

# The Engineering Land Reclamation and Application of Underground Cave in Shaanxi

Zhang Lu<sup>1,2,3,4,a</sup>

<sup>1</sup>Shaanxi Provincial Land Engineering Construction Group, Co., Ltd, Xi'an 710075, China;

<sup>2</sup>Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710021, China;

<sup>3</sup>Key Laboratory of Degraded and Unused Land Consolidation Engineering, the ministry of Natural Resources, Xi'an 710021, China;

<sup>4</sup>Shaanxi Provincial Land Consolidation Engineering Technology Research Center., Xi'an, Shaanxi 710075, China.

<sup>a</sup>luluqiaofeng@126.com

## Abstract

The study about popularization and application of hollow village land reclamation from the underground cave reclamation technology in Yaozhou of Shaanxi, which provided the scientific reference improve the land utilization of idle homestead in our country. Through these engineering patterns of excavating the underground cave, leveling land, building cropland ridge, irrigation and water conservancy, field road and farmland protection in project area, which were used as popularization and application of underground cave engineering reclamation technology. 292 hm<sup>2</sup> disused homestead was renovated in the project, adding new arable land with 285 hm<sup>2</sup>, which were popularized to the whole province land reclamation with about 14667 hm<sup>2</sup> and new arable land with about 12800 hm<sup>2</sup>. The popularization and application of technology formed the land comprehensive improvement use new mode of fertile land construction and modernization new rural construction as a whole in Shaanxi abandoned land, which improves land utilization ratio, simultaneously, guarantees the economic, ecological and social benefits of the new villages.

## Keywords

Hollow village, Underground cave, Land reclamation, Popularization and application.

## 1. Introduction

With the acceleration of social development, the rural population went out to work, and the population became "hollowed", old villages were abandoned but not demolished, and homesteads were "hollowed". A large number of rural areas in China have gradually evolved into "hollow villages" or "abandoned villages"[1-5]. Therefore, researching "hollow village" renovation technology is of great significance in order to effectively solve the problem of idling homesteads in rural areas, relieve the pressure of land demand in my country, increase land utilization, and promote the construction of new countryside.

## 2. Hollow Village Renovation Goals

First, improve land utilization. The land occupied by abandoned old homesteads in rural areas cannot be cultivated or lived in, causing a great waste of land resources and further intensifying

the contradiction between man and land. Therefore, increasing the utilization rate of land is the primary goal of the renovation of the "hollow village".

Second, improve the living environment and the personal safety of residents. The dilapidated kiln houses in some old rural homesteads are on the verge of collapsing, directly threatening the normal life and production of the masses. Improving the status quo makes the renovation of "hollow villages" practical.

Third, develop the construction of rural civilization. Due to uninhabited abandoned houses on old rural homesteads, many villagers use their old houses to raise livestock, resulting in "dirty, chaotic, and poor" environmental sanitation in the village, seriously affecting the living environment and physical and mental health of these residents. The construction of rural civilization is inseparable from the effective renovation of "hollow villages".

Fourth, standardize rural management. According to the "Land Management Law" of the People's Republic of China, the new homesteads in rural areas must be retired. However, in reality, due to the loose and chaotic management of rural land and the extensive planning of homesteads, farmers still occupy land while building new homesteads. The original homestead is piled up with sundries and used for raising livestock. The renovation of "hollow villages" will help standardize rural management and promote the reform of the management system.

Fifth, build rural infrastructure. The existence of old rural homesteads disperses farmers' living areas, the distribution area of rural villages is too large, and the extension of villages is too long, which increases the difficulty of unified construction of rural infrastructure such as water, electricity, roads, communications, and public facilities. Greatly affected the further development of the rural economy and society. "Hollow Village" remediation is not only land remediation, but also improve the construction of rural infrastructure, enrich life, and increase production.

Sixth, protect assets. At present, the rights and interests of the state and rural collectives have not been reflected after the transfer of rural homesteads. The transactions of rural homesteads are mostly "black-box" operations and arbitrarily set prices. This illegal transfer of collective land needs to be properly rectified in the "hollow village". The rights and interests of the transferee are guaranteed, and the rural collective or state land assets are effectively protected. To sum up, in the current situation where arable land is greatly reduced and the demand for building a conservation-oriented society is increasing, it is urgent to save land and use land rationally. The renovation of "hollow villages" has attracted widespread attention.

### 3. Project Implementation and Design

#### 3.1. Project Site Selection

The project area is located in Xiaoqiu Town, northwest of Yaozhou District, Tongchuan City, Shaanxi Province. The main types of abandoned homesteads in this area are pit kilns. The living space of pit kilns is underground. The floor of the kiln roof is production land. The roof is a place for the sun in the sun. The pit cave dwellings are generally 6-14 hole kilns, and the most 16 holes are basically arranged in a grid of "well". The main landform is an undulating platform, which is a loose Quaternary sediment of loess. The underlying bedrock is deeply buried with a thickness between 250 and 400 m. It is a northeast-southwest syncline fault structure with an altitude of Around 900 m. The soil is fertile and farming is convenient. However, the per capita arable land area in the project area is only 0.14 hm<sup>2</sup>, which is 0.112 hm<sup>2</sup> less than that of the entire district. With the development of social economy, in recent years, about 80% of farmers have bid farewell to kilns and moved into new houses. However, the construction of new homes occupies arable land and fertile land, and the idle kiln-style houses cannot be reclaimed in time, resulting in a disorderly layout of residential areas and a great waste of land resources. In

addition, due to the lack of matching canal systems and land leveling, there is a large gap between the actual irrigated area and the designed irrigated area, the utilization rate of water resources is not high, and the land production potential has not been fully utilized.

### 3.2. Building Demolition and Pit Kiln Excavation

The excavation of pit kilns is the most important part of the project construction, which directly affects the construction and quality of other projects in the future. Therefore, before construction, the distribution and quantity of pit kilns in each project area and the kilns in each courtyard must be reviewed. The quantity is checked in detail, and the topographic map and planning map are marked one by one. At the same time, the construction diagram of the kiln excavation project and the construction technical points of the kiln excavation project are drawn and compiled: (1) The excavator must have a bucket capacity of 1.2 m<sup>3</sup> or more Large excavators; (2) The construction line must go to the kiln palm; (3) For the cave dwellings near the existing houses in the planning area, full consultation must be conducted with the house owner. After the villagers agree, the house reinforcement shall be adopted Construction can only be carried out under the condition of safety measures. In principle, excavation is not allowed outside the planned area; (4) During construction, each cave must be dug and filled (using the excavator's own weight to repeatedly roll), and no funnel shape should appear in the middle. (The height difference should not be greater than 1.5 m). The original water cellar in the courtyard must also be filled; (5) During the excavation process, the constructors and safety personnel of the construction unit must comprehensively assess the safety and quality of each cave excavation on site. Record the current situation of each kiln and the results after the excavation; (6) After the construction is completed, the kiln palms of each cave dwelling must be exposed for acceptance.

Table 1 shows the statistics of earthwork construction engineering quantity during the reclamation process.

Table 1 Classification of engineering quantity statistics

Project	Unit	Quantity
Excavator digging	m <sup>3</sup>	1951228.94
Loader loading earthwork	m <sup>3</sup>	1510309.11
55KW bulldozer leveling	m <sup>3</sup>	1560983.15
Earthwork by digging ditches manually	m <sup>3</sup>	3092.83
U-shaped overall lining volume	m <sup>3</sup>	1030.94
Base layer compaction	m <sup>2</sup>	73707.18
Pavement cushion	m <sup>2</sup>	40505.67
Precast concrete components	m <sup>3</sup>	26.36

### 3.3. Land Leveling Project

(1) Use instruments to release the field and road construction scope lines according to the planning plan and drawings; (2) The height difference between the fields and the gradient within the fields are strictly in accordance with the requirements of the design drawings, and special circumstances can be based on the flow direction of the irrigation canal. The project department and the construction unit negotiated and decided that the height difference between two adjacent points in the field after leveling (determined according to the size of the field, the maximum is not more than 50 m, the minimum is not less than 20 m) shall not be

greater than the designed height difference of 20 cm, the largest in the field The height difference shall not be greater than the design height difference of 30 cm; (3) Under the premise of following the overall planning layout, earthwork balance in the fields is required in principle to minimize the amount of earthwork movement between the fields; (4) The field surface is level, The filling part of the kiln is evenly compacted and can be 30-50 cm higher than the ground surface. If there are irrigation conditions, it should be irrigated with water to prevent the soft fill from causing settlement; (5) For fields bordering residential houses and roads, it is required to take The minimum distance between the soil and the house is 10 m, the distance is 1.5 m from the road, the height difference should not be greater than 1.5 m, and the slope ratio is 2:1.

#### 4. Project Promotion and Application Value

Yaozhou Xiaoqiu Town Rural Abandoned Homestead Renovation Project started preparations in September 2004 and was completed and accepted in December 2005, which lasted one year and four months. The total investment of the project is 20,033,300 yuan, 292 hm<sup>2</sup> of homesteads will be renovated, 285 hm<sup>2</sup> of cultivated land will be added, and the investment per hectare is about 316.83 yuan. Convert the original unused waste land into usable arable land, fully tap the potential of land reserve resources, and increase the utilization rate of local land resources. The completed 285 hm<sup>2</sup> irrigated land has all been transferred to the village group for management and operation. Yaozhou District (2005-2009) achieved a total output value of 29.3189 million yuan, of which wheat output value was 8.2093 million yuan, corn output value was 8.2093 million yuan, and fruit forest and other output value was 12.903 million yuan. Through comprehensive management, the production conditions in the project area have been significantly improved, the area of arable land and the total grain output have been increased, and agricultural efficiency and farmers' income have been increased. The comprehensive benefits of the project area have been significant, which has effectively promoted the construction of a new socialist countryside in the project area.

In the past ten years, in various cities and counties of Shaanxi Province, sporadic or small-scale projects have been organized, designed, constructed, and comprehensively renovated through the application of "Integrated Technology for Comprehensive Renovation of Rural Abandoned Homesteads", renovating 14,667 hm<sup>2</sup> of rural abandoned homesteads, and net increase of 12,800 hm<sup>2</sup> of arable land . Among them, 9467 hm<sup>2</sup> of cultivated land in Guanzhong, 2000 hm<sup>2</sup> of cultivated land in northern Shaanxi, and 1333 hm<sup>2</sup> of cultivated land in southern Shaanxi. Through comprehensive rectification, the annual grain output value was 244,156,300 yuan, the annual grain output value in northern Shaanxi was 51,582,300 yuan, and the annual grain output value in southern Shaanxi was 34,388,200 yuan.



Figure 1 The current situation of the abandoned homestead in Xiaoqiu Town, Yaozhou before and after reclaiming

## 5. Conclusion

According to the National New Urbanization Plan (2014-2020), scientifically and rationally establish a rural homestead exit mechanism, actively promote the coordinated development of urban and rural areas, and maintain 1.8 billion mu of arable land unwaveringly, with great potential for reclamation and land use after the renovation of Hollow Village. It is diverse. Newly-added arable land, crop planting, modern facility agriculture, and new rural construction are the main directions of utilization. According to statistics, the remediation potential of hollow villages across the country reached 149 million mu by the end of 2015, and the rural areas of Shaanxi Province can be directly reclaimed. The homestead area will reach 1.8 million mu. The hollow village renovation project involves Changwu, Yaozhou, Chengcheng and other counties, with a total promotion area of more than 700,000 mu in Shaanxi, and an additional 18,800 mu of cultivated land [6].

Carry out pit and kiln renovation, strengthen the intensive use of land, and increase the utilization rate of land, thereby speeding up the adjustment of industrial structure, increasing farmers' income, and promoting economic development in the project area. Based on the research on the renovation technology of pit kilns in Shaanxi Province, the former uninhabited dilapidated villages have been turned into 10,000 acres of fertile land. The renovation effect is remarkable, and it can be promoted to other types of abandoned homesteads in Shaanxi Province and even the country. The dikeng kiln project in Xiaoqiu Town, Yaozhou, Shaanxi has proved the engineering application and promotion value of scientific and rational land remediation, and affirmed the strategic significance of the comprehensive remediation of abandoned rural housing sites from the perspective of land reclamation and utilization and new rural construction. It is of great significance to realize the balance of occupation and compensation, ensure agricultural efficiency, increase farmers' income, change the appearance of rural areas, improve agricultural production conditions, and manage the social, economic and ecological benefits of the region, and have important advancement significance in building a new socialist countryside.

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