RAILWAY ENGINEERING (CENG 4242)

CHAPTER 4 RAILWAY STATION

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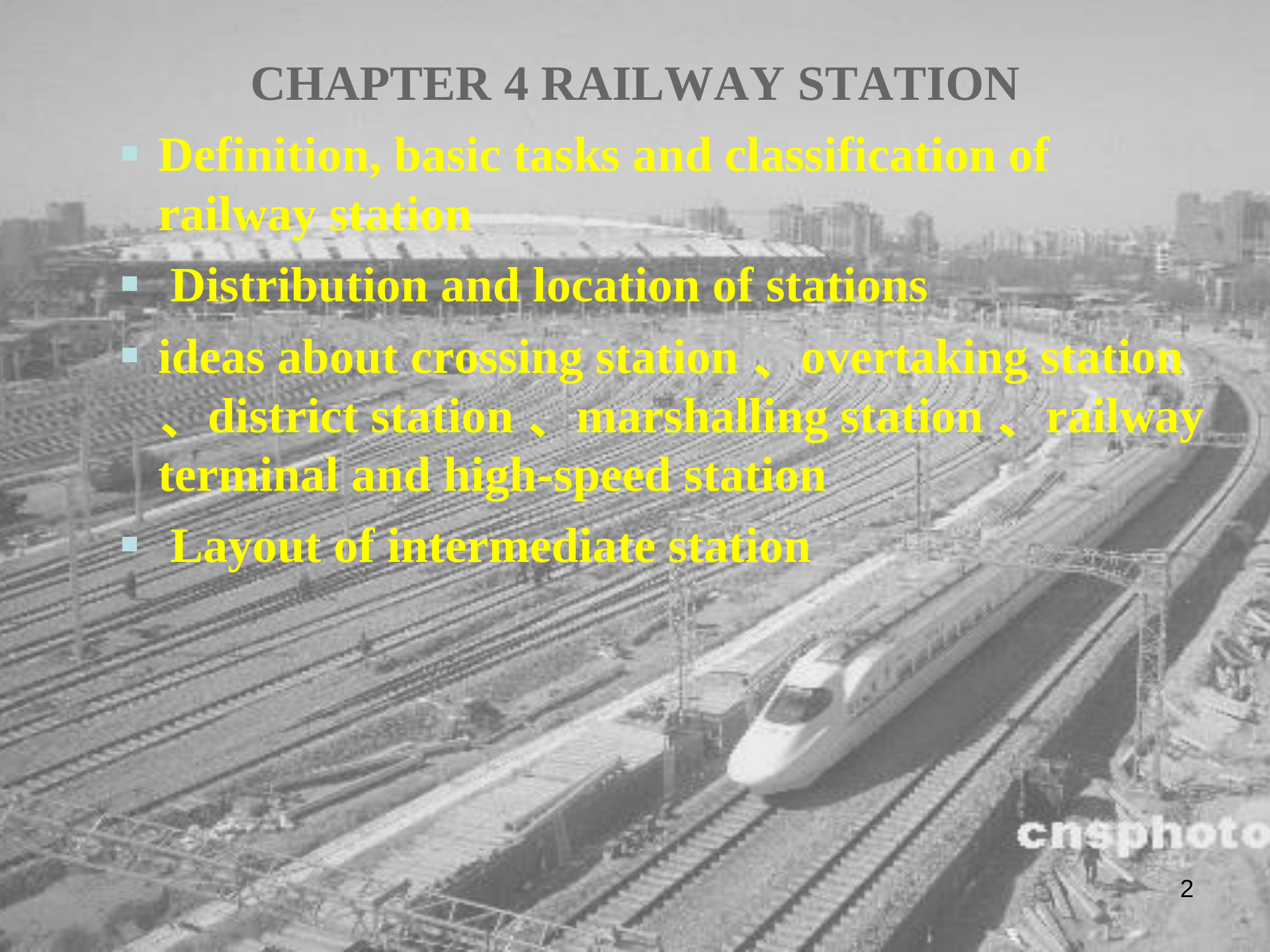
- Definition, basic tasks and classification of railway station
- Distribution and location of stations
- ideas about crossing station、overtaking station、district station、marshalling station、railway terminal and high-speed station
- Layout of intermediate station



4.1 Definition, Basic tasks and Classification of railway station

Definition

- Station is a basic production unit of railway transportation, integrating technical equipment relating to transportation.

- Basic tasks
  - Passenger traffic service and goods traffic service, such as passengers' boarding and alighting, goods consignment, goods loading and unloading, goods delivery and safekeeping, etc.

boarding and alighting

goods consignment

- Various technical operations of railway transportation , such as train reception and departure, passing, overtaking, disassembly and marshalling, change of locomotive and train crew, train technology and freight examination

train reception and departure

disassembly and marshalling

train technology and freight examination

Classification

According to the character of technical operation

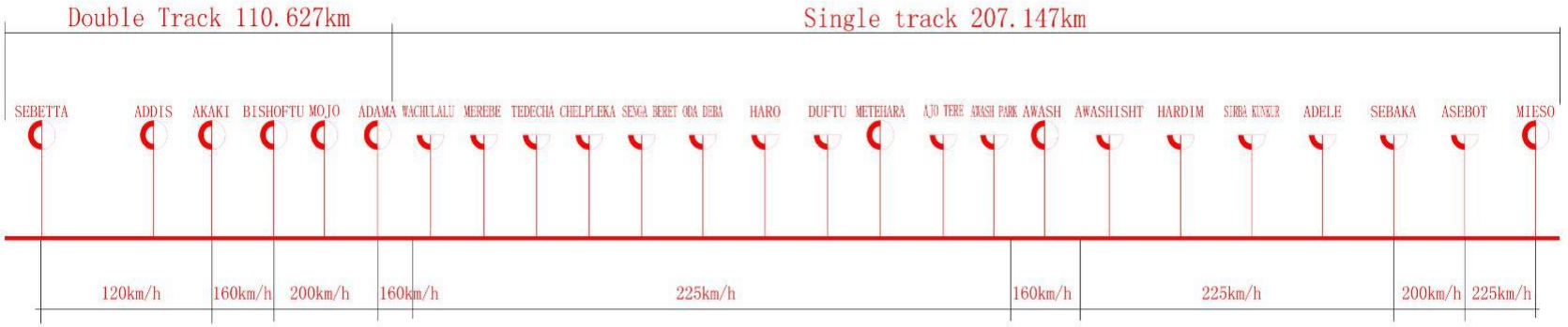
- ***In passenger traffic line***: the overtaking station, the intermediate station, and the originating train departure-arrival station
- ***mixed passenger and freight railway***: crossing station, overtaking station, the intermediate station, district station and marshalling station

According to the passenger and freight traffic volume

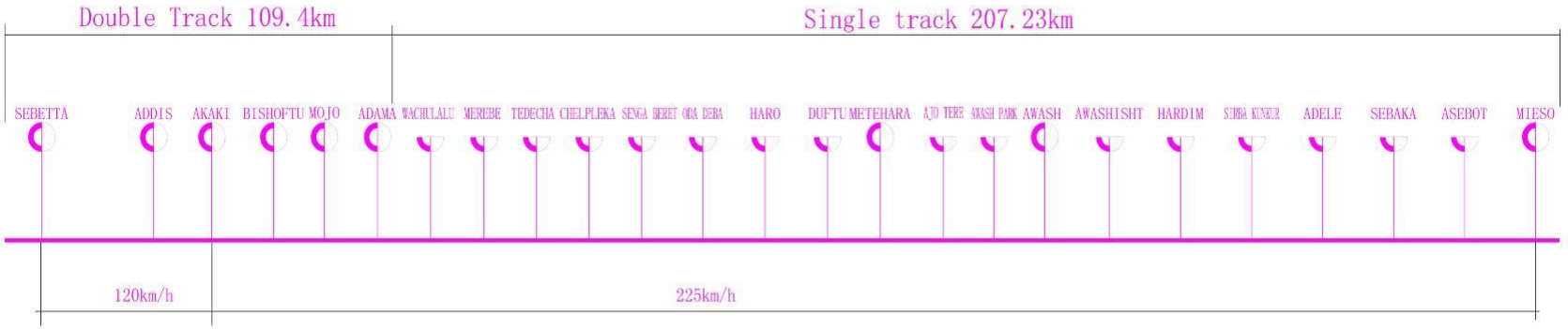
- ***in passenger traffic line***: super-large station, large station, medium station, and small-sized station
- ***mixed passenger and freight railway*** : super class station, Class-I, II, III, IV and V stations

4.2 Distribution and location of station

- Meaning of distribution and location of station
  - Complying with the transportation requirement, distribution and location of station shall be confirmed *after comprehensively considering factors including* topographical and geological conditions, difficulty degree of engineering; conditions for other tracks connecting, and whether it is convenient for local passenger and freight transportation



Scheme A



Scheme B

- Basic principle of distribution of station
  - To ensure an ***enough passing capacity***, a railway line is divided into several sections.
  - Combining distribution of station with route selection

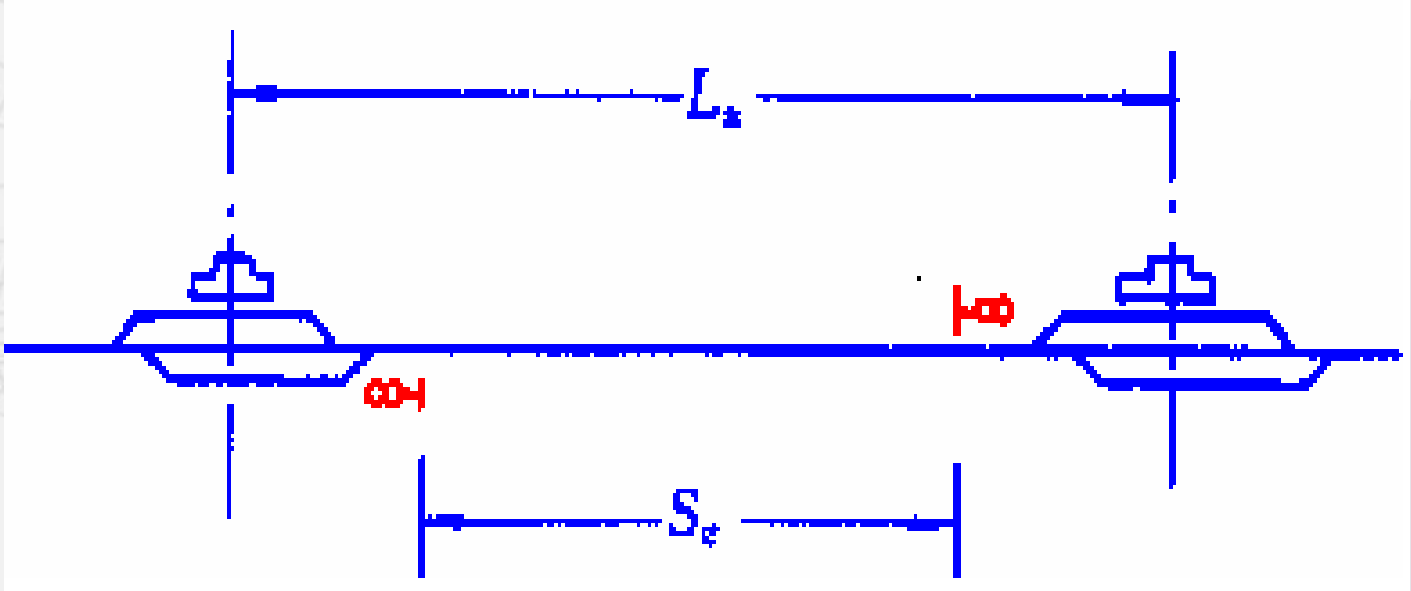


Fig. diagram of section in a single-line railway section, with home signal s as train spacing point of sections.

- Steps for distribution of station
  - **railway line for passenger traffic**
    - firstly distribute the large station according to the distribution of cities along the route of line, and then distribute medium and small station based on the plane location
  - **line for mixed passenger and freight traffic**
    - firstly distribute district stations together with the design of locomotive routing; then combining the paper location of line, distribute generally intermediate station, passing station or overtaking station to meet the required passing capacity

4.3 Rules for station distribution and Location

Distribution of district station for mixed passenger and freight railway

Method of distribution of station

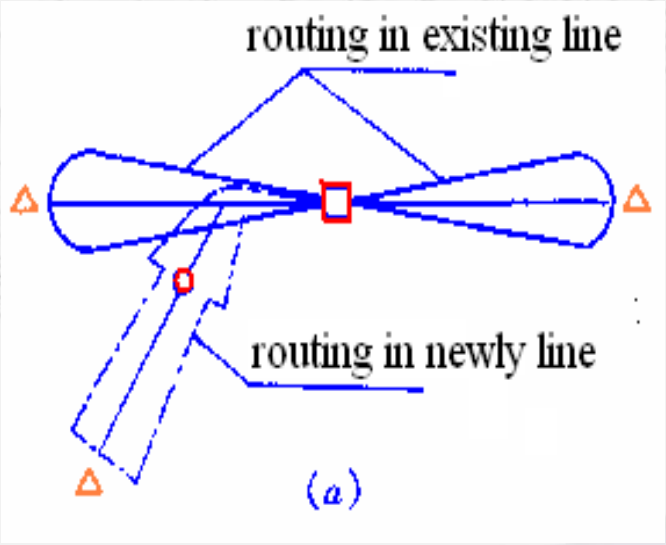
District station

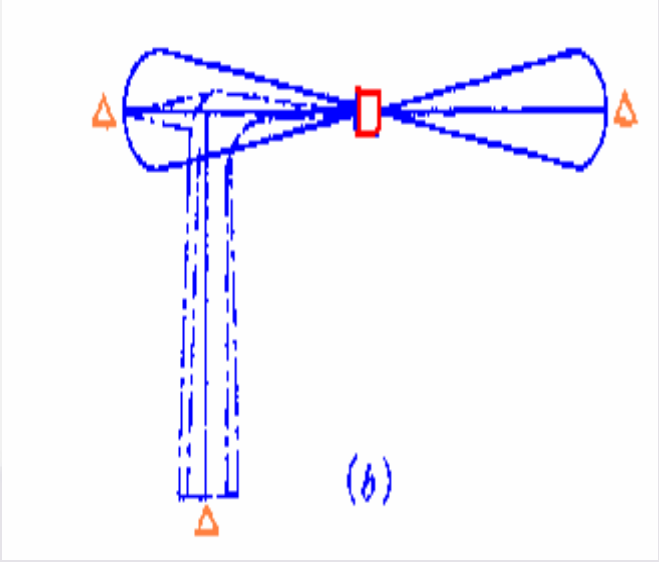
- ✓ *District station is one kind of important technical operation stations on mixed passenger and freight railway*
- ✓ *Distribution of district station has great influence on the strike of alignment, engineering and operation conditions, especially the operation efficiency of the locomotive.*

- Distribution of district station

  Rules for distribution

  - District station shall be layout together with the location of track connection station
    - Using the basic depot of the existing line
    - the newly built basic depot of the design line and turn back at the district station of the existing line

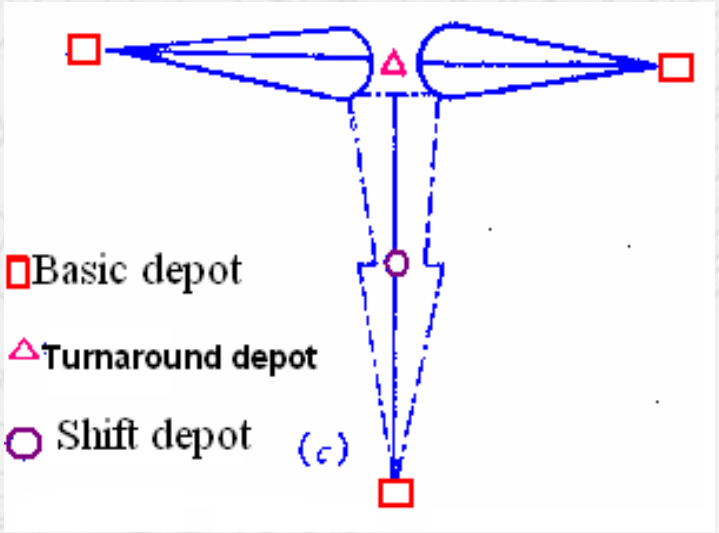


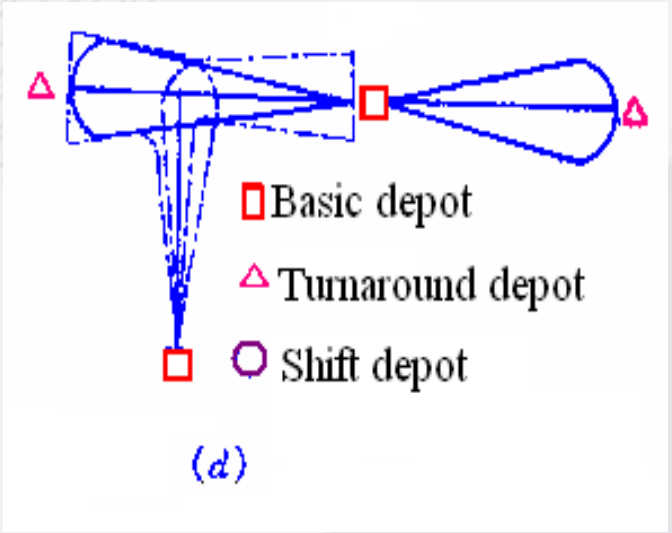


Using the basic depot of the existing line

Rules for distribution

- ***The newly built basic depot of the design line and turn back at the district station of the existing line***





Rules for distribution

- Try to close to large cities, larger towns industrial and mining enterprises to meet the requirements for collection and distribution of passenger and freight flow and improve the production and living conditions of the railway personnel.

- Location of station shall be planned in accordance with the development of the city and town.

Rules for distribution

- District station shall be located in the place *in plain terrain and sound geological condition,* with less farmland, convenient for treatment of “waste gas, waste water and waste residue” and with convenient water source and power supply.

- To reduce investment in train reorganization equipment and complete assisting vehicle equipment, it is suitable to set up the district station at train transfer places and assisting vehicle pick-up places.

Distribution of Intermediate Station, Passing Station or Overtaking Station(mixed line for passenger and freight)

Purpose of setting the stations

- To meet the desired carrying capacity of railway and serve the passenger and freight transportation of urban and rural along the line.
- The passing station and overtaking station shall be distributed according to the running-time standards of freight trains required by carrying capacity

- The annual traffic capacity and number of carriage pairs shall meet the national requirements
- The station distribution of newly-built double-track railway shall apply different standards according to the various categories of trains, pairs of passenger trains and running speeds

Designed Running Speed（km/h）		**160**	**140**		**≤120**		
Pairs of Passenger Train（pair/d）		**—**	**≤30**	**>30**	**≤20**	**21～40**	**>40**
Type of Locomotive	**E**	**20**	**25**	**20**	**30**	**25**	**20**
	D	**25**	**40**	**35**	**45**	**40**	**—**

- The intermediate station for passengers and freight transportation shall be properly distributed as per the average daily volume and in combination with other transport ways in local areas, and in coordination with the urban or regional program.
- In particular, the intermediate station shall comply with the technical operation requirements, if any.
- Topographical, geological, hydrographic and railway operation conditions shall be taken in to consideration

Distribution of Intermediate Station, Passing Station or Overtaking Station(mixed line for passenger and freight)

- The shuttle running time of the adjacent districts in single-track technical station shall be shorter than the maximum shuttle running time from station to station. The regulations are specified as follows:
  - *Running time between the adjacent stations* in the district station shall be reduced by 4 min in district station respectively;
  - In other technical stations, if the carrying capacity from station to station is influenced by the *technical operation* time, and such influence cannot be eliminated easily in the future, the station-to-station running time needs to be reduced as required

- Minimal inter-station distance of newly-built railway:
  - Single-track: no less than (≥) 8km
  - Double-track: no less than (≥) 15km
  - The intersection distance of railway junction terminal shall be no less than (≥) 5km.

    Stations in too short distance will cause additional construction and operation costs, and even worsen the operational indicators.

Distance between station (***High-speed line for passenger traffic***）

The distance between two stations of high-speed railway with passenger transportation business is mainly constrained by the city layout and distance between cities.

- In addition, as train running speed of high-speed railway is not the same, *it's necessary to set up an overtaking station* between passenger stations with long-distance for high-speed railway to keep the distance between stations balanced

- Generally, the average distance between two stations including an overtaking station is preferably 30-50 km. When the distance between naturally distributed passenger stations is longer than 50 km, if the section enjoys unlimited throughout capacity, and no overtaking station is set in the section, future station-adding condition shall be maintained.

Distribution of large intermediate stations

- Large intermediate station of special line for passenger train is usually set in the railway junction terminal, municipality and *provincial capital city, and enjoys abundant passenger transportation business*

- Large intermediate stations mainly deal with service for stopping of most high-speed and medium-speed trains, and passing operation of few high-speed and medium-speed trains as well as starting and ending operation of many high-speed trains.

- To *attract passengers from large and small cities* along the railway, general intermediate station of special line for passenger train is distributed as per the location of municipality, county town and county-controlled city along the railway.

- the distribution of High-speed passenger dedicated line shall be good for attracting passengers from large and small cities along the railway.

Other factors:

- *When the high-speed railway line is close to the track-connection passenger station of the existing railway (connecting the existing stations of main line in many directions), with more passengers transiting high-speed line and local reception and departure, high-speed station should be set near the existing station preferably*

– Distribution of station shall meet the needs of distribution of passenger flow, travel convenience for urban dwellers, train operation optimization, design capacity and maintenance. distribution of station should also be convenient for travelling at traffic hubs

Location of station

Rules

- Combining the urban and rural layout and meeting the requirement of local passenger and freight transportation
- Engineering conditions including landform, geology, relocation and reconstruction
- Making full advantage of the existing railway facilities
- Combination of station location and urban planning
- Reasonable combination between station location selection and section main line

Location of station

Passing and overtaking stations

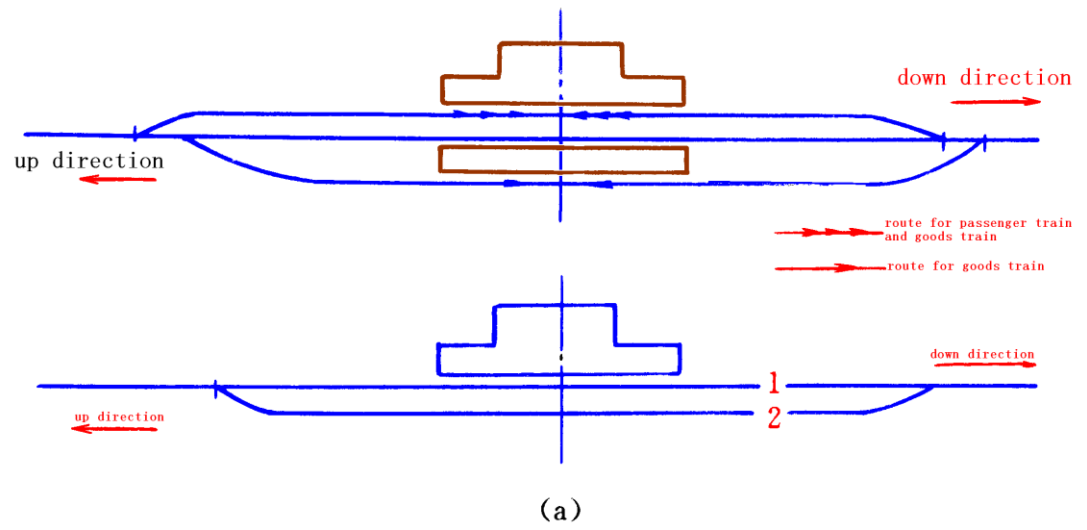
Passing station

- ✓ Passing stations are set on the passenger-and-freight single-track railway
- ✓ It deals with the arrival and departure, meeting and passing. Besides, there may be a little passenger and freight business.
- ✓ Arrival-departure tracks shall be laid in passing stations, and facilities for communication, signal, and passenger alighting and boarding as well as technical offices shall be provided

Passing station

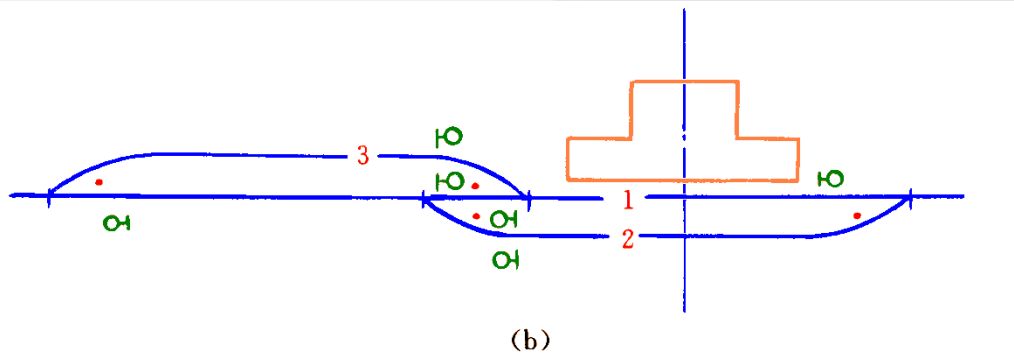
Passing station layout diagram

transverse station



(a)

tandem station



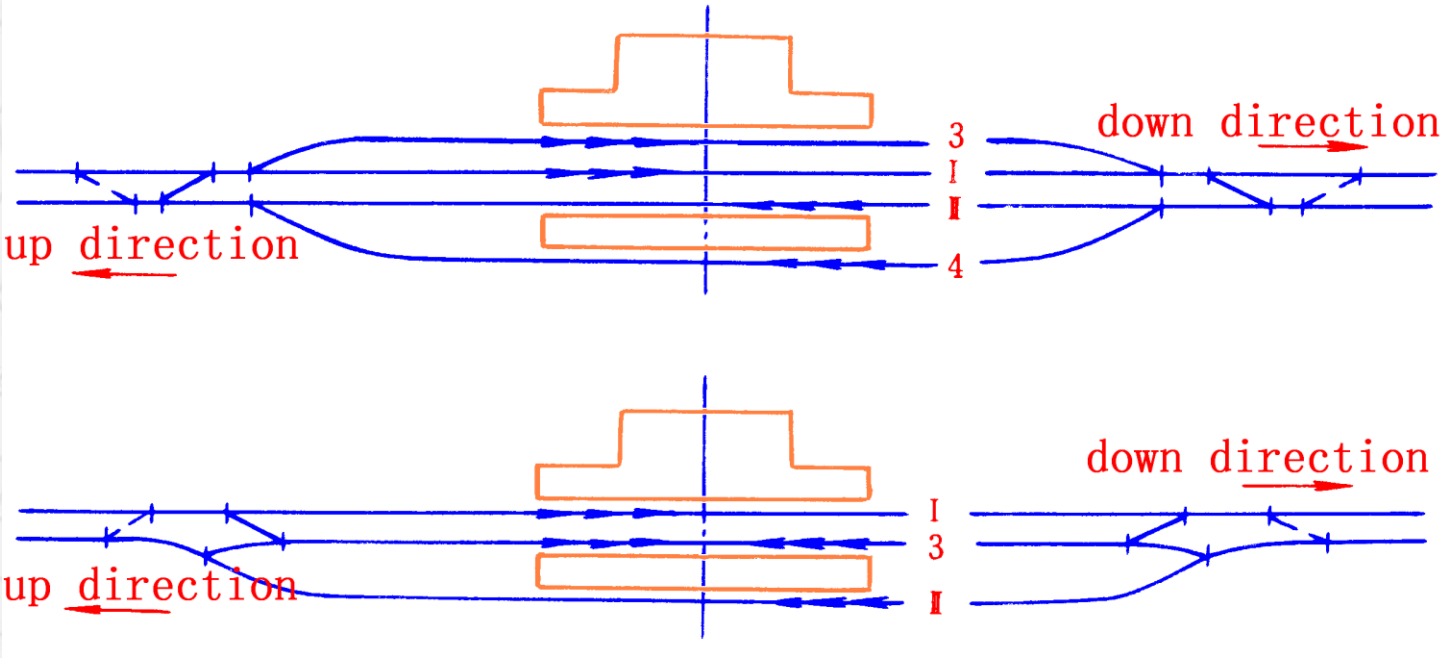
(b)

Overtaking Station

- ✓ Stations set on double track railways and responsible for dealing with the surpassing of trains travelling in the same direction are called overtaking stations.

- ✓ The main task of overtaking station is to deal with the *passing-through of the trains on the main line, entering and exiting the arrival-departure track of waiting trains and stop-and-waiting of trains*.
- ✓ Overtaking station on passenger-and-freight railway may deal with *shunting of trains in opposite directions* when necessary, and a little passenger and freight business.
- ✓ Arrival-departure tracks shall be laid in passing stations, and *facilities for communication, signal, and passenger alighting and boarding as well as technical offices* shall be provided.

Overtaking station layout diagram



Overtaking station with one single arrival-departure track for passenger and freight

4.4 Intermediate station Layout

Operation

- Commercial operation
  - ticketing
  - passenger alighting and boarding
  - luggage receiving and distributing
  - freight consignment storage and handover

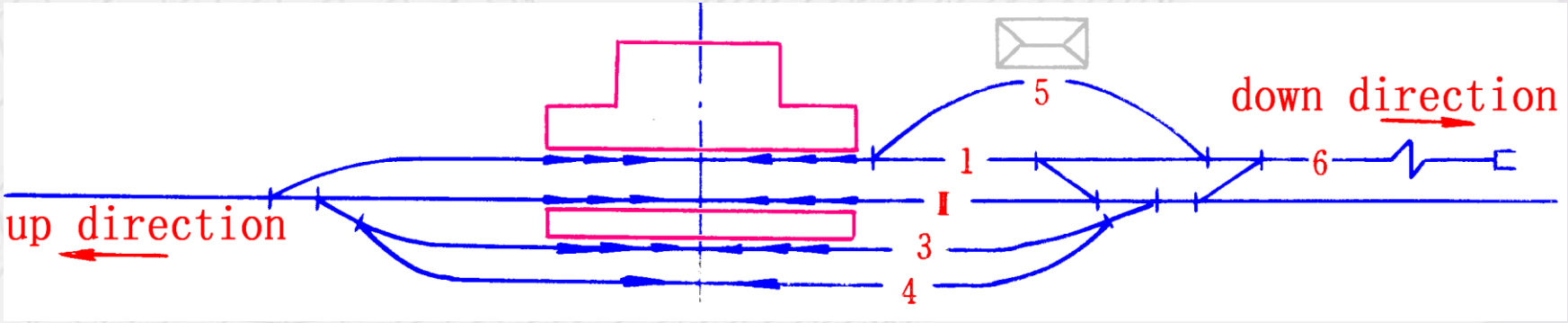
boarding and alighting

goods consignment

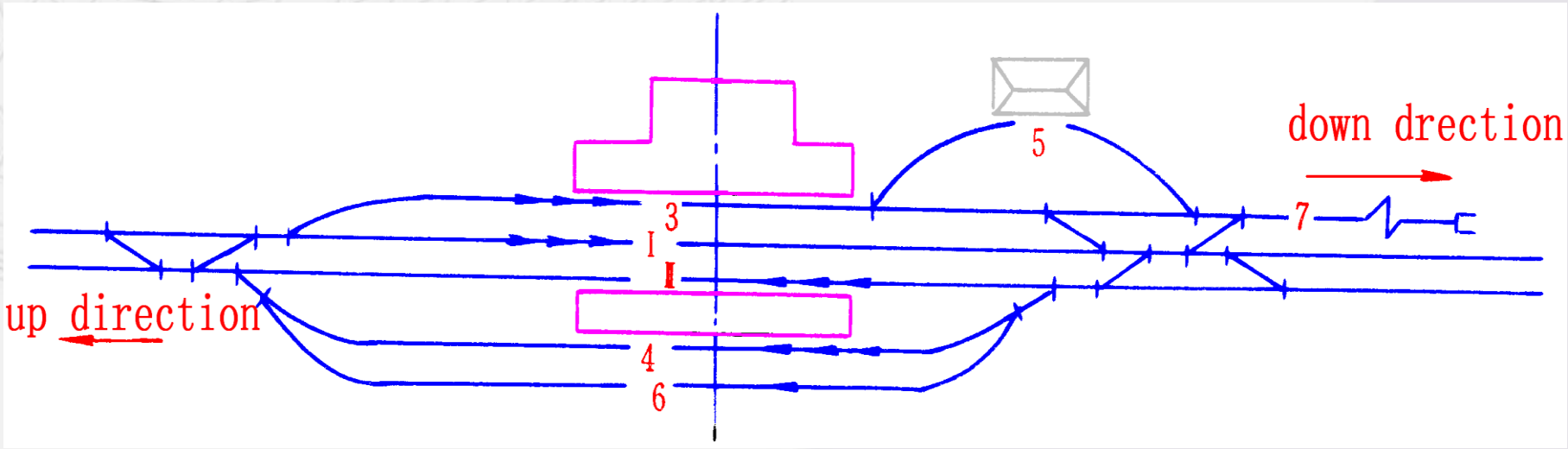
- Technical operation
  - dealing with the passing and surpassing and departure of trains
  - attaching and detaching
  - less-than-carload train shunting
  - taking-out and placing-in of cars and loading-unloading operations

- special line operations are offered for double line railway to adjust the trains in opposite directions. Operations such as assisting vehicle attaching and detaching, waiting and turn-around and preparation shall be dealt with at intermediate stations for locomotive turnaround as well as those for assisting vehicle starting and ending.

Layout diagram



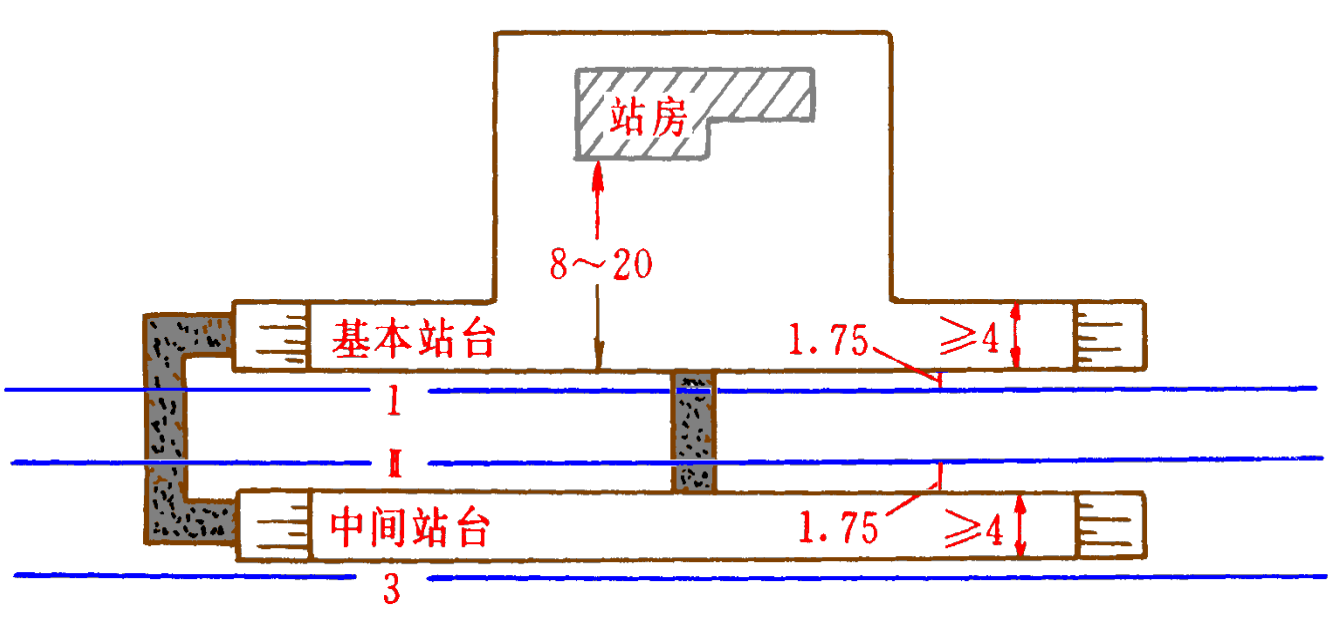
Single-track Intermediate Station Diagram



Double-track Intermediate Station Diagram

Main equipment of facilities

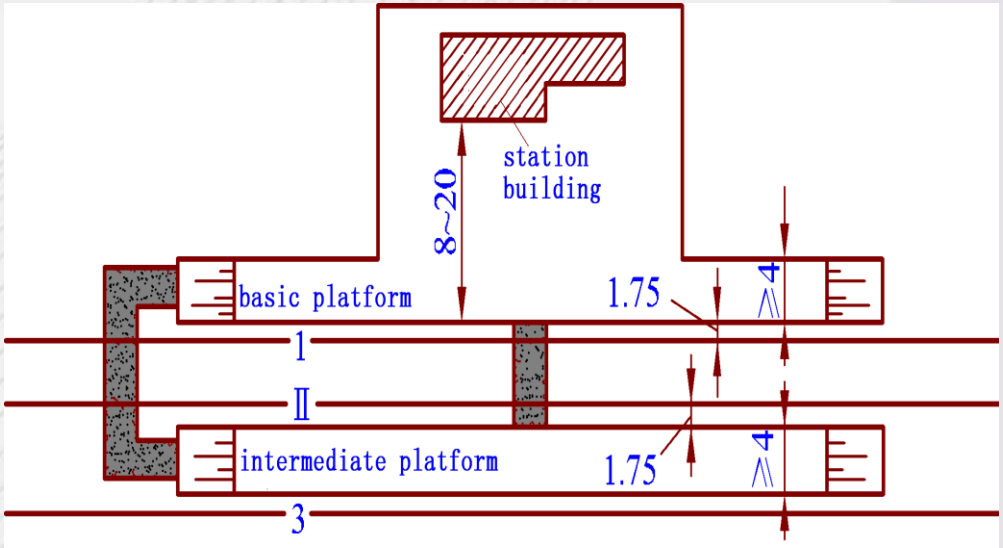
- ***Passenger traffic facility***
  - passenger station building
  - Platform
  - level corridor or overpass facilities



❖ *Passenger station building shall coordinate with urban planning and the general layout diagram of the station and shall be convenient for passenger passing*

❖*The station building shall be placed near residential area and to the best shall be erected at the middle part so that the passengers alighting and boarding may be as convenient as possible.*

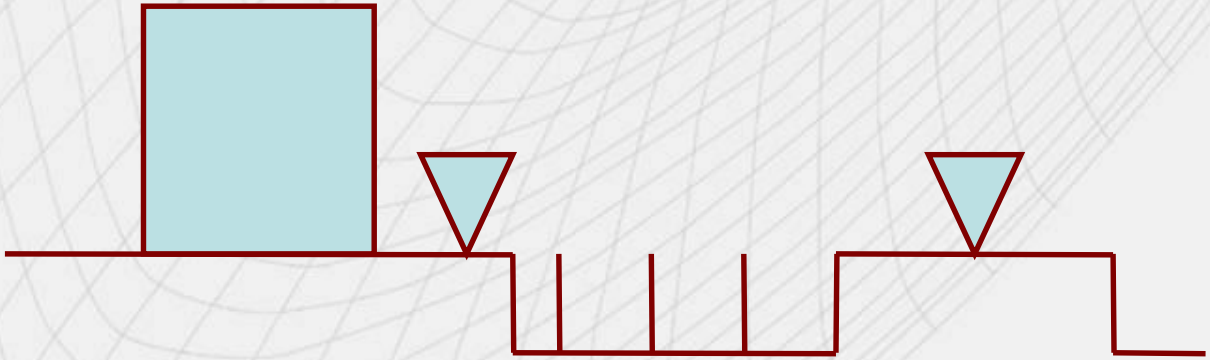
Passenger platform



- classification
  - Basic and intermediate platforms
- Length of platforms
  - length of the platform shall be set as 300~500m, subject to the recent passenger amount and train length and enlargement needs.
  - When passenger amount is relatively small and the train is relatively short, the platform length may be reduced properly.

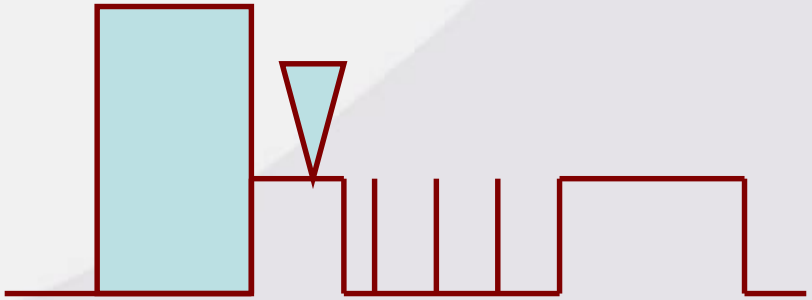
- Width of platforms
  - Single-track railway intermediate platform ***width shall be no less than 4m and double track railway shall be no less than 5m***. When overpass facilities are provided the platform shall be widened as needed.
- Height of platform
  - High platform（1100mm）
  - Middle platform（500mm）
  - Low platform（300mm）

Relation between platform and building



•**Level track**

•**Above track**



•**Under track**

- **Passenger traffic facility**
  - Passenger station building
    - **Relation between platform and building**
    - The scale of station building is subject to the largest number of the passengers waiting for trains at one time. Intermediate station building scales are mostly medium or small, and ***generally fixed design is adopted. Common capacity of small station building may be 50, 100, 200 and 400 persons.***

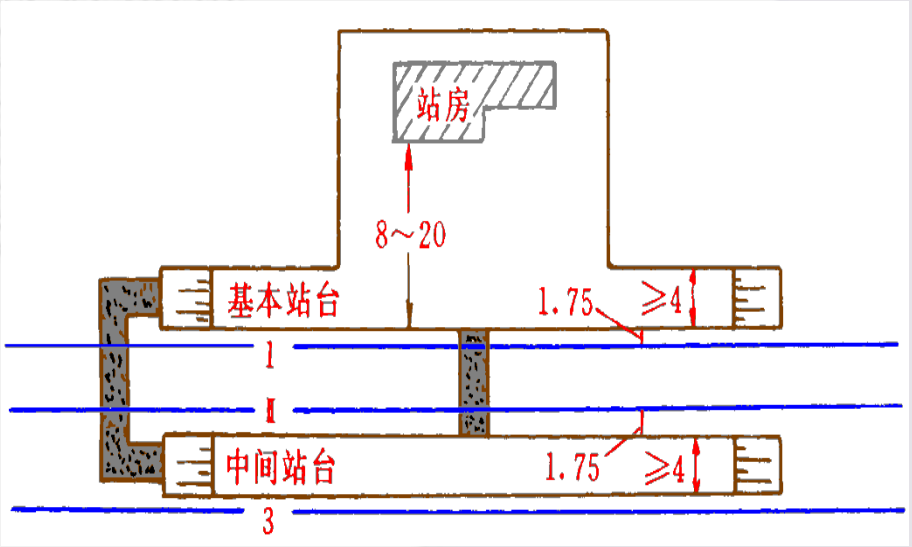
•level track

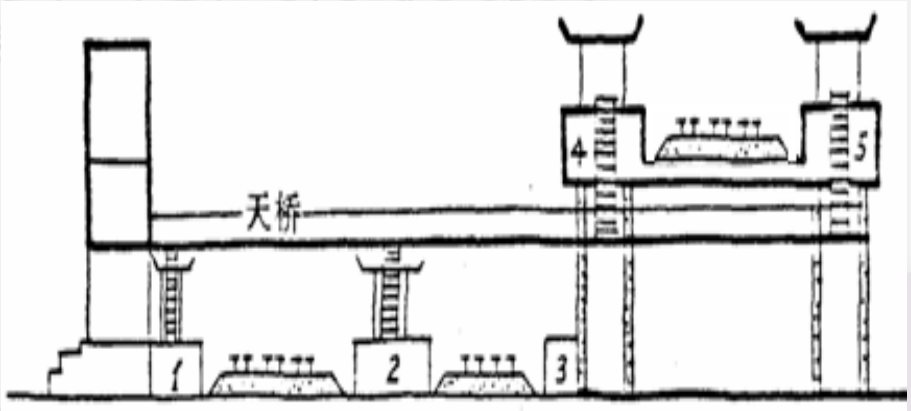
•Above track

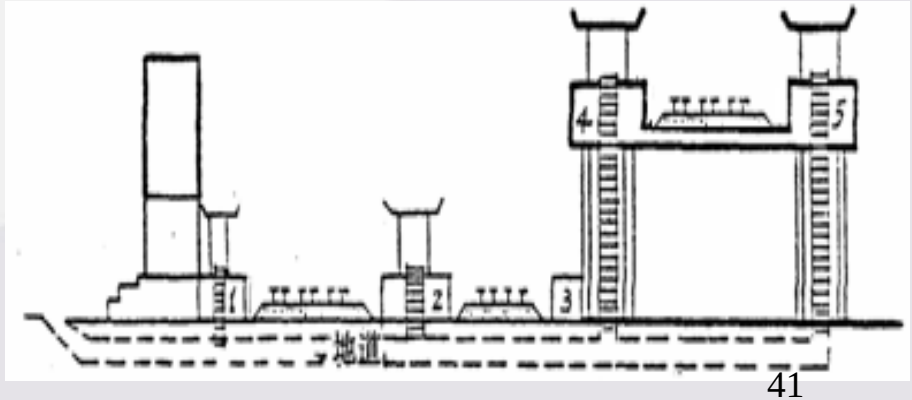
•Below track

Level passageway and overpass (bridge) facilities

- Level passageway
  - 1~2
  - At the two ends or middle
- overpass (bridge)
  - over-bridge
  - tunnel







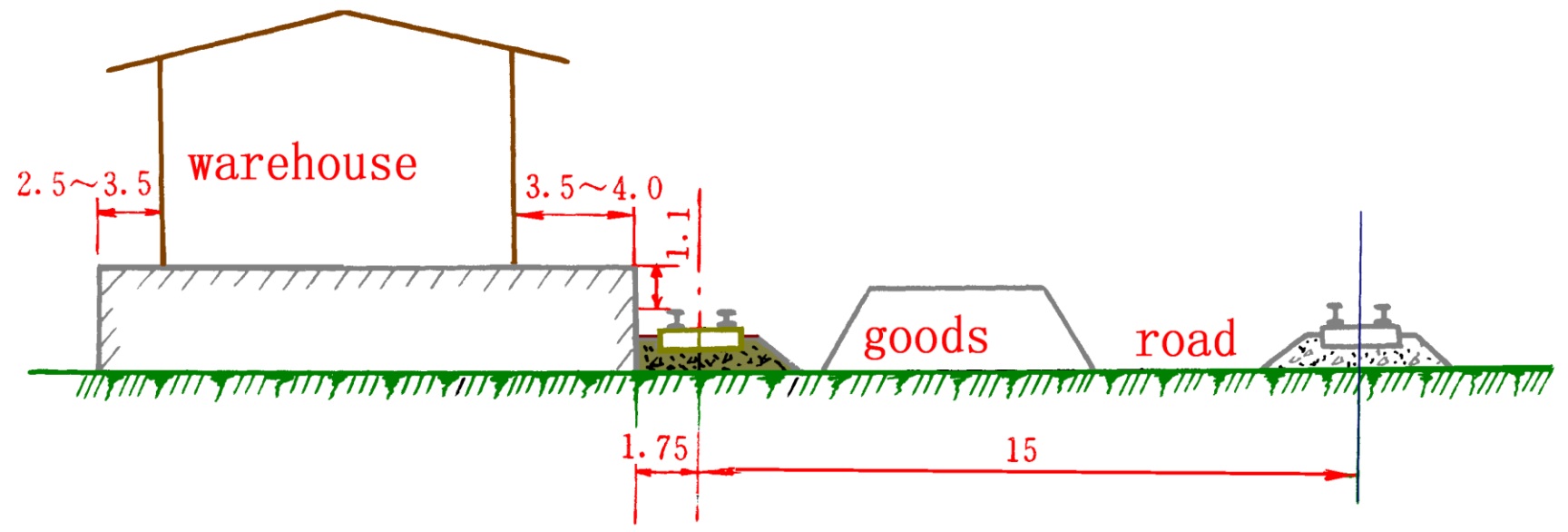
- **Goods equipment**
  - One or two level corridors shall be provided between the main platform and intermediate platform for passage, the corridor shall be no less than 2.5m wide.
  - When needed, overpass and subways may be constructed in large and medium station where the passenger amount (i.e. the alighting and boarding persons) is large.

Fright yards

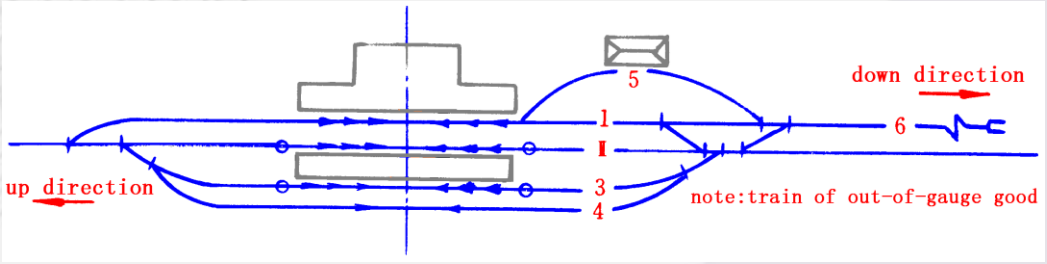
Include Warehouse, freight platform, freight track, loading and unloading facilities, freight offices

Freight platform

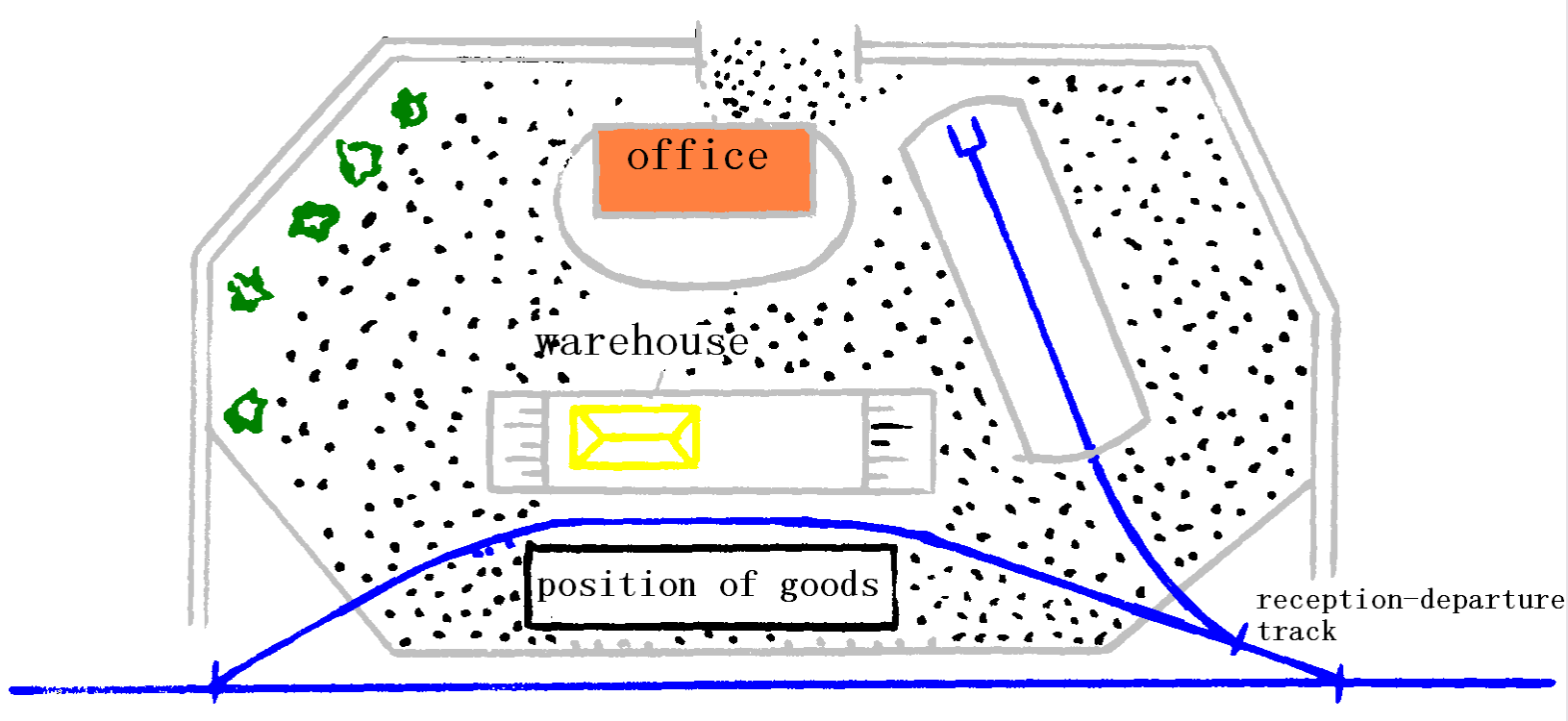
- **ordinary platform——1.1m higher than the top of rail**
- **high platform ——over 1.1m higher than the top of rail**



- Tracks Equipment
  - Main line
  - Station tracks
    - arrival-departure track
    - freight track
    - lead track
    - storage siding
  - Private sidings
    - Branch
    - special line
    - industrial enterprise line
  - tracks for special purposes
    - safety line
    - refuge siding



Typical layout of freight yard



Home work- Assignment…

Plane Calculation of Intermediate Station….Next