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CASE STUDY

Optimizing Road Use in a Congested City

In the People's Republic of China, Yichang city is building a sustainable urban transport system with a bus rapid transit corridor as its backbone.

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Overview

Located in the central part of the People's Republic of China, Yichang city in Hubei province is being developed as a modern logistics hub. However, the plan faces challenges linked to the negative effects of rapid urbanization. High demand for the transport of both people and goods has already caused congestion.

The Hubei–Yichang Sustainable Urban Transport Project provides an optimal solution to current and projected congestion in the city. By building a bus rapid transit system with a complementary bypass road, the project addresses the need for mass transit and reduces transshipment bottlenecks.

Once completed, the project is expected to facilitate residential, commercial, and industrial developments in the northern part of Yichang's urban area.

The Asian Development Bank-supported project demonstrates key steps toward achieving an integrated and sustainable transport network. These include comprehensive pre-project planning, considering low-cost yet strategic options, designing for inclusiveness, and prioritizing safety and the environment.

This was adapted from a case study in Lessons from ADB Transport Projects: Moving Goods, Connecting People, and Disseminating Knowledge.

Project snapshot

Dates	• **December 2011-June 2013:** Technical assistance project (Asian Development Bank) • **August 2013:** Approval date (ADB loan) • **30 June 2018:** Estimated completion date

Cost	• **US$ 515.1 million:** Estimated cost of the project • **US$ 150 million:** ADB loan
Institutions and Stakeholders	**Executing agency** • Yichang Municipal Government **Implementing agency** • Yichang Municipal Urban Construction Investment and Development Group **Financing** • Asian Development Bank (ADB)

Context

Yichang is going through major changes. The city, which is already the second largest in Hubei province, is growing rapidly. It has five counties, three sub-cities, and five districts, with an area of 21,000 square kilometers and a population of 4.1 million people. About half of the population lives in 828 square kilometers of urban area. The urban population is projected to increase to 2.8 million by 2030 because of internal migration.

In 2010, Yichang's per capita gross domestic product was 38,181 Chinese yuan (CNY), higher than the provincial averages of CNY27,906 and the national average of CNY37,977.

Challenges

Several factors cause congestion in the city. Private vehicles account for about 75% of all person-trips, mainly in the central business district. This is exacerbated by illegal parking and hawking, as well as poor enforcement of traffic laws. This mishmash of traffic woes has rendered mass transport ineffective.

Another factor is transshipment transport, since Yichang's major roads are important arteries in inter-regional traffic. The Three Gorges Dam, which lies at the northern tip of the city, brings in huge bi-directional freight volume to Yichang. In 2010, it reached 90 million tons. It is projected to reach 85 million tons in 2020 and 248 million tons in 2030.

The dam has limited ship-lock capacity. This means traffic requiring pass-dam transshipment could also increase to 85 million tons in 2020, and 148 million tons in 2030 from 12.4 million tons in 2010. This presents a huge challenge for the city with its major streets already contested by daily urban commute. A bypass road is needed to handle this growth in traffic without causing more congestion and traffic safety issues in the city.

Yichang's industries are also growing at an accelerated pace. To sustainably support this growth, access to logistics facilities, inland waterways, the airport, and central business district must be improved.

Solutions

The Government of the People's Republic of China aimed to address these challenges through the Hubei–Yichang Sustainable Urban Transport Project. The project was initiated in December 2011 with technical assistance from the Asian Development Bank (ADB). It introduced a bus rapid transit (BRT) system along Dongshan Avenue, which is the main arterial road of the city, and a bypass road to carry freight traffic and connect newly developing urban and industrial areas. The project is estimated to be completed in June 2018.

The bus system provides a greener mass transit option, augmented by pedestrian and bike lanes. It offers commuters convenient and flexible transport option, and complements the scenic city of Yichang, which runs parallel to a portion of the Yangtze River.

The bypass road facilitates transshipment traffic from freight operations at the Three Gorges Dam, which passes through the city center on its way to different parts of the province.

The BRT system, along with the bypass road, is a strategic response to accommodate current and future transport demand in Yichang, and further strengthen the city's role as a regional logistics hub.

The project took special care in the preparation and design phases, as the BRT system along with its other components are to be the backbone of Yichang's sustainable urban transport system.

Policy dialogue with city government

Yichang's original proposal was focused on road building, not the BRT system. The city at first wanted to build more roads, rehabilitate the major city roads, and build more logistics infrastructure.

Through policy dialogues with ADB and technical advice from the Institute for Transportation and Development Policy, Yichang agreed to change its plans to a bus-based system.

Comprehensive pre-project analysis

The project first conducted an exhaustive study of the urban transport system in Yichang. It carried out surveys of bus speeds, boarding and alighting time, frequency and occupancy, and number of bus stop

transfers. It also gathered data on bus routes and the locations and conditions of bus stop stations. These data were collated and analyzed, and their results were used as inputs to the transport system design.

The study revealed, among other things, that service reliability needs great improvement on some routes as waiting time varied from 6 minutes to 26 minutes. Bus stops were of very poor quality; they were too narrow, offer insufficient protection against the weather, and are often encroached by taxis. These conditions showed that bus operations were not given sufficient priority by the government.

The project also considered freight traffic in the city before actual implementation.

Overall, this step in project preparation reflects a holistic approach in urban transport planning. It led to an urban transport system specifically designed to address not just current and future transport demand, but the safety, quality, and reliability concerns surfaced by the intensive pre-project study.

Extended and customized corridor design

The BRT corridor will be 23.9 kilometers long with a route that connects the main residential and business districts with the city's new logistics and industrial park and the high-speed railway station. The corridor, comprised of segregated bus lanes located in the middle of the road, will have 37 fully enclosed bus stations.

Initially, the corridor was supposed to start at the northern end of the Dongshan District and end at the Yichang East railway station in Juecheng, excluding the highly residential Yilling District in the north. However, the pre-project study showed a clear demand for transport from Yilling to the city center and vice versa. The corridor was extended to the area. This showed high demand promises more financial returns vis-à-vis higher ridership figures. Also, land use development in a fast developing district offers opportunities for a mutually beneficial integration of a smart urban transport system and residential and commercial development in the area.

However, Yilling district's road was not wide enough to accommodate a two-way corridor and a general traffic lane. After traffic analysis, the project proposed that the general traffic lane run in one direction with a roundabout section where vehicles can make a U-turn to the opposite side. This will allow a segregated two-way bus lane. Continuous bike lanes on both sides will be kept at 1.5 meters wide, and will be reduced to only 1 meter at some critical locations.

Collaboration with stakeholders

In the original BRT corridor design, resettlement of old residential and commercial buildings owned by a state-owned company on Yemingju Road, the 2.4 kilometer central business district with a hilly and narrow section, was required to install exclusive bus lanes and general traffic lanes for a mixed flow section along the road.

The project demonstrated the importance of collaboration with stakeholders, in this case, a state-owned company, to pursue road widening to accommodate the bus system. Through dialogue, the project

implementers and the company, which owned the properties concerned, agreed to resettle the old apartments and buildings to widen the section from 24 meters to 36 meters. This agreement allowed for a consistent design along the central business district section of the BRT corridor, facilitating urban renewal.

Design of bus stations

The locations of the bus stations were based on where the current bus stops are, the nearest intersections, physical conditions of the roads, transport demand, feedback from local stakeholders, and pedestrian access flows into the corridor.

Their details vary, depending on the passenger demand and bus flows in the short and long term, fleet requirements, physical conditions of the roadway, and aesthetic and cost factors. One station was especially customized, i.e., made shorter than other stations, to minimize the need for relocation of affected entities beside it. This tailored design will not hamper access to the buses, nor impair station operation.

Multimodal passenger hub

Two of the factors that discourage commuters from using mass transport in Hubei are the distance between bus stations, and difficulty in transferring from one mode of transport to another.

Without the project, there would only be seven bus stops from the north side to the south side of the main city center and only five from south to north, and with no proper nonmotorized transport lanes. Each stop had an average interval of 870 meters.

With the bus system, the intervals among the 18 bus stations along the main city center will be about 550 meters, and will have an integrated nonmotorized transport lanes and bike parking facilities so that even cyclists who wish to board buses can park their bikes and access the bus stations.

At the same time, the bus system will be connected to provincial bus terminals. This way, provincial bus passengers can easily transfer to the bus system to go around the main city.

Another added value of the project is its connection to the East Railway Station, making it more convenient for passengers to transfer from the high-speed train to the bus station and vice versa. The connections among the bus system, provincial buses, and the high-speed rail are housed in one huge passenger terminal plaza, providing a multimodal passenger hub, in addition to the nonmotorized transport lanes that run alongside the bus system’s corridor.

Road safety and accessibility features

The project alloted wide pedestrian paths, especially in the central business district, ensuring connectivity to the bus stations. These pathways were connected to safer crossings situated at bus stops, road intersections, and when no bus stops or intersections occur, every 100 meters. Many of

these crossings have signals and were provided with medians or refuge islands for added safety.

The project design also specified improving bicycle facilities along the bus system's corridor to support accessibility and traffic safety for nonmotorized transport. It also emphasized continuous and well-separated bike lanes. These walkways and bike lanes were arranged to ensure that not only are they connected to the bus stations, but to rail and provincial bus terminals as well.

Road network improvement through the bypass road

The project features a 23.4 kilometer extension of the Dongshan 4th Road to accommodate through-traffic and freight traffic, including pass-dam transshipment. This component of the project will be constructed in the northern part of Yichang's urban area according to expressway standards to enable heavy traffic to bypass the city center.

The proposed design for this road took into consideration several factors: the constraints imposed from existing and proposed land uses surrounding the site, the possible tunnel locations, and land requirements for interchanges.

The bypass road will have three main sections, each designed differently, and runs along a mountainous terrain. This road will have 13 bridges, with spans ranging from 20 meters to 30 meters that will go over rivers, reservoir, and valleys. It will also feature tunnels that will burrow through Grade IV classified rocky mountains. The whole length of the bypass road will have space for sidewalks and amenity strips on either side and, in some areas, auxiliary roads and, for tunnels, emergency areas.

Results

The project will provide large benefits to the urban population. It will facilitate residential, commercial, and industrial developments in the northern part of Yichang's urban area, providing economic development and job opportunities for nearby residents. These benefits are in addition to reduced travel and waiting time, and a convenient, more comfortable, and safer mass transit option.

The project components provide strategic additions to Yichang's urban development plan, which aims to improve and develop nine comprehensive logistics park areas and an urban distribution center in the city. These facilities, which include an airport and inland ports, will further expand the operational capacity of the Three Gorges Logistics Center, and would complete the city's vision of an efficient multimodal logistics network made up of ports, railway, roads, and the airport. The bus system and the bypass road will not only complete this complex transport and logistics architecture, it will also inject sustainability into the whole transport network.

Currently, even if the whole project is yet to be completed, plans are already underway for Phase 2 of the Yichang Bus Rapid Transport, which will further enhance connectivity within the city by building another BRT corridor that will complement and extend the reach of the first corridor. The planned corridor will run parallel to the first, along Fazhan Dadao, connect to the first bus station in Yunji, and end at Chendong. It will add walkway connections for 12 bus stations and two footbridges that will cross

the east railway. It will also integrate a public bicycle system and extend the greenway established in the first project.

The BRT system and the bypass road construction are crucial components of the city and the province's goal of making Yichang an effective and efficient center for transport and logistics. The project has also catalyzed and set the tone for further expansion of the urban transport network in the city.

Lessons

The project demonstrates key steps toward achieving an integrated and sustainable transport network. It shows doable actions that could help cities formulate and calibrate transport systems in favor of multimodality, sustainability, and cost effectiveness.

Conduct comprehensive study prior to planning

This project was designed to complement the other transport modes available in Yichang. It addresses choke points, and completes a seamless interchange between and among transport options. It demonstrates how transport options can actively support local trade and development by strategically decongesting city centers and diverting transshipment traffic. A comprehensive study prior to urban transport planning did not only inform project design but also the decision makers in the city, enabling them to appreciate actual and future transport needs. The comprehensive study enabled project implementers to convince decision makers of the wisdom behind the project design, which was backed up by evidence-based data.

Consider low-cost yet strategic options

In many cities in Asia, there is a prevailing notion that building more roads and complex transport infrastructure can address congestion in urban roads. The project shows that there are more sustainable solutions to congestion. In Yichang, building a BRT corridor with a complementary bypass road can be more effective than building an intricate network of flyovers and interchanges in addressing urban congestion, traffic safety issues, and accommodate future growth. It shows value for government money, where savings can be used to extend coverage and maximize benefits of sustainable transport options.

Design for inclusiveness

Residential districts are usually connected by roads that can be conveniently accessed only by private vehicles. This project linked up a residential district with the bus system's corridor. It enhanced access to the city center and indirectly to other parts of the region in a more sustainable way, not only through the bus system which connects to ports, provincial terminals and the planned airport, but also through the network of bicycle lanes and walkways. This emphasizes the point, that ultimately, transport should benefit more people. This can be a model for inclusive and sustainable transport development across Asia.

Prioritize people's safety and the environment

Another key learning from this project is the way it has customized sections of the bus system's corridor to prioritize people and the environment. It provided refuge islands and signal systems so that pedestrians will have easier and safer road crossings along the bus system's corridor. In addition, it has adjusted the design of its corridor so that a portion near the river would not need more complex construction to prevent harm to the natural environment. It has also redesigned a station so that demolition of surrounding facilities will be minimized.

Resources

ADB. *Hubei-Yichang Sustainable Urban Transport Project*.

ADB. 2017. *Lessons from ADB Transport Projects: Moving Goods, Connecting People, and Disseminating Knowledge.* Manila.

Funzi: Mobile Learning for Everyone

Related link

ADB. 2016. *Putting Chinese Commuters into the Fast Lane*. Project Results. 9 December.

Case Study: *How to Move Nearly 30,000 People per Hour Across a City*

Case Study: *Bringing Innovation to Bus Rapid Transit*

Case Study: *Efficient City Transport for Those Who Do Not Own Cars*

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Li Dongxiang has 30 years of experience in development finance, project management, regional cooperation and integration, public-private partnership, and

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