
Hefei-Wuhan Section of
New Shanghai-Wuhan-Chengdu Railway Corridor

Scheme of Utilizing Foreign Capital

FEASIBILITY STUDY REPORT

Auszug

**The Fourth Survey and Design Institute of
China Railways**

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July 2005, Wuhan

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President:



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1 General Description

1.1 Study Basis

JCD (2004) No. 125 with the title of *Notice on Asking for Preparation of Foreign Capital Introducing Scheme for New Hefei-Wuhan Railway*

1.2 Scope of the Project

Total length of the main track of the new Hefei-Wuhan Railway is 356.15 km; the project includes two auxiliary projects of Hefei Terminal and Wuhan Terminal.

1.3 Design Year

Short term: 2017; long term: 2027.

1.4 Signification and Function of the Construction

The Shanghai-Wuhan-Chengdu Rapid Transit Railway Corridor will run through 6 provinces and municipalities such as Sichuan, Chongqing, Hubei, Anhui, Jiangsu and Shanghai, it will radiate to Zhejiang and Jiangsu Provinces, and it will connect the upper, middle and lower reaches of the Yangtze River, so it is another key railway corridor crossing over the Yangtze River Drainage Area. Within the catchment area of the project, total area is 1.265 million square kilometers, population is 420.12 million persons, GDP is RMB 4167.8 billion yuan, and GDP per capita is RMB 10276 yuan, which is 1.26 times of average level of that of the whole country, so total population and GDP of the railway corridor is the next to the Beijing-Shanghai Railway Corridor. Besides, the natural scenes in the area are particular, tourism resources such as famous scenic sites, nature reserves and human landscapes are abundant, which attract a large number of tourists at home and abroad to come to tour. Not only natural resources and human resources but also economies in the direct catchment area take a very important position in the whole country. The construction of the Shanghai-Wuhan-Chengdu Rapid Railway Corridor is in favor of forming the most convenient corridor between the middle and west China areas and the east China area, in favor of exchange of capital, techniques and human resources among east, middle and west China areas and introducing of foreign capital and techniques, it also is of significance for enhancing lateral communication between the underdeveloped area in west China and the

developed area in the southeast coastal area, promoting regional economic development along the line, improving big development of the west China area, shortening the gap between the west China area and east China area, and realizing "all-round construction of an affluent society".

At present, there is short of a convenient Railway Corridor from Chengdu, Chongqing through Wuhan to Hefei, Nanjing and Shanghai, it causes long-distance reroute of railway passenger and freight transport, prolonging traveling time of passenger and freight transport, decreasing market competition capacity of railway, and it also constrains the economic links among east, middle and west China areas. The Shanghai-Wuhan-Chengdu Rapid Railway Corridor is one of backbones of "four longitudinal and four transverse" rapid passenger transport railway networks in the medium-and-long term railway network plan approved by the State; the successive construction of the corridor can fill up the gap in the railway network, perfect and optimize railway network layout, shorten the traveling time of passengers from Wuhan to Hefei and Shanghai about 6.5 h and 12 h respectively, and it can shorten the traveling time of passengers from Chengdu and Chongqing to Hefei and Shanghai about 20-25 h. At the same time, it can run high-density intercity rapid transit trains between Shanghai, Wuhan and Chengdu and other large and middle cities along the line, which will greatly upgrade the market competition capacity of railway and enlarge market share of railway.

This line is an important component part of the Shanghai-Wuhan-Chengdu Rapid Railway Corridor; it runs in west-east direction and crosses over Anhui and Hubei Provinces; from the point of view of overall situation of national economic development, this area is a combination place of the south and north zones, and a bridge connecting the east and west China areas, so it takes a role of linking up of south and north China areas and connecting east and west China areas. The construction of this section of railway can form the Shanghai-Wuhan-Chengdu Corridor at an early date, and it also can bring the people in the old liberated areas such as Hong'an, Macheng and Jinzhai along the line to cast off poverty and become better off at an early date.

To sum up, the construction of this project is of significance and function for national economy and railway network.

1.5 Physical Features along the Line

1.5.1 Topographic Form and Landform

This line runs through the west area of Anhui Province and the east area of Hubei Province; from Hefei to Lu'an City, there is an alluvial, diluvial and constructional plain of the Yangtze River and Huaihe River, ground height is 50~85 m, topography is even, among that, the higher terrace forms sub-ground forms of ridge and col after denudation. Along the line, most lands belong to paddy field; from Lu'an to the east of Jinzhai County, there is a denudated low-relief terrain with ground height of 60~100 m and relative height difference of 30 m, with developed vegetation, and most of slope of hill is cultivated as dry land; between the west of Jinzhai County and Macheng, it belongs to the north slope of the middle part of the Dabieshan Mountain, which is the backbone of watershed of the Yangtze River and Huaihe River, mountains stretch and ravines cut deeply, from south to north, topography changes from higher to lower, so it belongs to a low mountainous area with sea-level elevation more than 1000 m and relative height difference up to 500 m, among that, river valleys cut deeply and vegetation develop; the relative height difference in local hill area is 10~25 m. In the section from Macheng to Wuhan, except for local humpy land, most land belongs to the lacustrine and alluvial-flood plain of the Yangtze River and Hanjiang River with ground elevation of 20~60 m, topography is even, land belongs to fertile land.

1.5.2 General Description of Engineering Geology

① Lithology of Stratum

The exposed strata along the line mainly are the strata of Dabieshan division of North China strata zone such as Dabieshan group of the Archean Group, Hong'an group of the Proterozonic group, Dabieshan group of the Presinian System, stratum of the Simian System, strata of the Holocene Series and Pleistocene Series of the Quaternary System, and local strata of the Jurassic System and the Tertiary System.

Bedrock in the section from Jinzhai County to Macheng is exposed basically, mainly is regional metamorphic rock, quartz schist, gneiss and migmatite. In local area there is exposed intrusive rock of Yanshanian, amphibolite, hornblendite, pyroxenite, and monzonite, plagiogranite and diorite. There is some of sandstone, glutinite and sandshale of the Jurassic System near Macheng Station, with smaller scope of exposing.

The strata of the Quaternary System are spread over all the low-mountainous hill areas and intermontane valleys, in the plain areas from Hefei to Lu'an and Macheng to Wuhan, main soil is clay of the upper and middle Pleistocene with weak and middle-level expansibility, and clayey soil of the Holocene Series, and local riverbed contains pebble soil and sand strata with coarse grains.

② Special Geological Phenomenon

Special rock and soil along the line mainly is soft soil and swelling clay.

Soft soil mainly is distributed over the first terrace and lacustrine area of the Yangtze River in the section of Macheng-Hankou and local col section, with lenticle state, and the distribution length is about 60 km. According to the feature of soft soil, the line shall pass through in the form of embankment or bridge, whose settlement and stability can not meet the requirements of the design, so the foundation shall be consolidated and it shall consider a widening design for shoulder settlement. For the low embankment with height lower than that of subgrade bed, it shall consider consolidation treatment measure for the foundation base.

Swelling clay mainly is distributed over the two sections of Hefei-Lu'an and Macheng-Wuhan, which belongs to weak and middle-level swelling clay. When the line passes through in the form of cutting, the height of the side slope shall be controlled within 10 m, the maximum height shall be controlled in 12 m, and side slope shall be consolidated and protected.

1.5.3 Seismic Dynamic Parameters

Section DK0+000~DK38+000: 0.1g (7 degree of basic earthquake intensity);

Section DK59+200~DK125+000: 0.1g (7 degree of basic earthquake intensity);

Other sections: 0.05g (6 degree of basic earthquake intensity).

1.5.4 Hydrogeologic Features

Alluvial and diluvial plain area: except that local area contains alluvial clay and sand clay stratum of the Quaternary System with poor water content, in the other river terraces and floodplains, there is fine sandy gravel stratum containing abundant water, with larger water

content and buried depth about 0.5~2.5 m; there is pore phreatic water and void confined water, which can meet the requirement of water supply for the railway. Main supply sources of groundwater are atmospheric precipitation and river surface water.

Plain area of denudation: the surface layer is al+plQ3 clay and silty clay, underwater is fissure phreatic water with buried depth under 5 m, with poor water permeability and smaller water quantity, so it is a water-shortage stratum.

Denudated hilly area and low mountainous area: groundwater is bedrock fissure water, water quantity is related to the development extent of fissure, most areas are water-shortage stratum and local area is a poor aquifer, and the supply source of groundwater is atmospheric precipitation, which has no erosiveness on concrete.

1.5.5 Hydrometeor

This section of railway runs across the two major drainage basins of the Huaihe River and Yangtze River; the Dabieshan Mountain is the watershed of the two major water systems. The area to the north of the Dabieshan Mountain belongs to the Huaihe River Drainage Basin, and to the south it is the Yangtze River Drainage Basin. The line spans the Sheshui River, Daoshui River and Jushui River and branch water systems on the north bank of the Yangtze River to the south of the Dabieshan Mountain; it spans Bihe River of the Huaihe River drainage basin to the north of the Dabieshan Mountain. The mountainous rivers are ephemeral streams, the slope of river bed is bigger, and river water level rises and drops abruptly. Flood is formed by rainstorm, April and May per year are plum rainy period, short-term and intensive rainstorm happens in the period from June to August, and most of major flood in the past years happened in the flood season from June to August.

The climate of the area along the line belongs to subtropical monsoon climate, winter drying and raininess in summer, alternation of wetting and drying, obvious four seasons. Annual average precipitation is 900~1600 mm, precipitation in the mountainous area is more than that in the hilly and plain areas, and annual precipitation in the hinterland of the Dabieshan Mountain is 1500~2000 mm. The period from June to September every year is a flood season, precipitation in this period takes more than 60 per cent of that of the whole year. Annual mean temperature is 14.6°C~16.4°C; January is the coldest month with average monthly temperature of 1.4°C~3.3°C and extremely lowest temperature of -12.9°C~-24 °C; July is the hottest month with average monthly temperature of 27.2~28.7°C and extremely

highest temperature of 43.3°C. Annual average frostless period is 210~259 days. Southeaster prevails in Spring and Summer, and northwester prevails in Autumn and Winter. The maximum wind force is 8~9 degrees with wind speed of 21~25 m/s.

2 Main Technical Standards

- (1) Railway classification: Class I;
- (2) Number of main track: double tracks;
- (3) Ruling grade: 6‰;
- (4) Design speed of passenger train: 200 km/h; reserved for 250 km/h and higher development conditions;
- (5) Minimum radius of curve: 4500 m;
- (6) Kinds of traction: electric traction;
- (7) Weight of traction: 4000 t;
- (8) Effective length of arrival and departure track: 850 m;
- (9) Type of blocking: automatic block system;
- (10) Construction clearance: to meet the running condition of double-layer container trains.

3 Economy and Traffic Volume

3.1 Economic Features

The Hefei-Wuhan Railway starts from Hefei City of the capital of Anhui Province in the east end, runs through Lu'an City, Dabieshan Mountain and Macheng City in Hubei Province, finally ends in Wuhan City of the capital of Hubei Province. The land area along the line was 37567 km² in 2002, with total population of 20 million persons, of which, nonagricultural population of 7.46 million persons.

The cultivated land area along the line was 955 kha, realizing total agricultural output value of RMB 36.1 billion yuan, and gross output of grain mass of 6.2 million t. The industrial base along the line was tremendous, an industrial system with rather complete fields was formed basically which took some industries as the backbone such as automobile, machinery, electronics, metallurgy, chemical industry and food industry; it realized gross industrial output value of RMB 231.8 billion yuan in 2002, steel yield of 8.56 million tone and energy output of 17.6 billion kwh.

The mineral resources along the line are abundant, but the variety is unbalanced, energy resource extent is short, and nonmetal ore reserves are rather abundant.

The tourism resources along the line are abundant, the natural scenes are beautiful, and the famous scenic site and human landscape shine each other. There are some scenic spots and historical sites such as the East Lake Scenic Spot, Yellow Crane Tower and Guiyuan Temple in Wuhan; three platforms and eight scenes such as Magu Immortal Cavity in Macheng; Dahuashan Mountain, Dongshisun, Yanshan Stockaded Village, Jiugong Stockaded Village and Tiantang Stockaded Village in Lu'an; and "Luyang Eight Scenes" in Hefei; all of these scenic spots and historical sites attract a large amount of tourists at home and abroad to come to tour.

worded: Railway Network Argentina

3.2 Sectional Freight Flow Density and Pairs of Passenger Trains

3.2.1 Sectional Freight Flow Density Forecast

Sectional Freight Flow Density of Hefei-Wuhan Railway unit: 10,000 t

Section		Short term		Long term	
		up	down	up	down
(1) Wuhan-Macheng		1950	1800	2090	2300
thereinto	Exist Macheng-Wuhan linking	1050	1225	1090	1330
	Hefei-Wuhan Railway	900	575	1000	970
(2) Macheng-Lu'an		900	575	1000	970
(3) Lu'an-Hefei		2300	1370	4700	3005
thereinto	Exist Xi'an-Nanjing-Railway	1400	805	3700	2050
	Hefei-Wuhan Railway	900	565	1000	955

3.2.2 Passenger Traffic Volume Forecast

Sectional Passenger Flow Density and Pairs of Passenger Trains of Hefei-Wuhan Railway in Design Years

Section		Passenger flow density (10,000 persons)		Pairs of passenger trains (pair/day)	
		Short term	Long term	Short term	Long term
(1) Wuhan-Macheng		1895	2692	63	87
thereinto	Exist Macheng-Wuhan linking	150	232	5	7
	Hefei-Wuhan Railway	1745	2460	58	80
(2) Macheng-Lu'an		1735	2446	58	80
(3) Lu'an-Hefei		2130	2970	72	100
thereinto	Exist Xi'an-Nanjing-Railway	310	435	12	17
	Hefei-Wuhan Railway	1820	2535	60	83

3.3 Annual Traffic Capacity in Long Term Required by the State

It is proposed that the freight traffic volume shall be 10.00 million t and passenger trains shall be 150 pairs for annual traffic capacity of the Hefei-Wuhan Railway in long term.

4 Train Operation Organization

4.1 General Description of Distribution of Stations

The distribution of stations shall be studied and determined comprehensively mainly according to distribution of cities, passenger capacity, trains operation schedule and operation modes, scheduled running diagram and their design capacity and requirements of technical operation, and combining topographic form, landform and hydrogeological conditions; generally speaking, the distance between new stations shall be 20~40 km.

There will be 16 stations along the line; the general description of distribution of these stations is shown in the following table.

Distribution Table of Stations

Station	Center trackage	Character	Station spacing (km)	Remarks
Hefei	XK3+428	Passenger station	7.342	Existing
Taohuadian	18K3+838	Intermediate station		
Hefeixi	HK2+400	Mixed passenger and freight station	8.486	
Chang'anji	DK28+163	Overtaking station	12.335	
Nanfenlu	DK66+650	Overtaking station	31.316	
Lu'an	DK96+268	Intermediate station	29.618	Newly built
Dushan	DK116+100	Overtaking station	19.832	Existing
Jinzhai	DK148+460	Intermediate station	31.804	
Tiantangzhai	DK178+700	Overtaking station	30.245	
Dunytang	DK204+230	Overtaking station	25.847	
Sanhe	DK232+790	Overtaking station	28.56	
Xinmacheng	DK257+300	Intermediate station	24.561	Newly built
Hong'an	DK296+700	Intermediate station	39.40	
Huangpi	DK327+728	Intermediate station	30.031	
Xinhengdian	DK342+000	Overtaking station	13.72	
Hankou	DK364+755	Passenger station	22.755	
				Existing

In the above-mentioned table, Hefei, Taohuadian, Hefeixi, Chang'anji, Lu'an, Hong'an, Huangpi and Hankou Stations are the existing stations; the others are newly built stations. Wuhan Terminal Station handles the passenger transport operation of this line from and to the Beijing-Guangzhou Passenger Railway. Besides, East Hefei Station in Hefei Terminal and Jiang'anxi Station in Wuhan Terminal handle technical operation of freight trains.

Average station spacing in the new line section is 25.47 km, of which, the longest station spacing is 39.40 km in Xinmacheng-Hong'an section, and the shortest station spacing is 13.72 km in Huangpi-Xinhengdian section.

4.2 Pairs of Passenger Trains and Freight Trains in Design Year

According to the passenger and freight traffic volumes and organization of train flow in the design years, the pairs of trains for this line are shown in the following table.

Table of Pairs of Passenger Trains and Freight Trains

Section	Year	Passenger train (pair)	Freight train (pair)			Total	Remarks
			Container	through	Pick-up and drop		
Hefei-Lu'an (Hefei-Wuhan Railway)	Initial stage	54	2	6		62	10 pairs of passenger trains from Nanjing-Xi'an Railway
	Short term	72	3	8		83	12 pairs of passenger trains from Nanjing-Xi'an Railway
	Long term	83	4	8		95	
Hefei-Lu'an (Existing Xi'an-Nanjing Railway)	Initial stage			8	3	11	
	Short term			13	3	16	
	Long term	17		38	3	58	
Lu'an-Macheng	Initial stage	43	2	6		51	
	Short term	58	3	8		69	
	Long term	80	4	8		92	
Macheng-Wuhan (Hefei-Wuhan Railway)	Initial stage	47	2	6		55	4 pairs of way trains operate in Macheng Station
	Short term	63	3	8		74	5 pairs of way trains operate in Macheng Station
	Long term	87	4	8		99	7 pairs of way trains operate in Macheng Station
Macheng-Wuhan (Existing Macheng-Wuhan Railway)	Initial stage			10	2	12	
	Short term			11	2	13	
	Long term			13	2	15	

4.3 Design Carrying Capacity and Traffic Volume Adaptation Situation

According to the analysis conclusion of transport organization pattern, the function of this line is located in that passenger transport is main and it keeps one eye on a small amount of freight transport.

V-shape possessive interval for maintenance is adopted for this line, and comprehensive possessive interval for maintenance for equipments adopts 240 min.

Through analyzing and calculating, the traffic capacity and traffic volume adaptation situation of this line are shown in the following table.

Table of Traffic Capacity Adaptation

Section	Year	Carrying capacity in the section computed on the basis of parallel train working diagram (pair)	Serviceability (pair)	Pairs of passenger trains (pair)	Passenger traffic capacity (10,000 passengers)	Passenger flow density (10,000 passengers)
Hefeixi-Lu'an	Short term	240	149	72	5215	2130
	Long term	240	154	83	5390	2490
Lu'an-Macheng	Short term	240	86	58	3010	1735
	Long term	240	81	80	2835	2446
Macheng-Hankou	Short term	240	123	63	4305	1895
	Long term	240	115	87	4025	2692

The above-mentioned table shows that the transport capacities in short term and long term in the study years can meet the requirements of transport volumes.

4.4 Delimiting of Administrations

The Hefei-Wuhan Railway is divided into two sections that are administrated by the Wuhan Railway Administration and the Shanghai Railway Administration respectively, the delimiting point is located near the boundary of the two provinces, the delimiting trackage is DK212+300, and the delimiting station is Duniyitang Station (dominated by the Shanghai Railway Administration).

7 Land Acquisition, Demolishment, and Resettlement of Affected Residents

7.1 General Description

The Hefei-Wuhan Railway Line starts from Hefei Station, goes firstly through the Feixi County of Hefei City, Jin'an District, Yu'an District and Jinzhai County of Lu'an City, in the middle through the Dabieshan Mountains and into Hubei Province, and then, goes through Macheng City and Hong'an County, finally into Huangpi District of Wuhan City, where it merges into the Zhengzhou-Wuhan Passenger Dedicated Line, and is led in Hankou Railway Station, and ends at Hankou Railway Station. The whole line goes through two provinces, 4 cities and 7 districts and counties, is with a building length of 409.053 km and a total main-line length of 356.150 km, among which the length of section of main line located in Anhui Province is 201.599 km, while the length of section of main line located in Hubei Province is 154.551 km. The length of section of main line under jurisdiction of the Shanghai Railway Administration is 204.339 km, while the length of section of main line under jurisdiction of the Wuhan Railway Administration is 151.811 km.

The project gains great supports of people and local governments in the areas along the line, for construction of the project will improve significantly local traffic conditions, accelerate development of land resource in the areas along the line, drive development of tourisms in Dabieshan Mountain Area, make people who live in Dabieshan Mountain Area quicken their steps to cast off poverty and to get rich.

At earlier route-selection stage of the project, we synthetically took factors such as social benefits, economic benefits and etc. into consideration, and conferred fully with officials of local governments and local residents living along the line on track alignment and station distribution. On the premise of meeting the requirements stipulated in specifications of track design, we revised track alignment and station arrangement proposal in many places according to suggestions made by officials of local government and local residents, in this way, some demolishment and removal are avoided, and area of farmland and arable land occupied by the line is lessened.

2 Land Acquisition, Demolishment and Affected Scope of Residents

For construction of track, stations, and other permanent facilities of the project, land with

an area of 16089 *mu* must to be taken over for use, among which 8370 *mu* in Anhui Province, and 7719 *mu* in Hubei Province. For construction of the project, some roads, rivers, canals and ditches must change channel, this makes it necessary to expropriate land with an area of 1950 *mu*, among which 1128 *mu* in Anhui Province, and 822 *mu* in Hubei Province. At construction stage of project, land with an area of 6740 *mu* shall be temporarily taken for use as soil borrow and spoil spots, among which 6740 *mu* in Anhui Province, and 2933 *mu* in Hubei Province. For details please see the following table. (note: one *mu* equals to 666.7 square meters)

Summary of Quantities of Land Expropriated in Anhui Province for Construction of the Hefei-Wuhan Railway Line (unit: *mu*)

Sorts	Paddy field	Dry land	Economic forest	Wast eland	Flood land	wood land	pond	Stew	Vegetable field	House site	Fruit forest	Hilly country	Subtotal
Railway territory, permanent	3870	1823	259	353	7	828	206	85	86	635	218		8370
Land for channel change and road relocation, permanent	397	416								100		216	1128
Land for soil borrow and spoil spots, temporary	1255	1697				358						497	3807
Subtotal	5522	3935	259	353	7	1186	206	85	86	735	218	713	13305

Summary of Quantities of Land Expropriated in Hubei Province for Construction of the Hefei-Wuhan Railway Line (unit: mu)

Sorts	Paddy field	Dry land	Economic forest	Wast eland	Flood land	wood land	pond	Stew	Vegetable field	House site	Fruit forest	Hilly country	Subtotal
Railway territory, permanent	2761	2470	154	289	26	633	378	55	66	753	134		7719
Land for channel change and road relocation, permanent	265	255								89		212	822
Land for soil borrow and spoil spots, temporary	766	1362				334						471	2933
Subtotal	3793	4087	154	289	26	967	378	55	66	843	134	684	11474

For construction of the project, an area of 1041000 square meters of building must be demolished and removed, among which, 363000 square meters in the section of Anhui Province, and 678000 square meters in the section of Hubei Province.

Summary of Quantities of Buildings Demolished and Removed in Anhui Province for Construction of the Hefei-Wuhan Railway Line (unit: square meter)

Administrative unit		Nor Under Jurisdiction of Railway Units					Under Jurisdiction of Railway Units			
		Simple house	Bunga-low	Bunga-low	Workshop	School	Sub-total	Bunga-low	Bunga-low	Sub-total
Hefei City	Hefei urban Area	637	40253	57164	842		98896	3852	8123	11975
	Feixi County	1686	28617	20034	1484	240	52061		331	331
	Subtotal	2323	68870	77198	2326	240	150957	3852	8454	12306
Jin'an City	Jin'an District	436	26335	20790		1504	49065			0
	Yu'an District	2883	46047	30791	7594	4118	91433	242	520	762
	Jinzhai County	598	23849	19278	1815		45540			0
	Subtotal	3917	96231	70859	9409	5622	186038	242	520	762
Subtotal quantity Anhui Province		6240	165101	148057	11735	5862	336995	4094	8974	13068

**Summary of Quantities of Buildings Demolished and Removed in Hubei Province for
Construction of the Hefei-Wuhan Railway Line (unit: square meter)**

Administrative unit		Nor Under Jurisdiction of Railway Units						Under Jurisdiction of Railway Units		
		Simple house	Bunga-low	Bunga-low	Workshop	School	Sub-total	Bunga-low	Bunga-low	Sub-total
Huanggang City	Macheng city	4	68331	27239	3147	1770	100491			0
	Hong'an County		12454	5978	307	1808	20547	1251	23671	24922
	Subtotal	4	80785	33217	3454	3578	121038	1251	23671	24922
Wuhan City	Huang pi District		23860	35295	14430	1079	74664	150		150
	Wuhan urban Area	5152	28857	307663	17808	6584	366064	26702	77573	104275
	Sub-total	5152	52717	342958	32238	7663	440728	26852	77573	104425
Subtotal quantity of Hubei Province		5156	133502	376175	35692	11241	561766	28103	101244	129347

70 percent of land occupied by the project is farmland and arable land, so for construction of the project, about 10522 persons will be affected by land acquisition, while about 18930 persons in near 5703 families will be influenced by building demolition and removal.

7.3 Implementation Schemes of Land Acquisition, Demolishment and Resettlement of Affected Residents

As the Employer of the project, MOR will provide the project with capital for land acquisition, building demolition and removal, and relocation and resettlement of emigrants according to relevant regulations and laws of PRC and the agreement entered into between MOR and Anhui Province and Hubei Province, and this item of capital is included in total engineering investment of the project. According to the agreement entered into between MOR and Provinces, Anhui Province and Hubei Province will deal with nuts and bolts of land acquisition, building demolition and removal, and relocation and resettlement of emigrants based on taking responsibility for surplus or deficits. Once there is any deficit, Anhui and Hubei provinces will supply it by way of investment, and their investment will be regarded as stocks of these two provinces in railway.

For land acquisition, the Employer will pay land compensation, resettlement assistance allowance, and compensation for green corps, and plants on field according to the relevant

regulations and laws. For the temporarily occupied land for construction of the project, after completion of the project, it will be recovered by taking respectively measures, such as replanting vegetation, renewing cultivation, re-digging ponds, and etc. For soil (residue) spoil spots where re-cultivation cannot be realized, their top surfaces shall be leveled up, and their side slopes shall be protected by planting vegetation as far as possible, so as to effectively prevent them from soil erosion and water losses, and environmental pollution, and keep being in harmony with natural environment.

The former owners shall carry out demolition, removal, and reconstruction of buildings themselves after they receive compensation. Lump-sum compensation shall be paid to the owners before they begin to build new houses. The sites of their new house shall be provided by the local government without any charge, and also the owners can get building materials of their old houses left after demolition without any charge.

7.4 Measures to reduce impacts of the project

7.4.1 Project plan and design period

Undoubtedly, the construction of project will involve land acquisition, demolition and removal and resettlement, while the condition of production and living of local residents will irrevocably be affected as well. In order to reduce the social and economical impacts of the construction of project, the design institute and the employer take some effective measures during project plan and design period.

(1) In the comparison of optimization for design plan, to take as many considerations as possible to the local social and economical impacts and treat it as key concerns for choosing the optimization plan.

(2) In order to lessen the land acquisition and resettlement as far as possible, design institute follows the rules during design period as below:

(A) To avoid the densely populated and residential area as far as possible, to reduce location;

(B) To lessen acquiring cultivated lands or acquiring land as much as possible;

(3) To optimize the construction design, to shorten the construction period, and to

reasonably arrange the timing of house removal and construction.

7.4.2 Project construction period

(1) To enhance the mechanism of public participation. Before the start of construction, to post the following items in the impact area and resettlement area in the form of bulletin:

(A) The starting time of construction;

(B) The construction schedule;

(C) The compensation policies for land acquisition and demolition and removal and resettlement;

(D) The monitoring measures for immigrants and former residents of resettlement area;

(2) Measures to lessen dust raising. In order to provide a clean and comfortable environment within construction area, and to reduce the impact to the ambient environment, we will spray water on the surface of construction convenient road located in the densely populated area when it has been cloudy and windy for continuing days. The construction units will plan the route of transportation of earthwork timely and avoid over load, while taking measures to protect soil from dropping along the road and covering the road everywhere to impact the cleanness of the environment.

(3) The treatment of waste on-site: since the construction period is long, the construction workers are in large amount, therefore there will be a lot of living garbage and waste on site. Following the rules of local environmental and hygiene authorities, the construction units shall clean the garbage and waste in time to keep the construction area on-site tidy and to avoid the breeding and propagation contagious diseases.

(4) During the construction period, to use local materials in top priority; to facilitate the local transportation and labor provided that the technical condition could be meet. Thus the impacted people can be benefited from the construction of project.

7.4.3 Implementation period of land acquisition, demolition and removal and resettlement of the project

In case that the relocation could not be avoided, the following measures will be taken to lessen the impact of construction to local environment:

(1) To enhance the information collection for basic data, deeply analyzing the local social and economical status and future development; to make a practical plan of resettlement based on the real situation; to guarantee the impacted people not to lower their living standard because of the construction.

(2) To strengthen the internal and external monitoring, to set up a smooth and highly efficient mechanism and channel of feed-back. To shorten the period of information treatment as much as possible, to ensure the various problems incurred on construction site to be treated in a timely manner.

(3) During the construction, the construction units are required to take efficient measures to lower impacts to the local production.

In a word, the main targets of emigrant relocation and resettlement are to resume incomes and living level of people influenced by the project as quickly as possible, and to minimize economic and social environmental impacts on them. Emigrant resettlement shall ensure that all people affected by the project can receive aids, can regain fields and job opportunities (for example, residents influenced by land acquisition and building demolition and removal will be given priority in gaining job opportunities created by highway construction) after being relocated and resettled, and ensure that their living level can be raised, at least can be the same as they once were. The resettlement work will include: to provide land within a village and group; to improve infrastructure facilities; to develop the second or the third industry; to make economic compensation; to purchase insurance. We will carry out the policy of "exploitive resettlement", to ensure the resettlement area have basic material living condition, while providing potentiality for long term development; to combine resettlement with area development and economical progress; to lead the residents of resettlement become more rich, reaching the same or better living standard.

Environmental Impact Assessment

Conclusions of Assessment on Environmental Status Quo

Ecological Environment

The line is located in the subtropical monsoon climate zone, where climate is warm and humid, rainfall is plentiful, and natural conditions are favorable. Types of soils in the area along the line mainly include red earth, brown earth, yellow brown earth and paddy soil, among which paddy soil is the main cultivated soil. In the areas along the line there are a great variety of vegetation, and abundant forest resource. However, its forest resource mainly includes plantation and economic forest.

The minimum distance between the designed boundary of the Anhui Tianma National-grade Natural Reserves and the line is 8 km, so the project will not destroy rare wild plant resource that exists in the Tianma National-grade Natural Reserves, and will not invade and occupy the habitat and main active areas of the rare animals living in the Tianma National-grade Natural Reserves.

8.1.2 Noise Environment

Values of environmental noises at given points along the boundary of the existing railway lines located in territories of Wuhan City and Anhui province show that degrees of noise at all points, except the Wuqi Multi-storied Building, meet requirements specified in GB 12525-90.

Degrees of environmental noises at 20 schools located in the evaluated areas such as the Anhui Province Power Technical School, and etc., can meet requirements of teaching environment.

Value of environmental noises at the Wuhan Zhongde Psychological Hospital is 60 dBA during daytime, and 50dBA at night, can meet requirements of hospital environment.

Values of environmental noises at 12 dwelling districts more than 30 m away from the existing railway line in Wuhan urban area, such as Jinjiadun Dwelling District and etc., can meet requirements specified in GB 12525-90 both during daytime and at night.

At the affiliated blocks of apartments of the Fourth Engineering Construction Bureau of China Railway, Xingmin Village, Shilidian Village, and Tianyaohuayuan Dwelling District distributed along the existing Hefei-Jiujiang Railway Line inside Hefei City, values of environmental noises both during daytime and at night meet the requirements specified in GB12525-90.

8.1.3 Vibration Environment

For existing sections of the line, environmental vibration at sensitive points 30 m away from the line can meet requirements of environmental vibration specified in GB 10070-88 '*Standards of Environmental Vibration in Urban Areas*'; and for new sections of the line, environmental vibration at sensitive points, such as villages and schools, can meet requirements of environmental vibration specified in GB 10070-88 '*Standards of Environmental Vibration in Urban Areas*'.

8.1.4 Water Environment

(1) For oil-containing wastewater discharged from the existing Hefei Passenger Train Technical Servicing Point, all of its pollution factors after treatment can meet requirements of Class 3 specified in GB 8978-1996. For sewage discharged from the main outlet of the sewage pumping station of the Hefei Passenger Car Depot, it can meet requirements of Class 3 specified in GB 8978-1996 '*Sewage Comprehensive Discharge Standard*'.

(2) Before and after construction of the project, no change presents in aspect of service properties of the Hefei Passenger Train Turn-around Depot and the Hefei Passenger Train Technical Servicing Depot, changes only present in quantities of services, so after completion of the project, quality of discharged sewage basically will not change, and can meet requirements of Class 3 specified in GB 8978-1996.

(3) For sewage discharged from the main outlet of the existing Hefei East Locomotive Operation Depot, it contains oil pollution factor. All its pollution factors, except oil factor, can meet requirements of Class 2 specified in GB 8978-1996.

8.1.5 Ambient Atmosphere

(1) As a whole, ambient atmosphere quality in the areas along the line is good, can meet requirements of Class 2 stipulated in GB '*Standard of Ambient Atmosphere Quality*'. However, acid-rain pollution exists in some areas along the line (all along-the-line areas in Anhui province are acid rain areas).

(2) The boiler exhaust gas treatment facility in the existing Hankou Railway Station is working well; concentration of discharged pollutant can meet requirements of Class 2 stipulated in GB 13271-2001 '*Boiler Atmosphere Pollutant Discharge Standard*', so it is not necessary to replace old facility with new one and to take further environmental protection measures in this design.

8.1.6 Solid Wastes

Solid wastes produced in the areas along the line mainly include boiler slag from the central heating boiler room in Hankou Station area, house refuses produced by working and living staff refuses from passenger trains, and etc. Volume of boiler slag produced by boiler rooms in the areas along the line is 788.40 t/a, and volume of refuses discharged by stations is 4197.5 t/a.

For slag produced by the coal-fired boiler of the existing Hankou Railway Station, generally it is firstly taken away, then sold, and finally used for making bricks or paving roads, so it basically presents no impact on environment.

For refuses from the existing Hefei and Wuhan Railway Stations, it will be gathered and treated by local environment sanitation agencies after being classified for complex recycle, so it presents little impact on environment. Because the refuse treatment facilities in these two stations present surplus of capacity, have capacity to dispose refuses produced by the new Hefei-Wuhan Railway Line, it is not necessary to rebuild or extend refuse treatment facilities in the existing stations.

8.1.7 Electromagnetic Environment

For this electromagnetic environment assessment, we carried out an overall investigation in the areas along the proposed railway line. At suburban areas of Hefei City and Wuhan City, most of residents' houses have been provided with closed-circuit television system; however, at the Dabieshan mountainous area, most of residents' houses receive TV signals through antennas, so it is possible to be interfered there by the electrified railway line. In order to survey interference on TV receiving, we carried out monitoring in 8 dwelling districts that have not provided with closed-circuit television system. Monitoring results show that among 43 channels receiving signals by antenna, 12 channels are with a satisfied signal field intensity, which can comply with value of nominal available field intensity specified by the Ministry of Broadcast and Television, meanwhile, signal-noise ratio of these channels can arrive at 35 dB, which is required for residents to televise normally; 18 channels can not meet requirements of field intensity of TV though they are with a satisfied signal-noise ratio of 35 dB; 13 channels can neither meet required value of field intensity nor required value of signal-noise ratio. On an overview, signal field intensity of most TV channels in areas along the line cannot meet requirements, and TV receiving quality is lower.

8.2 Conclusions of Prediction and Assessment

8.2.1 Ecological Environment

(1) Land with an area of 1072 ha is newly expropriated by the project as permanent railway territory, in addition to that, land with area of 449ha is newly expropriated by the project as temporary railway territory acting as soil borrow and spoil spots, residue spoil spots, and temporary large-scale engineering construction site. The Hefei-Wuhan Railway Line is a key traffic construction project of our state; land used for its principle part has been reserved in overall planning of land utilization in areas along the line, therefore, impacts of the project on land resources are unavoidable, but impacts of the project on regional environment are slight.

(2) Volume of earth-and stone- work of subgrade engineering and station and yard engineering totally is 30.39 million m^3 , among which, fill quantity is 18.14 million m^3 , and excavation quantity is 12.79 million m^3 .

Because fill quantity of the project is more than excavation quantity, soil borrow is necessary. Most of earth and stone mass gained by excavation are filled nearby, but affected by factors such as operation of the existing railway line, transport distance, traffic conditions along the line, soil condition (in some special sections of the line, soil quality cannot meet requirements of fill) and etc., some excavation earth cannot be filled, so it is still necessary to set soil spoil spots in some sections. All protection measures designed for soil borrow and spoil spots will be optimized at the next stage. If all designed protection measures are carried in construction, degree of environmental impacts will be minimized.

(3) During construction period, the project will cause water losses and earth erosion with volume of 196817 t. With implementation of protection measures such as dry masonry rubber slope, mortar masonry rubber slope, retaining wall / ballast wall and etc. and with improvement of road drainage facilities, in the areas where engineering protection measures have been implemented, soil erosion intensity will decline and change into slight degree. With increase of vegetation coverage area, in the areas where biological protection measures have been implemented, soil erosion will be quickly controlled; Soil erosion intensity will decline to slight degree 1-2 years after impletion of the project, and come back to present degree 2-3 years after impletion of the project.

(4) There are 170 extra-long, large and medium bridges with a total length of 109.68 km in the line. Bridge design has fully taken such demands into consideration as demands on draining excessive water, shipping irrigation, and etc. Provided construction of project is implemented strictly according to design documents and protection measures is carried out perfectly during construction period, construction of bridge engineering will not do harm to ecological environment in the areas along the line.

(5) There are 37 new tunnels with a total length of 64.027 km in the line, earth and stone mass from tunnels boring in the whole line is a cube of $1367.78 \times 10^4 \text{ m}^3$, among which a cube of $388.20 \times 10^4 \text{ m}^3$ will be used for construction of track engineering and station and yard engineering, a cube of $979.58 \times 10^4 \text{ m}^3$ will be spoilt. In the next design stage of the project, design shall take such aspects into account as comprehensive utilization of earth and stone mass from tunnels, reduction of spoil earth and stone mass, good implementation of protection measures in soil spoil spots.

Design of the project has adopted strict waterproofing measures and tunnel hole consolidation measures to prevent tunnels from possible water-rushing, mud boiling, and ground water losses and soil erosion. Provided construction of project is implemented strictly according to design documents and control and monitoring are carried out perfectly during construction period, all above-mentioned phenomena can be avoided.

Primary investigation of the project shows that there are no radioactive mine and other abnormal points.

8.2.2 Noise Environment

For low embankment sections and bridge sections of the line, in railway boundary 30 m away from center line of outer track, values of environmental noises exceed requirements specified in GB 12525-90 '*Noise Limitation of the Railway Boundary and Measuring Method*'. The measure of reducing noise is application of noise barrier shield. For high embankment sections and cut sections of the line, at points located along the railway boundary 30 m away from centerline of outer track, values of environmental noises basically meet requirements.

8.2.3 Water Environment

(1) For the Hefei Passenger Train Turnaround Depot and Passenger Train Technical Servicing Point, working character will not be changed only workload will be increased before and after completion of this project. So there will be basically no change in water quality of sewage discharged after completion of the project and the sewage discharge amount will be increased with increase of water quantity. After completion of this project waste water discharged by the Hefei Passenger Train Turnaround Depot and Passenger Train Technical Servicing Point can meet the requirement of Grade-III Standard in GB10070-88 after being treated by the exist sewage treatment facilities.

(2) After completion of this project sewage produced by the Hefei East Locomotive Depot will be entered into comprehensive sewage treatment plant after being pretreated respectively, each pollution factor of drainage is not in excess of the standard of Grade-II in GB8978-1996 *Standard of Comprehensive Sewage Discharge*.

(3) After completion of this project sewage produced by the Hankou Passenger Train Stock Servicing Point can meet the requirements of Grade-II Standard in GB8978-1996 *Standard of Comprehensive Sewage Discharge* after being treated respectively by the corresponding sewage treatment facilities. Car washing sewage produced by the passenger train stock servicing point can be used for washing vehicles after being treated and the water quality is in accordance with the standard of *Water Quality of Railway Production Lowgrade Water Utilization* in TB/T3007-2000 *Water Quality Standard of Railway Reclamation Water*.

(4) After the sewage treatment facilities being rebuilt in locomotive turnaround depot for Hankou dispatched passenger locomotive, sewage discharge can meet the requirements of Grade-II Standard in GB8978-1996 *Standard of Comprehensive Sewage Discharge*.

(5) Based on *Lu'an Municipal Environmental Functional Divisions*, the main function of Xianghongdian reservoir and its branch entered into reservoir are planned as a drinking-water source reserve; the existing circumstance of water quality is Category-II water body and the water quality goal will be controlled as Category-II.

(6) During construction of Xianghongdian Grand Bridge and bridge, waste and sewage such as excavation spoil, mud of bored pile of bridge, great muddy rainwater and domestic sewage produced by camp buildings will be discharged into the river if neglect of management which will affect its water quality.

(7) During construction, if the constructors strengthen their environmental protection consciousness and construct in civilized manner, influences of this project on 3 watercourses and 18 bays as well as Xianghongdian reservoir will be minimized.

(8) Environment risk will still exist due to complexity of railway transportation and various unpredicted factors. The operational unit should establish the information network for rescue from dangerous goods transport accident. The stations along the line will be as the junction point of the network, all the units within the station will be the member units of the command setup which directed by the station master. When great danger occurs they should report immediately to the administrative department in charge railway, local government, police and fire fighting department, environmental protection department and hygiene and disease control department, simultaneously contact rapidly with the unit in the information network for salvage which knows character of the freight well and prevent the dangerous goods from falling into Sheshui and Xianghongdian reservoir accordingly minimize the impact on environment caused by accident as possible.

(9) This project will cross over other some rivers along the line such as Hangpi main canal, Pihe, Jvshui and Daoshui. There are some bridges designed to be constructed, they are: Pihe general main canal grand bridge, Pihe grand bridge, Jvshui grand bridge and Daoshui grand bridge. For the line crossing over the above rivers, measures suggested by the environmental evaluation should be adopted during construction of the bridges in order to prevent the water-source reserve from being polluted.

8.2.4 Atmospheric Environment

(1) The Hefei-Wuhan Railway will be constructed once as double-track electrified railway without loco exhaust emission due to adoption of electric locomotive. Clean energy will be adopted for this project such as solar energy and electric heater (no boiler installation adopted) thus it is in favor of protecting ambient air quality from being polluted along the railway line.

(2) Only one internal combustion engine will be increased in Lu'an railway area for this project with less atmospheric pollutant by loco which will basically have no effect on the local ambient air quality.

8.2.5 Solid Waste

After completion of the Hefei-Wuhan Railway, all kinds of wastes will be increased correspondingly with increase of passenger capacity in Hefei and Hankou station such as rubbish from the passenger train, consumption residues from waiting passengers and working personnel, daily domestic garbage from newly-increased railway fixed number of personnel for the whole line and the domestic garbage from the stations along the line.

After completion of this project, the annual discharge quantity of the rubbish from the stations of the whole line will be as 7533.24 t/a. All the rubbish will be collected and stored at fixed point then transported to the local environmental hygiene department for unified treatment, so it will not have effect on the ambient environment.

8.2.6 Electromagnetic Environment

After completion of the Hefei-Wuhan Electrified Railway, electromagnetic radiation emitted by the running train will decrease the signal to noise ratio of all the channels thus effecting on the users who watch TV by antenna. Among 8 sensitive televiue residential areas, 1 has good watch quality before the project and keeps normal watch quality after the project; another one has bad watch quality before and after the project; watch quality of the other 6 areas turned badly obviously after the project. In addition watch quality will also be influenced by the shelter and reflection to the television signal emitted by the train after the project.

Some control measures will be adopted, they are: installation of wired television system for 5 residential areas; installation of separated household satellite receiving system for 1 residential area.

After completion of the Hefei-Wuhan Electrified Railway, power frequency electric field and magnetic field produced by the traction substation will not be harmful to the health of the residents who are outside of the enclosing wall of the substation.

8.2.7 Participation of the Public

Construction of the Hefei-Wuhan Railway will be of far reaching importance to the areas along the line with respect to territorial development, economic development, and increase the frequency of alternation of the material and personnel. Moreover the local people are deeply concerned of self interests who hope to gain rational compensation and give much attention to

the environment effects caused by the Hefei-Wuhan Railway with enhancement of environmental protection consciousness. Therefore environmental protection should be paid much more when constructing the Hefei-Wuhan Railway and necessary effective measures should be adopted to reduce the influence of the construction on the ecological environment.

8.3 Final Conclusion

The Hefei-Wuhan Railway is an important part of national railway networks of "8 vertical trunks & 8 horizontal trunks" east-west corridors and "4 vertical trunks & 4 horizontal trunks" rapid passenger traffic networks corridors. Construction of this project will play an important role on the areas along the line of improving traffic environment, promoting regional economic development, optimizing railway network and quickening implementation of the national west development strategy.

But construction of this project will also bring about some adverse impacts on the ecological environment, water environment, acoustic environment and vibration environment of areas along the line. However there are some active and effective control measures adopted in the design, and some pertinent control measures and suggestions proposed in this report for the project. Provided these environmental protection measures are combined with the main part of project simultaneously strengthening construction supervision management, these bad impacts of the project on the environment can be controlled at a lower level, so we believe that this project is feasible in combined consideration of principle of unifying social, economic and environmental benefit.