

# Shanghai Evolution Building Shift Engineering Company

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*On my recent trip to China (October 2007), I visited this company in Shanghai and some of the projects it had recently completed or was about to undertake. This article profiles the nature of its work based on that experience, supplemented by information from the company brochure and websites.<sup>1</sup>*

Structural moving is a young business in China – twenty years ago a trip to explore the technologies used for moving buildings there would have yielded little or no information. Today, some 30 companies participate in the ‘integral shift’ industry. Most have evolved from general construction or engineering firms. The Evolution Building Shift Engineering Company, based in Shanghai and a leader in the field, was restructured in 2004 from the Liansheng Construction Project Company (Shanghai) with a registered capital of 8 million yuan (US\$1.08 million).

Lan Wuji, 51, a senior engineer and a graduate teacher of Tongji University, is the General Manager of Evolution, responsible for 42 staff. He explained that the principal strands of their work are moving buildings of historic interest, or that stand in the way of urban and residential planning. The company also lifts and lowers bridges, raises factory roofs, and as Mr Lan politely expressed it, they also ‘correct construction mistakes’. Consultancy work is also occupying more staff time – a recent feasibility study explored the possibility of raising the buildings on Shanghai’s famous Bund – all 1.6km of them – as part of a Traffic Reconstruction Project in anticipation of the 2010 World Expo Trade Fair. (An alternative, less ambitious scheme has subsequently been adopted). The company has also advised on Beijing’s National Olympic Stadium, providing a control programme for unloading the steel supports used in its complex pod-like structure.

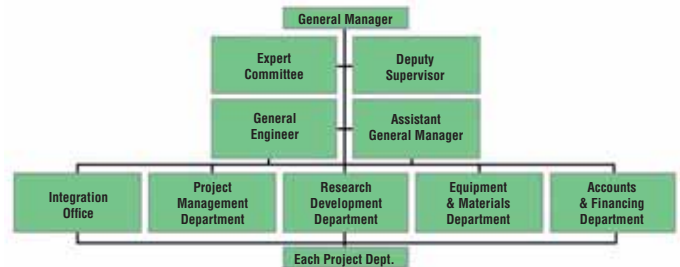
Mr Lan would argue that shifting rather than demolishing buildings is a more sustainable approach by causing less damage to the natural environment; it also brings good social benefits (eg helping to preserve historic buildings that would otherwise be destroyed) and of course distinct economic advantages, playing a part in shortening construction time and allowing new sites to be developed.



The Company Offices in Shanghai

The organisation of the company indicates both its tight structure as well as the importance placed on iterative review (‘Expert Committee’), R & D and the role of the engineer.

## Organizational Framework



Organisational Structure at Evolution

To this end, Mr Lan has gathered around him a team of experienced experts with a track record in undertaking challenging projects (over half the staff are involved in research and engineering). Jiang Huang Cheng is a British certified structural engineer, Lv Xilin is Director of a Structural Engineering and Disaster-Prevention Institute in Shanghai with experience of anti-seismic analysis and building monitoring; and two further members of the team, Zhu Qihua and Lin Qiquan are professors in the field of engineering.

The team’s qualifications reflect the close links enjoyed between the structural moving industry and universities – the latter clearly bring essential intellectual and technical rigour to the planning and execution of projects.

Buildings on the Bund



The company's partners therefore include ZhiJiang, Northern Jiantong, South East and Central South Universities. Most significantly, Evolution has established the 'Building Shift Research Centre' – the first institute of its kind focussed on moving buildings in China - at Tongji University in Shanghai; this acts as the company's research & development department. Academic credibility is further enhanced and professional horizons extended through staff involvement in the review of national technology codes and membership of various bodies such as the Engineering Standards Committee and the Senior Professors Association of China.

The fruits of all this experience are directed, as the brochure translation quaintly expresses it, at investing each project the company undertakes with 'elegant professional theory'. Each move is seen as an opportunity to refine design methods, and lessons learnt are shared with a wider audience through the publication of technical papers in Construction Technology and other Engineering journals.<sup>2</sup> The company also does not shy away from media coverage, with various projects featured in programmes on China Television (CCTV) and articles in the People's Daily.

The pursuit of both a solid academic reputation and full public exposure through the media is vital to Evolution's development strategy; both ingredients serve to place the company firmly in the sights of government contracts – in a country where all the land is state-owned, all major construction and engineering jobs emanate from this source. A sequence of shots featuring Mr Lan and key government officials at project sites is strategically positioned at the front of Evolution's brochure.

The government is responsible for driving an unprecedented spurt of urban growth; one consequence is that in some cities whole areas are being razed; yet a small percentage of structures standing in the way of development do escape demolition, providing the key opportunities for Evolution to step in and provide the technology, skills and experience to remove them out of the way of the bulldozers. Economics dictate that, as far as relatively new buildings are concerned, only those of significant size and bulk are potential candidates. The Wuzhong Hotel, located at Yumin Road, Ningxia province, was re-located in 2005 out of the way of new development. Measuring



**The Wuzhong Hotel**

43.04 metres long and 17.64 metres wide to give an overall floor area of 12700m<sup>2</sup>, the 13 storey concrete structure weighed 20,000 tons. Evolution shifted it 82.5 metres, setting a new record for the height, floor area and weight of a building move.<sup>3</sup>

The speed of change inevitably demands massive infrastructure improvements. A number of other large concrete framed structures have become inconvenient obstacles in the way of rapidly evolving road systems. In 2004, Evolution moved two similar buildings for this reason – the Zhongmei Clothing Comprehensive Building was in the way of the new Tianjin expressway; its 6 storey bulk with a floor area of 5200m<sup>2</sup> was shifted north 40 metres. The Zhangzhuang Building Complex in Xinxiang, Henan Province, a more



**The Zhongmei Building**



**The Zhangzhuang Complex**

irregular shaped building with a total floor area of 6328.5m<sup>2</sup> and weighing 11,000 tons, had to be moved a total of 15 metres to clear the way for a new road.

The company benefits from another offshoot of rapidly changing infrastructure needs - the requirement for bridges to be raised or strengthened in response to increasing road and water traffic; over the two-year period 2003-5, Evolution was involved in at least nine such raising projects, ranging from raising the 85 metre span of the 'encased tie' bridge at Wusong in 2004, to lifting up by 2.5 metres the concrete wind bridge at Lianshi, weighing 4320 tons, in 2006.



**Wusong bridge with a span of 85 metres and weighing 3600 tons, during raising (May 2004)**



**Hu-Ju-Shen Land bridge, and weighing 3600 tons, during raising (May 2004) Lianshi, Huzhou. Raised 2.5 metres. Note the form of cribbing used (May 2006)**

As new roads and apartment blocks wash over the landscape, other older 'obstacles' in the path of development are encountered, but in these cases there has been a slow but growing realization that they should be somehow protected. The preservation of cultural relics through a process of 'listing' ie bringing them under state protection - is a relatively recent phenomenon in China. However, listing does not, necessarily root these buildings forever to their original locations; and development opportunities usually override the concerns of purist conservationists. One of the first structure moves undertaken by the Company (1999) was of the protected historic gateway (Siming Public Apartment) in Renmin Road, Shanghai. Built in 1797 and the focus of Chinese-French confrontations in the nineteenth century, it is a brick structure, 10.8 metres wide and between 0.5 and 1.3 metres thick. The gateway had to be raised 0.9 metres, rotated 23°, and shifted 10.6 metres.

**Built in 1797, the Siming monument is a testimony to the struggle of the Chinese people against colonial oppression. In 1874, the French wanted to enlarge their quarter and a number of workers were killed in the resistance. In 1898, the French relinquished it after a further city-wide strike in protest.**



In 2001, a more unusual challenge presented itself in the shape of an 800 year-old tree, in Linghou, Zhejiang; with a root base spreading over 34 metres, its 4000 ton bulk was moved 40 metres out of the way of the bulldozers. ('No different to moving a large flower pot', according to Mr Lan). In another move – in this case involving the former British Embassy in Beijing (now the Office building of Ministry of Public Security) the tree stayed where it was, and the 3,500 ton building was instead manoeuvred around it. Built in 1903, this European style, two storey structure measured 74.5

metres by 17.5 metres giving a total floor area of 1800m<sup>2</sup>. To avoid the tree, the Embassy had first to be moved five metres towards the west, then it was shifted 25 metres back, followed finally by a 45-metre shift west again.



**The Ancient Tree, Lingkou**



**The British Embassy, Beijing**

But the 'jewel' in Evolution's portfolio of moved historic structures is the massive Concert Hall in Shanghai. Built in 1930 as the Nanking Theatre in European neo-classical style (despite being designed by the Chinese architects Fan Wenzhao and Zhao Chen), the building used to house the best cinema in Shanghai; it was renamed Beijing Theatre in 1950 and was transformed into a concert hall in 1959. Closed for a facelift on Aug 31<sup>st</sup> 2002, the Shanghai Media & Entertainment Group proceeded to invest 159,000,000 yuan (US\$18.2 million) to complete....

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