DIGITAL TRANSFORMATION IN RAILWAYS

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MRT LRT KRL
- 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:

**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)

By cities Prioritized 2020-2024
How to get there?
Development paths to complete urban mobility by Integrated city management

* PN : Priority National
HOW
TO CONTROL NETWORK INFRASTRUCTURE
AND
ROLLINGSTOCK

Source: Photo Drone PT. Adhi Karya (Persero)
HUMAN CAPITAL: Workforce Must Have The Relevant Digital Skills

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

Key Characteristic of Mobility Development Stages

<table>
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<tr>
<th>Mobility 4.0</th>
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<tbody>
<tr>
<td>Smart transportation system</td>
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<tr>
<td>- Intelligent mobility based on digital solutions</td>
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<tr>
<td>- Automated mobility processes (ordering, booking, driving etc.)</td>
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<td>- Personalized packages on demand</td>
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1. Flexibility – abilities to learn and use multiple platforms, systems and solutions
2. Programming and database fundamentals – 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 identifying 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 TECHNOLOGICAL 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

CONTINUOUS COMMUNICATION BETWEEN TRAINS AND TRACKSIDE

SOURCE: SIEMENS 2019

SIGNALLING & INTEROPERABILITY
- Broadband
- Mobile internet
- Internet of Things
- Cloud computing
- Big Data Analytics

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

TELECOMMUNICATION
- Radio Tetra On Board
- Wireless Access Point
- CCTV System
- AMS

SCADA
- AFC
- 3rd RAIL

DEPOT EQUIPMENT

LRT JABODEBEK
- Track Guard MKII computer interlocking system (XIL)
- 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 SOUTH SUMATERA
- Fixed Block
- Cab Signal
- ETCS LEVEL 1
- SIL - 4

TELECOMMUNICATION
- TETRA
- Back Bone Fiber Optic

POWER SYSTEM
- 750 VDC
- Third Rail Bottom Contact

SCADA

LRT JAKARTA
- CBTC - MRT Jakarta
- CBTC - LRT Jabodebek
- CBTC - SKY TRAIN
- CBTC - LRT Palembang
- ETCS
- Highspeed Rail
- CTCS level 3

SIGNALLING SYSTEM
- Fixed Block
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SKYTRAIN AIRPORT SOETA

SIGNALLING SYSTEM
- MRT Jakarta - CBTC
- LRT Jabodebek - CBTC
- SKY TRAIN - CBTC
- LRT Palembang - ETCS
- Highspeed Rail - CTCS level 3

SOURCE: LEN, 2018
Case Study of LRT Jabodebek: Signaling System

**TCSS (Train Control Signaling System) enables**
- **GoA3** Driverless Train Operation (DTO) for passengers

**Future lines 4 to 6 will be developed during Phase 2**

- 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)

**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 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

**Depot Layout**

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

- Light maintenance
- Dyn. Test Track
- Stabling Tracks, GoA03

**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
9) Self-aware infrastructure
10) Infrastructure 4.0
11) Maintenance 4.0
12) Self-aware rolling stock
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. 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
Ministry of Transportation
Directorate General of Railway

THANK YOU