RAILWAY ENGINEERING (CENG 5412)

CHAPTER 7
ORGANIZATION OF TRAIN OPERATION

Chapter 7 Organization of Train Operation

- Train formation
- Organization of car flow and fright train formation plan
- Train Diagram & Carrying capacity

7.1 Train Formation

Definition, Classification & Number of Train

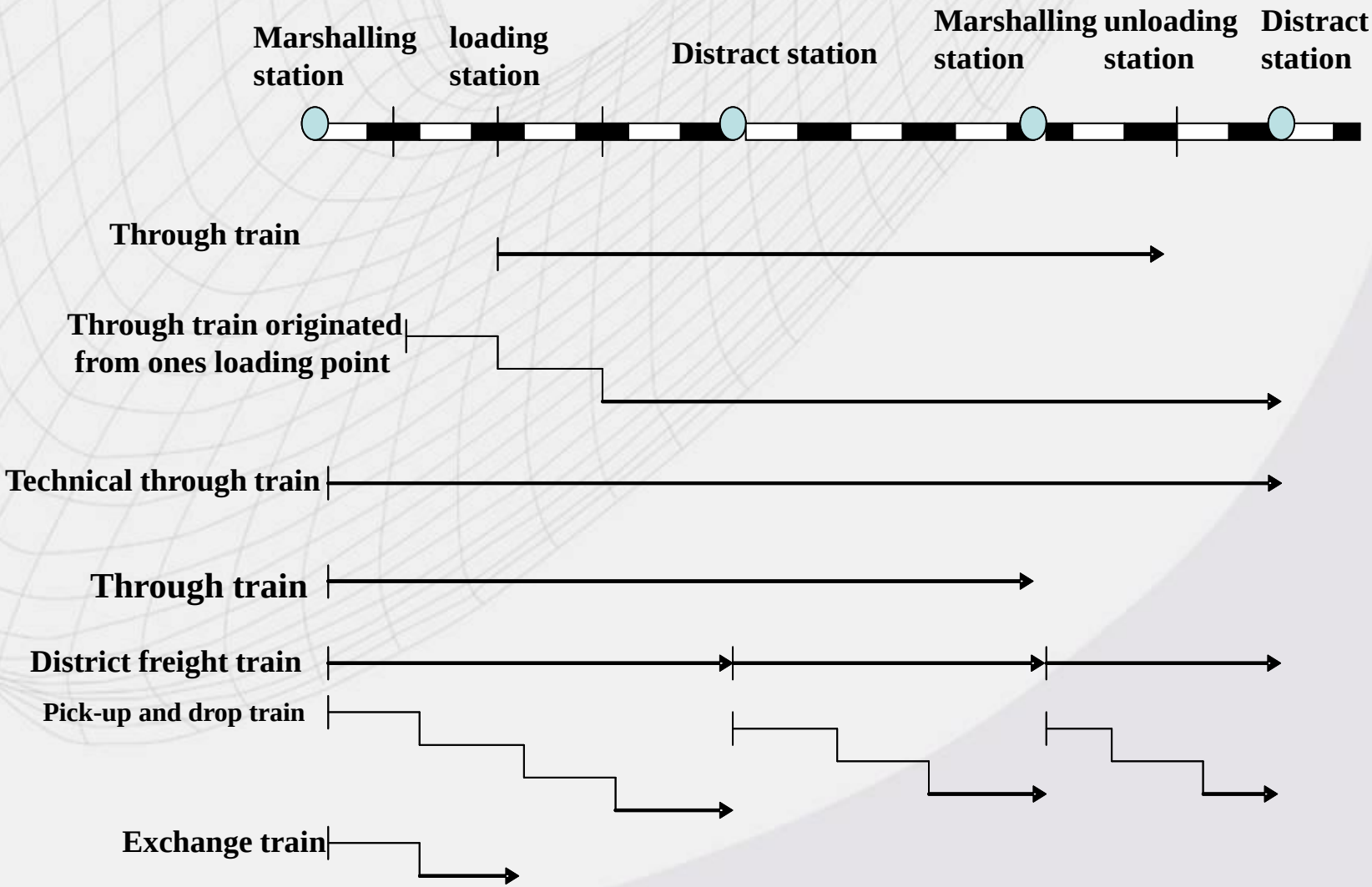
The train refers to the marshalling train set with locomotive and prescriptive train signs.

Classification of the train according to the nature of transportation

1. *Passenger train (express, fast and ordinary passenger train)*
2. *Mail and parcel train (express, fast mail, baggage and parcel train)*
3. *Troop train*
4. *Freight train (five out scheduled, express, heavy-duty, through, direct, insulated, self-owned vehicle, district, pickup, overrun and exchange train)*
5. *Service train*

Classification according to the place and driving distance of formation

- **Through train** (through train originated from one loading point, coal direct, oil direct, through train with empty cars, technical through train)
- **Direct train**
- **District train**
- **Pickup and drop train**
- **Exchange train** (district exchange train, junction terminal transfer train)
- **Short-haul train**


Marshalling station
loading station
Distract station
Marshalling station
unloading station
Distract station
Through train
Through train originated from ones loading point
Technical through train
Through train
District freight train
Pick-up and drop train
Exchange train

Classification according to features and applications of transportation：

- Five out schedule
- Express freight train
- Overrun train
- Heavy haul train
- Insulated train
- Self-owned train

Classification according to train numbers and formation methods

- **Single group train**
- **Group train**

Train number

1. In order to identify the nature and grade of the train, and to facilitate the train organization and management, each train is labeled particular number which is called train number.
2. Trains that are bound for capital and driving from the branch to the main are up train, labeled double train number; whereas, the trains are down train, labeled single train number.

The main classification and numbers of freight train

SN	train types	Nature or purpose	numbers
1	Through train originated from ones loading point	The train which In a loading station or several stations after the grouping, and through a or above marshalling yard train operations without adaptation.	85001~85998
2	Technical through train	The train which in technical points in the organization， through a or above marshalling yard train operations without adaptation.	10001~19998
3	Through freight train	The train which in technical points in the organization， through a or above section of the station operations without adaptation.	20001~29998
4	District freight train	The train which in technical points in the organization， reach the adjacent technology station, do not make Vehicles Abstract hanging jobs within the section	30001~39998
5	Pick-up and drop train	The train which in technical points in the organization，and make Vehicles Abstract hanging jobs at intermediate station in adjacent intervals.	40001~44998
6	Exchange train	train travels at each station in inner-bureau	45001~49998
7	Overweight freight train	The train which total traction weightsmore than 5000t	71001~72998
8	“Five fixed” train	Fixed, fixed line, fixed trips, timing, pricing cargo direct express trains	80001~81998
9	Fast freight train	The car used to transport Fresh perishable and emergency operation cargo quickly	82701~82798

Organization of Car Flow and Freight Train Formation Plan

Car flow and Train flow

- ***Car flow***—the collections of vehicles with some destination by railway transport. When it comes to traffic flow, we use number of passing vehicles in one day to calculate
- ***Train flow***—the collection of trains with some destination.

Traffic flow and train flow are called transport flow totally

- Organizing the goods traffic into traffic flow is the main problem to resolve;

- managing traffic flow into train flow is the main task of freight train formulation plan (for short ***"train formulation plan" or "formulation plan"***);

- while the organization of train flow which manipulate the train traffic order mainly depend on the train diagram to accomplish the task.

The definition of car flow organization

- Converting the car flow into train flow is called wagon flow organization;
- Accordingly, the plan of converting the wagon flow into train flow is called formulation plan. Specifically, wagon flow organization mainly resolves two problems:
  - （1）How to marshal trains in every direction of road network
  - （2）Every branch absorbs what kind of wagon flow

Common operations of car flow organization

Freight flow

In a certain period, freight flow is formed by transporting goods from the place of dispatch to place of delivery。

1. Freight volume

The total sum of goods delivered from every station, is also the total sum of flow volume from each branch,

$$N = \sum N_i = \sum n_j \qquad (\mathrm{t})$$

At the formula： **Ni —goods tonnage of each station, t;**

nj —freight volume of each branch, t

2. Density of freight traffic：

The total sum of goods traffic through every district, that is:

$$D = \sum D_i \qquad (\mathrm{t})$$

Where D_i —Goods traffic through every district, t

3. Freight turnover：

The total sum of a product of the density of freight traffic and length in every district

$$T = \sum D_i L_i \qquad (\mathrm{t \cdot km})$$

where：L_i —Length in every district，km；

D_i —Freight flow volume through every district，t；

4.Average haul of freight traffic

The ratio of freight turnover and freight volume

$$S = \frac{T}{N} \qquad （\text{km}）$$

Where T—tonnage of freight of every station, t；

N —freight flow volume of every branch, t。

Fright Train Formation Plan

Content of formulation plan

The questions resolved by formulation plan:

（1）which stations to formulate;

（2）planning trains with corresponding stations;

(3）what kind of trains to be marshaled

（4）what direction of car flow can be marshaled

（5）the way to marshal the wagon flow into train mixed unit train or grouping; group with station; formulation with order of stations

（6）Arrange different train numbers

7.3 Train Diagram and Carrying Capacity of Line

Train diagram is to indicate the range of operating trains and in railway stations or through the time to send the technical file, which provides train occupies the interval procedures, train arrival and departure of each station (or through) time, the train in the run-time interval, the train stops at the station and the locomotive routing time, weight and length of trains, train the whole way the basis of the organization

Function

① railway enter the market, competing products in the market;

② railway transport enterprises to train safe, on-time operation and cost-effective to organize the work of the train rail transport production plans;

Carrying Capacity of Line

1.Definition

In the conditions of using ***certain types of rolling stock and certain train operation organizational methods***, ***the maximum number of trains can be passed by a variety of fixed equipment in railway section in unit time (usually one night)***

2.Classification：

- ***Designed carrying capacity***
- ***Existing carrying capacity***
- ***Required passing capacity***

- The carrying capacity of the block Section can be calculated according to the following fixed equipment：
  - Block section
  - station
  - Depot equipment and conditioning equipment
  - Water supply equipment
  - Electrified railway power supply equipment

The carrying capacity calculated by fixed equipment above may be varied. The weakest capacity of fixed equipment limits the capacity of the entire section, the capacity is the final carrying capacity of the block section.

Ways of strengthening carrying capacity

To meet the demand, railways should take measures to strengthen the railway carrying capacity mainly by:

-Expanding the railway network length

-Improving the weight of the train

-Increasing the traffic density

7.4 Organization of Station Operation

Receiving-departure operation

- Blocking device: To ensure trains run at section (or blocking section) intervals, only one train in the same section is allowed to run in a main line at the same time, preventing that the trains in the same direction run into each other or that the trains in the opposite directions make collision .

The technical equipment to achieve this requirement is called blocking devices.

- ***Train route: The path in a station occupied by the train when it arrives, departure or passing through the station is called train route***

The operations required：

（1）Carry on section block；

（2）Ready the route for receiving-departure；

（3）Open and close home signal or starting signal；

（4）Pass the running taken when not using semi-automatic block and automatic block);

（5）Receive or send trains and instruct train departure

Shunting operation of stations

- The tuning-shifting of rolling stock in rail transportation can be divided into two categories:
  - Those operations which run across the site is called "train's running work".
  - Those tuning-shifting operations done in the station or outside of that range but not in another station is called "shunting work“.

Shunting operation plan is the specific action plans which explain how to break up, marshal, receive or send or pick-up and drop trains for shunting groups. Shunting operation should be done based on the shunting operation plan.

1.Classified by the purpose

- **Break-up shunting**
- **Marshalling shunting**
- **Pick-up and drop shunting**
- **Receive or send vehicles shunting**
- **Other shunting**

2.classified by the devices

- **lead track shunting**
- **hump shunting**

Station daily operating plan

Definition

Station daily operating plan Includes shift operating plan, stage operating plan and Shunting operation plan .

shift operating plan

1、the contents of the shift operating plan：

（1）receiving plan

（2）departure plan

（3）car loading,car unloading and Emptying plan

（4）Shift work index

（5）Key tasks and higher-level indicators

- stage operating plan

Stage operating plan mainly solves the following three questions :

1、Determine the source cars of starting train

2、Shunting locomotive plan

（1）hump locomotive

（2）lead track locomotive

（3）locomotive to receive or send vehicles

3、 Receiving-departure track operating plan

（1）using receiving-departure track compactly

（2）reduce cross-interference

Key indicators of station work

1. Indicators of the Numbers

Number of Loading and unloading cars

Tonnage of cargo sent,

Number of Sending and receiving trains and cars

Number of inbound and outbound car handled

2. Quality indicators

Remain time of a goods vehicle

Average remain time of transit trains

Punctuality rate of freight trains at departure

Railway Traffic Production Plan and Railway Traffic Control

Railway transportation production plan

Railway transportation production plan is divided into long-term plans, annual plans and monthly plans according to its preparation period ,and is made up of month Railway goods transportation plan and Railway transportation technical plan.

key comprehensive index of Rail transport

1.Railway transport density：

2.Truck turnaround time：

3.Freight locomotives's product per day：

4.Tonne-kilometer cost of conversion：

Rail transport Dispatching

Basic tasks：

- Proper organization of transportation and production, guarantee or exceed transportation and production tasks and technical indicators.

  At the same time, the vehicle distribution and the composition of traffic must be in the normal range as technical plan requires.

  In daily railway dispatching work, traffic dispatching and train dispatching are scheduled to the entire core.

Thank you Very Much!

Mequanent M.

(AAiT)

May, 2013