

Railway Stations

- ✓ ***Rules for station distribution and location of station***
- ✓ ***Classification of station***
- ✓ ***Distribution of stations***
- ✓ ***Location of stations***
- ✓ ***Type of station(intermediate stations)***
- ✓ ***Method to design stations***

Rules for station distribution and location of station

- *Station is a basic production unit of railway transportation, integrating technical equipment relating to transportation.*
- *Passenger traffic service and goods traffic service, such as passengers' boarding and alighting, goods consignment, goods loading and unloading, goods delivery and safekeeping, etc*
- *Various technical operations of railway transportation , such as train reception and departure, passing, overtaking, disassembly and marshaling, change of locomotive and train crew, train technology and freight examination*

Classification of station

- *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 marshaling station.*

Distribution of stations

- *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.*

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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

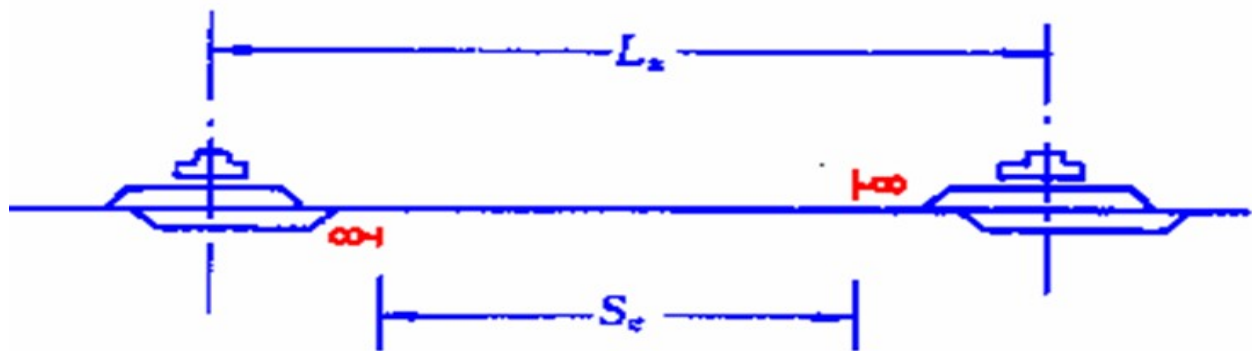


Fig. diagram of section in a single-line railway section, with home signals as train spacing point of sections.

Steps for distribution of station

Railway line for passenger traffic

- firstly distribute the large station according to the 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.

Method of distribution of 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.

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- *Therefore, several distribution schemes must be made by integrating the design of routing. And a reasonable and convenient scheme of station distribution should be determined after technical and economic comparison in terms of carefully make technical and economic comparison.*

Rules for distribution of stations

- *District station shall be layout together with the location of track connection station.*
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- *Motor train depot (station) in lines for passenger traffic is usually located at high-speed train departure station. Therefore, distribution of motor car depot (station) is materially the distribution of high-speed train departure station and terminal station.*
- *At start station and terminal station of High-speed passenger line dedicated line, motor car depot shall be layout.*
- *while at large railway junction terminal, large intermediate station in municipality and provincial capital city, and distributable motor train maintenance station or operation station, inspection and service point shall be layout.*
- *Distribution of motor car depot (station) shall combine train operating plan and train traction power analysis calculation, in favor of circulation operation of motor train unit*
- *Distribution of motor car depot (station) shall be made in accordance with the requirement of the transportation organization as well as the parking condition of motor train unit in the high-speed station at night.*

Purpose for setting station

- *To distribute the passing station, overtaking station and intermediate station on the mixed passenger-freight railway is to meet the desired carrying capacity of railway and serve the passenger and freight transportation of urban and rural along the line.*

Distance between stations rules

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- *Average distance between stations in Japanese Tokaido Shinkansen is 34.3 km and its longest section is 68.06 km. The shortest distance between stations in Sanyo Shinkansen is 10.55 km. The longest and shortest distances between two stations are 100 km and 9.9 km respectively.*
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- *Average distance between passenger stations of Beijing-Shanghai Railway is about 55km.*
- *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 throughput 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*
- *e.g. Tianjin Station, Ji'nan Station and Nanjing Station of Beijing-Shanghai High-speed Railway*

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The design of railway terminal and large passenger statons of big cities shall comply with following principle:

- 1) According to the overall plan of urban and railway terminal, it shall be realized gradually that of “separated tracks for passenger and freight traffic, passenger traffic inside city while freight traffic outside city”.*
- 2) Determine number of passenger station based on comprehensive study.*
- 3) Select location based on approach directions and urban master plan to develop urban traffic hubs.*
- 4) Make the allocation of EMU depot and workshop based on approach directions and upsized with space for further development.*
- 5) The connecting line for running cross-line train shall be set up according to the traffic demand and the principle of connecting for primary lines and passenger transfer for secondary lines.*

Location of stations

Combining the urban and rural layout and meeting the requirement of local passenger and freight transportation

- Station can directly handle passenger and freight transportation business. The location of station should widely attract passenger and freight flow to a great extent. Under the conditions of complying with the transportation capacity stipulated by the state, the running time between two stations shall be adjusted properly and stations shall be set near the cities and towns, as well as large industrial and mining enterprises, so as to meet the requirements of local transportation.*

Generally, intermediate passenger station of high-speed railway is relatively small, in which the buildings are designed in coordination with urban facilities. Therefore, high-speed railway station can be set in the downtown to provide much more convenience for the urban residents and attract more passengers.

- When it is hard to make lines and stations close to cities or industrial and mining enterprises, it is required to formulate schemes of branch (close to) or highway combined transport (not close to) as appropriate and make a comparison.*
- Intermediate station of high-speed railway shall be located in the downtown preferably. When it's quite difficult to realize or it costs too*

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much, try to set the station near the downtown or close to the city region.

- Station covers a wide area and has many buildings and equipment. Therefore, station shall be located in plain terrain with sound geological condition. Try to keep the route parallel with the contour line. Avoid setting the station in high-filling and deep-excavated place, high bridge and tunnel to reduce the work quantity of engineering and facilitate operation management and maintenance. Water source and power supply shall be taken into consideration while selecting the location of station.*
- To meet the requirement of transportation capacity, mixed passenger and freight railway is to set a passing station or an overtaking station at both sides of puerto in Yueling section. The location of station shall be proposed in accordance with the overall condition of Yueling section and the transportation requirement. From the perspective of engineering, generally speaking, station close to puerto shall be located in the terrain with slow longitudinal gradient and sound leading line.*
- When the route is across deep ditch and toward downstream of a river, if the landforms and geological conditions in both sides are not quite different, the station should be set behind the ditch to lower the height of bridge.*
- The existing railway facilities can be considered as one of the factors for comparison of station location of special line for passenger train. High-speed railway station close to the existing station creates a condition for making full use of the existing railway facilities, which utilizes the existing passenger transportation facilities like station building, waiting room, square, etc., channels including underpass and overhead channel, and living service transportation facilities in the station area and lowers investment in railway and city.*
- As the window for external contact of a city, railway station and leading line are an important part of city foundations. Its land use and location scheme are among the urban planning. The existing railway station shall be coordinated with the current city functions and suitable for the development planning of city decades later.*
- To reduce the project investment, route selection should be as straight as possible in consideration of various factors. However, it's a*

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common phenomenon that “the station location is good but the route isn’t smooth or the route is smooth but the location is bad.” For that reason, treat it differently as per different places. Compare the cost to the achievement. Abandon the scheme with no advantages or more disadvantages than advantages.

Type of station

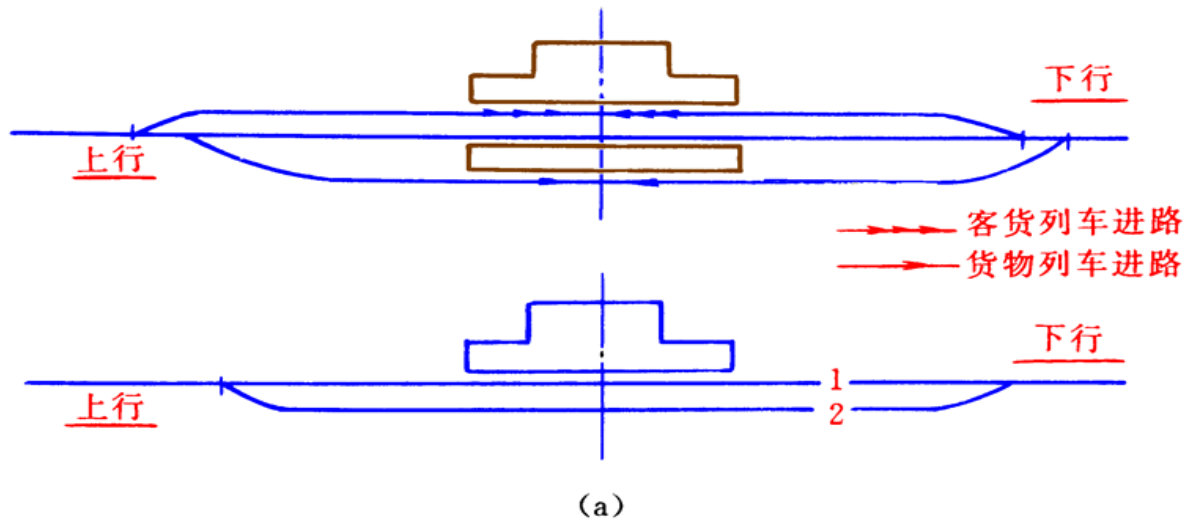
- ❖ *Passing station and overtaking station*
- ❖ *intermediate station*
- ❖ *district station*
- ❖ *marshaling station*
- ❖ *Terminal area*
- ❖ *High-speed railway station*

Method to design 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 layout diagram **Transverse station**



- Transverse passing station is featured by the transverse arrangement of arrival-departure tracks. Therefore the station site is short; the investment is small; the personnel on duty can oversee the two throats; management is very convenient; the track application is very flexible and the layout of the station is very tight.
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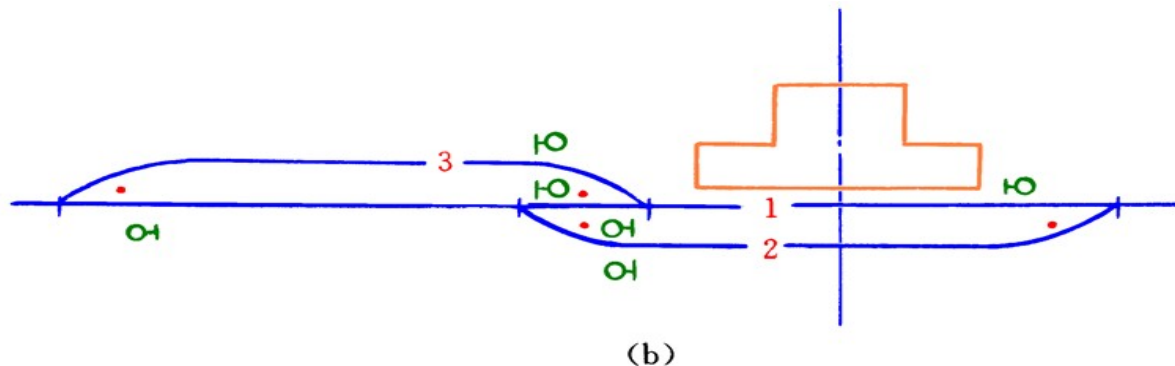
Tandem station

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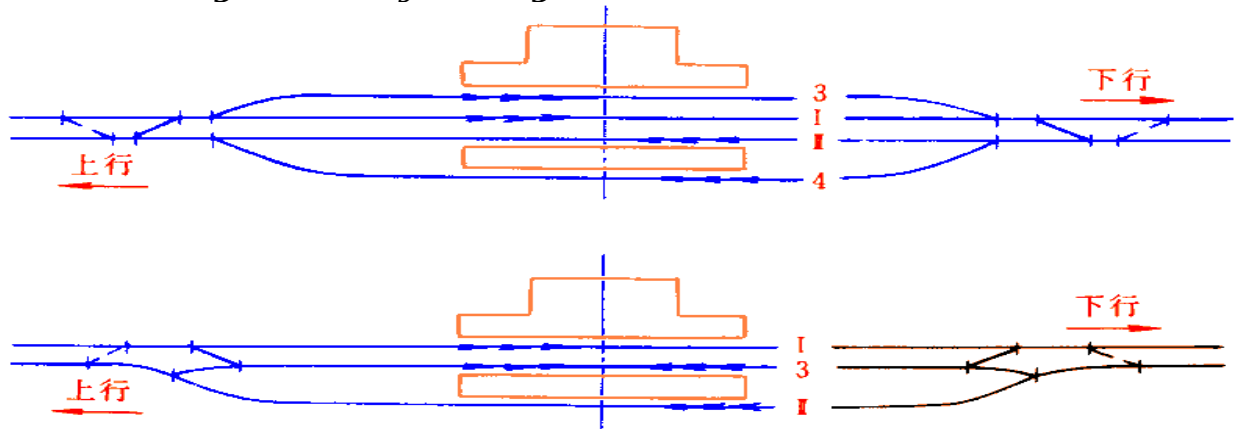


- *The Arrival-departure tracks staggering layout is favorable for organizing passing without requiring the trains to stop, and is convenient for overload train passing. Communication between the personnel on duty and the train driver is very convenient. The station site may be narrower; therefore, work amount can be reduced at narrow locations.*
- *However, the station site of longitudinal layout is longer than transverse layout, sufficient grade track may be longer, path of shunting service for attaching and detaching of the cars may be longer and the turnout maybe dispersed and management is inconvenient. Therefore, only in sections where the terrain is narrow and through capacity requirement is high, or passing without requiring the trains to stop as well as over-long trains operates longitudinal passing stations are adopted.*
- *Two arrival-departure tracks shall be laid in a passing station so that the station can offer three-passing conditions; when traffic amount is relatively small one track is ok. Station with only one arrival-departure track shall not be set for more than two consecutive ones so as to ensure that, in case that when abnormal conditions happened, the run chart can be adjusted.*
- *Usually intermediate platform is not set in passing station. In case there are many passengers and long-term development is very rapid, intermediate platform may be provided between the arrival-departure track opposite to the passenger station building and the main line.*

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.
- Usually intermediate platform is not set in passing station. In case there are many passengers and long-term development is very rapid, intermediate platform may be provided between the arrival-departure track opposite to the passenger station building and the main line.

✓ **Overtaking station layout diagram**



- ✓ Generally, transverse layout is adopted in overtaking stations. The advantages of transverse layout are: the station site is short, project expense is low, manning can be cut and management is convenient, arrival-departure track application is flexible and the station layout is tight. Usually two arrival-departure tracks shall be set in one Overtaking station on the two sides by the main line so that the trains in the two directions can wait simultaneously.
- ✓ Intermediate stations account for most of the stations, so proper design of intermediate station is very important to fulfill the transport mission of railway system and intensify the connection between urban area and the countryside. A comprehensive and accurate knowledge shall be gained of the task, operation content and requirements for various facilities of intermediate station for a possible good design of the intermediate station. This section mainly introduces the designing method for intermediate stations of passenger and freight railways.

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Passenger-only railway intermediate station will be introduced in Section V of this chapter.

Intermediate station operation

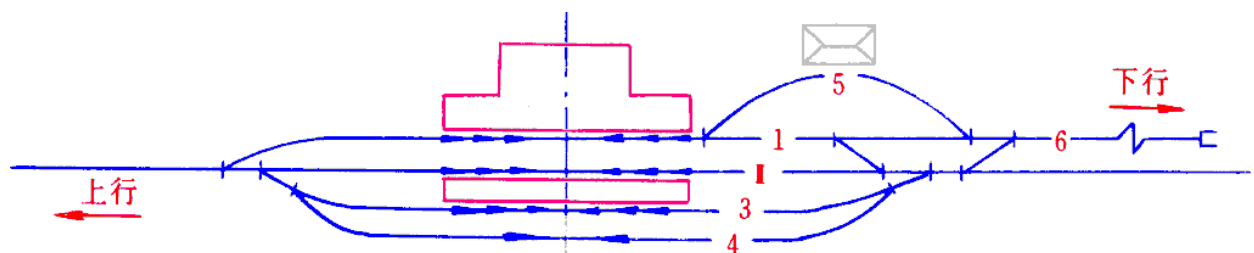
Commercial operation

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

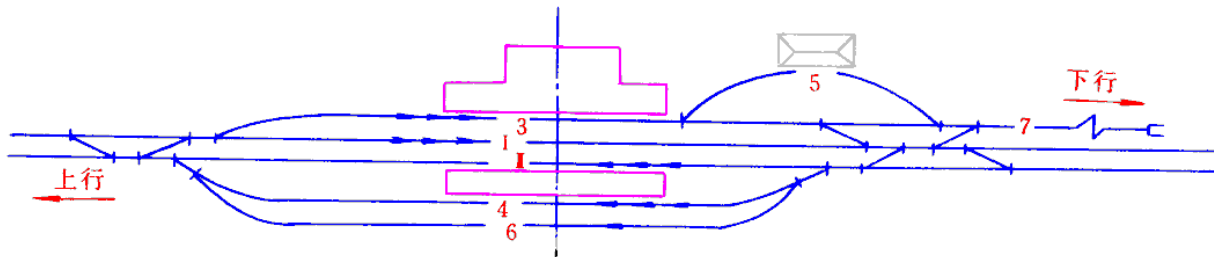
Technical operation

- ✓ 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.

Intermediate station layout diagram



Single-track Intermediate Station Diagram



Double-track Intermediate Station Diagram

- ✓ Transverse layout diagrams are usually adopted in intermediate station. Common layout diagrams of intermediate station for Single-track and double tracks are as shown fig above.
- ✓ These two diagrams boast good safety for the passengers, convenient loading and unloading for less-than-carload cars and car attaching and detaching, good conditions for car waiting and convenient maintenance and modification and expansion.
- ✓ Two crossings shall be set at the throat areas at the two ends of the station so that the train running on one main line can be switched to the other main line and keep running, by which the requirements of shunting, and adjustment is needed, reverse running of the train and receiving and departing trains in two directions can be met or during section route overhaul, temporary fault or other conditions, when operation should be adjusted.

The technical operation process of various trains

- ✓ in the intermediate station is to be introduced with Fig. above, so that knowledge can be gained of the work content of intermediate station. (Note: Chinese railway adopts a left side running system).
- ✓ Passenger and freight train receiving and departure: track 1 of the main line shall be open for running after the personnel on duty in the station and neighboring station processed blocking issues
- ✓ Receiving and departure of passenger and freight train stopping at the station: after blocking issues are completed, the passenger train is

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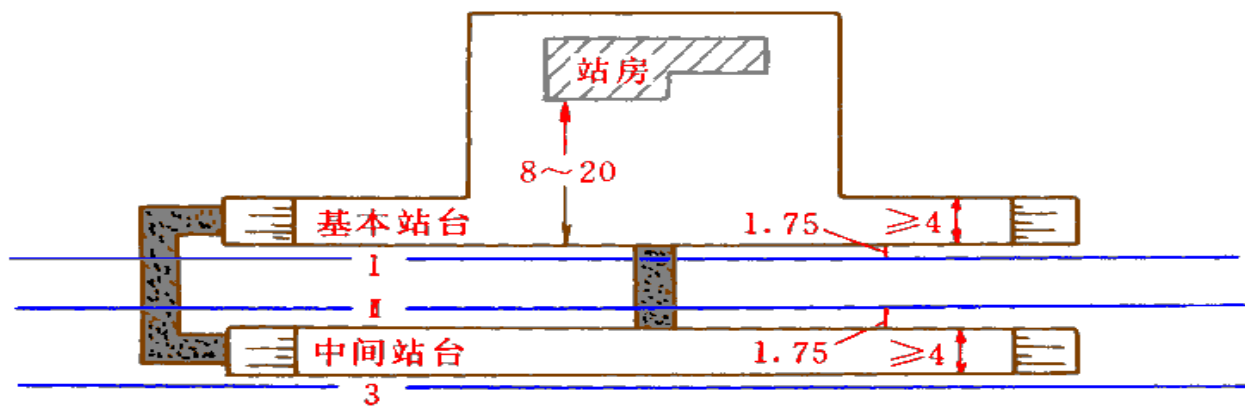
connected to Track 1 or II; when Track 1 and II are occupied, Track 3 may be connected, freight train can be connected to Track 1, 3 or 4.

- ✓ *Dealing with attaching and detaching operation: downward moving train for attaching and detaching shall be connected to Track 1. After the car(s) is detached, the train arrived at the station shall be dragged by locomotive to run into lead line 6, then run reversely into loading & unloading Line 5 and deal with the loading & unloading operations.*
- ✓ *If there is already a downward moving train in Line 5, the two trains shall be attached together and dragged out by a locomotive, then sent into Track 1 through Lead Track 6 and detached, then the*
- ✓ *locomotive will send the train arrived to Track 4 for detachment through lead track 6, then the locomotive will return to Track 1 through lead line 6 and the train shall be attached and preparing for departure.*
- ✓ *Most upward moving train for attaching and detaching shall be connected to Track 4. After the locomotive is detached, it will run along an idle track to the end of the detached train, and the train arrived at the station shall be dragged by it to run into lead line 6, then run into loading & unloading Line 5 and deal with the loading & unloading operations. The locomotive will then drag the waiting train to lead line 6 and send the waiting train to Track 4 for attachment. After it is detached, the locomotive will run along the idle track to the head of the train and get attached to the train and then waiting for departure. If there is already downward moving train in Line 5, then the pick-up and delivery process may be similar to the downward moving trains.*
- ✓ *Loading & unloading without detaching: manning and corresponding facilities shall be prepared in advance to load and unload the train on the arrival-departure track during the time when the train is stopped for passing and water adding operations.*
- ✓ *Seen from the basic operation process, still, detaching and attaching operation is influenced by train formation. Other operation methods are also not fixed. Each station can formulate a pragmatic operation rule and provide the process of each technical operation as per its specific condition.*

Main Equipment Configuration of Intermediate Station

Passenger traffic facility

- ❖ *passenger station building*
- ❖ *Platform*
- ❖ *level corridor or overpass facilities*

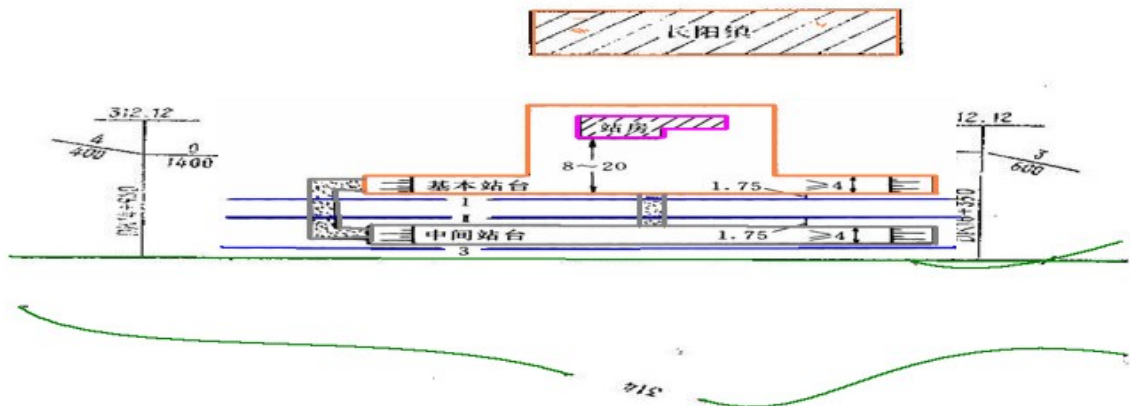


Passenger station building

- ✓ *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.*
- ✓ *The passenger station building shall keep a certain distance from the central line of the nearest track, so more tracks may be added at the building side. Generally, distance between outer wall of the building ledge and platform edge should be 8 to 20m; when condition is unfavorable, a shorter distance can be adopted, but it shall never be shorter than the main platform width*

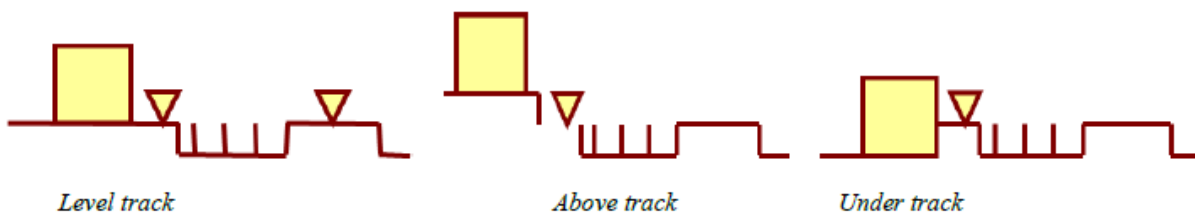
Passenger traffic facility

Place of passenger station building



Relation between platforms and building

- ✓ The ground of station building shall be kept at the same height with the main platform or at least the difference shall be as minor as possible (Line-level model Fig. (a)). When the terrace is difficult, the station building floor may be higher (track-above model Fig. (b)) or lower than the main platform floor (track-below model Fig. (c)).



- ✓ 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.

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.

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Width of platforms

- ✓ Width of the platform shall be determined subject to the largest alighting and boarding person, luggage vehicle type, size of buildings and facilities set in the platform when the passenger train stops by the station platform.
- ✓ The main platform width within the range of station building from the outer wall edge of the building ledge to the platform edge shall be no less than 6m, and other part shall be no less than 4m.

