Signaling System and Communication System on Shinkansen of JR-EAST

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- Outline of Shinkansen of JR-East
- Signal system (Automatic Train Control system)
- Train radio system
- COSMOS (Computerized safety maintenance and operation systems of Shinkansen)
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Overview of our Shinkansen

- **Length of network**
  - Shinkansen: 1134.7km
  - Mini-Shinkansen: 275.9km
  - **Total**: 1410.6km

- **Average number of passengers**
  - About 260,000 per day

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<table>
<thead>
<tr>
<th>Number of trains per day</th>
<th>Maximum number of trains per day</th>
<th>Number of trains between Tokyo and Omiya per hour</th>
<th>Average time delay per train</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 2 0</td>
<td>4 1 5</td>
<td>1 5</td>
<td>Less than 1 minute</td>
</tr>
</tbody>
</table>

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Outline of the JR-EAST Shinkansen

- **Characteristic of the JR-EAST Shinkansen**

  - Through operation between Shinkansen lines and converted conventional lines
    - Includes several types of rolling stock
    - Coupling and uncoupling operation performed at some stations en route
  - Complicated train operation system
    - Operates five routes from Tokyo Station
    - All trains run between Tokyo and Omiya (trains run frequently)
    - Minor trouble can affect punctuality of trains

  We had replaced it Digital one for safety, customer satisfaction and efficiency, which can exchange lots of dates.
Innovations in Train Control System - 1
- Conventional ATC -

- Travel time and train headway are both longer.
- Any progressed train brake performance is not effective.

Replace with Digital ATC
Innovations in Train Control System - 2
- Digital ATC -

- Allowed speed (emergency brake)
- Allowed speed (normal brake)
- Train speed

- Optimal brake control fit for each brake performance.
- The travel time and train headway can be reduced.
- Coping with disruptions in the time schedule is becoming flexible.
- Maintenance–free due to monitor it remotely from OCC.
Innovations in Train Operation - 1

COMTRAC

（Computer aided traffic control system）

- It is difficult for support for through operation between Shinkansen lines and converted conventional lines and Coupling and uncoupling operation at some en route stations.
- Difficult to support for opening the new line.

COSMOS

（Computerized safety maintenance and operation systems of Shinkansen）

Development of new COSMOS with latest technology
Innovations in Train Operation - 2

- **COSMOS**
  - Switching from centralized PRC to station-distributed-type PRC.
  - CRT operation displays and control boards.
  - Train dispatchers and operators operate trains, conduct temporary speed control, and operate shunting and maintenance vehicles directly.
Onboard-wayside communication

- **Analog train radio**
  - Voice call only
  - Shortage of channels

- **Digital train radio**
  - All data lines flexibly configured for packet transmission
  - 37 channels instead of 24 channels
  - High-qualiy voice call
New data-based applications

- **Train maintenance support system**
  - Monitoring terminals are set up at the control center and all the trains to monitor the operation of running Shinkansen trains in real time.

- **Operation command notice system**
  - The monitor in the trains driver’s cab displays messages, slow-down instructions and other data to the train crew issued by a controller in the control center.
  - Train operation changes in a railway emergency, for example, can be quickly and reliably conveyed for safer, accident-free runs.
Countermeasures for heavy snowfall

- **Areas of heavy snowfall**
  - Niigata and Aomori are areas of heavy snowfall in Japan.
    - Heavy snowfall damages ground equipment, posing problems maintenance.
      (Snow adhering to train in cold region and heavy snow areas, falls to grand level.)
    - Improving maintenance efficiency to install protectors for transponders and cables near the track.
JR East will continue to take on new challenges with technological innovations in its efforts to realize safe and stable transport.

...Thank you for your kind attention