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Big Data Analysis Application Experience to Traction Power Demand for HSR

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Introduction

◆ Profile of THSRC- HSR Route Plan

- **The total length 349 km**
- **12 Stations constructed**
- **5 Depots**
 - Lioujia Depot
 - Wurih Depot
 - Taibao Depot
 - Main Workshop
 - Zuoying Depot
- **Operation times from 06:15 to 24:00 every day(July 1, 2016)**



Overview of Train Service

Service Level and Patterns (July 1, 2016)

Direction	Trains per day					Trains per week
	Mon	Tue~Thu	Fri	Sat	Sun	
Northbound	66	64	74	67	83	482
Southbound	62	62	79	71	74	472
Both directions	128	126	153	138	157	954

	NAG	TPE	BAN	TAY	HSI	MIA	TAC	CHA	YUL	CHY	TNN	ZUY	Trains per week	Travel time (mins)
B Pattern	⊙	⊙	⊙				⊙					⊙	268	105
B' Pattern		⊙	⊙				⊙			⊙	⊙	⊙	24	105
	⊙	⊙	⊙				⊙				⊙	⊙		110
C Pattern	⊙	⊙		⊙			⊙	⊙	⊙	⊙	⊙	⊙	12	130
D Pattern	⊙	⊙	⊙	⊙	⊙		⊙			⊙	⊙	⊙	342	130
E Pattern	⊙	⊙	⊙	⊙	⊙	⊙	⊙						68	77
E' Pattern							⊙	⊙	⊙	⊙	⊙	⊙	14	65
F Pattern	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	226	145



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Overview of Traction Power

- 7 Bulk Supply Substations, BSS

- Service Range of BSS along MainLine

- BSS1(Nangang, Taipei, and Banqiao, 45.5km)

- BSS2(Taoyuan, and Hsinchu Stations, 47.5km)

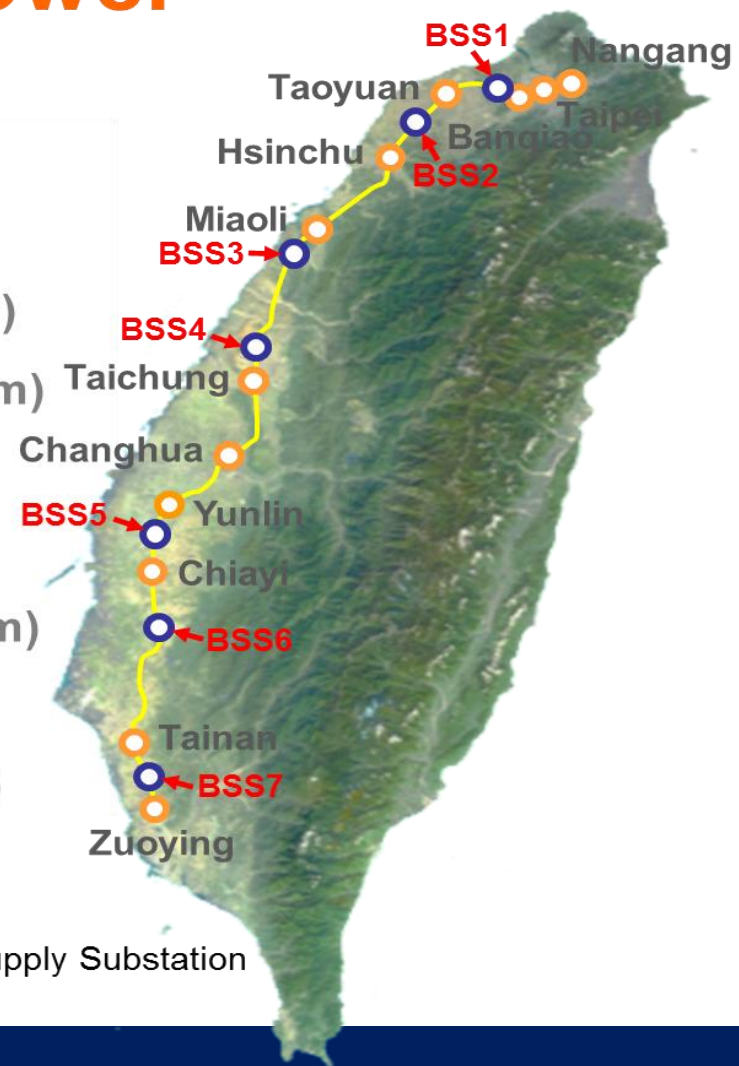
- BSS3(Miaoli Station, 51.8km)

- BSS4(Taichung Station, 55.7km)

- BSS5(Changhua, and Yunlin Stations, 56.0km)

- BSS6(Chiayi Station, 53.0km)

- BSS7(Tainan, and Zuoying Stations, 44.5km)



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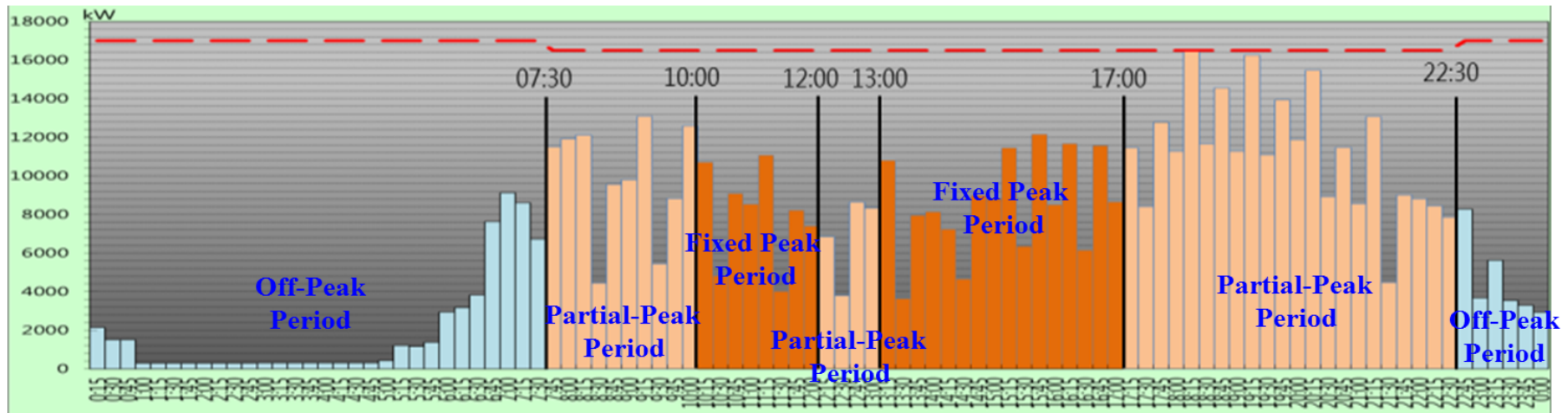
Demand and Contract Capacity

- **What is the “Demand”?**

It is based on maximum kilowatts consumed (averaged over 15 min) during each Time of Unit(TOU) period.

- **What is the “Demand Contract Capacity”?**

It is a agreement between customer and Utility for the Demand which is applicable to pay contract capacity charge and subjected to specified minimum.



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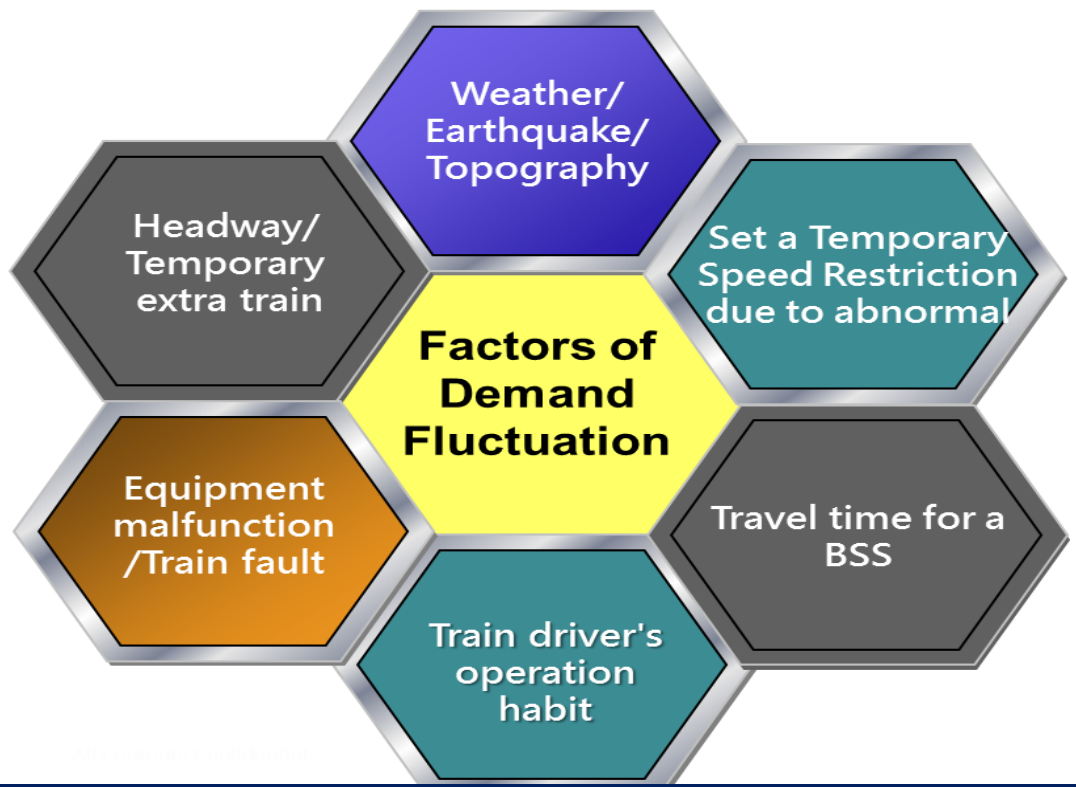
Why Big Data?

Predictive Analytics
Data Science

Large/Raw data
Complex data

Correlation
More Accurate

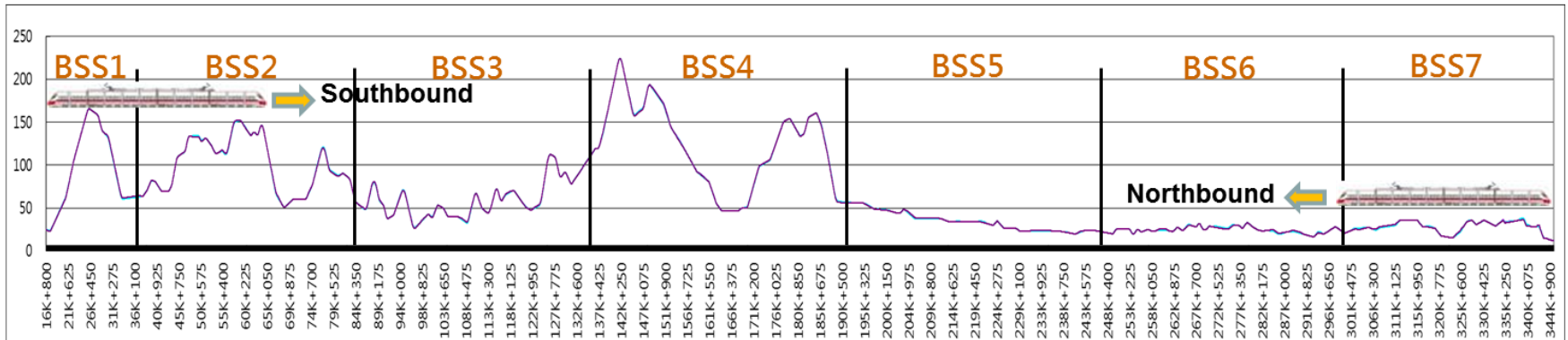
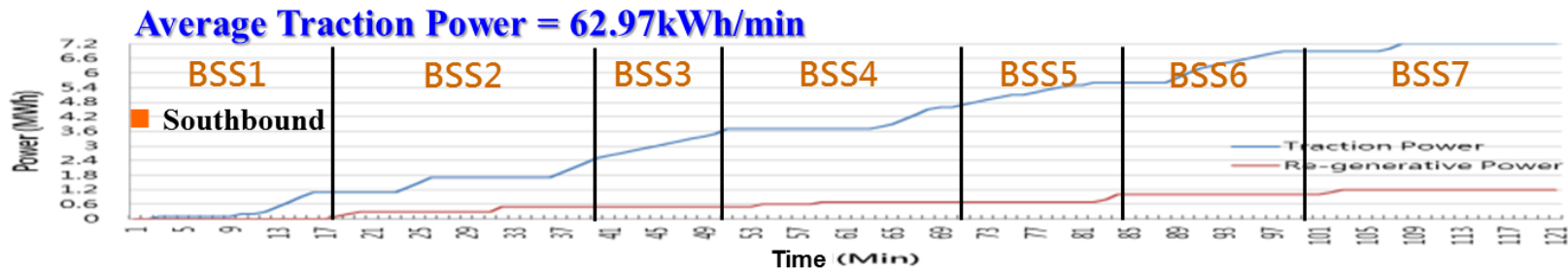
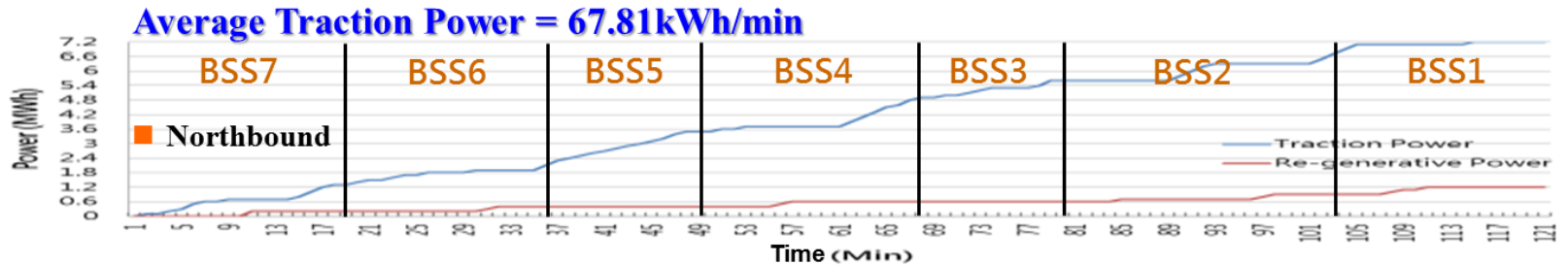
- ▶ Relational
- ▶ Non-Relational
- ▶ Real Time Intelligence
- ▶ Data Discovery



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Demand Fluctuation affected by Topography



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What are we
looking at?

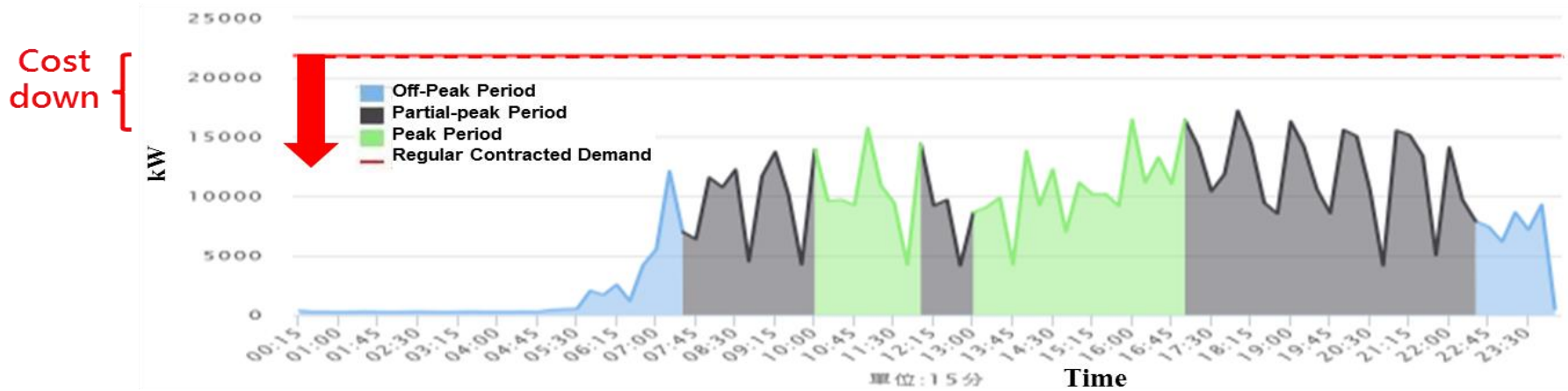
- **Optimal Contract Capacity**
- Best time frame for additional service trains
- Intelligent management APP module of exceeded demand capacity warning



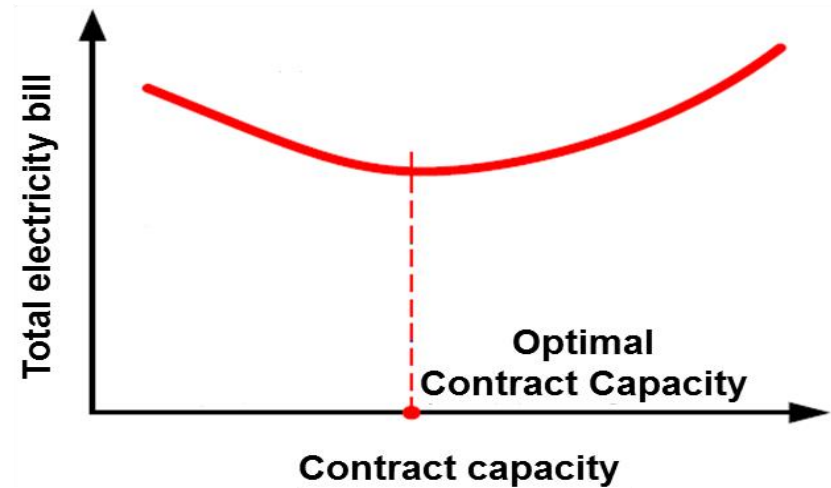
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Optimal Contract Capacity



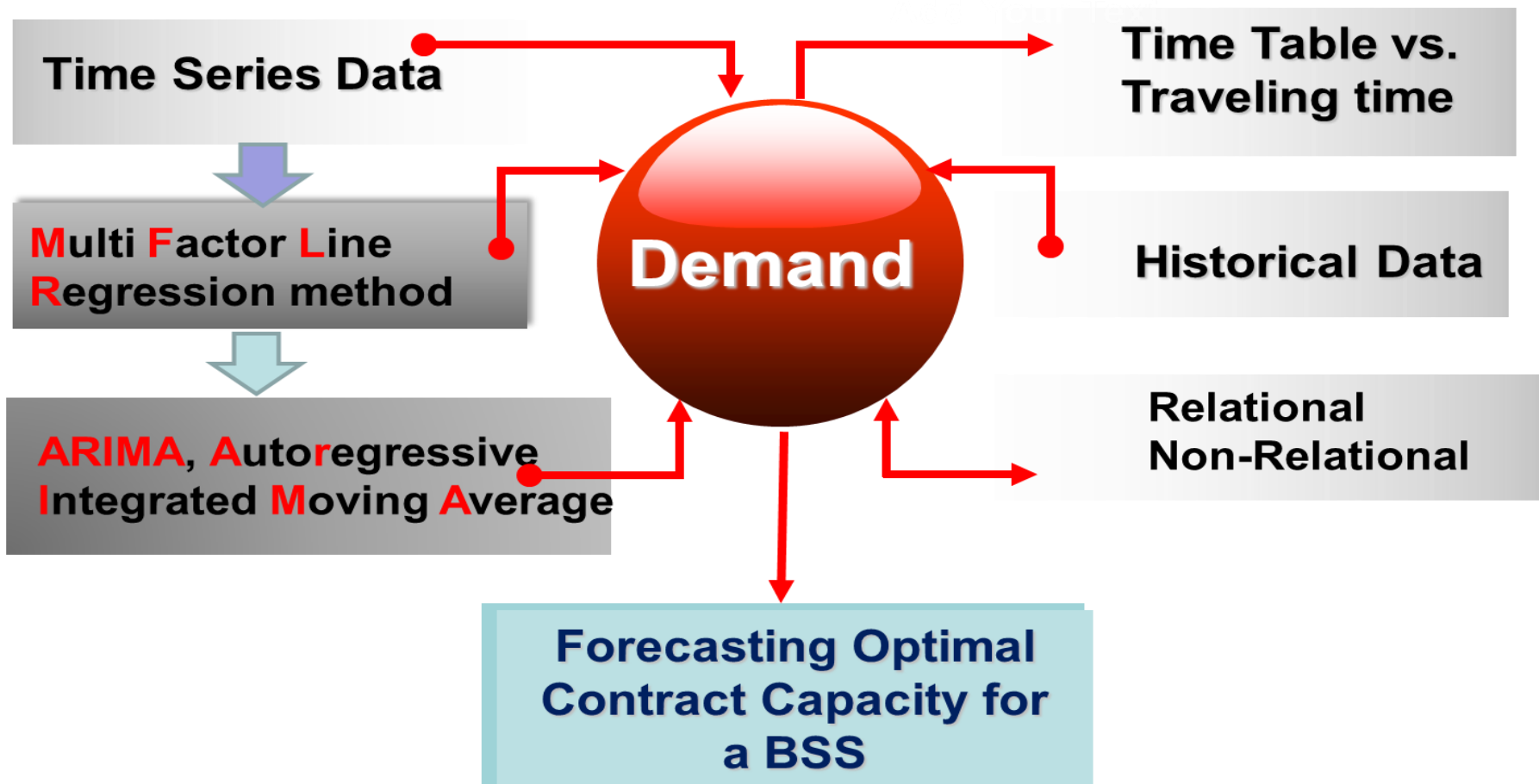
- Lower cost in the longer term, through better capacity planning approach, thus as Big data technology introducing.
- Accurate assessment of Contract Capacity must be made by good utilization.




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Optimal Contract Capacity





What are we looking at?

- Optimal Demand Contract Capacity
- **Best time frame for additional service trains**
- Intelligent management APP module of exceeded demand capacity warning



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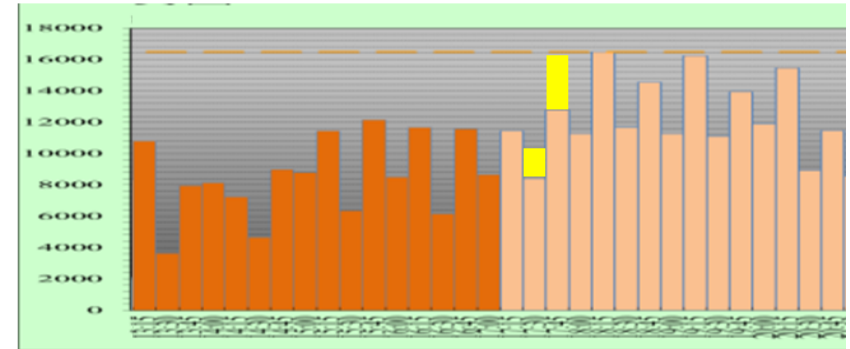
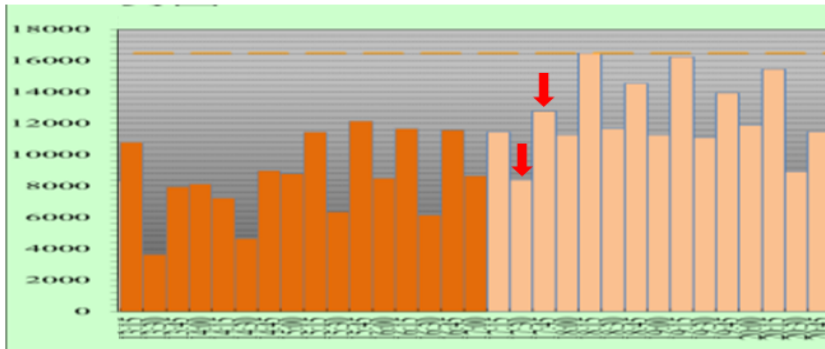


Best time frame for additional service Trains

- **Considering** on both passenger services principle and power demand variation due to additional train service, Based on the Big Data technology to estimate the optimum power demand, search out best time slot for inserting of the additional train service and avoid the possibility of exceeding the contract demand capacity, to reduce unnecessary cost.




Time frame for additional service trains



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What are we
looking at?

- Optimal Demand Contract Capacity
- Best time frame for additional service trains
- **Intelligent management APP Tool**

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Demand Monitor and Smart Driving

- **Based** on the time table and power demand characteristic to develop the APP which could be used by train driver and train controllers. Combined with the existing train driver “Smart Driving” activities, which feedback on demand trend and characteristic, to achieve the goal of economic operation.



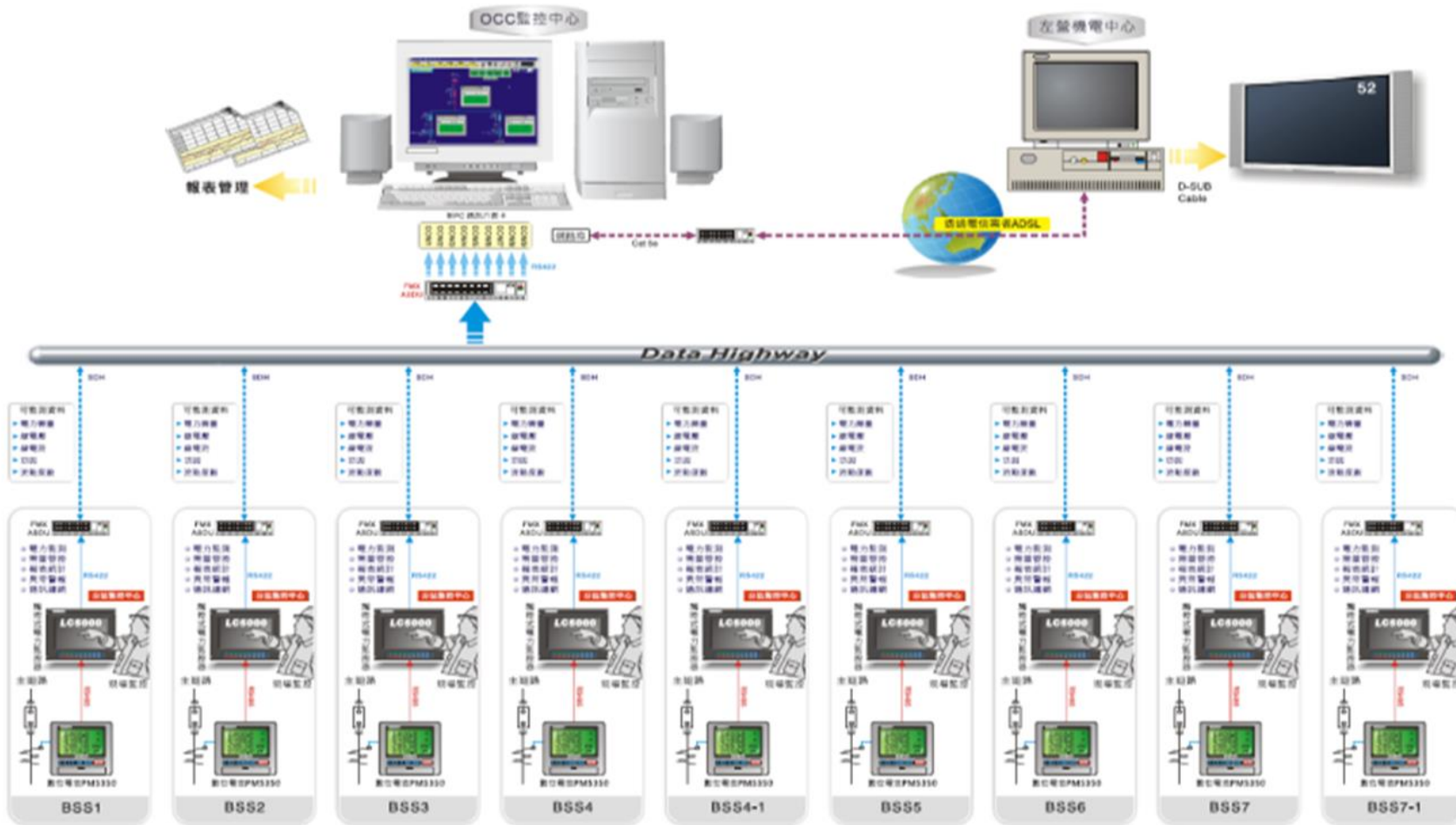
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Demand Monitoring System

Operation Control Center

Back office



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Demand Monitoring System



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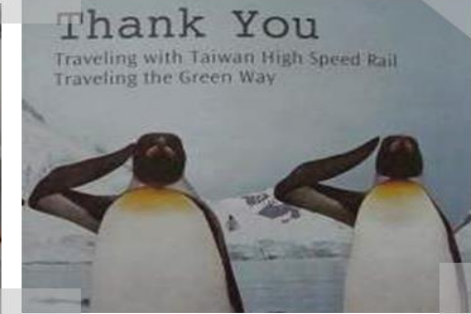
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Next Steps

Step forward to Demand Big Data Survey

- Optimal Demand solution through Big Data exploring
- Good Demand utilization lie in best time frame of adding trains.
- An Intelligent management APP module development is applicable to real-time and on-site operators, which make added value for economical operation.



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