

Research on Construction Program of Logistics Base of Shenmu West

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Abstract. Dealed with the research on program of rail connection at Shenmu West Station on line from Shenmu West to Logistics Base in the paper, designed expansion and reconstruction of Shenmu West Station, researched into program of logistics base station layout, track number and yard layout, sketched layout of logistics base station. The research will be important for Shaanxi coal transportation, potential development of Bao-Xi Line, local economy development and promotion of west development.

Introduction

Shenmu County is located in Northern Shaanxi, an area bounded by Shanxi Province and Inner Mongolia. Shenmu is rich in coal resources. As motive power and gasification power with environment protection advantage, coal in Shenmu is competitive in world energy resource market. In the period of the 12th five-year plan, with the north-south rapid track on Bao-Xi Line opening to traffic, Shenmu West Logistical Park has been built to meet the need of energy product transport. As a systematic project of Shenmu West Logistical Park, Shenmu West Logistics Base will become highway-railway combined transport junction for energy base in Northern Shaanxi. The paper studied on construction program of new Shenmu West Logistics Base Station, connection of railway tracks and reconstruction of Shenmu West Station.

Research on rail connection program and reconstruction program of Shenmu West Station

View on existing equipment of Shenmu West Station.

Shenmu West Station is a intermediate station on Bao-Xi Line, with a station center mileage of K207+850. Red God Line is led into station from Baotou end, led out of from Xi'an end, relieved by grade separated junction on Bao-Xi Line. There are 8 arrival-departure lines at double-tracked Shenmu Station. All lines are designed in double routes. The shortest effective length is 1050m. There is a basic platform at the station. The freight yard is located on Xi'an end. Locomotive turnaround point is on Baotou end, as shown in figure 1.

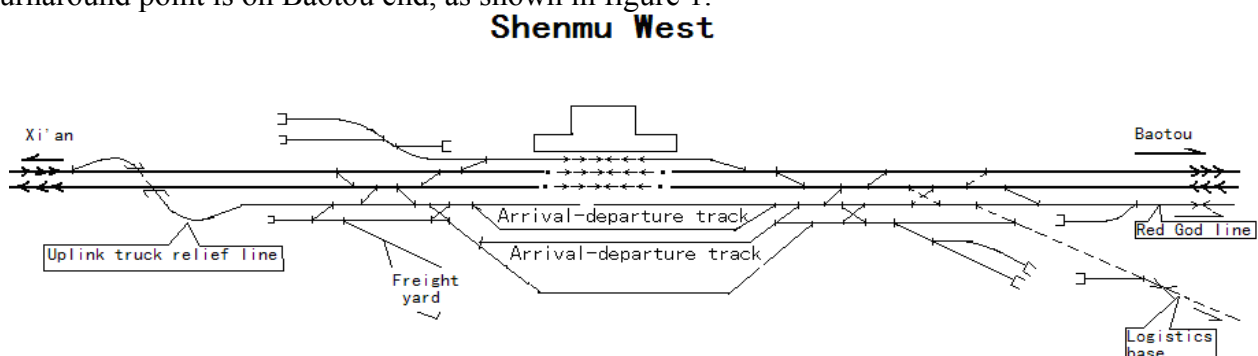


Figure 1. Shenmu West Existing Station and Logistics Base Rail connecting program

Determination of through line number

Shenmu West Logistics Base is a project for blue carbon transport from Logistics Park. The short term and long term plan for down direction (from Logistics Base to Shenmu West direction) are respectively 4 Mt and 10 Mt. Future plan is 25Mt, less than 35Mt.

According to stipulations in 《Code for Design of Railway Line》, single line should be built for logistics base. The transport capacity can meet near and far future need [1].

Research on railway junction program

Shenmu West Station is a through station with 2 throat zones both on Xi'an end and on Baotou end. On Xi'an end, there is a freight yard, the up freight relief line and the grade-separated relief layout of Bao-Xi Line. If rails were connected from this end, level and vertical section of the route from Logistics Base to Shenmu West would be worsened. Train directions would have to be changed, standing time at station would be prolonged and passing capability would be influenced. So it is not a proper site for rail junction.

At Shenmu West Station on Baotou end, there are through lines, Red God Lines and Station Tracks. The common point of the 3 positions is that freight on the new line flows to Xi'an direction and the new line has satisfactory running conditions. Trains from Xi'an direction can take Red God up relief line without crossing Bao-Xi Line. Railway connection starts at station tracks, operation and passing capacity on Bao-Xi Line and Red God Line will not be disturbed by new line trains, with little construction difficulty. It is a better choice.

Research on reconstruction program of Shenmu West Station

Reconstruction program of throat zones at Shenmu West Station. Railway junction of Logistics Base direction is located at arrival-departure tracks at Shenmu West Station on Baotou end. According to requirement in 《Code for Design of Railway Station and Terminal》 [2], a safety track should be built on the new line to prevent side collision between trains of new line direction and Red God direction. In order to improve flexibility of station throats and arrival-departure tracks, 4 crossovers should be added between Logistics Base Line and Bao-Xi Line. In this way, trains of Logistics Base direction and Baotou direction can go through arrival-departure formalities at any routes. For details, shown in figure 1.

After reconstruction, throat zone at Shenmu West Station on Baotou end will become flexible. With parallel routes for up-down trains on Bao-Xi Line and Red God Line, arrival-departure trains at Logistics Base, as well as for locomotive servicing operation, the capacity can meet transport demand.

Determination of arrival-departure line quantity. Blue carbon and coal dispatched by Shenmu West logistics base are mainly transported to central and southern Shaanxi, east China and south-west China. Till the year of 2015, 4 Mt of blue carbon and coal will be dispatched. Till the year of 2020, 10 Mt will be dispatched. About 600,000 t of machinery and building materials, such as steel, arrive at Shenmu West Logistics Base yearly. Direct transport is adopted between Shenmu West and Logistics Base. Traction capacity is 5000t, the same as that in Bao-Xi Line. Attached wagons will reach 60. Average net load of bulk goods wagon is 54t. Thus 4 pairs of trains are needed daily in the near future. 9 pairs are needed daily in the future. According to needed train pairs, 1 arrival-departure track is needed in the near future, 2 tracks are needed in the future.

At present, 5 pairs of goods trains, 4 pairs of passenger trains of Bao-Xi Line are handled at Shenmu West Station daily. 10 pairs of goods trains of Red God Line are handled daily. All passenger trains and goods trains are of passing trains. Thus 1 up track and 1 down track are needed for Bao-Xi Line. Red God Line is used for passing trains. A relief siding is built at the south end of the station. Trains on Red God Line will not interfere with trains on Bao-Xi Line. 1 through track is needed for Red God Line. 1 arrival-departure track is needed in the near future, 2 tracks are needed in the future for Logistics Base. 1 arrival-departure track is needed for station goods. Thus, after rail connection at Logistics Base, 5 arrival-departure tracks will be needed in the near future, 6 tracks are needed in the future at Shenmu West Station. There are 8 arrival-departure tracks at Shenmu West Station now (not including 2 through lines). So, line capacity can meet the increased transportation demand in both near and far future. No new arrival-departure tracks will be added.

Research on Layout Program of Logistics Base Station

Layout of Logistics Base Station.

There are 2 forms for layout, namely through station and dead-end station. Through station is usually built on railway trunk lines. Dead-end station is usually stretched into urban or industrial areas for convenient urban goods transport, which has the advantages of less place taking, short distance between railway line and truck road, less construction investment, suitability for landforms, less crossings between tracks and roads, less interference between loaded and empty wagons in the yard, thus, operation safety can be ensured. When transport capacity is raised, dead-end station can be easily reconstructed.

The yard layout of Logistics Base Station is better to be designed in transversal type, which has the advantages of integrated equipment installation, convenient management, less place taking and less investment, but not convenient for shunting operation. Because no frequent shunting are needed, it will not create much effect.

Determination of loading-unloading track

In 《Code for Design of Railway Station and Terminal》 [2], formula for effective length of goods track is [6]:

$$L = \frac{Q\alpha t}{365qn} \quad (1)$$

In the formula:

L — overall effective length of loading-unloading track (m)

Q — yearly arrival-dispatch goods quantity (t)

α — unbalanced coefficient of goods arrival and departure. Large and intermediate sized yard adopts 1~1.5; small sized yard adopts 1.3~2

l — average length of wagon (m), adopt 14m

t — occupancy time of goods section (d)

q — average net load of wagon (t)

n — goods section row number, goods section arranged within one train length

Determination of freight tracks in blue carbon and coal dispatch area. Parameter values: yearly quantity of blue carbon and coal dispatched from Logistics Base Station is 4Mt in the near future, 10Mt in the far future. Long range plan is $Q=10000000t$.

Yearly transport capacity of the station is 10Mt, far more than 1Mt. As intermediate level of a large goods yard, α is 1.3.

For bulk goods, according to 《Code for Design of Railway Station and Terminal》, $t=2d$, $q=54t$. The value of n is related with the size of loading-unloading machinery, moving distance and passageway width. In this design, blue carbon will be loaded with internal combustion loaders, coal will be loaded with silo loaders. $n=2$. Goods section is designed as 2 rows to ensure adequate goods tonnage.

All parameters are taken into formula (1), $L=9233.8(m)$.

Trains in this district will be attached with 60 wagons. Each wagon is 14m long. Train length is 840m. Calculated by entire loaded train, 11 freight tracks will be needed.

Determination of Goods tracks in Building Materials Area. Parameter values: in the future, yearly arrival quantity of building materials at Logistics Base will reach 600,000t. $Q=600000t$; $\alpha=1.3$; $t=4d$; $q=48t$ [4].

Building materials are large-heavy goods. n is related with overall width of goods, loading machinery span and passageway width. According to formula (2) [4]:

$$n = \frac{ldp}{q} \quad (2)$$

in formula (2):

d — overall width of goods section on one side or both sides of loading-unloading track (m). Gantry crane is used. Overall width of goods section is usually 5-6m, adopt 5m.

p — average goods tonnage placed in one square meter(t/m^2). According to stipulation in 《Code for Design of Railway Station and Terminal》 [2], $P = 1 t/m^2$

Taken into formula (2), $n=1.45$.

Take the result into formula (1), $L=1719.4$ (m)

The calculated track quantity is 2.

Determination of effective length of lines. Through transport is designed between Logistics Base Station and Shenmu West Station. Entire train will be loaded or unloaded at station. Traction capacity is 5000 t, drawing 60 wagons. Effective length of each track is designed as 1050m, the same as that of Bao-Xi Line.

Research on Plane Layout of Logistics Base Station

From west to east, Logistics Base is arranged with Blue Carbon loading area, Coal loading area and Building materials storage area. 13 loading-unloading tracks are needed. 1 locomotive track is needed for shunting locomotives and leading locomotives. According to classification of technical operation, Logistics Base Station is of intermediate station. 1 lead track is needed for the heavy shunting operation. A whole loading system can be equipped together with the lead track for effective transport of large quantity of coal from the station. Station Plane Layout is shown in figure 2[3].

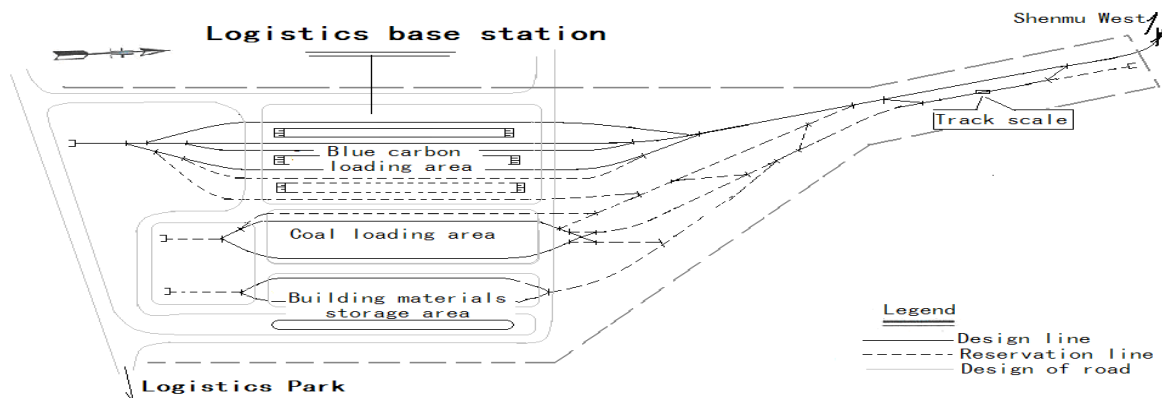


figure 2. Plane Layout of Logistics Base Station

6 tracks are needed for loading and arrival-departure operation in Blue carbon loading area, and a goods platform is equipped. According to train length, platform is determined as 900m. 2 rows of goods can be arranged on both sides of platform, altogether 16m long. Platform width is determined according to overall goods width, selected loaders and passageway. Low platform can be adopted. To raise platform efficiency, 2 loading tracks can be laid out on both sides of the platform. In the near future, arrangement of 2 platforms with 4 tracks can meet the demand of 4Mt transport capacity. For the future, 1 platform with 3 tracks can be reserved [5].

Coal loading area is reserved for future use. It can be constructed in different stages according to transport demand. There are altogether 5 arrival-departure tracks, 1 locomotive track, 1 lead track. Arrival-departure tracks are arranged in parallel with blue carbon loading tracks, dealing with train arrival-departure and hand-over operation. Large dispatch quantity will result in frequent locomotive turnarounds and track exchanges. So locomotive tracks are designed on the west side of coal loading area for short moving distance and convenient locomotive movement in Blue carbon loading area and Building materials area[5].

Installed with rapid loading system, shunting track is located on the east side of Logistics base through line, on in-coming end. Rapid loading system is located at the head of lead track. Operation style: arrived empty wagons are cleaned, serviced on arrival-departure tracks. Cleaned wagons are pushed into lead track by shunting locomotive till rapid-loading tower. With even speed, empty wagons are pulled through rapid-loading tower by locomotive, and loaded. Loaded wagons are pulled by shunting locomotive to arrival-departure track. The operation style is called "Pushing the empty and pulling the loaded". Although the position of lead track will result in longer running distance for shunting locomotive, the place on the north end of Logistic Park can be best used. With short station span from north to south and with closely integrated station layout, less place will be occupied and less money will be invested.

Building materials storage area is reserved for future use. The area can be constructed in

different stages according to transport demand. 2 loading-unloading tracks are equipped with gantry crane for handling large heavy goods.

In the rear of blue carbon loading area, coal loading area and building materials area, a track is designed for reserved locomotives to turn around and exchange tracks.

Conclusion

Shenmu is the largest coal producing county in China. The construction of Shenmu West Logistics Base is of great significance for transport potential of Bao-Xi Line and local economic development. With the Logistics Base, energy shortage in north China will be relieved, economic development in central and western regions will be promoted. Research on the program is necessary and timely.

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