

**METRO CORRIDOR FROM HUDA CITY CENTRE TO CYBER CITY  
AND SPUR TO DWARKA EXPRESSWAY**

**Table 1: Abstract of Cost Estimate**

S. No.	Item	Amount (Rs. in Crore)
1	Land	208.52
2	Alignment and Formation	1150.97
3	Station Buildings	756.00
4	Depot	80.00
5	P-Way for main line & depot	212.33
6	Traction & power supply	382.88
7	Signaling and Telecom	393.20
8a	Environment	11.97
8b	R & R incl. Hutments etc.	2.90
9	Misc. Utilities	171.00
10	Capital Expenditure on Security	9.92
11	Capital Expenditure on Inter modal integration	81.00
12	Rolling Stock	480.00
13	Total of all items except Land and R&R	<b>3729.26</b>
14	General Charges including Design charges @ 5% on all items except land and R&R	<b>186.46</b>
15	Total of all items including G. Charges except land and R&R	<b>3915.73</b>
16	Contingencies @ 3 %on all items except land and R&R	<b>117.47</b>
<b>Gross Total including Contingencies (excluding Land and R&amp;R Cost)</b>		<b>4033.20</b>
<b>Gross Total including Contingencies (including Land and R&amp;R Cost)</b>		<b>4244.62</b>
<b>Central GST &amp; Basic Customs duty</b>		<b>299.26</b>
<b>State GST</b>		<b>264.15</b>
<b>Total Cost including Taxes &amp; Duties</b>		<b>4808.02</b>

**Table 2: Detailed Capital Cost**

S. No.	Item	Unit	Rate (₹ in Crore)	Qty.	Amount (₹ in Crore)
<b>1.0</b>	<b>Land</b>				
a	Central Govt. Land -Permanent (for Alignment, Depot, stations, without Solatium)	Ha	LS	0.10	2.30
b	Central Govt. Land -Temporary	Ha	LS	0.00	0.00
c	Central Govt. Structures-Permanent	Ha	LS	0.01	0.10

S. No.	Item	Unit	Rate (₹ in Crore)	Qty.	Amount (₹ in Crore)
d	State Govt. Land -Permanent (for Alignment, TSS, Stations, without Solatium)	Ha	LS	4.49	0.00
f	State Govt. Land -Temporary	Ha	LS	4.50	0.00
g	State Govt. Structures -Permanent	Ha	LS	0.12	0.98
h	Private Land -Permanent (for Alignment, Depot, Stations, including Solatium)	Ha	LS	6.53	203.65
j	Private Structure - Permanent including Solatium	Ha	LS	0.18	1.49
	<b>Sub Total (1)</b>				<b>208.52</b>
<b>2.0</b>	<b>Alignment and Formation</b>				
2.1	Elevated section (Viaduct) including in station portion (Two-tracks) - Main Corridor	R. Km.	37.00	25.16	931.05
2.2	Elevated section (Viaduct) including in station portion ( Single track) - Main Corridor (Shyam Chowk to Mousari Avenue)	R. Km.	20.00	1.18	23.60
2.3	Elevated section (Viaduct) including in station portion ( Single track) - Main Corridor (Shyam Chowk to Vodafone Belvedere)	R. Km.	20.00	0.36	7.10
2.4	Elevated section (Viaduct) including in station portion (Two-tracks) - Spur to Dwarka Expressway	R. Km.	37.00	1.85	68.45
2.5	Elevated Section (Special Span - 34m+45m+34m = 113m)	Each	15.58	2.00	31.16
2.6	Elevated Section (Special Span - 34m+60m+34m = 128m)	Each	17.65	2.00	35.29
2.7	Elevated Section (Special Span - 34m+45m+75m+45m+34m = 233m)	Each	32.12	1.00	32.12
2.8	Entry to Depot	R. Km.	37.00	0.60	22.20
	<b>Sub Total (2)</b>				<b>1150.97</b>
<b>3.0</b>	<b>Station Buildings</b>				
<b>3.1</b>	<b>Elevated Station including finishes (Type -I: 130mx20m)</b>				
a	Elevated station (Civil including finishes) excluding Viaduct in Station portion	Each	20.00	26.00	520.00
b	Elevated station (E&M including lift & escalator)	Each	8.00	26.00	208.00

S. No.	Item	Unit	Rate (₹ in Crore)	Qty.	Amount (₹ in Crore)
<b>3.2</b>	<b>Elevated Station including finishes (Type -II: 130mx28m - Single Platform and Single level at Cyber City)</b>				
a	Elevated station (Civil including finishes) excluding Viaduct in Station portion	Each	20.00	1.00	20.00
b	Elevated station (E&M including lift & escalator)	Each	8.00	1.00	8.00
	<b>Sub Total (3)</b>				<b>756.00</b>
<b>4.0</b>	<b>Maintenance Depot</b>				
a	Civil works (Stabling Depot)	LS			55.00
b	EM works + Machinery & Plant + General Works	LS			25.00
	<b>Sub Total (4)</b>				<b>80.00</b>
<b>5.0</b>	<b>P-Way</b>				
5.1	Ballastless track for elevated section (two tracks)	Route Km.	6.60	25.30	166.98
5.2	Ballastless Track for Spur to Dwarka Expressway (two Tracks)	Route Km.	6.60	1.85	12.21
5.3	Ballastless track for elevated section (Single track)	Track Km.	3.30	1.75	5.78
5.4	Ballastless track for entry to Depot	Route Km.	6.60	0.60	3.96
5.5	Ballasted track for Depot	Track Km.	3.90	6.00	23.40
	<b>Sub Total (5)</b>				<b>212.33</b>
<b>6.0</b>	<b>Traction &amp; power supply (750V DC Third Rail)</b>				
6.1	Elevated section including SCADA (Two Tracks)	R. Km.	11.00	25.30	278.30
6.2	Elevated section including SCADA for Spur to Dwark Expressway (Two Tracks)	R. Km.	11.00	1.85	20.35
6.3	Elevated section including SCADA (Single Track)	Track Km.	5.50	1.75	9.63
6.4	For entry to Depot	R. Km.	11.00	0.60	6.60
6.5	For Depot	Track Km.	3.00	6.00	18.00
6.6	RSS/TSS	Each	25.00	2.00	50.00
	<b>Sub Total (6)</b>				<b>382.88</b>
<b>7.0</b>	<b>Signaling and Telecom.</b>				
7.1	Signaling - Main Corridor	R. Km.	4.40	28.50	125.40
7.2	Signaling - Depot	Track Km.	3.20	6.00	19.20
7.3	Signaling - On Board Equipment	Per Train	1.70	53.00	90.10
7.4	Signaling - Upgradation on existing Rapid Metro	R. Km.	3.00	10.00	30.00

S. No.	Item	Unit	Rate (₹ in Crore)	Qty.	Amount (₹ in Crore)
7.5	Telecommunication - Station	Per Station	4.50	27.00	121.50
7.6	Telecommunication - Depot	Per Depot	3.50	2.00	7.00
7.7	Automatic fare collection	Per station	through PPP		
	<b>Sub Total (7)</b>				<b>393.20</b>
<b>8.0</b>	<b>Environment and R &amp; R incl. Hutments etc.</b>				
a	Environmental Cost	As per details given in Chapter 15			11.97
b	R & R				2.90
	<b>Sub Total (8)</b>				<b>14.87</b>
<b>9.0</b>	<b>Miscellaneous Utilities</b>				
a	Civil works	R. Km.	3.00	28.50	85.50
b	Electrical Works	R. Km.	3.00	28.50	85.50
	<b>Sub Total (9)</b>				<b>171.00</b>
<b>10.0</b>	<b>Capital Expenditure on Security</b>				
a	Civil works	Per Station	0.30	27.00	8.02
b	EM works	Per Station	0.07	27.00	1.91
	<b>Sub Total (10)</b>				<b>9.92</b>
<b>11.0</b>	<b>Capital Expenditure on Inter modal integration including Footpath for pedestrians</b>	Per Station	3.00	27.00	<b>81.00</b>
<b>12.0</b>	<b>Rolling Stock</b>	Each	8.00	60.00	<b>480.00</b>
<b>13.0</b>	<b>Total of all items except Land and R&amp;R</b>				<b>3729.26</b>
<b>14.0</b>	<b>General Charges including Design charges @ 5% on all items except land and R&amp;R</b>				<b>186.46</b>
<b>15.0</b>	<b>Total of all items including G. Charges except Land and R&amp;R</b>				<b>3915.73</b>
<b>16.0</b>	<b>Contingencies @ 3 % on all items except land and R&amp;R</b>				<b>117.47</b>
<b>17.0</b>	<b>Gross Total including Contingencies (excluding Land and R&amp;R Cost)</b>				<b>4033.20</b>
<b>18.0</b>	<b>Gross Total including Contingencies (including Land and R&amp;R Cost)</b>				<b>4244.62</b>
<b>19.0</b>	<b>Central GST &amp; Basic Customs duty</b>				<b>299.26</b>
<b>20.0</b>	<b>State GST</b>				<b>264.15</b>
<b>21.0</b>	<b>Total Cost including Taxes &amp; Duties</b>				<b>4808.02</b>



S. No.	Description	Total cost without Taxes & duties (Cr.)	Taxes and duties							Total Taxes & Duties (Cr.)
			Basic Customs Duty (Cr.)	IGST (CGST portion) (Cr.)	IGST (SGST portion) (Cr.)	Total Customs Duty (Cr.)	CGST (Cr.)	SGST (Cr.)	Total GST (CGST & SGST) (Cr.)	
<b>7</b>	<b>Environmental Works</b>	11.97	0.00	0.00	0.00	0.00	0.72	0.72	1.44	<b>1.44</b>
<b>8</b>	<b>Miscellaneous Utilities</b>									
	Civil works	85.50	0.00	0.00	0.00	0.00	5.13	5.13	10.26	<b>10.26</b>
	EM works	85.50	0.00	0.00	0.00	0.00	5.13	5.13	10.26	<b>10.26</b>
<b>9</b>	<b>Security</b>									
	Civil works	8.02	0.00	0.00	0.00	0.00	0.48	0.48	0.96	<b>0.96</b>
	EM works	1.91	0.00	0.00	0.00	0.00	0.11	0.11	0.23	<b>0.23</b>
<b>10</b>	<b>Intermodal Integration</b>	81.00	0.00	0.00	0.00	0.00	4.86	4.86	9.72	<b>9.72</b>
<b>11</b>	<b>Rolling stock</b>	480.00	9.89	18.17	18.17	46.23	17.28	17.28	34.56	<b>80.79</b>
<b>12</b>	<b>Rent on Temporary Land</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.00</b>
<b>13</b>	<b>General Charges</b>	186.46	0.00	0.00	0.00	0.00	16.78	16.78	33.56	<b>33.56</b>
<b>14</b>	<b>Total</b>	<b>3915.73</b>	<b>35.11</b>	<b>64.51</b>	<b>64.51</b>	<b>164.13</b>	<b>199.64</b>	<b>199.64</b>	<b>399.27</b>	<b>563.40</b>
<b>Total Central GST &amp; Basic Customs duty</b>									<b>299.26</b>	
<b>Total State GST</b>									<b>264.15</b>	
<b>Total Taxes &amp; Duties</b>									<b>563.40</b>	

# 19. FINANCIAL ANALYSIS & NON FARE BOX REVENUE ASSESSMENT

## 19.1 INPUT FOR THE ANALYSIS

The financial analysis has been carried out for the proposed Metro corridor. Project cost includes various associated costs in terms of:

- Capital cost of project
- Operation and Maintenance Costs
- Replacement and capital cost for capacity augmentation

Capital cost of project includes design, civil works, electrical works of traction & power supply, signal and telecommunication, rolling stock and maintenance depot. O&M cost is based on costs of functioning of Delhi, Bangalore and Chennai Metro.

### 19.1.1 Capital Cost

The cost of land is estimated at **Rs. 208.52 Crore** including Rs. 205.14 Crores for private land and Rs. 3.38 Crores for government land. The cost of R&R is estimated to be **Rs 2.90 Crore**. The total cost of project including land and R&R cost but excluding taxes and duties is estimated at **Rs. 4244.62 Crore**. The Central GST, Basic Customs Duty and State GST amounts to **Rs. 563.40 Crore**. The capital cost components at Sept'2021 prices are given in **Table 19.1**.

**TABLE 19.1: CAPITAL COSTS**

Cost Component	Amount (Rs. in Crore)
Construction Cost excluding GC, Contingencies, Land and R&R	3729.26
Land Cost	208.52
R & R incl. Hutments	2.90
General Charges and Contingencies	303.93
<b>Construction Cost including land and R&amp;R, GC and contingencies</b>	<b>4244.62</b>
<b>Taxes</b>	<b>563.40</b>
Central GST & Basic Customs Duty	299.26
State GST	264.15
<b>Total Cost including Taxes &amp; Duties</b>	<b>4808.02</b>

### 19.1.2 Completion Cost

Considering the length Gurgaon Metro, it is expected that the construction will take 4 years, so the operation can start by Year 2026. The phasing of expenditure of 4 years is considered in the ratio 10:30:35:25. For financial analysis both Govt and private land costs have been considered and acquisition of land will require payouts in initial years, land acquisition would be completed in two years with cost phasing of 50:50. It is proposed to start land acquisition and construction work in Year 2022 and commission the system by Year 2026.

With escalation factor of 5% p.a. (on all costs excluding taxes<sup>1</sup>, land and R&R), the Completion Cost of the project including taxes & duties but without land and R&R, IDC and Front End Fee is estimated to be **Rs. 5419.18 Crore** and with taxes & duties it is estimated at **Rs. 5758.46 Crore**.

The details of completion cost under different scenarios are as per **Table 19.2**.

**TABLE 19.2: DETAILS OF COMPLETION COSTS (Rs in Crore)**

Particulars	Completion Cost
Cost without taxes & duties, w/o Land and R&R and w/o contingencies	4364.23
Cost of Contingencies	117.47
Cost of Central and State Taxes	563.40
Cost of Land and R&R	211.42
Cost excl. Land and R&R & w/o Contingencies but with Central & State Taxes	<b>4927.63</b>
<b>Cost with Central &amp; State taxes, Contingencies and Land and R&amp;R</b>	<b>5256.53</b>

The details of escalation in basic cost of project from 2022 price levels to 2025 price levels is shown in **Table 19.3** below.

**TABLE 19.3: COMPLETED COST OF PROJECT**

FY	Cost at Sept 2021 Levels	Escl. Factor <sup>2</sup>	Completion Cost with escalation	Progress
	Construction Cost (excl. Tax, Land, R&R, Contingencies)		Construction Cost (excl. Tax, Land, R&R, Contingencies)	
2022	391.57	1.0222	400.25	10%
2023	1174.72	1.0733	1260.79	30%
2024	1370.50	1.1271	1544.68	35%
2025	978.93	1.1834	1158.51	25%
<b>Total</b>	<b>3915.73</b>		<b>4364.23</b>	<b>100%</b>

<sup>1</sup> In reference to PIB OM No. 30(07)/PFC.1/2022 dt. 14.12.2022

<sup>2</sup> Escalation factor from Sept 2021 onwards is calculated as  $(1+5\%)^{\wedge(\text{April (year)} - \text{Sept 2021})}$  (in years). For example, escalation factor applicable for FY 2022 is  $(1+5\%)^{\wedge(\text{April 2022} - \text{Sept 2021})} = 1.05^{\wedge(6/12)} = 1.05^{\wedge 0.50} = 1.02$



### 19.1.3 Operation & Maintenance Costs Estimates

#### ➤ Basis of O&M Cost Estimates

The O&M Cost has three major components which include:

- Manpower Cost
- Energy Cost
- Maintenance Cost

The O&M staff has been considered at 35 persons per route km. The average salary of the staff is assumed to be 8.47 lakhs per annum for the year 2019. The escalation factor used for staff cost is taken at 9% per annum to provide for growth in salaries.

The maintenance expenses for the Gurgaon Metro have been considered at Rs. 1.82 Cr/km in the year 2019. The escalation factor used for maintenance expense is taken as 5% per annum

The energy cost has been calculated as per the train operation plan (explained in detail in Chapter 8).

Several measures have been proposed for the Gurgaon Metro which will help in reduction of O&M cost. These include:

- Use of energy efficient LED lights in place of conventional lights.
- Installation of solar panels on the rooftops of all elevated stations and the sheds of the depot. The solar energy harnessing is proposed with RESCO model as adopted in various metro projects. Fixed tariff as per the power purchase agreement shall be applicable for a period of 20-25 years. This shall result in savings in energy cost due to use of solar energy.
- Preventive maintenance schedule as given in Maintenance depot chapter shall be followed so as to reduce the number of breakdowns. This will ensure the smooth operation of the trains.
- CBTC (Communication Based Train Control) Signaling system has been proposed which will enable the trains to operate with high frequency and improve the operational capability of the system.
- Outsourcing of various activities like ticketing, crowd control, housekeeping etc.

#### ➤ O&M Cost Estimates

Based on above principles, O&M Cost for this corridor has been worked out and shown in **Table 19.4**. The total O&M cost in the year 2026 is estimated at **Rs. 251.17 Crore**. The total O&M cost in the year 2031 is estimated at **Rs. 377.81 Crore**. The Table also gives the requirement of Additional and Replacements costs as well.

To cater to increased traffic demand, additional Rolling Stock would be required. Additional investment of **Rs. 994.70 Crore** in the Year 2031, **Rs. 641.93 Crore** in Year 2041 has been estimated. The replacement cost for Electrical and S&T Assets of the corridors is estimated to be **Rs. 1910.29 Crore** in the year 2045.

**TABLE 19.4: OPERATION AND MAINTENANCE COSTS WITH ESCALATION**

Year	Staff Cost Escl @9%	Maintenance Expenses Escl @5%	Energy Charges Escl @5%	Total O&M Cost	Addition/ Replacement Cost (Cr.)
2026	130.06	66.20	54.91	251.17	
2027	141.77	69.51	61.46	272.74	
2028	154.53	72.99	68.53	296.05	
2029	168.44	76.64	76.14	321.22	
2030	183.60	80.47	84.33	348.40	
2031	200.12	84.49	93.20	377.81	702.14 (Addition of 72 coaches)
2032	218.13	88.71	99.76	406.60	
2033	237.76	93.15	106.77	437.68	
2034	259.16	97.81	114.17	471.14	
2035	282.48	102.70	122.06	507.24	
2036	307.90	107.84	130.47	546.21	
2037	335.61	113.23	139.39	588.23	
2038	365.81	118.89	148.87	633.57	
2039	398.73	124.83	158.99	682.55	
2040	434.62	131.07	169.70	735.39	
2041	473.74	137.62	181.11	792.47	1248.20 (Addition of 105 coaches)
2042	516.38	144.50	193.24	854.12	
2043	562.85	151.73	206.12	920.70	
2044	613.51	159.32	219.86	992.69	
2045	668.73	167.29	234.41	1070.43	1503.92 Replacement of 25% of Elec. & 50% S&T assets
2046	728.92	175.65	249.87	1154.44	
2047	794.52	184.43	266.30	1245.25	
2048	866.03	193.65	283.71	1343.39	
2049	943.97	203.33	302.24	1449.54	
2050	1028.93	213.50	321.93	1564.36	
2051	1121.53	224.18	342.82	1688.53	
2052	1222.47	235.39	364.95	1822.81	

Year	Staff Cost Escl @9%	Maintenance Expenses Escl @5%	Energy Charges Escl @5%	Total O&M Cost	Addition/ Replacement Cost (Cr.)
2053	1332.49	247.16	388.45	1968.10	
2054	1452.41	259.52	413.39	2125.32	
2055	1583.13	272.50	439.91	2295.54	

## 19.2 MEANS OF FINANCE

The Revenue for this corridor of Gurgaon metro will mainly consists of fare box collection and revenue from other non-fare box sources such as property development, advertisement, parking, taxes etc. Estimation of revenue from fare box and non-fare box source has been made.

### 19.2.1 Fare Box Revenue

#### ➤ Projected Traffic Demand

The ridership on this proposed corridor of Gurgaon metro system has been estimated at 4.17 Lakh passenger trips per day in the year 2026. The ridership figures for key horizon years are given in **Table 19.5**.

**TABLE 19.5: EXPECTED METRO RIDERSHIP IN HORIZON YEARS**

Year	Passenger Trips per day (Lakh)
2026	4.17
2031	7.26
2041	8.81
2051	10.70

#### ➤ Trip Length Distribution

The trip length distribution has been taken on the basis of the available details on land use, corridor composition and existing traffic characteristics in the catchment areas of various sections of the corridor. The trip length distribution is given in **TABLE 19.6**.

**TABLE 19.6: TRIP LENGTH DISTRIBUTION**

Trip Length (Km)	Year 2026	Year 2031	Year 2041
0-2	9.63%	9.41%	9.03%
2-5	19.72%	21.08%	21.13%
5-12	43.39%	45.68%	46.69%
12-21	24.02%	21.11%	20.61%
21-36	3.24%	2.72%	2.53%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### ➤ Fare Structure

**Table 19.7** gives the fare structure proposed for this corridor of Gurgaon Metro and is based on the fare structure of DMRC. Assuming fare revision of 5% every 2 years starting from year 2020, fare structure for Gurgaon Metro for horizon years has been worked out.

**TABLE 19.7: FARE STRUCTURE FOR DELHI METRO 2019-2020**

DISTANCE SLAB (KM)	FARE IN RS.
0-2	10
2-5	20
5-12	30
12-21	40
21-36	50

### 19.2.2 Non Fare Revenue

Non-fare sources of revenue incorporated in financial analysis are as follows:

- Advertisement a) in stations, b) inside and outside trains
- Rental from Kiosks inside the stations
- Film shooting Charges
- Telecom cable & Tower license fee
- Semi-naming Rights of Stations

The assumptions of unit rates and rates of increase are tabulated in **TABLE 19.8**.

**TABLE 19.8: RATES FOR NON FARE BOX REVENUES**

Type of Revenue	Unit Rate (Rs)	Rate of Increase (%)
Advertising panels inside and outside stations	2,500 per sqm per month	5% every year
Train wrap (Outside for 30% of Train Racks)	30 lakh per train wrap per month	5% every year
Advertisement inside train coach	25000 per coach per month	5% every year
Kiosk rentals	2000 per sqm per month	5% every year
Film shooting charges	Rs. 4 Lakh/ hour for inside Train/Station assumed for 8 hrs and once in 4 months i.e. 24 hrs in a year	5% every year
Telecom Cable & Tower license fee	2500 per Km per month for entire track length, 75000 per Km per month for underground section Telecom Tower License fees @Rs. 15000 per month for elevated stations	10% every 2 years
Semi-naming Rights of Stations	15 Lakh per station per month Assuming 50% stations given for semi-naming rights in 2025, 60% in 2031 and 70% in 2041	5% every year

Advertising in stations is proposed at following locations with areas as mentioned in **TABLE 19.9**.

**TABLE 19.9: ADVERTISING AREA**

S. No.	Place of Advertisement	Area of Advertising (in Sqm)
1	Elevated Stations Advt. (27 Stations)	9,746

Based on above parameters, revenue estimation from non-fare box sources has been made. The summary of non-fare revenue under the heads of advertisement receipts, rentals from kiosks, Film Shooting, Telecom Cable & Tower (License fees), and semi-naming rights is presented in **TABLE 19.10**.

**TABLE 19.10: NON FARE BOX REVENUE**

Revenue Stream	Total Revenues (in Rs. Crore)		
	2026	2031	2041
Advertisement Receipts	129	206	397
Rentals from Kiosks	5	6	9
Film Shooting Charges	1	2	3
Telecom Cable & Tower (License fees)	5	6	9
Semi naming Rights of Stations	36	52	100
<b>Total</b>	<b>175</b>	<b>271</b>	<b>518</b>

**19.2.3 Revenue from TOD**

The total revenue from TOD as estimated in previous chapter is given in **TABLE 19.11**.

**TABLE 19.11: TOTAL REVENUE FROM TOD (VCF)**

	Total Revenue (in Rs. Crore)		
	2026	2031	2041
Total Revenue from TOD	115	147	240

The year wise revenue from non-fare box sources including TOD up to 2054-55 is presented in **Table 19.12**.

**TABLE 19.12: TOTAL REVENUE FROM TOD & NON FARE BOX SOURCES**

Year	Total Revenue (Rs. In Crore)		
	Revenue from TOD (VCF)	Revenue from Non-Fare Box Sources	Total
2026	115	175	290
2027	121	184	305
2028	127	193	320
2029	134	203	336
2030	140	213	353
2031	147	271	418
2032	155	285	440

Year	Total Revenue (Rs. In Crore)		
	Revenue from TOD (VCF)	Revenue from Non-Fare Box Sources	Total
2033	162	299	462
2034	170	314	484
2035	179	330	508
2036	188	346	534
2037	197	364	561
2038	207	382	589
2039	217	401	618
2040	228	421	649
2041	240	518	758
2042	252	544	795
2043	264	571	836
2044	278	600	877
2045	291	630	921
2046	306	661	967
2047	321	694	1015
2048	337	729	1067
2049	354	765	1120
2050	372	804	1176
2051	391	844	1235
2052	410	886	1297
2053	431	930	1361
2054	452	977	1429
2055	475	1026	1501

#### 19.2.4 Total Revenue

The total annual revenue through the fare box and other sources for both the corridors is given in **Table 19.13**.

**TABLE 19.13: TOTAL REVENUE COLLECTION (Rs. In Crore)**

Source of Revenue	2026	2031	2041	2051
Fare Box Revenue	514	969	1504	2323
Non-Fare Box Revenue	290	418	758	1235
<b>Total Revenue</b>	<b>804</b>	<b>1387</b>	<b>2262</b>	<b>3558</b>

### 19.3 OPERATIONAL VIABILITY/FIRR

The FIRR for the project with capital costs including all taxes and revenues from fare box and non-fare box sources works out to be **14.07 %** for the base case and its detailed calculations are presented in **Table 19.16**.

FIRR under various scenarios has been computed and shown below in **Table 19.14**.

**TABLE 19.14: COST AND RIDERSHIP SENSITIVITY**

Scenario	FIRR
FIRR with Farebox, Advt. revenue and TOD revenue (" <b>base case</b> ")	14.07%
FIRR with Farebox, Advt. revenue but w/o TOD revenue	12.04%
FIRR with only Farebox	7.11%

#### 19.4 SENSITIVITY ANALYSIS

The FIRR of the project is sensitive to revenues, and capital costs. The sensitivity of the project with respect to these factors is given in **Table 19.15**. It can be seen that the project is more sensitive to ridership variations than to variations in costs.

**TABLE 19.15: COST AND RIDERSHIP SENSITIVITY**

Parameter	+5%	+10%	-5%	-10%
Capital Cost	13.57%	13.11%	14.61%	15.19%
Ridership	14.63%	15.18%	13.49%	12.89%

**TABLE 19.16: GURGAON METRO FIRR WITH ALL TAXES (RS. IN CRORE)**

Year	Completion Cost	Taxes and Duties	Additional Investment	Fare Box Revenue	Other income	Gross Revenue
2022	518	56	0	0	0	0
2023	1402	169	0	0	0	0
2024	1586	197	0	0	0	0
2025	1188	141	0	0	0	0
2026	0	0	0	514	290	804
2027	0	0	0	572	305	877
2028	0	0	0	664	320	984
2029	0	0	0	740	336	1076
2030	0	0	0	870	353	1223
2031	0	0	702	969	418	1387
2032	0	0	0	1038	440	1478
2033	0	0	0	1058	462	1520
2034	0	0	0	1127	484	1611
2035	0	0	0	1149	508	1657
2036	0	0	0	1235	534	1769
2037	0	0	0	1259	561	1820
2038	0	0	0	1357	589	1946
2039	0	0	0	1384	618	2002
2040	0	0	0	1475	649	2124
2041	0	0	1248	1504	758	2262
2042	0	0	0	1599	795	2394
2043	0	0	0	1630	836	2466



Year	Completion Cost	Taxes and Duties	Additional Investment	Fare Box Revenue	Other income	Gross Revenue	O&M Cost	Net Cash Flows
2044	0	0	0	1759	877	2636	993	1643
2045	0	0	1504	1793	921	2714	1070	140
2046	0	0	0	1922	967	2889	1154	1734
2047	0	0	0	1959	1015	2974	1245	1729
2048	0	0	0	2086	1067	3153	1343	1810
2049	0	0	0	2127	1120	3247	1450	1797
2050	0	0	0	2278	1176	3454	1564	1890
2051	0	0	0	2323	1235	3558	1689	1869
2052	0	0	0	2483	1297	3780	1823	1957
2053	0	0	0	2531	1361	3892	1968	1924
2054	0	0	0	2728	1429	4157	2125	2032
2055	0	0	0	2782	1501	4282	2296	1987
<b>Project IRR</b>								<b>14.07%</b>

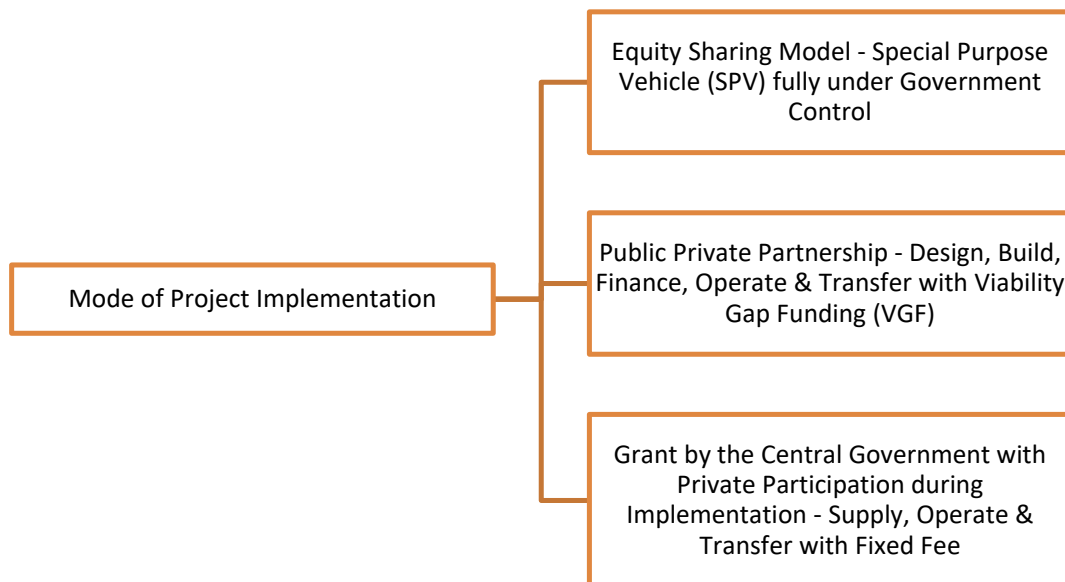
## 19.5 ALTERNATE MEANS OF FINANCING

The financing option for metro implementation depends upon selection of the dedicated agency created to implement the project. As per Metro Rail Policy '2017, the prominent models are:

- Equity Sharing Model (Special Purpose Vehicle fully under Government Control)
- Built, Operate & Transfer (BOT) or Public Private Partnership (PPP)
- Grant by the Central Government

Figure 19.1 presents the implementation models graphically.

**FIGURE 19.1: MODEL OF IMPLEMENTATION OF MRTS PROJECTS**



### 19.5.1 Equity Sharing Model (SPV Model)

Under this model, a Special Purpose Vehicle (SPV) is set up as a joint venture between Central Government and State Government for the implementation of the project and for its subsequent Operation & Maintenance. Under this arrangement Government of India and State Government make equal equity contribution and run SPV as a commercial enterprise. As per the prevalent practice, Central Government contribute 20% of the project cost as their equity contribution. An equal amount can be contributed by State Government aggregating the total equity to 40%. Remaining 60% is arranged as soft loan as ODA from bilateral/multilateral funding agencies. Delhi Metro Rail Corporation,

Bangalore Metro Rail Corporation, Chennai Metro Rail Corporation & Kolkata Metro Rail Corporation are some of the examples of success of such a SPV.

### 19.5.2 Public Private Partnership

As per Metro Rail Policy 2017, it is essential to explore private participation either for complete provisioning of metro rail or for some unbundled components of operations and maintenance costs of metro rail.

The fundamental principle underlying Public Private Partnerships (PPP's) as a development option for any infrastructure project is to combine the strengths of the private sector with those of the public sector in order to overcome challenges faced during construction & operation and to achieve better outcomes. The private sector can be expected to contribute to efficiency gains in the development of land, construction, operations and maintenance through the use of technology, better management and construction practices. In addition, the private sector should be expected to bring economies of scale from large projects and by involving a larger number of private partners.

However, the success of PPP will depend critically on designing PPP structures that make an appropriate allocation of risks, responsibilities, rewards and penalties, and create the incentives for value creation. Indeed, this risk allocation is the defining feature of the PPP strategy. The golden principle is that risks should be allocated to the entity best equipped to manage each risk. The expectation is that such an allocation of risks will not only produce the best possible program and project outcomes but also optimize costs. This should lead to good quality outcomes at optimum prices.

### 19.5.3 Grant by Central Government

Under this option Central Government would fund 10% of the project completion cost excluding private investment Land, R&R and state taxes. Remaining costs to be borne by state with Private sector participation.

**These models have been explored for implementation of this corridor of Gurgaon Metro.**

### 19.5.4 Case Studies of Private Sector Participation in MRTS in Indian Cities

Metro systems being planned in the cities of India have majorly adopted equity sharing model. Some of the cities have gone for private sector participation also. **Exhibits 19.1 to 19.4** give the examples of PPP in construction and operation of MRT system

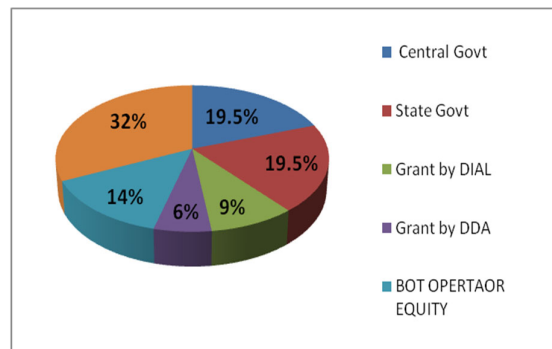
Some of the metro companies have involved private sector in O&M also. **Exhibits 19.5 to 19.7** give the examples of PPP in some of the O&M activities.

The involvement of private sector in O&M activities in case of Gurgaon Metro can be finalized at the time of operation.

#### EXHIBIT 19.1: DELHI AIRPORT LINE UNDER PPP MODEL

DMRC has implemented a High Speed Airport Link from New Delhi Railway Station to IGI Airport and further extension to Sector-21, Dwarka covering a distance of 22.7 KM with private sector participation. The project with an estimated cost of Rs. 3869 Crore has been implemented under a unique model of PPP where in the DMRC has undertaken the civil works with the funds being contributed by GoI, GNCTD, Delhi International Airport Limited and DDA (54%) and the cost of systems and Rolling Stock (46%) is being met by the private operator who will operate the system for 30 years, after which the system will revert back to DMRC. The approved funding pattern of the line is depicted in Figure 19-3. There have been some issues with the concessionaire and DMRC is now operating the system.

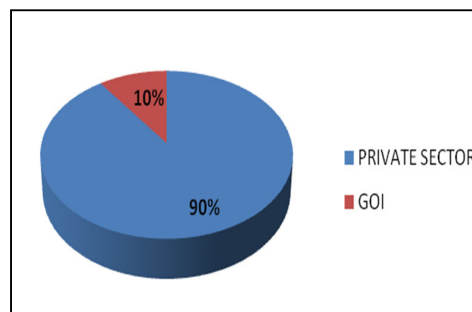
FIGURE 19.2 APPROVED FUNDING PATTERN OF DELHI AIRPORT LINE



#### EXHIBIT 19.2: HYDERABAD METRO UNDER PPP MODEL

Hyderabad Metro is the first PPP Metro Rail Project that has been sanctioned by Government of India. GoAP has undertaken the Hyderabad Metro Rail Project under Viability Gap Funding (VGF) scheme of GoI. The MRTS network include three high density traffic corridors with total length of about 71 km. The Project is being executed by L&T on design, build, and finance, operate and transfer (DBFOT) basis. GoAP will spend another ₹ 1,980 Crore towards land acquisition, R&R package, shifting of utilities and GoI will support the project with grant of ₹ 1,458 Crore as VGF. Figure 19-4 gives the funding plan of Hyderabad metro.

FIGURE 19.3 FUNDING PATTERN OF HYDERABAD METRO



**EXHIBIT 19.3: GURGAON METRO UNDER PPP MODEL**

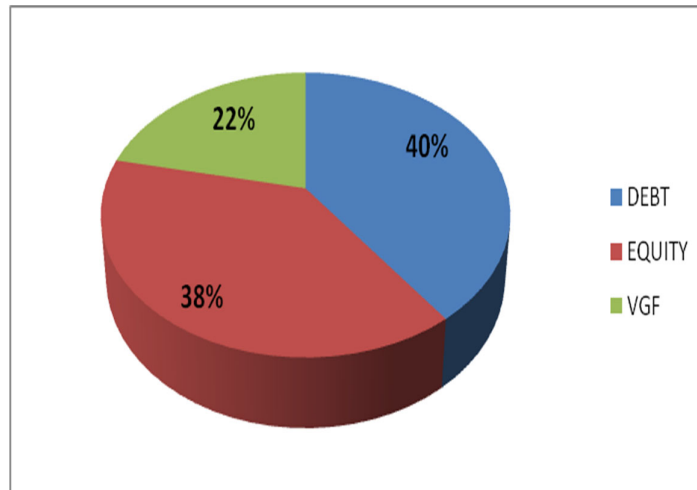
*Gurgaon's Rapid Metro project is India's first fully privately financed metro. With the project cost of Rs 1100 Crore, it has a network of 5.1 km connecting Cyber City, NH-8 & Sikanderpur Station (DMRC) in Phase I. The planned route for Rapid Metro acts as a feeder to the MRC's Jahangirpuri-Central Secretariat-HUDA City Centre (Yellow Line). A special purpose vehicle (SPV), Rapid Metro Rail Gurgaon Limited (RMGL) was formed to construct, operate and maintain the metro.*

**EXHIBIT 19.4: MUMBAI METRO LINE 1 & 2 UNDER PPP MODEL**

*In contrast to the SPV model adopted for construction of metro rail system in the city of Delhi, Bangalore, Chennai & Kolkata, the Maharashtra government has opted Build Own, Operate & Transfer (BOOT) model in the city of Mumbai.*

*So far, 2 lines covering a distance of 44 KMs (Line 1 of 11.07 KMs from Versova – Andheri - Ghatkopar with a total cost of Rs. 2356 Crore and Line 2 of 32 KMs from Charkop – Bandra – Mankurd with an estimated cost of Rs. 8250 Crore) have been awarded to private operator for construction and operation by giving Viability Gap Funding by GoI & Maharashtra State Government to the extent of Rs. 650 Crore and Rs. 1532 Crore for Line 1 & Line 2 respectively.*

*Mumbai Metro One Private Limited is a Joint Venture Company formed by Reliance Energy Limited, a Reliance ADA Group Company, Veolia Transport, France and Mumbai Metropolitan Region Development Authority (MMRDA) incorporated under the Companies Act, 1956 to implement this project. **Figure 19-5** gives the funding pattern of Mumbai Metro Line 1. Line 1 is now operational. There are some issues with the concessionaire and the implementation mechanism for Line 2 is being revisited.*

**FIGURE 19.4 FUNDING PATTERN OF MUMBAI METRO LINE 1**

**EXHIBIT 19.5: PPP IN O&M ACTIVITIES IN BANGALORE METRO**

*Bangalore Metro Rail Corporation Ltd (BMRCL) has signed a memorandum of understanding (MoU) with the Embassy Group to build the Kadubeesanahalli Metro station. Embassy Group will pay Rs 100 Crore to BMRCL in installments. The group is the first corporate to sign the agreement under the public-private partnership scheme.*

*The station, to be located just outside the Embassy Tech Village on the Outer Ring Road, will be on the recently approved 17-km North-South Metro corridor linking Silk Board Junction with Krishnarajapuram.*

*The construction will be done in accordance with the façade designs and specifications approved by BMRCL. The period of concession and permission granted to Embassy Group will be for 30 years starting from the date of commencement of commercial operations and could be extended further on mutual terms. The agreement mandates that the group will maintain Kadubeesanahalli Metro station, including housekeeping and maintenance, along with all the equipment, according to specifications laid down by the corporation.*

*The partnership also means the group will be entitled to utilize the pre-determined spaces for advertisements. Embassy can also use the leasable retail space measuring approximately 3,000 sq. ft at the Metro station. Embassy will also have the advantage of leveraging the linear zone of 250 metres around the Kadubeesanahalli Metro station.*

**EXHIBIT 19.6: PPP IN O&M ACTIVITIES IN LUCKNOW METRO - AFC**

*LMRC has tied up with M/s HDFC Bank for Fare Collection System and Provision of Allied Banking Application for Phase I (21 stations of North South Corridor of the project). The Bank was offered two options for partnership*

*Option 1 – Annual royalty payable by bidder to LMRC (including provisions of TVMs and RCTMs)*

*Option 2 – Annual royalty payable by bidder to LMRC (excluding provisions of TVMs and RCTMs)*

*The Royalty Shall increase by 20% on completion of every 3 years on an compounding basis.*

*M/s HDFC Bank opted for Option 2 i.e. Annual Royalty payable by Bidder to LMRC (excluding provisions of TVMs and RCTMs). HDFC Bank pays Rs. 1000 as Annual Royalty under option 2 to LMRC. While opting for option 2, following cost is being incurred by HDFC Bank in discharging the obligation.*

*Annual Manpower Cost (including dress) – Rs. 101.17 Lakh*

*Annual Cash Management Charges – Rs. 53.4 Lakh*

*Annual Maintenance Charges – Rs. 3.00 Lakh*

*Total - Rs. 157.54 Lakh*

*The above cost will be increased by approx 9% annually considering the inflation and other cost.*

**EXHIBIT 19.7: PPP IN O&M ACTIVITIES IN KOCHI METRO - AFC**

*Kochi Metro Rail Limited (KMRL) has signed a public-private partnership (PPP) pact with Axis Bank for the automated fare collection (AFC) system. Under the agreement, investment for the entire funding required for the AFC system will be undertaken by Axis Bank, which will also maintain it for 10 years. The bank will pay a royalty of Rs 209 Crore over the next 10 years for the right to be KMRL's partner in this endeavour. In return, Axis Bank will get the right to issue co-branded cards, which will function as a smart card as well as a ticket, to the users of the metro. In addition to this, 0.2 per cent of Axis Bank's gross revenue, from the utilisation of this card outside KMRL's ecosystem in various mercantile outlets and internet transactions, will also accrue to KMRL over the next 10 years.*

*The AFC system is a critical core component of any metro system. It includes complex hardware and software installed at entry points of metro stations as well as buses and boats. It uses radio frequency identification devices (RFID) to collect fares from the users. In such a system, the metro ticket can be in the form of a co-branded card or an NFC-enabled smart phone or a 'patch' on a mobile device or any other surface with NFC stickers or QR code, or even as a paper-coupon. The smart card can be linked with any bank account of the user, in any bank.*

*KMRL is planning a 'click and collect' system whereby the commuter will be able to order goods and services using this card, which can be delivered at all metro stations. It is also planning to start a drive for including a variety of local and national goods and services that can be accessed using the KMRL-Axis Bank co-branded card. In addition to the co-branded card, the bank will also develop a mobile app, which can be used for ticketing as well as e-commerce. This initiative is unique in that it is for the first time that 'open-loop' smart cards are being introduced in the metro system.*

**19.5.5 Equity Sharing Model (SPV Model) for Gurgaon Metro**

Under this model, a Special Purpose Vehicle (SPV) will be set up as a joint venture between Central Government and Government of Haryana for the implementation of the project and for its subsequent Operation & Maintenance. As per the prevalent practice, Central Government contribute 20% of the project cost excluding land and state taxes as its equity contribution. An equal amount will be contributed by State Government aggregating the total equity to 40%. In addition to equity, GoH will also fund the cost of land and state taxes. Remaining amount of 60% is to be taken as Term Loan from either Multilateral Agencies or Commercial Banks.

Since, metro projects are capital intensive and the terms of commercial banks are costlier, financing from multilateral agencies like JICA, WB or ADB is preferred as seen from numerous examples of funding of metro rail projects in India. The loan from these bilateral/ multilateral funding agencies as ODA loans

is being provided to GOI which in turn releases the same to SPV under a Pass Through Assistance (PTA) mechanism. Since the loan will be in foreign currency (USD or JPY), fluctuation in exchange rate at the time of repayment is considered to be borne by the Central Government and State Government in proportion of their shareholding. Alternatively, the funding agencies can release the loan to the SPV for which a sovereign guarantee will be required from Central Government, the cost of which at applicable rates (1.2% on external borrowings as per GFR 2017) shall have to be borne by the SPV. Foreign exchange variation in such eventuality will be borne either by the SPV or GoH. In either case loan shall be repaid by SPV from the income streams of metro operations.

The funding pattern developed under this model (SPV) is placed in **Table 19.17**. Equity Cash Flows (considering soft loan from multilateral funding agencies and excluding cost towards hedging of exchange rate risk) is placed at Annexure 19.1.

**TABLE 19.17: FUNDING PATTERN UNDER SPV WITH CENTRAL TAXES**

Source of Funding	Amount (Rs in Crores)	% Of contribution
Equity by GoI	746.56	16.66%
Equity by GoH	746.56	16.66%
SD by GoH for Central Taxes	149.63	3.34%
SD by GoI for Central Taxes	149.63	3.34%
Soft loan from multilateral agencies/Term Loan	2688.57	60.00%
<b>Total</b>	<b>4480.95</b>	<b>100.00%</b>
SD by GoH for Land and R&R	211.42	
SD by GoH for State Taxes	264.15	
<b>Total Cost</b>	<b>4956.52</b>	
SD by GoH for IDC and Front End Fee	60.73	
PPP Component (AFC for Stations)	135.47	
Contribution by Local Bodies	300.00	
<b>Total</b>	<b>5452.72</b>	

#### 19.5.6 Public Private Partnership – DBFOT with VGF for Gurgaon Metro

In this model, the private firm may be responsible for designing, building, operating and maintaining the entire project. Government of Haryana will bear the cost towards land including R&R irrespective of the model of PPP. The metro rail being a social sector project not many private parties are available to bid for such a project. Besides quite expectedly the private operator may



demand assured rate of return in the range of 16% to 18% or a comfort of guaranteed ridership.

The operation period by a private entity is considered as 30 years, Debt: Equity ratio for all financing by private entity is considered as 70:30, with long term cost of debt as 12% p.a. The Private Partner will develop the infrastructure with its own funds and funds raised from lenders at its risk (that is, it will provide all or the majority of the financing). The Private Partner is also responsible for operating (supply and running of rolling stock) and managing the infrastructure life cycle (assuming life-cycle cost risks) for a specified number of years. To carry out these tasks, the Private Partner, will usually create an SPV.

The bid parameter in such projects is either Premium (as percentage of revenues) if the funds coming from users are sufficient to cover O&M expenses and long-term maintenance with a surplus that can then be used as a source to repay the financing of the construction of the asset, and where no Bidder is offering a Premium, bidding parameter is the Grant required (as per VGF scheme of Government of India). The Grant/ Premium is computed for a target pre-tax equity IRR of private entity as 18%. Based on above, the funding pattern without additional income from PD is provided in **Table 19.18**. Equity Cash Flows to Concessionaire is provided in Annexure 19.2.

**TABLE 19.18: FUNDING PATTERN UNDER PPP – BOT WITH VGF**

Particulars	Amount	% of
	(Rs in Cr)	Contribution
VGF by Gol	594.22	10.27%
VGF by GoH	594.22	10.27%
Equity by Concessionaire	1157.00	20.00%
Concessionaire's Debt @ 12% p.a.	2699.66	46.66%
IDC (to be borne by Concessionaire)	740.48	12.80%
<b>Total</b>	<b>5785.58</b>	<b>100.00%</b>
Land and R&R by GoH	211.42	
PPP component (AFC installations) by private party	135.47	
<b>Total</b>	<b>6132.47</b>	

#### 19.5.7 Grant by the Central Government – Supply of System and O&M by Private Participation

Under this model, Government of Haryana will bear the cost towards land including R&R and state taxes. Central Government shall provide a grant of 10% and post-construction of civil assets by State Government the Private Partner installs the system (signaling and telecommunication assets), procures

rolling stock and operates and maintains all these assets. The State Government collects all the revenue and pays the Private Partner a monthly/annual payment for operations and maintenance of the system. The remuneration given could comprise of a fixed fee and a variable component, which would depend on the quality of service provided and the fixed fee is computed for a target pre-tax equity IRR of private entity as 18% which will be financed through the revenue generated in the project. For our analysis, a fixed fee escalated at long-term WPI i.e. 4% p.a. is considered. Equity Cash Flows to Private Partner is provided in Annexure 19.3. Based on above, the funding pattern is provided in **Table 19.19**.

**TABLE 19.19: FUNDING PATTERN UNDER FIXED FEE MODEL**

Particulars	Amount (Rs in Cr)	% of Contribution
Capital Contribution by Gol	478.10	10.00%
Capital Contribution by GoH	3102.07	64.88%
Equity by Concessionaire	360.24	7.53%
Concessionaire's Debt @ 12% p.a.	840.55	17.58%
<b>Total</b>	<b>4780.96</b>	<b>100.00%</b>
Land and R&R by GoH	211.42	
State Taxes by GoH	264.15	
IDC (to be borne by Concessionaire)	230.55	
PPP component (AFC installations)	135.47	
<b>Total</b>	<b>5622.55</b>	

The total fund contribution of Gol & GoH for the Gurgaon Metro corridor under analysis as per above alternatives excluding land and state taxes is tabulated in **Table 19.20**.

**TABLE 19.20: COMPARISON OF THREE IMPLEMENTATION MODELS (Rs. Crore)**

Particulars	SPV	VGF	Fixed Fee
Contribution by Gol	896.19	594.23	478.10
Contribution by GoH	896.19	594.23	3102.07
<b>Sub-Total</b>	<b>1792.38</b>	<b>1188.45</b>	<b>3580.17</b>
Land and R&R by GoH	211.42	211.42	211.42
State Taxes by GoH	264.15	0.00	264.15
IDC by GoH	60.48	0.00	0.00
<b>Total</b>	<b>2328.43</b>	<b>1399.87</b>	<b>4055.74</b>
<b>Present Value @8% of Net Cash Flow to Public Entity</b>	<b>5545.24</b>	<b>470.13</b>	<b>3484.34</b>

It can be seen from the above table that the return in terms of PV of Net cash flows to Government is highest in case of Fixed Fee model, however the contribution of

Government under Fixed Fee model is much higher than that under SPV model, contribution of Governments under SPV model is more than that of VGF and less than that of Fixed Fee model. Although under the VGF model, the contribution of Government is lowest, the entire revenues for the Concession Period are accruing to the Private Partner with no return on Government's contribution. Accordingly, based on a balance between Capital contribution by Govt. and Return to the Government, the SPV model is most preferable and therefore it is proposed that the project may be implemented on SPV Model. As per new Metro Rail Policy 2017, it is essential to explore private participation either for complete provisioning of metro rail or for some unbundled components of operations and maintenance costs of metro rail.

Accordingly, under SPV model for implementation of Gurgaon Metro project following activities have been identified for private participation:

- i) Private participation in Automatic Fare System by completely outsourcing operation of Ticket Operating Machines (TOMs), Ticket Vending Machines (TVMs) and Card Recharge Machines including Smart Cards provisions and Merchant Acquirer functions.
- ii) Maintenance contracts with System suppliers for Rolling Stock and Signaling systems in place of in house maintenance.
- iii) Station Civil and E&M maintenance and parking management.
- iv) Exploring long term lease of Elevators at Metro Stations

The cost of the AFC Installations to be borne by a private partner is estimated at **Rs. 121.24 Crore** at September-2021 price level which translates to completion cost of **Rs. 135.47 Crore** in the year 2026.

**ANNEXURE 19.1: EQUITY CASH FLOWS TO GOVERNMENT (EXCLUDING STATE TAXES) IN THE SPV MODEL**

Period	Construction Cost	Front End Fee	Net Revenue	Loan Opening Balance	Withdrawn	Interest	Principal Repayment <sup>3</sup>	Interest Repayment	Closing Balance	Equity CF
2022	574	5	0	0	0	1	0	0	0	-578
2023	1571		0	0	95	8	0	0	95	-1468
2024	1783		0	95	1481	18	0	0	1576	-284
2025	1329		0	1576	1113	28	0	0	2689	-188
2026	0		553	2689	0	32	0	0	2689	553
2027			604	2689		32	0	32	2689	572
2028			688	2689		32	0	32	2689	656
2029			754	2689		32	0	32	2689	722
2030			874	2689		32	0	32	2689	842
2031			1009	2689		32	0	32	2689	977
2032			1071	2689		31	134	31	2554	905
2033			1082	2554		30	134	30	2420	918
2034			1140	2420		28	134	28	2285	977
2035			1150	2285		27	134	27	2151	989
2036			1223	2151		25	134	25	2016	1063
2037			1232	2016		23	134	23	1882	1074
2038			1312	1882		22	134	22	1748	1156
2039			1319	1748		20	134	20	1613	1164
2040			1389	1613		19	134	19	1479	1236
2041			1470	1479		17	134	17	1344	1318
2042			1539	1344		15	134	15	1210	1390
2043			1545	1210		14	134	14	1075	1397

<sup>3</sup> ODA Loan is considered with financing terms are 10 years moratorium, 20 years repayment, 1.20% interest rate and 0.20% Front End Fee.

Period	Construction Cost	Front End Fee	Net Revenue	Loan Opening Balance	Withdrawn	Interest	Principal Repayment <sup>3</sup>	Interest Repayment	Closing Balance	Equity CF
2044			1643	1075		12	134	12	941	1496
2045			1644	941		10	134	10	807	1499
2046			1734	807		9	134	9	672	1591
2047			1729	672		7	134	7	538	1587
2048			1810	538		6	134	6	403	1670
2049			1797	403		4	134	4	269	1659
2050			1890	269		2	134	2	134	1753
2051			1869	134		1	134	1	0	1734
2052			1957	0		0	0	0	0	1957
2053			1924	0		0	0	0	0	1924
2054			2032	0		0	0	0	0	2032
2055			1987	0		0	0	0	0	1987
<b>Total</b>	<b>5257</b>	<b>5</b>			<b>2689</b>	<b>571</b>	<b>2689</b>	<b>484</b>		<b>21.43%</b>

**ANNEXURE 19.2: EQUITY CASH FLOWS TO CONCESSIONAIRE IN DBFOT WITH VGF MODEL**

Period	Capital Cost	Revenue	O&M Cost	Cash Flow before debt	Equity With drawn	Loan Opening Balance	With drawn	Interest	Principal Repay-ment	Interest Repay-ment	Closing Balance	Equity Cash Flow
2022	386	0	0	-386	386	0	0	0	0		0	-386
2023	1157	0	0	-1157	771	0	386	23	0		386	-794
2024	1350	0	0	-1350	0	386	1350	127	0		1735	-127
2025	964	0	0	-964	0	1735	964	266	0		2700	-266
2026	0	689	251	438	0	2700	0	324	0		2700	114
2027		756	273	483	0	2700	0	313	180	313	2520	-10
2028		857	296	561	0	2520	0	292	180	292	2340	89
2029		943	321	621	0	2340	0	270	180	270	2160	171
2030		1083	348	734	0	2160	0	248	180	248	1980	306
2031		1240	378	862	0	1980	0	227	180	227	1800	456
2032		1323	407	916	0	1800	0	205	180	205	1620	531
2033		1357	438	919	0	1620	0	184	180	184	1440	556
2034		1441	471	970	0	1440	0	162	180	162	1260	628
2035		1479	507	972	0	1260	0	140	180	140	1080	651
2036		1581	546	1035	0	1080	0	119	180	119	900	736
2037		1623	588	1035	0	900	0	97	180	97	720	758
2038		1739	634	1105	0	720	0	76	180	76	540	850
2039		1785	683	1102	0	540	0	54	180	54	360	868
2040		1896	735	1161	0	360	0	32	180	32	180	948
2041		2022	792	1230	0	180	0	11	180	11	0	1039
2042		2143	854	1288	0	0	0	0	0	0	0	1288
2043		2201	921	1280	0	0	0	0	0	0	0	1280
2044		2359	993	1366	0	0	0	0	0	0	0	1366
2045		2423	1070	1353	0	0	0	0	0	0	0	1353

Period	Capital Cost	Revenue	O&M Cost	Cash Flow before debt	Equity With drawn	Loan Opening Balance	With drawn	Interest	Principal Repay-ment	Interest Repay-ment	Closing Balance	Equity Cash Flow
2046		2583	1154	1428	0	0	0	0	0	0	0	1428
2047		2653	1245	1408	0	0	0	0	0	0	0	1408
2048		2815	1343	1472	0	0	0	0	0	0	0	1472
2049		2892	1450	1442	0	0	0	0	0	0	0	1442
2050		3082	1564	1518	0	0	0	0	0	0	0	1518
2051		3167	1689	1478	0	0	0	0	0	0	0	1478
2052		3369	1823	1546	0	0	0	0	0	0	0	1546
2053		3461	1968	1493	0	0	0	0	0	0	0	1493
2054		3705	2125	1580	0	0	0	0	0	0	0	1580
2055		3808	2296	1512	0	0	0	0	0	0	0	1512
<b>Total</b>	<b>3857</b>				<b>1157</b>		<b>2700</b>	<b>3170</b>	<b>2700</b>	<b>2430</b>		<b>18.0%</b>

**ANNEXURE 19.3: EQUITY CASH FLOWS TO PRIVATE ENTITY IN FIXED FEE MODEL**

Period	Capital Cost	Revenue (Fixed Fee)	O&M Cost	Cash Flow before debt	Equity With drawn	Loan Opening Balance	With drawn	Interest	Principal Repay ment	Interest Repay ment	Closing Balance	Equity Cash Flow
2022	120	0	0	-120	120	0	0	0	0		0	-120
2023	360	0	0	-360	240	0	120	7	0		120	-247
2024	420	0	0	-420	0	120	420	40	0		540	-40
2025	300	0	0	-300	0	540	300	83	0		841	-83
2026	0	489	251	238	0	841	0	101	0		841	137
2027		513	273	240	0	841	0	98	56	98	785	87
2028		539	296	243	0	785	0	91	56	91	728	96
2029		566	321	245	0	728	0	84	56	84	672	104
2030		594	348	246	0	672	0	77	56	77	616	112
2031		624	378	246	0	616	0	71	56	71	560	119
2032		655	407	248	0	560	0	64	56	64	504	128
2033		688	438	250	0	504	0	57	56	57	448	137
2034		722	471	251	0	448	0	50	56	50	392	144
2035		758	507	251	0	392	0	44	56	44	336	151
2036		796	546	250	0	336	0	37	56	37	280	157
2037		836	588	248	0	280	0	30	56	30	224	161
2038		878	634	244	0	224	0	24	56	24	168	165
2039		922	683	239	0	168	0	17	56	17	112	166
2040		968	735	232	0	112	0	10	56	10	56	166
2041		1016	792	224	0	56	0	3	56	3	0	164
2042		1067	854	213	0	0	0	0	0	0	0	213
2043		1120	921	199	0	0	0	0	0	0	0	199
2044		1176	993	183	0	0	0	0	0	0	0	183
2045		1235	1070	165	0	0	0	0	0	0	0	165



Period	Capital Cost	Revenue (Fixed Fee)	O&M Cost	Cash Flow before debt	Equity With drawn	Loan Opening Balance	With drawn	Interest	Principal Repay ment	Interest Repay ment	Closing Balance	Equity Cash Flow
2046		1297	1154	142	0	0	0	0	0	0	0	142
2047		1362	1245	116	0	0	0	0	0	0	0	116
2048		1430	1343	86	0	0	0	0	0	0	0	86
2049		1501	1450	52	0	0	0	0	0	0	0	52
2050		1576	1564	12	0	0	0	0	0	0	0	12
2051		1655	1689	-34	0	0	0	0	0	0	0	-34
2052		1738	1823	-85	0	0	0	0	0	0	0	-85
2053		1825	1968	-143	0	0	0	0	0	0	0	-143
2054		1916	2125	-209	0	0	0	0	0	0	0	-209
2055		2012	2296	-284	0	0	0	0	0	0	0	-284
<b>Total</b>	<b>1201</b>				<b>360</b>		<b>841</b>	<b>987</b>	<b>841</b>	<b>756</b>		<b>18%</b>

**ANNEXURE 19.4: BREAK UP OF CAPITAL COST**

<b>S. No.</b>	<b>Item</b>	<b>Amount (Rs. in Cr.)</b>
1	Alignment and Formation	1150.97
2	Station Buildings incl. Civil works, EM works, Finishes	756.00
3	Depot including civil, EM, Machinery & plants, general works	80.00
4	P-Way for main line, depot and depot connectivity	212.33
5	Traction & power supply	382.88
6	Signaling and Telecom	393.20
7	Environmental	11.97
8	Misc. Utilities	171.00
9	Capital Expenditure on Security	9.92
10	Capital Expenditure on Inter modal integration including Footpath for pedestrians	81.00
11	Rolling Stock	480.00
<b>12</b>	<b>Total Cost at Sept-2021 price levels except Land, R&amp;R, Contingencies, Central &amp; State Taxes</b>	<b>3729.26</b>
13	General Charges incl. Design charges (Civil+EM works) @ 5% on all items except Land & R&R	186.46
14	Contingencies @ 3 %	117.47
<b>15</b>	<b>Total Cost at Sept-2021 price levels (except Land, R&amp;R, Central &amp; State Taxes, IDC and PPP cost)</b>	<b>4033.20</b>
16	Escalation at 5% p.a	448.50
<b>17</b>	<b>Total Cost with Escalation (excluding Taxes, Land, R&amp;R and Contingencies)</b>	<b>4481.70</b>
18	Central Taxes including basic customs duty	299.26
<b>19</b>	<b>Total Cost including Central Taxes (excluding Land, R&amp;R and State Taxes) at Sept 2021 price levels (15+18)</b>	<b>4332.45</b>
<b>20</b>	<b>Total Cost including Central Taxes (excluding Land, R&amp;R and State Taxes) with escalation at 5% p.a. (17+18)</b>	<b>4780.96</b>
21	Land Cost	208.52
22	R&R Cost	2.90
23	Total of Land and R&R Costs	211.42
24	State Taxes at Sept 2021 price levels	264.15
<b>25</b>	<b>Total Cost with Central and State Taxes including Land and R&amp;R but excluding PPP component (AFC installations) at Sept 2021 Price Levels (19+23+24)</b>	<b>4808.02</b>
<b>26</b>	<b>Total Cost with Central and State Taxes with escalation @ 5% p.a including Land and R&amp;R but excluding PPP component (AFC installations) (20+23+24)</b>	<b>5256.52</b>
27	PPP component (AFC installations)	135.47
28	Interest during Construction	55.35
29	Front End Fee	5.38
<b>30</b>	<b>Total Completion Cost incl. IDC, Front End Fee &amp; PPP Component (AFC Installations) (26+27+28+29)</b>	<b>5452.72</b>

## 20. ECONOMIC ANALYSIS

### 20.1 APPROACH AND METHODOLOGY FOR ECONOMIC ANALYSIS

The economic appraisal has been carried out within the broad framework of Social Cost – Benefit Analysis Technique. It is based on the incremental costs and benefits and involves comparison of project costs and benefits in economic terms under the “with” and “without” project scenario. In the analysis, the cost and benefit streams arising under the above project scenarios have been estimated in terms of market prices and economic values have been computed by converting the former using appropriate shadow prices.

This has been done to iron out distortions due to externalities and anomalies arising in real world pricing systems. The annual streams of project costs and benefit have been compared over the analysis period of 30 years to estimate the net cost / benefit and to calculate the economic viability of the project in terms of EIRR & ENPV.

#### 20.1.1 Evaluation Assumptions

Project horizon comprises of the construction and operation period of the rail based transit project. The annual streams of project costs and benefit have been compared over the analysis period of 30 years to estimate the net cost / benefit and to calculate the economic viability of the project in terms of EIRR. The key assumptions used in the evaluation are listed in **Table 20.1**.

**TABLE 20.1: KEY EVALUATION ASSUMPTIONS**

Parameter	Assumption
Price Level	September '2021
Construction period	4 Years
First year of operation of MRTS	2026
Daily to annual factor	340

#### 20.1.2 Development of Alternative Scenarios

The development of the two scenario starts with estimating the traffic and the modal share in these scenarios for the system. **Table 20.2** gives the estimated traffic and modal share in different horizon years for Metro. It can be seen that the total estimated demand in the year 2026 is about 33.36 Lakh which is

expected to rise to about 78.17 Lakh in the year 2051. In the year 2026, rail based transit system is expected to cater to about 5.34 Lakh trips per day which is expected to rise to about 8.98 lakh in the year 2051.

**TABLE 20.2: ESTIMATED DEMAND AND MODAL SHARE IN 'WITH' AND 'WITHOUT' SCENARIO**

Mode	Trips Without Mass Transport System				Trips with Mass Transport System			
	2026	2031	2041	2051	2026	2031	2041	2051
Bus	753287	1238074	1478406	1765391	656639	1061196	1263567	1542474
Car	307532	505447	603564	720726	261223	425980	506994	618511
2 Wheelers	1406472	2311624	2760351	3296184	1257755	2014982	2400260	2931888
Auto	868452	1427355	1704430	2035290	786121	1254245	1494365	1825883
HMRTC Metro (Gurugram)	-	-	-	-	374006	726098	881563	898833
Total	3335744	5482500	6546750	7817590	3335744	5482500	6546750	7817590

## 20.2 ESTIMATION OF ECONOMIC COST OF MRTS

The economic costs of the capital works and annual operation and maintenance costs have been calculated from the financial cost estimates by excluding:

- Price contingencies/price escalations
- Import duties and taxes
- Sunk costs
- Interest payment, principal payment and interest during construction period

The economic costs (**Table 20.3**) have been derived from financial costs using following shadow price factor for each component to take care of the distortions brought by above factors.

**TABLE 20.3: FACTORS USED FOR CONVERTING PROJECT COSTS TO ECONOMIC COSTS**

S. No	Item	Factor
1	Capital Cost	0.83
2	Operations & Maintenance Cost	0.87

**Table 20.4** and **Table 20.5** give the capital and O&M costs of the system at September '2021 Price levels in financial and economic terms respectively.

**TABLE 20.4: FINANCIAL COSTS OF MRTS - CAPITAL AND O&M**

Cost Component	Metro (Rs. in Crore)
Capital Cost Including Land and R&R	4244.62
Taxes and Duties	563.40
O&M Costs	
• 2026	251.17
• 2031	377.81
• 2041	792.47
• 2051	1688.53

**TABLE 20.5: ECONOMIC COSTS OF MRTS - CAPITAL AND O&M**

Cost Component	Metro (Rs. in Crore)
Capital Cost Including Private land and R&R	4241.24
O&M Costs	
• 2026	179.41
• 2031	193.57
• 2041	204.60
• 2051	215.62

### 20.3 ECONOMIC BENEFITS OF MRTS

Gurugram Metro will yield tangible and non-tangible savings due to equivalent reduction in road traffic and certain socio-economic benefits. The introduction of MRTS will result in reduction in number of buses, IPT, usage of private vehicles, air pollution and increase in the speed of road-based vehicles. This, in turn, will result in significant social benefits due to reduction in fuel consumption, vehicle operating cost and travel time of passengers. Reduction in accidents, pollution and road maintenance costs are the other benefits to the society in general. The benefit stream includes:

- Savings in Capital and operating cost (on present congestion norms) of carrying the total volume of passenger traffic by existing modes in case MRTS project is not taken up.
- Savings in operating costs of different modes due to de-congestion including those that would continue to use the existing transport network even after the MRTS is introduced.
- Savings in time of commuters using the MRTS over the existing transport modes because of faster speed of MRTS.

- Savings in time of those passengers continuing on existing modes, because of reduced congestion on roads.
- Savings on account of prevention of accidents and pollution with introduction of MRTS.
- Savings in road infrastructure and development costs that would be required to cater to increase in traffic, in case MRTS is not introduced.

The Quantification of some of the social benefits has not been attempted because universally acceptable norms do not exist to facilitate such an exercise. However, it has been considered appropriate to highlight the same, as given below:

- Reduced road stress
- Better accessibility to facilities in the influence area
- Economic stimulation in the micro region of the infrastructure
- Increased business opportunities
- Overall increased mobility
- Facilitating better planning and up-gradation of influence area
- Improving the image of the city

Following factors have been used for converting project benefits to economic costs (Table 20.6).

**TABLE 20.6: FACTORS USED FOR CONVERTING PROJECT BENEFITS IN TERMS OF ECONOMIC COSTS**

S. No	Item	Factor
1	Savings in Capital & Operating Cost of Buses	0.83
2	Savings in Capital & Operating cost of Private Vehicles	0.83
3	Savings in Passenger Time	1.0
4	Savings in VOC	0.9
5	Savings in Accident Costs	0.9
6	Savings in Pollution Costs	1.0

### 20.3.1 Input Parameters

Inputs used for Economic analysis have been collected from primary and secondary data sources. Vehicle Operating cost (VOC) and Value of Travel Time (VOT) are the two important parameters of Economic Analysis.

**Vehicle Operating Cost (VOC):** VOC is a function of speed, road roughness, carriageway, width/capacity, rise and fall per unit. The VOC unit cost have been

taken from the “Manual on Economic Evaluation of Highway Projects in India, 2009” by the Indian Road Congress (IRC).

The VOC has been adjusted for Gurugram according to the traffic, road conditions, fuel cost in the city as recommended in the manual. **Table 20.7** gives the mode wise VOC to estimate benefits accruing to the society from the project.

**TABLE 20.7: MODE WISE VOC FOR GURUGRAM**

Mode	VOC* Rs /Km
Car	6.7
2w	2.0
Auto	3.3
Bus	27.8

*\*Source IRC SP 30 (2009) Values brought to 2019 level*

**Value of Travel Time (VOT):** VOT is another important parameter of Economic Analysis. It refers to the cost of time spent on transport. It includes costs of both work and non-work trips. The value of travel time for MRTS passengers has been taken as that of deluxe bus. **Table 20.8** gives the mode wise VOT to estimate benefits accruing to the society from the project.

**TABLE 20.8: MODE WISE VOT FOR GURUGRAM MRTS**

Mode	Value of Travel Time Passenger/ Hour
Car	100
2w	50
Auto/Taxi	50
Bus	50
Metro	50

*\*Source RITES Primary Survey 2018*

Other operational parameters required to assess the savings in VOC and VOT, accidents, pollution for the system in the year 2051 are presented in **Table 20.9**.

**TABLE 20.9: MODE WISE OPERATIONAL PARAMETERS – METRO**

Mode	Average Lead KM	Veh-KM/ Day	Average Speed (Km/Hr)*		Occupancy
			Without MRTS	With MRTS	
Bus	7.94	200	13	17	40
Car	11.54	30	18	24	2.2

Mode	Average Lead KM	Veh-KM/ Day	Average Speed (Km/Hr)*		Occupancy
			Without MRTS	With MRTS	
2wh	8.42	20	18	24	1.1
Auto/Taxi	7.0	150	18	24	2.5

Source: RITES Primary Survey 2018, \* Derived from Transport Demand model

Other benefits that will accrue to the society include reduction in emission, savings due to reduction in accidents. The input for the benefit estimation from these parameters include the emission factors by vehicle category as given by CPCB (Table 20.10), vehicle and accident statistics and cost of accidents (Table 20.11) in Gurugram.

**TABLE 20.10: MODE WISE EMISSION FACTORS (Gram/Km)**

Vehicle Type/ Pollutant	CO	HC	NOX	PM	CO2
2-wheeler	1.4	0.7	0.3	0.05	28.58
Auto	2.45	0.75	0.12	0.08	77.89
Cars (incl. cabs)	1.39	0.15	0.12	0.02	139.52
Bus (incl. BRT)	3.72	0.16	6.53	0.24	787.72
Treatment Cost (Rs. /ton)	1,00,000	1,00,000	1,00,000	1,00,000	500

Source: Appraisal guidelines for Metro Rail Project Proposals MoHUA, GOI 2017

**TABLE 20.11: COST OF ACCIDENTS**

Type of Accident	Accident Cost (Rs.)	
	(2004 prices)*	(2019 prices)**
Cost of fatal accident	437342	909203
Cost of major accident	64256	133584
Cost of damage to Two wheelers	2286	4752
Cost of damage to Car	9763	20297
Cost of damage to buses in road accidents	32818	68226

Source: \*Appraisal guidelines for Metro Rail Project Proposals MoHUA, GOI 2017

\*\*derived using escalation factor of 5%

### 20.3.2 Estimation of Project Benefits

Quantifiable benefits accrued to the society owing to implementation of the Metro project include:

- Travel Time Savings
  - Travel Time Savings due to higher speed of MRTS project as compared to 'Without' project scenario.
  - Congestion reduction due to modal shift leads to fewer vehicles on roads. This also contributes to time savings of passengers travelling on other modes.
- Savings in Vehicle Operating Cost
  - Absence of vehicles on road due to modal shift passengers on MRTS



- Smoother operations of passenger trips of other mode vehicles owing to reduced congestion on roads.
- Savings from Accident Reduction
  - Reduction in fatal and injury accidents due less no of vehicles on roads
  - Savings in damage cost to vehicles involved in accidents.
- Savings from Pollution Reduction
  - Absence of vehicles on road due to modal shift passengers on MRTS
  - Less pollution due to reduced congestion on roads.
- Savings in Road Infrastructure Maintenance
  - With less no of vehicles on roads, expenditure on road maintenance is expected to go down. In the absence of data, a lump-sum expenditure of Rs. 48 Cr/ year has been assumed.

Above socio-economic benefits have been converted in money cost. With input from above tables, the accrued project benefits for Gurugram Metro during the frame work period of 30 years have been summarized in **Table 20.12**.

**TABLE 20.12: COMPARISONS OF SAVINGS FROM MRTS IN HORIZON YEAR – 2051**

S.NO	BENEFITS	MRTS	
		Amount (crore)	% Share
1	Travel Time Savings	697.20	42.89%
2	Savings in Vehicle Operating Cost	741.60	45.62%
3	Savings from Accident, Pollution & Road maintenance Reduction	186.80	11.49%
	<b>Total</b>	<b>1625.60</b>	<b>100%</b>

It is clear from the table that benefits irrespective of the system benefits are mainly come from saving of travel time by MRTS and road passengers (42.89%), VOC savings (45.62%), and Environmental benefit from emission reduction, accident reduction and road maintenance cost (together 11.49%).

## 20.4 EIRR FOR 30 YEARS

For deriving the values of economic indicators (EIRR, ENPV), cost and benefit stream has been constructed in terms of money value. The Toolkit on Finance and Financial Analysis 2013 by MoHUA, suggests that ENPV to be calculated on social cost of capital or government security rate. Accordingly, ENPV have been calculated on both the rates.

Metro Rail Policy 2017 prescribes 14% as acceptable EIRR rate for metro project, same has been considered as the social cost of capital. The government security rate in September '2021 is 6.20%. Accordingly, ENPV has been calculated based on these rates. The summary of the ENPV and EIRR is presented in **Table 20.13**. The cost and benefit streams for Metro system is presented in **Table 20.15**.

**TABLE 20.13: ECONOMIC RETURN PARAMETERS OF GURUGRAM METRO**

S.NO	PARAMETER	Metro
1	EIRR	21.79%
2	ENPV - Social cost of capital @14% - Government Security Rate@ 6.20%	Rs. 1931 Crore Rs. 9645 Crore

## 20.5 OUTCOME ON ECONOMIC VIABILITY

The project has EIRR more than 14%, indicating that the benefits to the society are more than the social cost of capital of 14%. It also meets the acceptable norm of MoHUA. Thus, the project is economically viable and should be implemented.

### 20.5.1 Sensitivity Analysis

The sensitivity analysis has been carried out to see the impact of change in critical parameters in the range of 5% to 15% on EIRR and is presented in **Table 20.14**.

**TABLE 20.14: SENSITIVITY ANALYSIS**

S. No.	Factor	Range		
		5%	10%	15%
1	Cost overruns due to delay or other factors	21.02	20.30	19.64
2	Increase in Maintenance Cost	21.66	21.52	21.39
3	Reduction in Ridership	21.61	21.44	21.26
4	Reduction in benefits	21.35	20.90	20.44
5	Combination of reduction in benefits and increase in cost	20.59	19.46	18.41

TABLE 20.15: COST AND BENEFIT STREAM FOR METRO SYSTEM (IN CRORE)

PRICE LEVEL: September'2021

Year	Capital Cost	O&M Cost	Additional Cost + Replacement Cost	Total Cost	Saving in Capital Cost of Reduced Buses	Saving in Capital Cost of Reduced of other vehicles	VOC Saving of all vehicles	Savings due to Decongestion Effect	Savings in Passenger time	Savings due to Less pollution	Savings due to Less number of accidents	Savings in Infrastructure Maintenance due to Less number of accidents	Total Savings	Net Cash Flow (Rs. in Crore)
2022	352.02			352.0									0.0	-352.0
2023	1056.07			1056.1									0.0	-1056.1
2024	1232.08			1232.1									0.0	-1232.1
2025	880.06			880.1									0.0	-880.1
2026		156.1		156.1	42.1	641.8	185.3	133.7	303.76	53.5	5.7	48.6	1414.5	1258.4
2027		158.5		158.5	4.5	68.5	204.8	144.7	328.9	58.5	6.3	48.6	864.8	706.3
2028		161.0		161.0	4.5	68.5	226.4	156.7	356.0	64.0	7.0	48.6	931.7	770.7
2029		163.5		163.5	4.5	68.5	250.3	169.6	385.4	70.0	7.8	48.6	1004.7	841.2
2030		165.9		165.9	4.5	68.5	276.7	183.6	417.3	76.6	8.6	48.6	1084.4	918.4
2031		168.4	501.1	669.5	4.5	68.5	305.9	198.7	451.8	83.8	9.6	48.6	1171.3	501.8
2032		169.4		169.4	4.5	68.5	338.2	215.1	489.1	91.6	10.6	48.6	1266.2	1096.8
2033		170.3		170.3	4.5	68.5	344.7	218.9	497.7	93.3	10.8	48.6	1287.0	1116.6
2034		171.3		171.3	4.5	68.5	351.3	222.7	506.5	95.0	11.0	48.6	1308.1	1136.8
2035		172.2		172.2	4.5	68.5	358.0	226.6	515.4	96.7	11.2	48.6	1329.6	1157.4
2036		173.2		173.2	82.3	1258.7	364.8	230.6	524.5	98.5	11.4	48.6	2619.5	2446.3
2037		174.2		174.2	1.3	19.8	371.8	234.7	533.7	100.3	11.7	48.6	1321.9	1147.8
2038		175.1		175.1	1.3	19.8	378.9	238.8	543.2	102.2	11.9	48.6	1344.7	1169.5
2039		176.1		176.1	1.3	19.8	386.2	243.1	552.7	104.0	12.1	48.6	1367.8	1191.7
2040		177.0		177.0	1.3	19.8	393.6	247.3	562.5	105.9	12.3	48.6	1391.3	1214.3
2041		178.0	730.8	908.8	1.3	19.8	401.1	251.7	572.4	107.9	12.6	48.6	1415.3	506.5
2042		179.0		179.0	1.3	19.8	408.8	256.1	582.5	109.8	12.8	48.6	1439.7	1260.8
2043		179.9		179.9	1.3	19.8	411.6	261.3	594.2	111.4	12.9	48.6	1461.1	1281.2
2044		180.9		180.9	1.3	19.8	414.5	266.6	606.2	113.0	13.0	48.6	1482.9	1302.0
2045		181.8	405.7	587.5	1.3	19.8	417.3	272.0	618.4	114.5	13.1	48.6	1505.1	917.5

Year	Capital Cost	O&M Cost	Additional Cost + Replacement Cost	Total Cost	Saving in Capital Cost of Reduced Buses	Saving in Capital Cost of Reduced of other vehicles	VOC Saving of all vehicles	Savings due to Decongestion Effect	Savings in Passenger time	Savings due to Less pollution	Savings due to Less number of accidents	Savings in Infrastructure Maintenance due to Less number of accidents	Total Savings	Net Cash Flow (Rs. in Crore)
2046		182.8		182.8	94.0	1436.9	420.2	277.5	630.9	116.2	13.2	48.6	3037.4	2854.6
2047		183.8		183.8	0.8	12.5	423.2	283.1	643.6	117.8	13.2	48.6	1542.8	1359.0
2048		184.7		184.7	0.8	12.5	426.1	288.8	656.6	119.4	13.3	48.6	1566.1	1381.4
2049		185.7		185.7	0.8	12.5	429.1	294.6	669.9	121.1	13.4	48.6	1589.9	1404.3
2050		186.6		186.6	0.8	12.5	432.0	300.5	683.4	122.8	13.5	48.6	1614.2	1427.5
2051		187.6		187.6	0.8	12.5	435.0	306.6	697.2	124.6	13.6	48.6	1638.8	1451.2
2052		188.6		188.6	0.8	12.5	438.1	312.8	711.2	126.3	13.7	48.6	1663.9	1475.4
2053		189.5		189.5	0.8	12.5	441.1	319.1	725.6	128.1	13.8	48.6	1689.5	1500.0
2054		190.5		190.5	0.8	12.5	444.2	325.5	740.2	129.9	13.9	48.6	1715.5	1525.1
2055		191.4		191.4	0.8	12.5	447.3	332.1	755.1	131.7	13.9	48.6	1742.1	1550.6
2056		192.4		192.4	101.4	1549.0	450.4	338.8	770.4	133.6	14.0	48.6	3598.6	3406.2
													<b>EIRR</b>	<b>21.79%</b>
													<b>NPV@14%</b>	1,931
													<b>NPV@6.20%</b>	9,645