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Yangon Circular Railway Development Project

Moe Thida　Zhu Zhui　Zhou Xiaojing
Muhammad Halley Yudhistira
Jeff Volinski

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Real Estate and Urban Development Policy 2011

Yangon Circular Railway Development Project

Moe Thida[1], Zhu Zhui[2], Zhou Xiaojing[3], Muhammad Halley Yudhistira[4], Jeff Volinski[5]

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Graduate School of Public Policy
The University of Tokyo
7-3-1, Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan
Phone:+81-3-5841-1349

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By Moe Thida, Zhu Zhui, Zhou Xiaojing, Muhammad Halley Yudhistira, and Jeff Volinski

Graduate School of Public Policy, University of Tokyo

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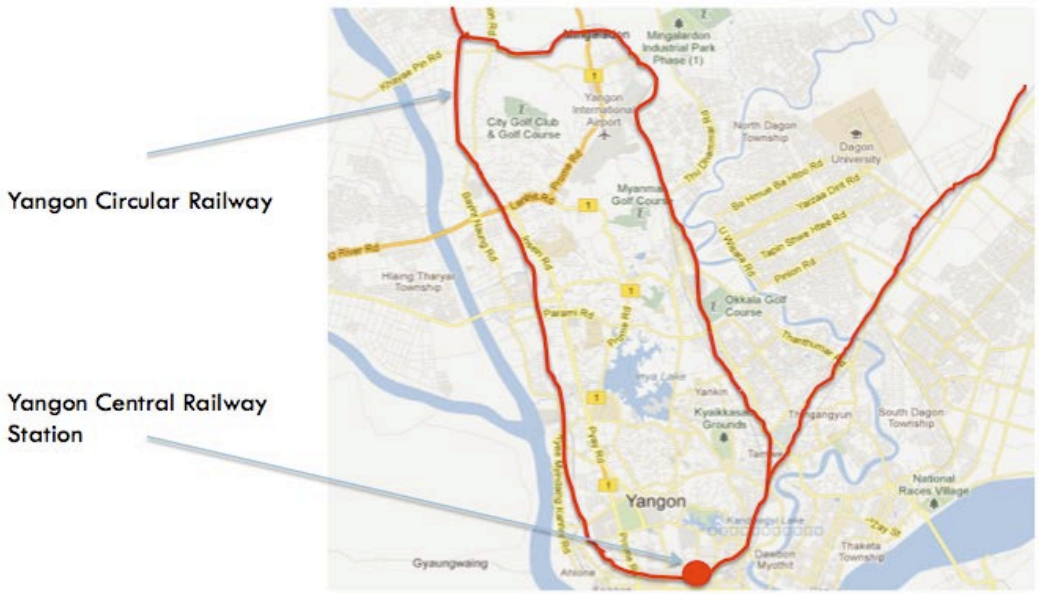
Executive Summary

This paper analyzes the Yangon Circular Railway, currently the only rail-based public transportation option in Yangon, Myanmar. Specifically, we consider the shortcomings of the Circular Rail, propose a series of improvements, and perform financial and cost-benefit analyses to assess the feasibility of improving the quality and capacity of the Circular Rail line.

First, we examine the current economic situation of Myanmar and Yangon and consider the implications for public transportation in Yangon. In general, Myanmar is a very poor country of 58 million people and there is little income available for consumption. Per capita GDP is about US$700 per year with approximately US$125 of household expenditure per month. Yangon is the commercial hub of Myanmar with higher population densities and higher population growth rates (3% versus 1.9%) than the rest of the country.

Figure 1: Yangon Circular Railway



This paper also briefly reviews the current transportation situation in Myanmar and in Yangon. There is quite a bit of public infrastructure that is currently being developed under government projects or left over from the British occupation period available for use. In Yangon, the Circular Rail line is the sole rail-based public transportation option. It suffers from poor quality, low speed, and infrequent service. Thus, it is relatively underused as a resource. Currently only 130,000 commutes per day are made on the line, which comprises only a few percent of all public transportation users in Yangon. Current fares are very low, with long trips costing about US$0.025 per ride. The bus system is currently much more

widely used. We believe that with improvements, the line can serve as the mainstay of the public transportation system in Yangon and provide a valuable public and environmental service for the city.

Table 1: Cost and Revenue Estimates for Yangon Circular Rail Project

Calculated Net Present Values (US$ million)		
Construction Cost	Operation Cost	Operating Revenue
367.7	545.02	579.39

To explore the costs and benefits more deeply, this paper looks at the financial effects and the quantifiable societal effects of a series of proposed improvements to the Circular Rail line. We find that construction costs aside, the project can become profitable in about 15 years when considering only operating income and costs. The large upfront costs associated with construction and refurbishment of existing infrastructure presents a challenge to financing the project. Construction costs are estimated at US$10 million per kilometer, for a total of approximately US$ 400 million. The calculated net present values of costs and revenue are summarized in Table 1.

For a more complete analysis, we consider the social benefits of an improved Circular Rail, including environmental and social cost savings. We find that although significant, social costs saved still do not cover the sizable construction costs. Total cost savings from reductions in commuting time (i.e. reducing the time lost in congestion, waiting for trains, etc.) and increased consumer surplus from the reduction in generalized costs (recognizing that the willingness to pay for this service by a large portion of the public is well above the price charged) are calculated to be approximately US$67,000 per day and US$21,000 per day respectively. In addition, the social benefits of the consumer surplus increases as demand of the rail line increases. A successful project will increase demand for rail travel in Yangon, which will lead to an extra benefit that is estimated to be US$ 39,400 per day. Thus, total social cost savings are estimated to be approximately US$ 39.1 million per year.

Finally, we consider using the “Japanese model”, or integrating real estate development in the construction of the Circular Rail line as a way to increase demand and increase revenues for the project company. Based on the best data available, we consider the most appropriate public private partnership (PPP) model and the costs and benefits of integrating real estate development into the project. Specifically, we find that real estate revenues could be significant and contribute for huge construction cost of rail, but specific numbers can only be calculated with the availability of better data.

1 Introduction

There are two main reasons why improvements in Yangon's rail system are chosen for this analysis rather than other modes of transport, such as the bus system. The first is that a railway system is more sustainable in supporting the "compact city" model in the long run. Developing Yangon into a compact city, where the growth of the footprint of the city is contained to manageable levels by maintaining high levels of population density and convenient public transportation options, requires higher capacity and faster public transportation. This requirement can be met by a well-functioning railway system more effectively than by a bus system. Recent experience shows that with its huge metropolitan population, Jakarta's bus system can only solve the problem of high transportation demand temporarily. The second is that railway development can attract high levels of investment from the private sector and promote real estate development around the station. This typically does not happen in case of a bus system. Such incentives can enable the Yangon local government to form public private partnerships (PPPs) such that government spending on railway improvement can be minimized.

Socio-Economic Situation of Myanmar

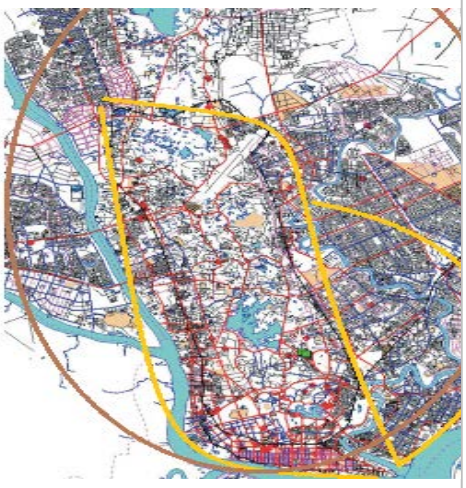
Myanmar is a country of approximately 58 million people that borders Bangladesh, India, China, Lao PDR, and Thailand in Southeast Asia. Approximately 70% of the population of Myanmar lives in rural areas, where the per capita GDP is about 600,000 kyats, or US$700. The annual population growth rate has averaged 1.9% per year from 1991 to 2009. In 2007, the capital of Myanmar moved from Yangon to Nay Pyi Taw, approximately 200km north, but Yangon remains Myanmar's most populous city.[1]

Figure 2: Myanmar and its major cities.

Myanmar has one of the world's lowest per capita GDP's and therefore one of the world's lowest per capita expenditures. It is estimated that the average monthly family expenditure is about US$125 at current exchange rates (780 kyat/USD).

[1]UN Country data.

Figure 3: Yangon city.



The city center is located within the yellow oval, and the yellow half-circle to the east of the oval indicates expansion in last 30years. The large brown circle indicates the recent expansion and general boundary of the city proper.

Table 2: The growth of Yangon city

Year	Population (million)	Municipal Area(km2)	Suburbs, new towns
1920	0.34	87	Kanbe, Thingangun, Kamayut, Thamine
1964	0.76	202	S/N Okalapa, Thaketa, Thuwanna
1985	2.5	347	
1991	4.0	580	Shwe Pyitha, Hlaing Thayar, S/N Dagon together with industrial zones
2011	5.9	600	

Yangon currently has a population of nearly 6 million people and has been growing steadily in size for the past one hundred years. The urban population growth rate in Yangon has outpaced national growth rate, and currently stands at about 3% annually. Yangon is the commercial hub of Myanmar and has the highest number of universities and health care facilities of any city in the country.

Table3: Household data for citizens in Myanmar

Household Income and Expenditure Survey			
Particulars	**Overall**	**Urban**	**Rural**
Average household size	4.72	4.87	4.67
Average monthly family expenditure (kyat)	97,145.7	113,320.5	90,631.8
Per capita expenditure (kyat)	20,581.7	23,269.1	19,407.2

Yangon is located on a peninsula near the confluence of the Yangon and Bago rivers, about thirty kilometers north of the Gulf of Martaban. The city itself has a large footprint, but the central commercial district is confined to a relatively small area at the southern tip of the peninsula. Recently, Yangon has been expanding to the east, west, and north in a series of both residential and industrial projects. The highest value of real estate is located near the central commercial district and the residential areas around the Inya Lake and Kantawgyi Lake where the urban facilities can access easily.

Transportation in Yangon

The main railway station in Yangon, Yangon Central Railway Station, is located on Myanmar's 5,403-kilometer national railway network. The network consists of 858 stations. The quality of the network is relatively poor, and many areas of the track are unusable during the monsoon season, and most parts can only be used at up to speeds of 24 kilometers per hour.[2]According to the Irrawaddy newspaper, the government of Myanmar

[2] Xinhua news, http://news.xinhuanet.com/english/2009-01/20/content_10688991.htm

is currently undertaking a plan that will extend the network by approximately 3,600 kilometers. Myanmar Railways operates both the national network of rail lines and Yangon's Circular Railway, the city's only intra-city rail line. The loop network has 39 stations that span 45.9 kilometers, and features about 200 coaches on 21 trains that carry approximately 130,000 passengers daily on 200 separate trips. It is estimated that the Circular Railway carries about 48 million passengers per year. The ticket price is approximately ten kyats (about US$0.02) per ride of fifteen miles or less, and twenty kyats for trips over fifteen miles.

Figure 4: Yangon land use plan.

The commercial district is located near the southern tip of the landmass near the confluence of the two rivers. Three recent expansion episodes are marked with the colors purple, orange, and yellow.

Along with rail travel, commuters in Yangon also make use of taxi, ferry, and bus transportation. It is estimated that there are more than 18,000 taxis in Yangon city, and the average fare is approximately 1500 kyat for a trip within the city. Ferries run across the Yangon River to connect the areas west of peninsular Yangon to the commercial district. It is estimated that 1,185,000 passengers take the ferry daily. Yangon has over 300 bus routes and a fleet of over 6400 busses that make over 30,000 bus trips per day. Busses, after the Circular Rail, are the cheapest form of transportation at about 200 kyat per trip. Approximately 3.14 million passengers ride busses in Yangon city every day.

Historically, ownership of vehicles in Myanmar is low because of low per capita GDP and because of the government's restrictive policies on importing foreign automobiles and motorcycles. Recently, the government has begun to relax such policies, and it is now legal to own motorcycles in rural areas of Myanmar. Similarly, it has become easier and cheaper to own cars, and it is expected that in the near future the number of cars on the road in Yangon and other areas of Myanmar will increase.

Transportation Problems in Yangon

A number of problems with the transportation system in Yangon make commuting difficult and time consuming. The Circular Rail system is Yangon's most affordable form of transportation, but the poor state of the rail line contributes to slow speeds and low service levels. It has been estimated that it takes nearly three hours to travel one loop. Trains are overcrowded and in poor condition. The train loop also does not extend into the main commercial district on the southern tip of the peninsula, which means that commuters are forced to take busses, taxis, or rickshaws in the commercial district, which contributes to severe congestion problems. The Circular Rail is heavily subsidized by the government and runs a significant budget deficit, which has prevented further investment in the system to upgrade performance.

Figure 5: Myanmar Railway's and Yangon Circular's network. (*source:* Ministry of Rail Transportation, Myanmar. (2011), *Facts about Myanmar Railway*.

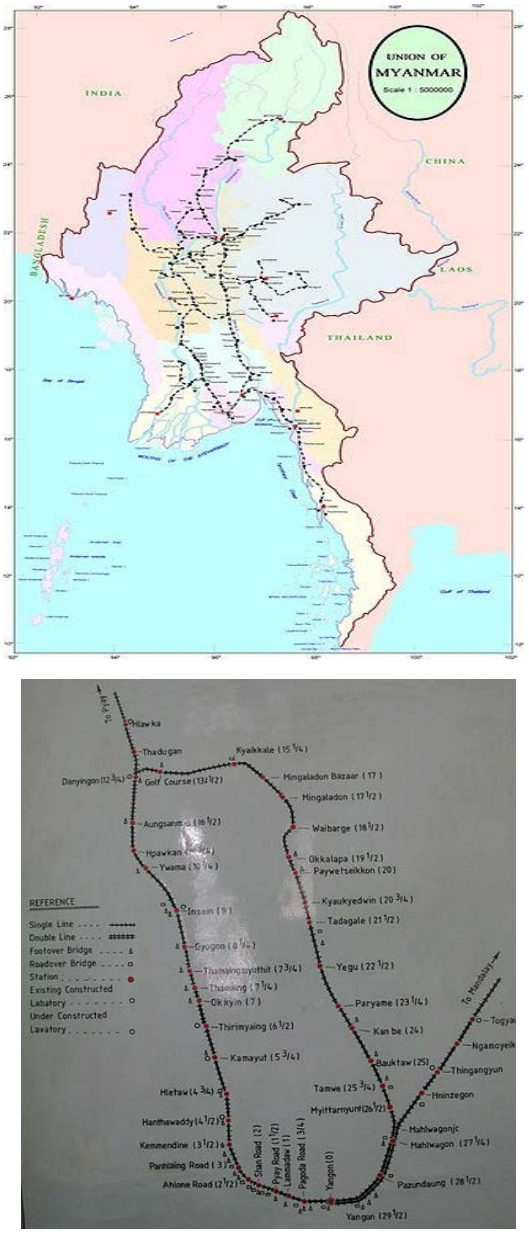
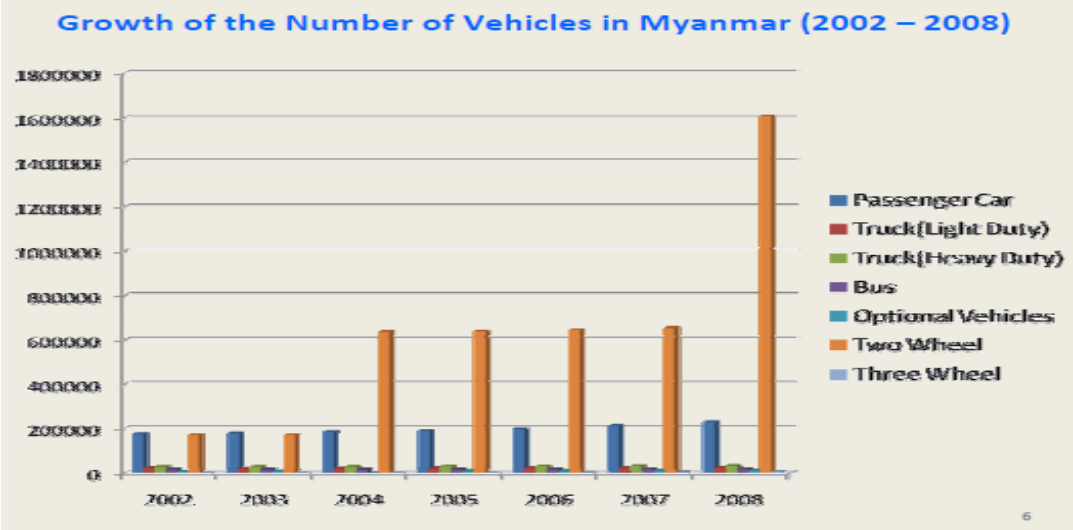


Figure 6: Vehicles in Myanmar. (*source: Fourth Regional EST Forum Presentation of Myanmar*)



2 Proposed Improvement on Circular Railways

Current conditions in the railway system in Yangon show that its service quality is poor. Low service frequency, slow speed, poor conditions of the station and its surrounding areas are main problems faced by the current railways system. Therefore, we propose three key objectives in improving the operation of the Yangon Circular Railway, as follows:

1. Increasing the frequency of train services
2. Improving train time schedule
3. Improving amenities inside and around stations

Objective I: Better Train Service

Better train service can be obtained by increasing the frequency of train services from 20 to 40 and then 80 services per day in the early stage and medium stage respectively. It is also proposed that this be achieved in parallel with improving average train speed from 15 to 40 km/h. There are several actions must be undertaken, including:

Figure 7: Wooden and Precast Concrete Sleepers

Wooden Concrete Precast

(source: http://www.kwena.co.bw/kwena-product-detail.php?id=38&name=INFRASTRUCTURAL%20PRODUCTS)

- Increasing the rail level. Current Yangon railway level is less than 25 cm, which is the ideal rail level used in the world's rail systems. Low rail levels prevent the train from running faster since it cannot completely absorb vibrations from high-speed rail.
- Replacing wood sleepers with precast concrete (PC). One-third of the Yangon circular railway has already been installed with precast concrete to strengthen the rail system. Next agenda is to complete all sections with PC.
- Replacing the current rail. With weight about 37 kilograms per meter, the current rail is only sufficient for slow speed trains with low frequency. A bigger rail gauge, for instance 50-70 kg/m as in Tokyo or Jakarta, must accompany higher speed and frequency service.

Objective II: Better Time Schedule

The current time schedule is not preferable for the passengers, as trains often run not as scheduled. The uncertain schedule refrains potential passengers from using railways and encourages them to use less-uncertain modes such as bus, private car, or taxi. To fix such problems, we propose installation of train radio system that the train driver can use to

anticipate the transportation conditions, To avoid train collision accidents, the train radio should provide clear communication along the railway line (JICA and Bappenas, 2004).

Objective III: Better Amenities

Better amenities are meant to increase the convenience and coziness of the train stations and therefore attract more passengers to use railways as their mode of choice. The actions are:

- Raising the platform level. Current platform is about 30 cm above ground level. However, this structure means the platform level is lower than train level and inconvenient for passengers. It will be dangerous as the service frequency increases. Increasing the platform level to 1 meter will make it more convenient for the passengers to enter the train since the platform level and the train level are about the same. In addition, a station bridge or tunnel must be provided to accommodate those passengers who want to cross to another platform.
- Adding or improving auxiliary infrastructures such as station maps, service schedules, waiting rooms, smoking rooms, toilets, and direction signs.

Adding plaza squares in order to accommodate transfers from any other mode of transport to rail and vice versa (i.e. a bus feeder system) is also suggested. Adding more parking for private cars should also be considered as some new towns have emerged recently (i.e. Mingaladon new town).

3 Financial Analysis

In the following section, we analyze the financial implications of the above changes and improvements to the Circular Railway Line.

Schedule

According to the current situation of the Yangon transportation system and the generally accepted procedures of railway construction projects, this circular railway improvement project will be carried out as a five-year phase-in plan. The schedule is as follows:

Table 4: Project Schedule

	Year 1	Year 2	Year 3	Year 4	Year 5
Phase I					
Phase II					
Phase III					

Phase I includes government plan and approval, public bidding, integration with the existing system and other preparation work. Phase II is the construction of the new railway. Phase III is the test ride and improvement of service.

Financial Estimations

Construction Cost

Table5: Construction Cost Examples

Location	Average Cost (mill. US$/km)	Remarks
Karachi Circular Railway`	51.6	including a resettlement project
European LRT Average	25	high quality
Jakarta Railway	14	tunnels and bridges
Toyama LRT Rehabilitation	9	
Africa LRT Average	5	technology assistance from China

The Yangon circular railway is a double-track over-ground light rail. The construction work in this improvement project includes replacing the foundation and sleepers, introduction of new tracks, and improvement of the facilities. Here are the costs of some similar projects from other countries in recent years.

Compared with other countries, the infrastructure in Yangon is poor, which might bring extra costs to the project. However, on the positive side, the land for the Yangon circular railway is ready and no resettlement of inhabitants is required. Additionally, as Myanmar also could get technology aid from Japan, we take Toyama LRT Rehabilitation Project as reference. The estimation of construction cost per kilometer would be 10 million US dollar, which includes 9 million dollars as regular cost plus 1 million dollars as contingency cost.

Operation Cost

The operation cost includes service and maintenance cost. Just like construction cost, it varies widely in different countries (Table 7). Compared with other cities, the labor cost in Yangon is low, but human resources (i.e. managers) are limited.

Table 6: Operation Cost Example (year 2011 data)

Railways	annual operation cost (million US$ / km)	annual ridership (million/ km)
Manila Line 1 - Philippines	1.5	7.1
Kuala Lumpur PUTRA - Malaysia	4.4	2.5
Mass Rapid Transit - Singapore	4.3	5.9
Metro Santiago de Chile	6.1	8.2
Sao Paulo Metro - Brazil	42.9	17.7

Our expected annual ridership in Yangon is 5.6 million per kilometer (according to the revenue estimation in following paragraph), which is close to Singapore. However, the economic development level is lower than Manila. We assume in the fifth year (the year of test ride), the operation cost would be 2 million US$ per kilometer, and there is 1% annual increase in following years.

Revenue

The current ridership of Yangon circular railway is 130,000 passengers per day. It is only 2% of Yangon population and hence there is a large amount of potential demand. Due to the bigger capacity, more trips and better service provided after the improvements are completed, expected ridership in the test ride year would be 700,000 passengers per day. The forecasted annual population growth rate of Yangon is 3%, and the amount of economic activities is assumed to increase; the expected ridership annual growth rate would be 5%.

Current ticket price of Yangon circular railway is 10 kyats for short trip and 20 kyats for long trip. After this improvement, our designed average ticket price would be 300 kyats ($0.3). Therefore, the expected ticket fare revenue would be US$ 76.65 million in the test-ride year and would increase at a 5% annual rate.

Interest Rate and inflation rate

This project is financed in US dollars; the current interest annual rate of USD is 1.5%. The annual inflation rate in Myanmar is 7 to 12% in the past five years; therefore, we assume there is an 8% average inflation rate in the years ahead.

Additionally, due to the high inflation rate, the ticket price might increase in the next 15 years. However, in our basic calculation, ticket price will be held constant as it is not easy to increase the fare of public service. However, in the conclusion of financial analysis we will also provide additional calculations in the case that the ticket price goes up with inflation rate.

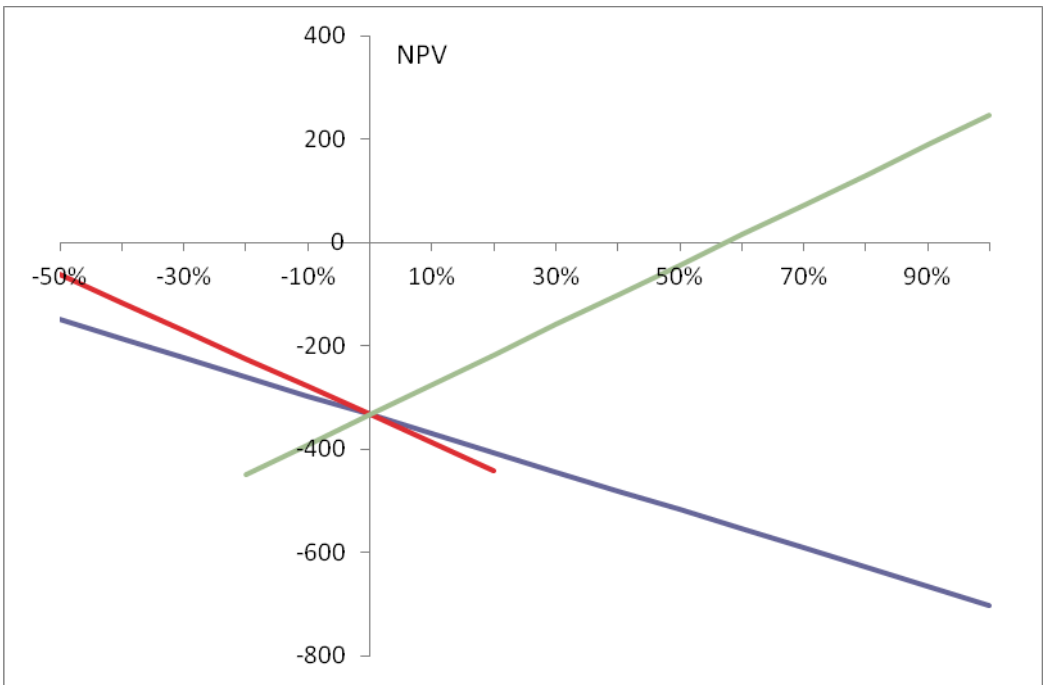
20-Year Cash Flow

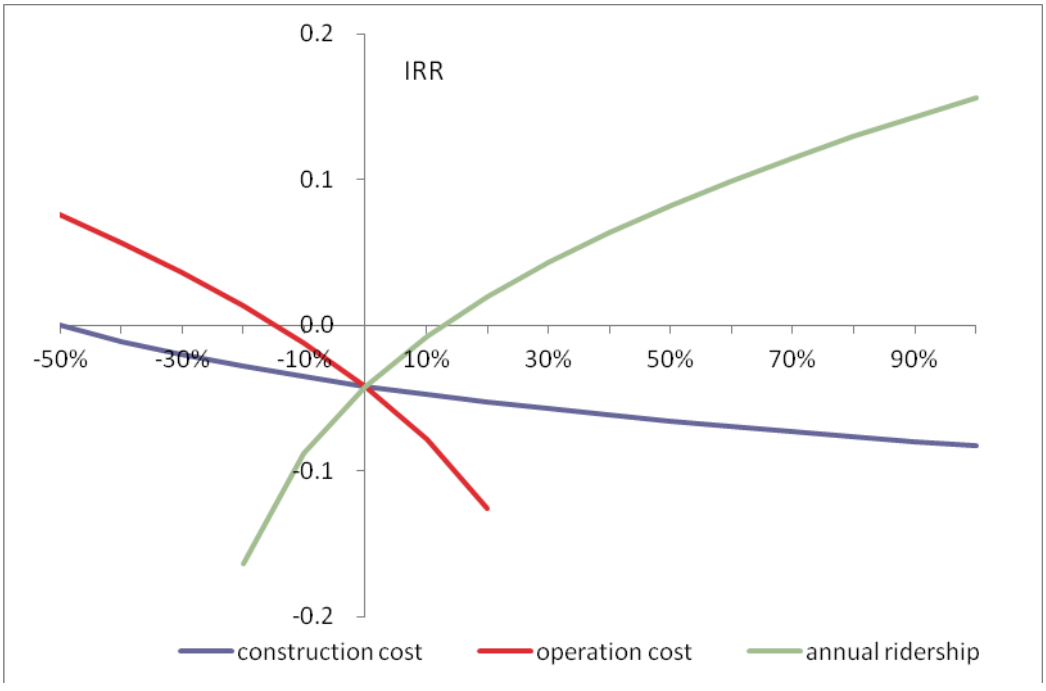
According to the cost and revenue forecast above, we have the financial balance sheet of Yangon Circular Railway as presented in Appendix 1.

Sensitivity Analysis

Sensitivity analysis is the study of how the uncertainty of input variables could affect the result. For this project, we examine the ex parte effect of the change in construction cost, operation cost, ticket price and ridership separately. Here are the results.

Figure 8: Sensitivity for NPV and IRR





Conclusion of Financial Analysis

The net present values of construction cost, operation cost and ticket revenue are $-367.71 million, $-545.02 million and $579.39 million respectively. Additionally, if the ticket price goes up with the inflation level, the net present value of revenue will be $621.85 million. Therefore the whole project can hardly finance itself; but without the construction cost, the operation of Yangon Circular Railway is profitable in 15 years.

According to the sensitivity analysis, the operation cost and ridership are sensitive variables for both NPV and IRR. The operation cost can be reduced by more effective management, but we do not go to the details here. For ridership, i.e. the demand side, if there were a 60% increase in demand, the NPV would be positive; and if there were a 200% increase, the IRR would be 26.2%, which makes it a desirable business investment. However, in practice, the increase of ridership will increase the operation cost, which we did not take into account in our calculations but may possibly decrease the profit. Another crucial point, which is difficult to forecast, is the inflation rate in Myanmar. If the government could lower the annual inflation rate to 2% in the future, like other Asian countries, then 25% increase in demand would make this project financially feasible.

Although the result of financial analysis is not attractive, this project is still socially desirable, which will be explained in the cost-benefit analysis part; and international aid and commercial plans could cover the financial gap, which will be discussed in our PPP project.

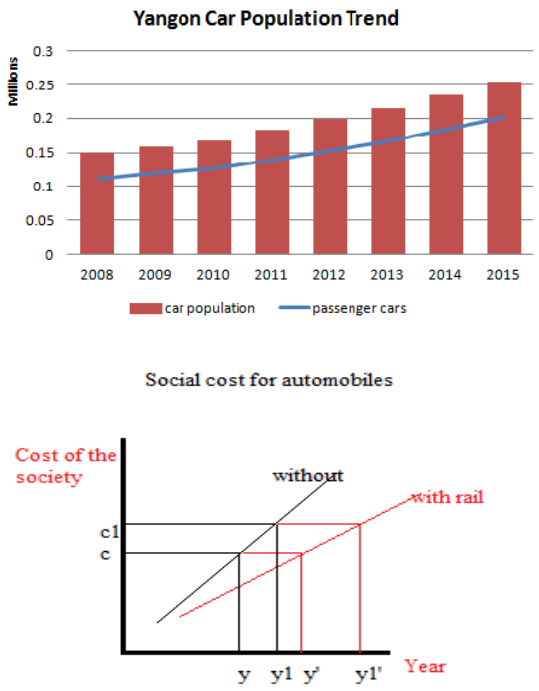
4 Cost Benefit Analysis of Yangon Circular Line

According to the financial analysis, the overall capital cost of the circular rail line is $367.7 million which covers the 5-year project construction period, with an additional annual operating and maintenance cost of $92 million and $76.65 million revenue per year received from the 700,000 commuters. This circular rail projects seems unprofitable although it can integrate environmental, social and economic sustainability of Yangon in the long term and ultimately reduce the consumption of fuel, traffic congestion and accidents. In this context, the accompanying cost-benefit analysis of the proposed projects is quantified in monetary expressions through social cost of automobiles, time saving for rail commuters and consumer surplus effects.

Social Cost of Automobiles

Although the automobile has allowed for convenient and easier access to remote places, it has negative external effects for society. The distinct impact is traffic congestion that delays motorized and non-motorized travel and also increases pollution emissions. Traffic congestion imposes economic costs by wasting people's time and by slowing the delivery of goods and services. In cities like Bangkok, Jakarta or Manila, traffic congestion costs account for 6% of GDP[3]. In order to calculate the social cost of automobiles shadow prices of US$ 0.10 /mile/car for United States[4] can be used which includes congestion, pollution, fuel dependency and accidents cost.

Figure 9: Social Cost Model. (Source: Myanmar Statistics 2010)



Myanmar, under the socialist system (for 25 years until 22 years ago), which had not encouraged private ownership, and military government system (for the past 22 years) restricted the increase of car population with high tax and permit system. Thus, road capacity was balanced with car population and congestion was not so severe, except for peak hours in Yangon. Recently, government has allowed the importation of cars and will relax the permit system. This policy will increase car population of Yangon and further lead

[3] See Santucci (2011).

[4] Parry, Walls, and Harrington (2007) analyzed and expected the external cost of automobiles used in U.S.

to the under-capacity of roads, higher congestion and also higher fuel consumption.

Yangon is the main commercial city of Myanmar and absorbs 50% of vehicles in Myanmar (excluding motorcycles, which are prohibited to use in Yangon). As per registered vehicles list in 2008, the automobile population is 0.15 million, of which 74% is passenger cars, with buses making up only 6%, although the majority of population still uses public transport. The increased rate of automobiles is 8-10% per year and the total number increased to 0.17 million in 2010, which is expected to reach 0.25 million in 2015. If the government cannot introduce alternative modes of public transport then the social cost for automobiles will become higher and higher together. The Government should take steps to alleviate this escalating problem by considering efficient public transport that can further replace the private car usage and reduce mounting social cost of cars.

Social Benefit of Circular Railway Improvement

Automobile-dominated transportation is a major contributor to air pollution. Many cities throughout the world are implementing strategies to reduce dependence on private vehicles and increase the use of public transport. A sustainable transportation system such as fuel-efficient and ecofriendly transportation system (e.g., bus rapid transit and electric train system) has been identified as a feasible strategic plan.

Although Yangon has operated the local commuter rail network that serves the metropolitan area, the ridership is only 3% (0.13 million) of public transportation users because of low quality of rail service with long commuting times. Up to 76% of Yangon city dwellers (4.5 million) rely on public transportation, especially the bus system, to commute from suburban areas to the central business district. Public transportation in Yangon, mainly buses and rail, is the most affordable mode of transport for those who have low per capita income and unable to own cars and motorcycles. That is indeed a good foundation to implement a sustainable transportation system. If the railway service can be improved to a regular schedule and faster service then demand for train will surely increase.

The expected user benefits will be obtained from several sources. These include reduction in travel times that users of present circular rail receive, benefits to users of other modes receive as a result of lower congestion, savings in the costs of other modes and reductions in emissions as a result of travelers being diverted from bus and auto to the rail. Because of the time constraints and lack of data availability for further analyses, the cost benefit analysis can focus only on time cost saving and additional consumer surplus of rail commuters.

(i) Travel Time Cost Saving: At present the circular rail takes at least 3 hours to finish one loop of 45.9 km, which leaves Yangon station and passes Mingaladon and Insein and arrives back to Yangon. Most of the commuters need to travel only the half loop to commute central business district and suburban area where the airport, highway bus gates and wholesale market exist. Travel time costs for present rail commuters (0.13 million/day) are based on the per capita GDP of Yangon and roughly calculated as US$0.5/ hour. The present commuters are spending US$ 37million/year for travelling with circular train. After the projects, the travel time for half loop will reduce to 35 minutes from 90 minutes and save US$ 24.7 million/year, which can increase commuters, and economic activities.

Figure 10: Time Cost Savings

Yangon-Mingaladon-Insein-Yangon (45.9km) Travel Time

For half route travel time cost (90 minutes) = US$101,562/day (**without project**)

For half route travel time cost (35minutes) =US$33,854/ day (with **project**)

Time cost saving= US$ 67,708 /day (For present rail commuters of 0.13 mn)

(ii) Additional Consumer Surplus: In addition to increased operating revenue from the rail service, the circular rail improvements can provide extra benefits in terms of increased consumer surplus. The impact of transportation improvement upon users of the service is measured by consumer surplus. The consumer surplus exists because users' willingness to pay is higher than the actual charged price for the service. The service can generate additional consumer surplus by reducing the cost paid by consumers. In fact, cost paid by the consumers to make a trip is the combination of fare price and travel time cost, which is the generalized cost for transportation. Therefore, transportation improvement reduces the generalized cost of travel by improving mobility, which in turn leads to an increase in consumer surplus.

Though the present ticket fare US$ 0.025 is far cheaper than other mode of transportation, time cost is higher and thus generalized cost for a trip become US$ 0.78/commuter. After improvement, it will reduce to US$0.67 per commuter as it can decrease time cost of commuting. A reduction in generalized cost generates rail user benefits ($21,125/day)

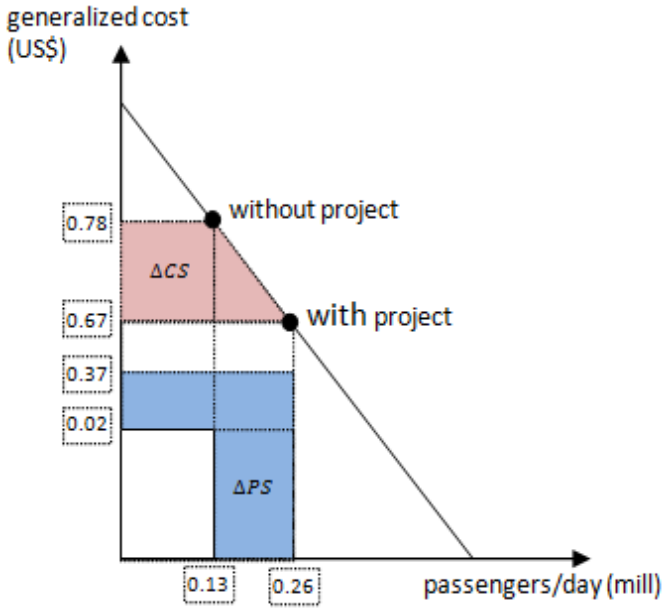
Box 1: Additional consumer surplus

Generalized Cost = Time cost+ Ticket fare

Measuring the benefit: rule of the half → B =1/2 (P'-P'')(Q'+Q'')

Social Benefit (increase in consumer surplus)= $21,125/day

Item	Without project	With project
Time cost	$0.75	$0.29
Ticket fare	$0.025	$0.375
Generalized cost(P)	$0.78	$0.67
Commuters(Q)	0.13 million	0.26 million



which can apply for existing users and increased commuters as shown in **Box (1)**.

The demand curve for the rail transport is determined by the ticket price, travel time and population catchments around the stations. Thus, the quantity demanded varies as the price and time needed to use the service varies. In addition, the impact of new housing projects around the stations can alter the demand schedule as people want to consume housing near easy transportation. In fact, this is the general equilibrium demand curve, which is interrelated with changes in various goods markets, such as housing and commercial activities around the stations and cost of other transport modes.

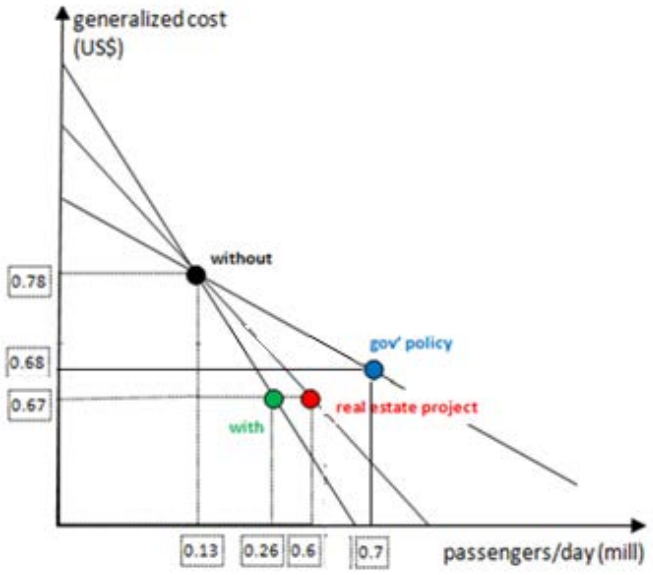
Box 2: Increased demand

Demand forecast= 0.7 million /day (Based on JapanTsukuba express way project).

Forecast demand can achieve with the additional services through government support policy for rail operation.

Change in Demand and Benefit

Item/day	Improved service	With real estate	With policy support
Demand (consumers)	0.26 million	0.6 million	0.7 million
Increased consumer surplus	$0.0211 million	$ 0.0383million	$0.0394 million
Revenue (producer surplus)	$0.0962 million	$ 0. 22 million	$ 0. 273 million



Although the ticket price is set higher (300 Ks) than present charges (20 Ks) the ridership can be greatly increased to 0.26 million (double in 1st Year) because of decreased generalized cost. However, this cost will become constant for a certain period after rail line improvement and service providers have diversified other businesses and services to alter the quantity demanded at any given price.

With increasing population, Yangon needs more entertainment sites and proper housing estates with easy access and affordable prices. If the rail operators can engage in other

businesses related to the urban life support industry, such as real estate development, entertainment and retail, the demand curve will shift out to the right and achieve ridership of 0.6 million/day. Furthermore, the improvement of government support policy for rail operators investing in urban development can attract private construction groups to invest in rail service and provide estate projects in suburban areas. Thus the demand curve for rail service will shift out by promoting the real estate market and may reach 0.7 million/day even though the fare price are set higher to cover the operating cost.

In order to realize the ambitious demand forecast, government support for the rail operator, who also will act as a land developer, is critical. The ridership can increase year by year together with increasing demand of other services and both consumers and producers of rail transport will become better off. User benefits of the 0.7 million commuters include both the consumer surplus ($0.0394 million/day) and the revenues from rail ($0.273 million/day) as shown in **Box (2**).

Impact on Bus Transportation

Yangon bus transportation system has been gradually improved with private sector involvement and extends the network to most of the urban area, although government strictly controls the bus fares (50-200 Kyats). However, insufficient management of the proliferation of routes, the poor quality of vehicles, inadequate bus networks, and lack of financial support are the problems faced by the bus system, which cause on-the-road competition and threaten the safety of the public. Government can settle those problems through the integration of rail and bus operation network.

Circular rail service improvement may affect indirectly the demand of the secondary market (bus transportation and taxi, with approximately 7000 taxi cars, and 283 bus lines with 6839 buses). If there is no price distortion, benefits and costs of indirect effect can cancel out each other and the secondary market changes can be omitted. In addition, small capacity bus and track used in existing bus transportation can be modified into feeder transportation to access terminal stations and main bus routes, so demand for secondary market cannot alter the demand situation extensively.

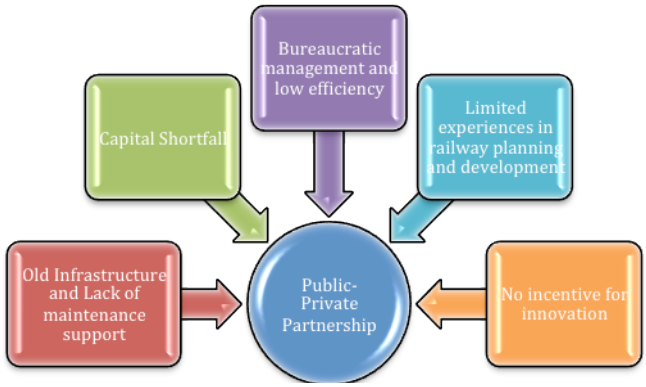
Conclusion for Cost Benefit Analysis

As noted above, implementation of the rail system will bring social benefits of reducing social cost of automobiles, increasing commuters' benefit and additional benefit such as environmental benefits, transportation safety, and productivity improvements. Moreover, rail transit can encourage more efficient land use and compact development patterns if the projects can integrate well with other modes of transportation and urban planning. The impacts of those benefits are difficult to quantify in monetary terms without a detailed analysis. Actually, the project can be profitable and the huge fixed capital cost can be subsidized through the real estate and commercial services by imitating the Japanese development model. In Japan, railway companies can survive and provide sustainable services by incorporating residential and commercial projects in rail operations that can increase land values, land productivity, and generate revenue. Therefore, the public private partnership scheme is proposed as a way of implementing the real estate solution into the Circular Railway project.

5 Public Private Partnership Model

This section intends to propose a scheme for a PPP and real estate development for the Yangon Circular Railway development project. The PPP aims to solve problems that exist in Yangon circular railway. The real estate development scheme focuses on the business profit side, providing funds to capitalize the transportation system.

Figure 11: Justification for the PPP model



The main problems that exist in the old railway system include old infrastructure and lack of maintenance support, capital shortfall, bureaucratic management and low efficiency, limited experience in railway planning and development, and no incentive for innovation (Figure 11). Among these, capital shortfall and technical inexperience are the two most urgent problems that cannot be solved by public sector alone. With the permission to pursue of foreign investment from central government, the railway improvement project can benefit from a private partnership. The private sector can contribute by helping to solve above problems, while providing capital and technology transfer for better transportation service.

The Proposed PPP Structure of Yangon Railway Project

The PPP structure can be divided into three parts. The first part is capital source. In order to smooth the project financing process, there are three capital and equity providers, government, equity investors and financiers. Second part is to select one contractor to rebuild the Yangon Circular Railway. For typical PPP projects, the Project Company or Joint Venture Company outsources construction and maintenance to contractors. Therefore, we could see in the middle of the graph below, the project company plays the role of the agent of the principal and constructor (Figure 12). The third section is the capital inflow from the PPP project. There are two main methods that could be used to accumulate capital inflow to recover the debt from financiers and provide future dividend for equity shareholders: one is the railway transportation operation, and the other is the real estate business. The income from real estate business mainly accrues from both the land price increase and the development of land for condominiums and commercial use.

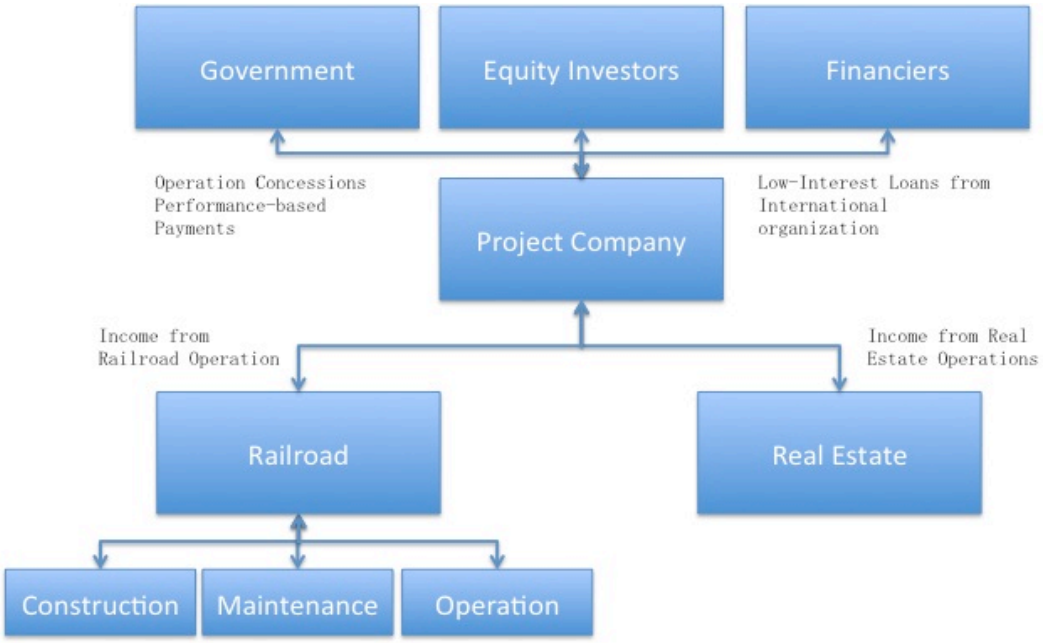
Railroad Development for Efficient Transportation Service

Partnership

Public Sector

Ministry of Railway Transportation ("MRT") is in charge of railway and road transport in Myanmar; hence, it represents the public sector for the development of Yangon circular railway.[5]

Figure 12: Proposed PPP Structure for Yangon Project



Private Sector

Project Company ("JV Corporation") is in charge of the construction and maintenance of Yangon circular railway, and also the improvement of infrastructure like the addition of sleepers. The selection of the constructor would involve international bidding, with the winner admitted to this program.

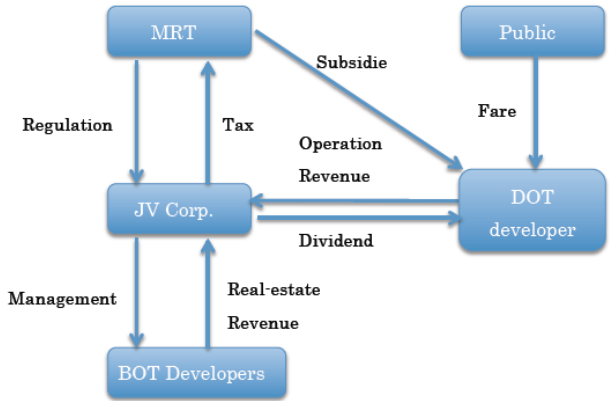
PPP type and Risk sharing mechanism

Designing the risk-sharing mechanism between public and private sector is a critical role of each party in the PPP project. In adopting the Develop-Operate-transfer (DOT) model, we can divide the risks shared between public and private sector in the following way. The public sector mainly takes the burden of regulation risk and contingent liability while the private sector mainly takes the burden of design and development risk, construction risk, performance risk, revenue risk, environmental risk and financial risk. The risk-sharing

[5] Ministry of Rail Transportation, Myanmar --Facts about Myanmar railways 2011

mechanism like this could properly reduce the risk that is originally wholly shouldered by public sector in the case that PPP model is not used. This would change the role of the public sector from service provider into regulator, which could largely improve the efficiency of project. The DOT model could fully benefit from the real estate development revenue as a capital source and ensure a stable return from operational revenue in ticket fees from the public. Joint Venture Corporation is founded specially to coordinate and combine the MRT and private sectors, to make sure the government involves in every decision of the railway development project. It could be divided into two divisions, one for railroad development, and the other for real estate development. In railway development division, only one DOT private developer is chosen to take the responsibility. The DOT developer could be granted fare adjustment rights under the regulation of the MRT. Also, the subsidy from the MRT and the real estate income collected by the DOT developer would ensure sufficient capital necessary for railway development and operation (Figure 13). As a part of the DOT model, the developer has been entitled the right to develop properties or gain partial revenue from auxiliary businesses. This makes the DOT model more flexible than BOT in finding capital sources.

Figure 13: DOT and BOT Structure



Real Estate Business as A Way of Covering the Financial Shortfall

Partnership

Public Sector

The MRT is in charge of railway and road transport in Myanmar; hence, it cooperates with the concerned institutions, and represents the public sector for the development of Yangon circular railway.

Private Sector

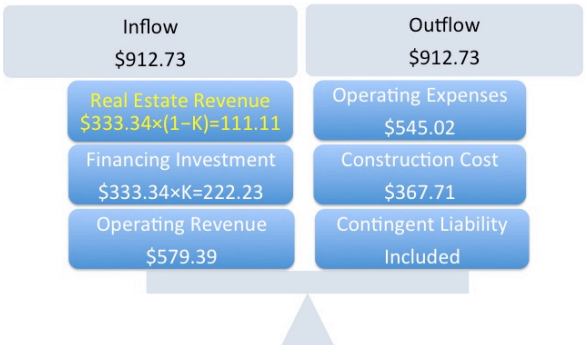
BOT developers are in charge of the real estate development. A corporation experience in real estate and business development can bring more profits to the project by incorporating the development of railway station department stores, rental housing, feeder transportation and other profitable programs. The development of auxiliary business could help to fully realize the potential of the commercial value of the land and generate revenue from real estate purchases of local citizens, which will help to compensate the loss from initial construction of the improved line and transportation operation. As at the beginning of the program, the capital burden is much higher than the later part, and revenue generated not

only from the natural increase of land price but also from successful side businesses would help release the capital pressure faced by the government.

Capital balance from real estate

As a rough calculation, let us examine how much money would have to be generated from real estate to make the project feasible. As we can see the capital balance (Figure 14), let us assume that the percentage of debt under debt to equity ratio is 2:1. Therefore, the capital inflow includes $111.11 million real estate revenue (K is the ratio of debt according to debt to equity ratio), financing debt of $222.23 million as well as operating revenue $579.39 million. The inflow equals the outflow part on the right with operating expenses of $545.02 million, construction cost $367.71 million and contingent liability (included in NPV of construction cost). The total balance of capital is $ 912.73 million.

Figure 14: Capital Balance



Land acquisition planning

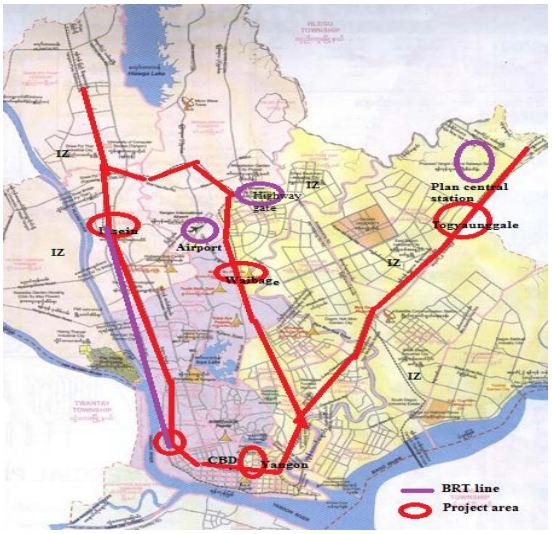
Land acquisition and development could be implemented in the districts as shown in Table 7. Government owned and Myanmar railway owned land could be contributed for area development projects with PPP system. According to other real estate projects in Myanmar undertaken by the Department of Human Settlement and Housing Development, the land tenure can be expected to be 60 years for residential use and 50 years for commercial use. The project life of a PPP, therefore, should be long enough to realize a return on investment.

The land acquisition in Insein, Tokyaunggale and Waibagi

Table 7: Land acquisition data

	US$/acre	Insein	Yangon	Tokyaunggale	Waibagi
Area (acres)		50	7.41	50	50
land cost (mill)	0.0125- 1	0.625	7.41	0.625	0.625
Intended population (mill)		0.2	1.4	0.2	0.2

Figure 15: Land acquisition areas for the Yangon Railway estate project



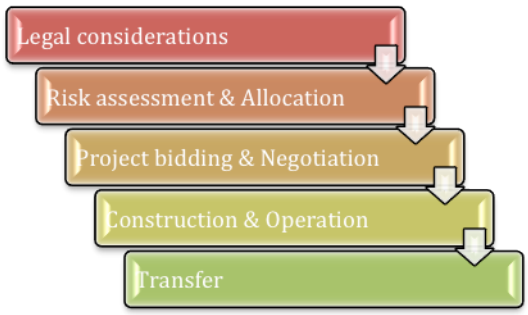
would be 50 acres each for the land prices in these districts are relatively cheaper as it is the outskirts of city. With the development of the railway system, the land price would naturally increase thus could generate high revenue that would make up for the construction cost and operation fees. Different real estate developers could undertake those different districts using the Built-Operate-Transfer ("BOT") model for market competition in real estate projects around the stations. The JV Corporation real estate division takes charge of land adjustment affairs and coordinating BOT developers from different stations.

Key Considerations for Implementing a PPP Project

PPP is one way to get capital financing and improve the efficiency of public infrastructure service providing. However, in order to run a smooth PPP project, there are also some key considerations that should be put an eye on before the construction begins.

(1) Proper legal environment for implementing PPP project

Figure 16: Implementation Steps



The legal environment for both public and private sectors ensures the proper right of private investors as well as the regulation role of public sector. The steps for implementing PPP project should at least include five parts (Figure 16). The first step is to have a strong legal framework to secure public and private interests and to reduce long-term uncertainties. This is important because the amount of capital necessary is huge, the repayment schedule is long, and the welfare of the public is involved. Aside from the legal issues related to the project development, land use regulations are in priority to be considered since it can directly affect the main source of revenue for the project company. Finally, regulations for foreign direct investment and the right permissioned for private participation in public services and real estate should be key considerations. Above all, it require refined and well-designed legal framework for implementing public-private partnership in Myanmar.

(2) Proper financing way to ensure the balance between public and private sectors

In Sullivan (2009), the author discussed two ways that can be used to maintain the public control while getting a first rate railroad facility: Fee-based V.S. Ownership financing. Fee-based financing sources the capital based on a consulting contract, the private sector would not bear any of the risk of the project's failure. The ownership financing, on the other hand, might take a long-term lease over a real estate property, hence shifts both risk and reward to the private sector. This could also be considered in Yangon circular railway development project.

From the private sector's perspective, the ownership financing would be desirable because the private sector could benefit from a significant financial return. Although the adoption of

BOT model in this program requires the selected real estate developers to shoulder the burden of construction risk as well as operational risk, under the land tenure provisions, the private sector could earn large financial returns that can make up for losses on railway operations. In addition, if the government is able to subsidize the railway operator, it could multiply the benefits for them. However, without further analysis, the optimal length of time to ensure the proper revenue generated for private developers and proper land property control for the public sector is unclear.

From the public sector's perspective, the fee-based financing seems more prudent as it avoids property transfer, which directly protects the revenue that generates from the real estate sector. However, it would increase the financial burden of public, which may also affect the railway demand. As the riding fare will definitely be increased as a part of the improvements to the railway system, some customers may choose the bus or other transportation to avoid paying the higher railroad fare. Nevertheless, if MRT subsidies the railway operator enough to compensate the loss from railway operation, it may be able to use fee-based financing and keep the ticket fare affordable by public.

(3) Experience and key aspects for successful international bidding and negotiation

Public-private negotiation could benefit from the experience of developing the railway system in the US and Ørestad, Copenhagen. The negotiation procedure between the public and private sector certainly demands a strong agenda and well-developed negotiating skills on the part of the government (Majoor, 2008). Empirical research shows that cities with strong-will and high-quality negotiation skills can get better results for the project (Savitch and Kantor, 2002). The lack of planning concepts and effective planning tools are the biggest shortcomings affecting the project success. Hence, the progressive planning ideals[6] that had been used in the case of Ørestad, Copenhagen, a well-designed agenda and well-developed negotiating skills would be critical for the success of Yangon circular railway development project.

For successful international bidding and negotiation, besides above experience, there are at least four aspects needed to be included in international bidding and negotiation: the price adjustment mechanism, the regulation mechanism, financial issues and assessment criteria. The price adjustment mechanism ensures the benefits for private participators; the regulation mechanism ensures the right of public under government control; the financial issues ensure the financial supply and demand of PPP project; and the assessment criteria ensures the quality of facility gained by public. These four parts may ensure the smoothness of PPP project and result in a win-win agreement among private investors and the government.

[6] The progressive planning ideals aimed to marry grand economic investments with long-term development of certain community benefits. See the article in the bibliography.

Conclusion

This paper considered several aspects of a project to improve the Yangon Circular Rail line. The current problems plaguing the system were investigated and a series of improvements were proposed. The financial implications were calculated, which showed that construction costs were large and significant, preventing the "bankability" of the project without other sources of revenue. To this end, this paper looked at the social cost savings provided by a higher quality rail line, and while significant, they are still smaller than the initial construction costs. Finally, we examined the possibility of using a PPP project structure to finance the project, providing an opportunity for the project company to derive additional revenue from the development and sale of real estate as a side business. There is significant potential here, but concrete cash flow projections are difficult to calculate because of lack of available data, population catchments and the unclear state of land law and land usage rights in Myanmar.

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APPENDIX (1) 20-Years Financial Balance Sheet (US$ million)

Year	Construction	Operation	Revenue	Net Currency
1	-114.75	0	0	-114.75
2	-114.75	0	0	-114.75
3	-114.75	0	0	-114.75
4	-114.75	0	0	-114.75
5	0	-91.80	76.65	-15.15
6	0	-92.72	80.48	-12.24
7	0	-93.65	84.51	-9.14
8	0	-94.58	88.73	-5.85
9	0	-95.53	93.17	-2.36
10	0	-96.48	97.83	1.35
11	0	-97.45	102.72	5.27
12	0	-98.42	107.85	9.43
13	0	-99.41	113.25	13.84
14	0	-100.40	118.91	18.51
15	0	-101.40	124.85	23.45
16	0	-102.42	131.1	28.68
17	0	-103.44	137.65	34.21
18	0	-104.48	144.54	40.06
19	0	-105.52	151.76	46.24
20	0	-106.58	159.35	52.77
NPV	-367.71	-545.02	579.39	-333.34
IRR				-4.17%

Here r = interest rate =0.015; f = inflation rate = 0.08;

NPV = net present value = $\sum_{i=1}^{20} \frac{V_i}{(1+r+f)^i}$;

IRR = internal return rate, $0 = \sum_{i=1}^{20} \frac{C_i}{(1+IRR)^i}$.

APPENDIX (2) Sensitivity Analysis

construction cost	-50%	0%	+50%
NPV($ million)	-149.5	-333.3	-517.2
%change in NPV	-55.1%	0	55.2%
IRR	-0.01%	-4.2%	-6.6%

operation cost	-20%	0%	+20%
NPV($ million)	-224.3	-333.3	-442.4
%change in NPV	-32.7	0	32.7%
IRR	1.4%	-4.2%	-12.6%

ticket price	-33%	0%	+33%
NPV($ million)	-526.5	-333.3	-140.2
%change in NPV	57.9%	0	-57.9%
IRR	NA	-4.2%	5.0%

ridership increase rate	2%	5%	8%
NPV($ million)	-430.3	-333.3	-208.8
%change in NPV	29.1%	0	-37.4%
IRR	NA	-4.2%	3.3%

annual ridership	-25%	-10%	0	+10%	+25%	+50%	+100%	+200%
NPV($ million)	-478.2	-391.3	-333.3	-275.4	-188.5	-43.7	246.0	825.4
%change in NPV	43.5%	17.4%	0	-17.4%	-43.5%	-86.9%	-173.8%	-347.6%
IRR	NA	-8.8%	-4.2%	-0.8%	3.2%	8.2%	15.6%	26.2%

APPENDIX (3) Economic surplus Calculation

Consumers surplus calculation				
Elements	without	with	real-estate development	government policy
Price(US$)	0.775	0.667	0.667	0.680
passengers (million)	0.130	0.260	0.600	0.700
Surplus (mill. US$/day)	-	0.021	0.038	0.039

Producers surplus calculation				
Elements	without	with	real-estate development	government policy
Price(US$)	0.025	0.370	0.370	0.390
passengers (million)	0.130	0.260	0.600	0.700
Surplus (mill US$/day)	0.003	0.096	0.222	0.273