

## ECONOMIC AND FINANCIAL ANALYSIS

1. The economic analysis of the Strengthening Sustainable Urban Transport for Ha Noi Metro Line 3 Project considered with- and without-project scenarios. Under the with-project scenario, the project's intended proposed access improvements, public transport system enhancements, and policy changes were assumed to be effective and to provide the benefits of integrated public transport in Ha Noi. The without-project scenario assumed that metro line 3 is operational but that the project's outputs were not delivered and the expected benefits of better coordinated, coherent public transit and urban transport in general were not achieved.

2. The economic assessment covered 35 years, 2014–2048, comprising 5 years of project preparation and construction during 2014–2018 and a 30-year benefit period. Benefits and costs were calculated in constant 2013 prices. Values were border equivalent prices for tradable goods, and domestic prices after removing the effects of taxes and subsidies for nontradable goods. The approach to the financial analysis follows the financial due diligence requirements.<sup>1</sup> Given that the project is not intended to cover all or a significant portion of costs through increased revenue and efficiency, the financial analysis focuses on the financial capacity of the project executing agency to meet the recurrent costs of operating and maintaining the developed facilities to ensure sustainability of project benefits.

### A. Demand Forecast

3. The analysis used transport demand forecasts for metro line 3 prepared in a 2008 feasibility study: 157,000 passengers per day in 2018 and 276,000 passengers per day in 2028.<sup>2</sup> Using the feasibility study estimate of a post-2028 traffic growth rate of 3.5% per annum, the daily demand in 2038 was estimated to be 458,000 passengers per day. The demand estimates in terms of the project station entries and exits excluded transfers between other metro lines. The daily demand in terms of passenger entries and exits at the project stations was estimated to be 141,365 passengers per day in 2018 and 411,886 passengers per day in 2038.

4. These demand forecasts took into account incremental demand on metro line 3 expected to result from the project. The demand for the sustainable transport measures was forecasted by assuming that the average perceived time saving per passenger to access metro stations would be 1.4 minutes. These time savings are conservatively assumed to be 10% of the project case mass rapid transit (MRT) demand (i.e., 11% of the base-case demand).<sup>3</sup> A summary of the forecast passenger trips is in Tables 1 and 2.

### B. Costs

5. The project's economic costs were derived from the financial capital cost estimate and the recurrent financial operation and maintenance (O&M) costs. The project capital cost included the costs of construction, equipment, project administration, design and management consultancy, land acquisition, and resettlement compensation. The equipment cost included the acquisition of a public transport information system, as well as the cost of midlife refurbishment

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<sup>1</sup> ADB. 2008. *Financial Management, Cost Estimates, Financial Analysis and Financial Performance Indicators. Operations Manual*. OM G2/BP. Manila.

<sup>2</sup> SYSTRA. 2008. *Hanoi Pilot Light Metro Line – Section Nhon-Hanoi Railway Station, Feasibility Study Report*. Ha Noi (final report, project reference: PIC-TRE-DOO-L00-00010-E-3A, December).

<sup>3</sup> This time saving was estimated by the study team by a systematic examination of how proposed measures would affect each access mode user at each station in 2018 and in 2038.

of rolling stock and replacement of electrical and mechanical systems at the expiry of a 15-year useful life. Economic costs excluded taxes, duties, price contingencies, and interest during construction, but included physical contingencies. The infrastructure has an economic life of 20 years and the systems and equipment have a useful life of 15 years.

6. The higher demand will require incrementally higher recurrent train O&M costs. The additional costs are estimated to reach \$1.3 million by 2028 and increase in line with traffic, representing 25% overall of the total net present value of project costs. Recurrent O&M costs were estimated to comprise 20% for human resources, 40%–45% for electricity, and 35%–40% for other expenses including insurance. The estimated O&M costs included an allowance for the recurrent cost of administering and evaluating the project.

**Table 1: Estimated Daily Demand by Access Mode, 2018**

Access Mode	Base Case (MRT 3)		SUT Alone		Project Case (MRT 3 with SUT)	
	No.	%	No.	%	No.	%
Walk-in or local walk	41,614	29.4	4,624	29.6	46,238	29.5
Cycle-in, share/ local cycle	7,065	5.0	785	5.0	7,850	5.0
Bus	42,083	29.8	4,676	29.9	46,759	29.8
Car driver	650	0.5	0	0.0	650	0.4
Car passengers	2,826	2.0	314	2.0	3,140	2.0
Taxi passengers	5,652	4.0	628	4.0	6,280	4.0
Motorcycle driver	19,950	14.1	2,217	14.2	22,167	14.1
Motorcycle passengers	21,524	15.2	2,392	15.3	23,916	15.2
<b>Total</b>	<b>141,365</b>	<b>100.0</b>	<b>15,635</b>	<b>100.0</b>	<b>157,000</b>	<b>100.0</b>

MRT = mass rapid transit, SUT = sustainable urban transport.

Source: Asian Development Bank estimates.

**Table 2: Estimated Daily Demand by Access Mode, 2038**

Access Mode	Base Case (MRT 3)		SUT Alone		Project Case (MRT 3 with SUT)	
	No.	%	No.	%	No.	%
Walk-in or local walk	120,893	29.4	13,993	30.3	134,886	29.5
Cycle-in, share/ local cycle	20,610	5.0	2,290	5.0	22,900	5.0
Bus	122,766	29.8	13,641	29.6	136,406	29.8
Car driver	1,896	0.5	5,000	10.8	6,896	1.5
Car passengers	8,244	2.0	916	2.0	9,160	2.0
Taxi passengers	16,488	4.0	1,832	4.0	18,320	4.0
Motorcycle driver	58,199	14.1	1,467	3.2	59,665	13.0
Motorcycle passengers	62,790	15.2	6,977	15.1	69,767	15.2
<b>Total</b>	<b>411,886</b>	<b>100.0</b>	<b>46,114</b>	<b>100.0</b>	<b>458,000</b>	<b>100.0</b>

MRT = mass rapid transit, SUT = sustainable urban transport.

Source: Asian Development Bank estimates.

### C. Benefits and Beneficiaries

7. The project's core benefits were identified using transport modeling and estimating the difference between passengers' perceived travel time and vehicle operating costs (VOCs) with and without the project.

8. **Perceived travel time.** The principal benefits are assumed to be perceived travel time savings, associated travel reliability, and land use value increases due to the project measures. The estimated average with-project perceived travel time saving per forecast metro line 3 passenger is about 1.4 minutes to access stations and the same to egress stations. The evaluation applied the transport appraisal rule of half to new passengers expected due to the

with-project sustainable transport measures, and each was estimated to perceive a benefit of about 0.65 minutes in each direction. These perceived travel time savings were multiplied by the value of time to derive the incremental changes in consumer surplus (perceived travel time benefit), the key user benefit (Table 3).

9. **Vehicle operating costs.** The forecasts of the number of car and motorcycle drivers switching to the metro due to the project measures and the relevant perceived costs were calculated outside the transport model. The price of fuel and other potential perceived out-of-pocket costs were not included in the calculation of consumer surplus. Consequently, switching car drivers were assumed to perceive the full avoided cost of vehicle operation. The unit VOCs used were computed using the Highway Design and Management Software Version IV.

10. **Other benefits.** The with-project benefits of environmental improvements and reduced transit fatalities expected to result from a shift from private vehicle travel to public transit are estimated to be more minor. Reduced crash costs and air pollution benefits were estimated using standard impact factors per vehicle kilometer adjusted to the economic conditions of the Hanoi area. Benefits from reduced carbon emissions were separately estimated using the Transport Emissions Evaluation Model. Table 3 summarizes the expected benefits by category of benefit. The users of the Hanoi region urban transport system are the beneficiaries.

**Table 3: Estimated Annual Benefits**  
(\$ million in 2013 constant prices)

<b>Benefit Category</b>	<b>2018</b>	<b>2028</b>	<b>2038</b>
<b>Perceived user benefits – consumer surplus</b>			
Existing users	0.879	6.410	11.941
New users	0.049	0.356	0.663
<b>Subtotal (these are all public transport users)</b>	<b>0.928</b>	<b>6.766</b>	<b>12.604</b>
<b>Other perceived benefits</b>			
Public Transport user reliability and quality uplift	0.232	1.692	3.151
Land use benefit: accessibility, agglomeration, and other land use benefits	0.046	0.969	1.891
<b>Decongestion benefits (remaining road users)</b>			
Time and VOC benefits	0.114	0.145	0.175
<b>Resource correction for mode switchers (unperceived VOCs)</b>			
Cars	0.013	1.920	3.826
Motorcycles	0.161	0.105	0.048
<b>Subtotal</b>	<b>0.174</b>	<b>2.025</b>	<b>3.874</b>
<b>Environmental benefits</b>			
Air pollution	0.045	0.238	0.430
Greenhouse gas	0.079	0.245	0.412
<b>Subtotal</b>	<b>0.124</b>	<b>0.483</b>	<b>0.842</b>
<b>Reduced crash costs</b>			
Private vehicles	0.010	0.016	0.022

VOC = vehicle operating costs.

Source: Asian Development Bank estimates.

## **D. Results of Economic Analysis**

11. With capacity maintained to required service levels, metro line 3 can continue to provide transport services and the associated benefits indefinitely. By capitalizing annuities included in terminal values of the project cost streams, allowances were made to ensure that the line would be equipped for an assumed 3.5% annual growth in passenger traffic from 2038 to 2058. The corresponding terminal values derived from these growth rates were calculated for inclusion in

the benefits streams. Table 5 shows the complete cost and benefit streams considered in the analysis. The evaluation of sustainable transport measures of metro line 3 showed an economic internal rate of return (EIRR) of 17.2%, a benefit–cost ratio of 1.58, and a net present value of \$15.2 million, using a discount rate of 12.0% per annum. The EIRR of the project when only considering time and VOC benefits is 14.0%.

12. The project is closely linked to the ongoing Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section),<sup>4</sup> and benefits will compound. The economic evaluation of the Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section) was carried out in 2009 but several factors have changed since, including implementation delay, cost overruns, and increased travel demand. A detailed reevaluation of this project is expected to become available in early 2015. Preliminary results indicate that the Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section) may remain viable, with an EIRR of 13.19%. The joint project Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section) plus the proposed project has a marginally higher EIRR of 13.24%.

13. The majority of the project beneficiaries are likely to be from the poorest 60% of households in Hanoi and have incomes lower than the city average. The main beneficiaries will be existing users of public transit, and 94.5% of the benefits in perceived travel time and improved transport reliability will accrue to them. Based on the 2008 feasibility study, it is estimated that up until metro line 3 opens, (i) up to 30.0% of trips planned by existing public transit users were not made,<sup>5</sup> (ii) 32.0% were made by bus, (iii) 27.0% were made by motorcycle, (iv) 5.6% were made by car, and (v) and 5.4% were made by taxi. Evidence suggests that bus passengers are mainly members of households in the lowest 40% income group. Motorcycle users may have slightly higher incomes on average. Surveys have indicated that females represent slightly less than half of all bus passengers and about half of all motorcycle and bus users.

## **E. Sensitivity and Risk Analysis**

14. The analysis tested the estimated EIRR for sensitivity to two key variables, separately and in combination: (i) increased project capital costs due to unexpected changes in fuel and other raw material costs; (ii) a decline in project benefits, to account for the uncertainties of estimation and the possible impact of high raw material and oil prices on growth and incomes; and (iii) both variables (i) and (ii). The results of the sensitivity testing (Table 4) indicate that achievement of an EIRR of above 12% is sensitive to changes in assumptions on the cost and the benefit levels, demonstrated by the switching values of 14% for the first variable and –13% for the second. Two further tests were undertaken. They showed that (i) a 1-year delay in opening of metro line 3, with the same investment schedule as assumed for the principal evaluation, would reduce the EIRR to 15.6%; and (ii) reduced annual gross domestic product growth in Viet Nam of 4% after 2020, rather than the base-case assumption of 6% for 2020–2030 and 5% thereafter, would reduce the EIRR to 15.1%.

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<sup>4</sup> ADB 2011. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Loan for the Socialist Republic of Viet Nam: Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section)*. Manila.

<sup>5</sup> Trips not made are by public transit users who avoided a trip as existing services are poor and unreliable. A small proportion of former pedestrian and bicycle trips (fewer than 3%) are assumed to be included in the new trips.

**Table 4: Sensitivity Tests**

<b>Scenario</b>	<b>EIRR (%)</b>	<b>Switching Value (%)</b>
Base case	17.2	
Capital costs are 20% above most likely value	15.1	50
Benefits are 30% below most likely value	13.1	(30)
Only time and vehicle operating cost savings considered	14.0	
Delay of 1 year	15.6	
Reduced GDP growth after 2020 (4% constant)	15.1	

( ) = negative, EIRR = economic internal rate of return, GDP = gross domestic product.

Source: Asian Development Bank estimates.

15. The risk of a cost increase is moderate and will be partly mitigated by strong international support to the implementing agency. In addition, the benefits are considered to have more upside than downside potential. This is because it is likely that a proposed road development plan for Ha Noi will not be implemented, which will result in much higher vehicle operating costs than projected in the analysis, thus make the savings in vehicle operating and other costs and the project benefits greater than now estimated.

#### **F. Affordability of the Project to Government**

16. The Hanoi People's Committee (HPC) will be the executing agency and the project owner, and will be responsible for operation and maintenance after project completion. The HPC's budget is financed directly through national and city taxes, duties, and other revenue sources including a portion of all national revenue against future budgetary support transfers from the Ministry of Finance. The financial analysis therefore focuses on the future financial position of the HPC, aiming to appraise its financial capacity to cover the recurrent expenditures of the project.

17. There is no consolidated information on revenue and expenditure by governments on the transport sector in Ha Noi. Available data indicates that the cost of providing bus services in Ha Noi in 2011 was \$60.5 million, with revenue of \$20.5 million. The substantial increase in bus fares in September 2012 will have markedly reduced the subsidy needed to provide the services. Ha Noi has an extensive road network of 1,600 kilometers (km) of primary roads, 1,200 km of district roads, and 13,000 km of local roads. This compares with around 6,000 km in Ho Chi Minh City, reflecting the larger geographic region of Ha Noi. The amount spent on road and transport infrastructure maintenance in Ho Chi Minh City in 2011 was approximately \$110 million, suggesting that expenditure on maintenance will be considerably higher in Ha Noi.

18. The total project cost of \$58.95 million is to be expended over a 4-year period—i.e., with average annual expenditure of \$14.7 million per annum. This is relatively modest when compared with other transport expenditure in Ha Noi. As the cost of the project is small relative to total transport expenditure by the HPC, it is concluded that the HPC has the absorptive capacity to undertake the additional expenditure associated with the project.

19. The future financial position of the HPC confirms its financial capacity to cover the recurrent costs to ensure the sustainability of facilities developed under the project. Moreover, given the government's support to the project by assuring that it will fund the operating expenditure and periodic maintenance, adequate budgetary amount for recurrent costs of operating the project is reasonably expected.

## **G. Financial Management Arrangements and Capacity**

20. The financial management assessment indicates that the Urban Transport Project Management Unit (UTPMU) (i) follows standard government policies and procedures for accounting and financial management, (ii) has good accounting and financial management capacity, (iii) has experience with implementing projects that have received external financial support, (iv) will be able to provide the project implementation division (PID) with the financial management and accounting services it needs to undertake the project subject to further training to provide the UTPMU with up-to-date and specific training to be fully familiar with ADB financial management requirements, and (v) will undertake nonroutine external audits of its own and Department of Transport's financial affairs. The UTPMU acknowledges these matters. They will be addressed by (i) participation of UTPMU finance and accounting staff in ADB financial management accounting training, and (ii) engaging external auditors to undertake annual audits of the project as required by ADB.

21. In addition, the UTPMU will need to (i) establish a specific account for the project with appropriate subaccounts in its accounting system to allow the separate and adequate recording of financial transactions under the project; (ii) assist the PID to prepare budgets and provide financial information for the management information system for the project to be developed by the PID, (iii) establish a mechanism to minimize foreign exchange risks with regard to loan funds during implementation of the project, (iv) prepare a summary procedures and accounting manual in Vietnamese to aid project-specific financial management, (v) designate specific staff to manage the project funds, and (vi) ensure sufficient staff have English language skills.

22. **Institutional strengthening needs.** An assessment has determined that key UTPMU staff need to participate in ADB financial management training so that they have a good understanding of (i) the basis on which the cost of the project was estimated, contract packages determined, financier contributions identified, and disbursement schedules established; (ii) ADB's policies and procedures on financial management; (iii) ADB's policies and procedures on financial matters related to procurement and contract management; (iv) ADB reviews regarding financial matters during project implementation; and (v) measures to ameliorate foreign exchange risks during implementation of the project.

23. **Auditing.** Under the project, external auditors will be engaged to audit the annual financial statements for the project for the year ended and assess the progress with the overall budget, in accordance with the acceptable accounting standards and in conformance with ADB procedures and guidelines. The audit will review the compliance with laws, regulations, and funding agreements that have a direct and material financial effect on the entity's financial report. The effectiveness of internal control over compliance with requirements that could have a direct and material financial effect on the financial statements as well as internal control over financial reporting will be assessed.

24. The auditing will be undertaken in accordance with ADB requirements, giving consideration to (i) accounting standards and policies, covering accounting standards and their applicability to financial reports on ADB-financed projects; (ii) financial reporting requirements for ADB-financed projects; (iii) auditing standards and auditor engagement, covering standards and their use in the audit of the financial reports of ADB-financed projects; and (iv) review of financial reports, including identification of actions to be taken where financial reports are overdue or are inadequate.

**Table 5: Economic Evaluation Results**  
(\$ million)

Year	Costs				Benefits <sup>a</sup>									
	Capital Cost		Ongoing Cost	Net Cost	Perceived User Benefits				Other Benefits				Total benefit	Net benefit
	Fixed assets <sup>b</sup>	Public transport fleet <sup>c</sup>	Infrastructure and Public transport operations		Existing users	New user	Reliability uplift	Reduced unperceived car operating costs	De-congestion benefits	Land use benefit	Reduced GHG air pollution accidents			
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	0.05	0	0	0.05	0	0	0	0	0	0	0	0	0	(0.05)
2015	2.56	0	0	2.56	0	0	0	0	0	0	0	0	0	(2.56)
2016	10.16	0	0	10.16	0	0	0	0	0	0	0	0	0	(10.16)
2017	6.70	0	0	6.70	0	0	0	0	0	0	0	0	0	(6.70)
2018	7.26	(0.85)	0.76	7.18	0	0	0	0	0	0	0	0	0	(7.18)
2019	0	0	0.52	0.52	0.88	0.05	0.23	0.17	0.11	0.05	0.13	1.63	1.10	
2020	0	0	0.55	0.55	1.43	0.08	0.38	0.36	0.12	0.14	0.17	2.67	2.12	
2021	0	0	1.14	1.14	1.99	0.11	0.52	0.54	0.12	0.23	0.21	3.72	2.58	
2022	0	0	0.77	0.77	2.54	0.14	0.67	0.73	0.12	0.32	0.24	4.77	4.00	
2023	0	0	0.38	0.38	3.09	0.17	0.82	0.91	0.13	0.42	0.28	5.81	5.43	
2024	0	0	0.35	0.35	3.64	0.20	0.96	1.10	0.13	0.51	0.32	6.86	6.51	
2025	0	0	0.62	0.62	4.20	0.23	1.11	1.28	0.13	0.60	0.35	7.91	7.29	
2026	0	0	3.71	3.71	4.75	0.26	1.25	1.47	0.14	0.69	0.39	8.95	5.24	
2027	0	0	1.99	1.99	5.30	0.29	1.40	1.65	0.14	0.78	0.43	10.00	8.01	
2028	0	10.19	0.20	10.39	5.86	0.33	1.55	1.84	0.14	0.88	0.46	11.05	0.65	
2029	0	0	1.39	1.39	6.41	0.36	1.69	2.02	0.14	0.97	0.50	12.09	10.70	
2030	0	0	1.73	1.73	6.96	0.39	1.84	2.21	0.15	1.06	0.54	13.14	11.41	
2031	0	0	3.27	3.27	7.52	0.42	1.98	2.39	0.15	1.15	0.57	14.19	10.92	
2032	0	0	2.72	2.72	8.07	0.45	2.13	2.58	0.15	1.25	0.61	15.23	12.51	
2033	0	0	1.59	1.59	8.62	0.48	2.28	2.76	0.16	1.34	0.65	16.28	14.69	
2034	0	0	1.65	1.65	9.18	0.51	2.42	2.95	0.16	1.43	0.68	17.33	15.68	
2035	0	0	2.00	2.00	9.73	0.54	2.57	3.13	0.16	1.52	0.72	18.37	16.37	
2036	0	0	5.18	5.18	10.28	0.57	2.71	3.32	0.17	1.61	0.75	19.42	14.24	
2037	0	0	3.55	3.55	10.84	0.60	2.86	3.50	0.17	1.71	0.79	20.47	16.92	
2038	0	9.24	1.85	11.09	11.39	0.63	3.01	3.69	0.17	1.80	0.83	21.51	10.42	

Year	Costs				Benefits <sup>a</sup>								
	Capital Cost		Ongoing Cost	Net Cost	Perceived User Benefits				Other Benefits				
	Fixed assets <sup>b</sup>	Public transport fleet <sup>c</sup>	Infrastructure and Public transport operations		Existing users	New user	Reliability uplift	Reduced unperceived car operating costs	De-congestion benefits	Land use benefit	Reduced GHG air pollution accidents	Total benefit	Net benefit
2039	0	0	1.90	1.90	11.94	0.66	3.15	3.87	0.18	1.89	0.86	22.56	20.66
2040	0	0	2.04	2.04	12.07	0.67	3.18	3.92	0.18	1.91	0.87	22.80	20.76
2041	0	0	2.74	2.74	12.19	0.68	3.22	3.96	0.18	1.93	0.88	23.03	20.30
2042	0	0	2.47	2.47	12.32	0.68	3.25	4.00	0.18	1.95	0.89	23.27	20.80
2043	0	0	2.20	2.20	12.44	0.69	3.28	4.04	0.18	1.97	0.90	23.51	21.31
2044	0	0	2.27	2.27	12.57	0.70	3.32	4.08	0.18	1.99	0.91	23.74	21.47
2045	0	0	2.88	2.88	12.69	0.71	3.35	4.12	0.19	2.01	0.92	23.98	21.10
2046	0	0	6.95	6.95	12.82	0.71	3.38	4.16	0.19	2.03	0.93	24.21	17.27
2047	0	0	5.08	5.08	12.94	0.72	3.41	4.20	0.19	2.05	0.94	24.45	19.37
2048	(3.74)	(2.94)	1.80	(4.87)	13.07	0.73	3.45	4.24	0.19	2.07	0.95	24.69	29.56
Present	17.60	1.70	6.70	26.20	22.00	1.20	5.80	6.80	0.60	3.20	1.80	41.4	15.20
Value Share <sup>d</sup>	67.2%	6.4%	25.7%	100%	53.1%	2.9%	14.0%	16.4%	1.5%	7.7%	4.4%	100.0%	...

<sup>a</sup> Conventional economic benefits.

<sup>b</sup> Fixed assets include property, infrastructure, and project management.

<sup>c</sup> Public transport fleet include expansion and replacement.

<sup>d</sup> Using a discount rate of 12%.

Source: Asian Development Bank estimates.