant Digital Skill

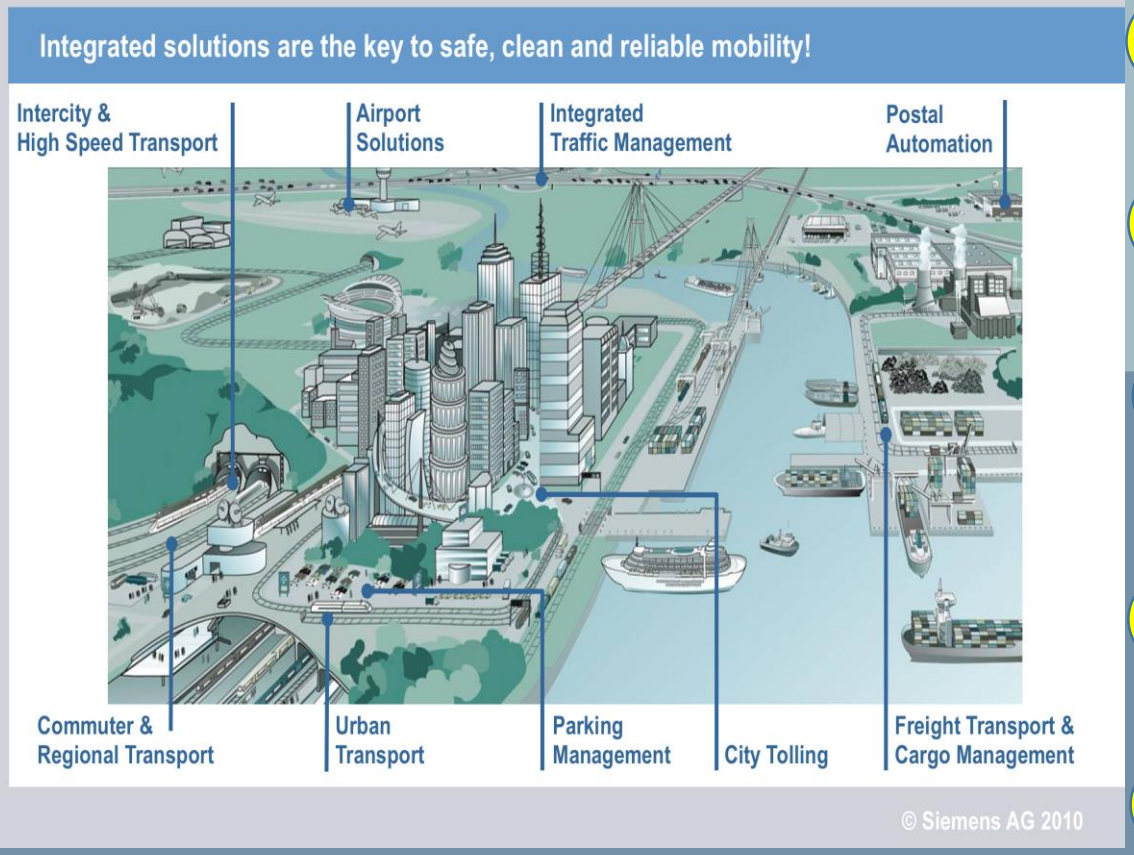
We Need To Put People At The Center of The Digital Future

Key Characteristic of Mobility Development Stages

Mobility 4.0

Smart transportation system

- Intelligent mobility based on digital solutions
- Automated mobility processes (order,ing, booking, driving etc.)
- Personalized packages on demand



1. **Flexibility** – abilities to learn and use multiple platforms, systems and solutions
2. **Programming and database fundaments** – computer science basic knowledge
3. **Communication and visualization** – capable of interpreting and translating data into actions and insights
4. **Analytical skills** – capability of analyzing datasets and indentifying problems
5. **Problem solving** – proactive attitude, looking for solutions
6. **Digital readiness** - abilities to work with electronic tools, documents and data
7. **Security and privacy** – understanding digital threats and risks arising from daily work
8. **Digital etiquette** – dealing with values, habits, patterns during data, platform and system usage
9. **Digital cooperation** - Organize and collaborate on online platforms and interfaces
10. **Curiosity and open mindset for digital change**

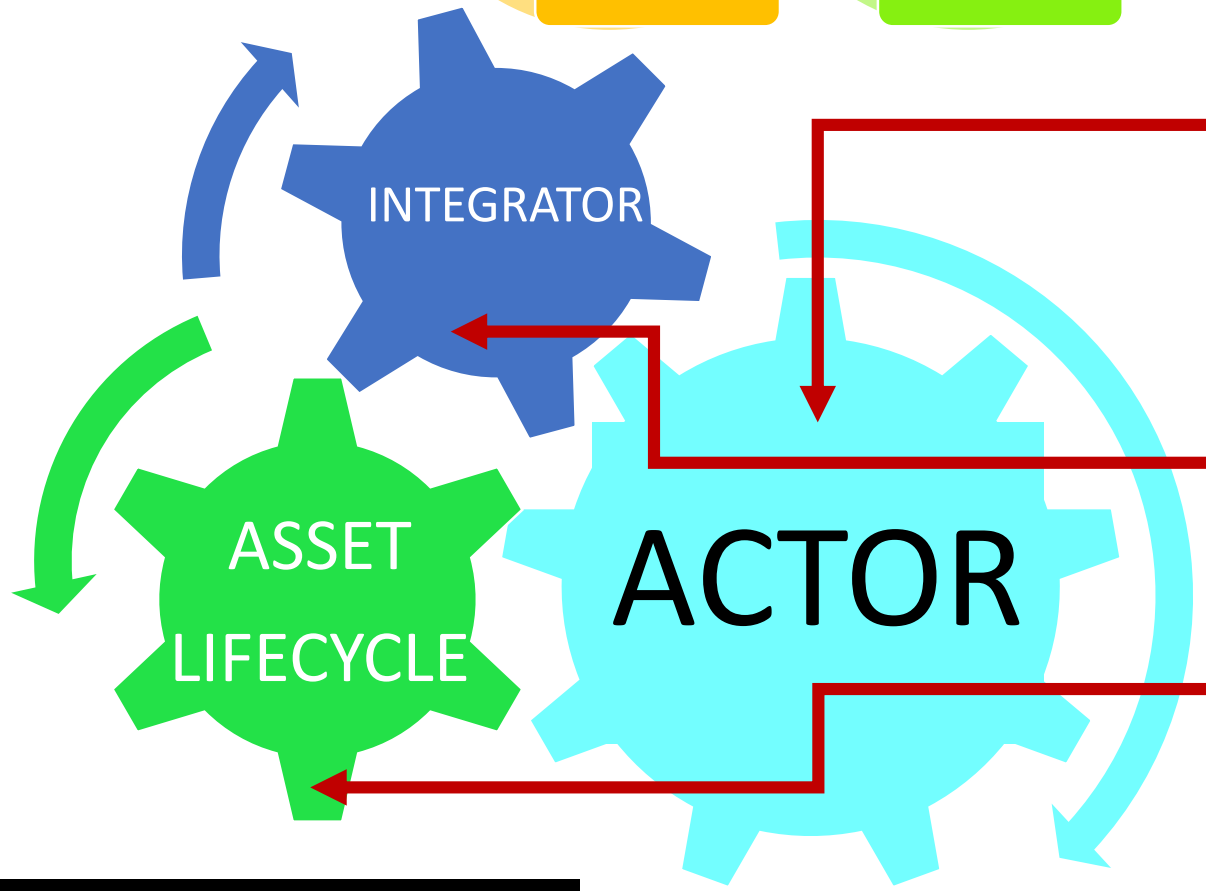
A GLANCE OF INDONESIA RAILWAY IDENTITY

HOW *TO IDENTIFY DIGITAL RAILWAY IN TECHNLOGICAL CHANGE*

- **STRENGTH**: Railway Industry; BUMN Sinergy; Government Policy
- **Weakness**: Technology Mastery; Dependence on Foreign Products; Regulatory Update; HR; Funding; Land acquisition
- **Opportunity**: Market Demand; Urban Mass Transportation; TOD; Information and Digital Technology; Global Rail Investment & Supply Market
- **Threat**: Technological Development; Environmental Issues

Source : Studi Teknologi Perkeretaapian Litbang Kemenhub, 2019

Trigger AREAS OF railway DIGITALISATION



1 Railways that are competitively synergized with industry

2 The implementation of an integrated, technological, affordable and capable railway

3 Respond to development challenges

SOURCE: various modified reference

TECHNOLOGY USE IN URBAN RAILWAY

SIGNALLING & INTEROPERABILITY

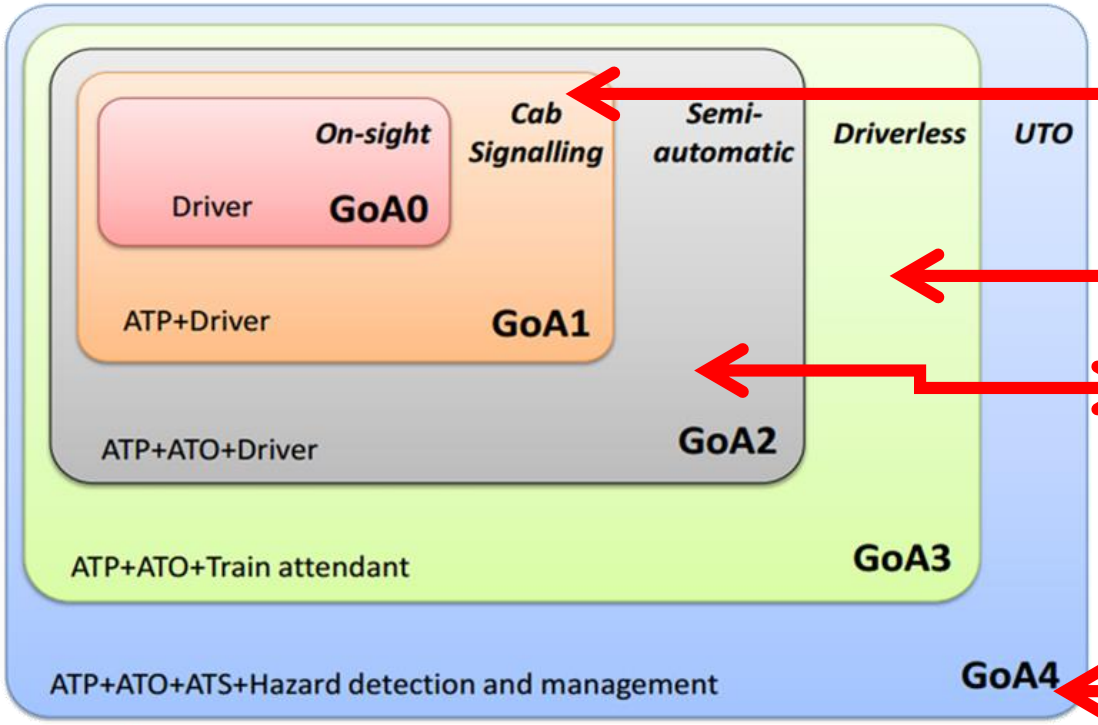
- **Broadband**
- **Mobile internet**
- **Internet of Things**
- **Cloud computing**
- **Big Data Analytics**

Connected train

Internet of Trains

- Implementation of GSM-R and ERTMS standards
- Cyber-security standards (NIS Directive)
- Ethernet Train Backbone Network (ETBN)
- Automated Train Operation (ATO)
- ATO over ERTMS solutions

SOURCE : SIEMENS 2019



Driving mode

Minimum functions

Continues communication between trains and trackside

Grade Of Automation

Signalling Technology:
MRT Jakarta- CBTC
LRT Jabodebek CBTC
SKY TRAIN CBTC
LRT Palembang – ETCS
Highspeed Rail – CTCS level 3

TELECOMMUNICATION	
Radio Tetra On Board	Radio Tetra Base Station
Wireless Access Point On Board	Wireless Access Point Wayside
CCTV System	AMS
SCADA	
AFC	
3rd RAIL	
DEPOT EQUIPMENT	

LRT SOUTH SUMATERA

LRT JABODEBEK

SIGNALING SYSTEM	
CBTC - Moving Block GOA 3 Interlocking SIL - 4	
Track Guard MKII computer interlocking system (IXL)	Radio Airlink
	Point Machine BSG 9
Track vacancy detection system based on the Clear Guard ACM250 axle counter	Controlguide Rail 9000 automatic train supervision system (ATS)
On Board Equipment	Train Guard MT

LRT JAKARTA

SIGNALING SYSTEM	
Fixed Block, Cab Signal	SIL - 4
ETCS LEVEL I	ATP
TELLECOMMUNICATION	
TETRA	Back Bone Fiber Optic
POWER SYSTEM	
750 VDC	Third Rail Bottom Contact
SCADA	

SKYTRAIN AIRPORT SOETA

SIGNALING SYSTEM	
Moving Block	ATP ATO
CBTC	SIL - 4
TELLECOMMUNICATION	
Radio Tetra	Back Bone Fiber Optic
POWER SYSTEM	
750 VDC	Third Rail Bottom Contact

SOURCE : LEN, 2018

Case Study of LRT Jabodebek : Signaling System

CBTC for Jabodebek

TCSS (Train Control Signaling System) enables

- **GoA3** Driverless Train Operation (DTO) for passenger

Signaling System

- Signaling System: Moving Block **CBTC**
- Headway: 3 & 6 Minutes
- Safety System: Automatic Train Protection (ATP)
- Main Control: Operation Control Centre (OCC)

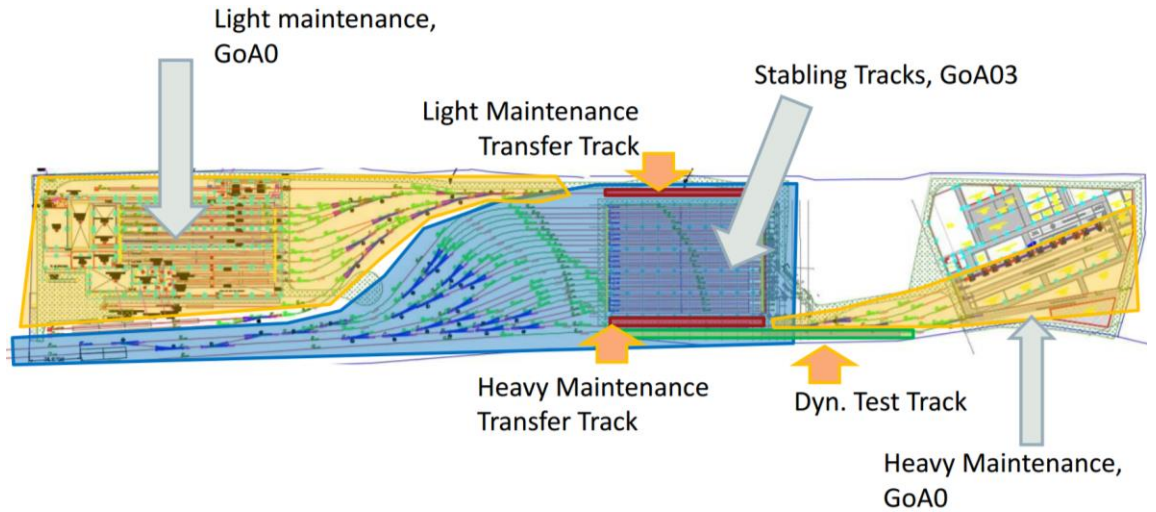
3 corridors in first phase: (~43 km)

- Line 1 : Cawang – Harjamukti (14.35 km);
- Line 2 : Cawang - Dukuh Atas (10.2 km);
- Line 3 : Cawang – Jatimulya (17.8 km);
- Depot : Bekasi Timur (End of Line 3).

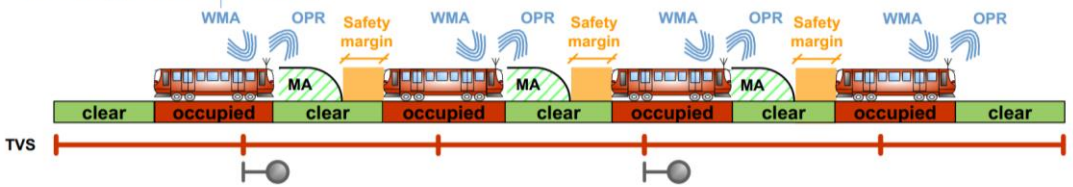
Future lines 4 to 6 will be developed during Phase 2

Depot Layout

The operation in Depot shall be supervised by a specific ATS : Depot Control Centre (DCC).



Moving block (≙ CTC)



CBTC signaling allows moving block train separation

- Each train reports its location, direction of travel and speed
- Safe distance between trains is defined by movement authority given to each train
- Minimum distance is safe breaking distance + safety margin

Train Control Signaling System

Jabodebek LRT Train Control Signaling System (TCSS) is composed of

- Automatic Train Supervision (ATS)
- Interlocking (IXL)
- Data Communication System (DCS)
- Automatic Train Control (ATC)
  - Automatic Train Protection (ATP)
  - Automatic Train Automation (ATO)

CBTC

Source : LRT Jabodebek Project, 2019

THE CHALLENGES FACING THE INDUSTRY

Key Technology

1) Big Data Analytics
2) Mobile Internet
3) Broadband
4) Cloud Computing
5) Additive Manufacturing
6) Robotics

Digital Concept for Railways

1) Connected Commuter
2) Intelligent Station
3) Smart ticketing
4) Mobility as a Service
5) Logistics 4.0
6) Freight as a Service (FaaS)
7) Intelligent freight car
8) Logistics Platforms

10) Infrastructure 4.0
11) Maintenance 4.0
12) Self-aware infrastructure
13) Self-aware rolling stock
14) Smart factory
15) Virtual Manufacturing
16) Connected train
17) Internet of Trains

Source : Siemens, 2019

AREAS OF DIGITALISATION OF RAILWAYS

THE CHALLENGES FACING THE INDUSTRY

SAMPLE SOLUTION

1 PASSENGER SERVICES	2 FREIGHT SERVICES	3 INFRASTRUCTURE & ROLLING STOCK MANAGEMENT	4 MANU-FACTURING	5 SIGNALING & INTEROPERA BILITY
1) Internet access on-board trains (3G/4G, potentially 5G) 2) Mobile applications, including intermodal travel 3) Embedded services and infotainment on-board trains and at railway stations 4) Systems integration via interoperable product service interfaces (IPSI) 5) Dynamic/Real-Time Passenger Information Systems 6) Automatic ticketing and information systems	1) Real-time train and freight cars tracking and tracing systems 2) Electronic shipping documents and e-invoices 3) New business models for freight logistics 4) The use of drones to monitor trains and ensure safety of cargo	1) Infrastructure monitoring systems 2) Predictive maintenance (PM) 3) Wayside Train Monitoring System (WTMS) 4) Dynamic railway infrastructure access systems	1) New technologies and materials 2) 3D technology 3) Virtual Reality (VR) 4) Industrial Internet of Things: integration IT and OT	1) Implementation of GSM-R and ERTMS standards 2) Cyber-security standards (NIS Directive) 3) Ethernet train backbone network (ETBN) 4) Automated train operation (ATO) 5) ATO over ERTMS solutions

Source : Siemens, 2019

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THANK YOU