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LIST OF ACRONYMS

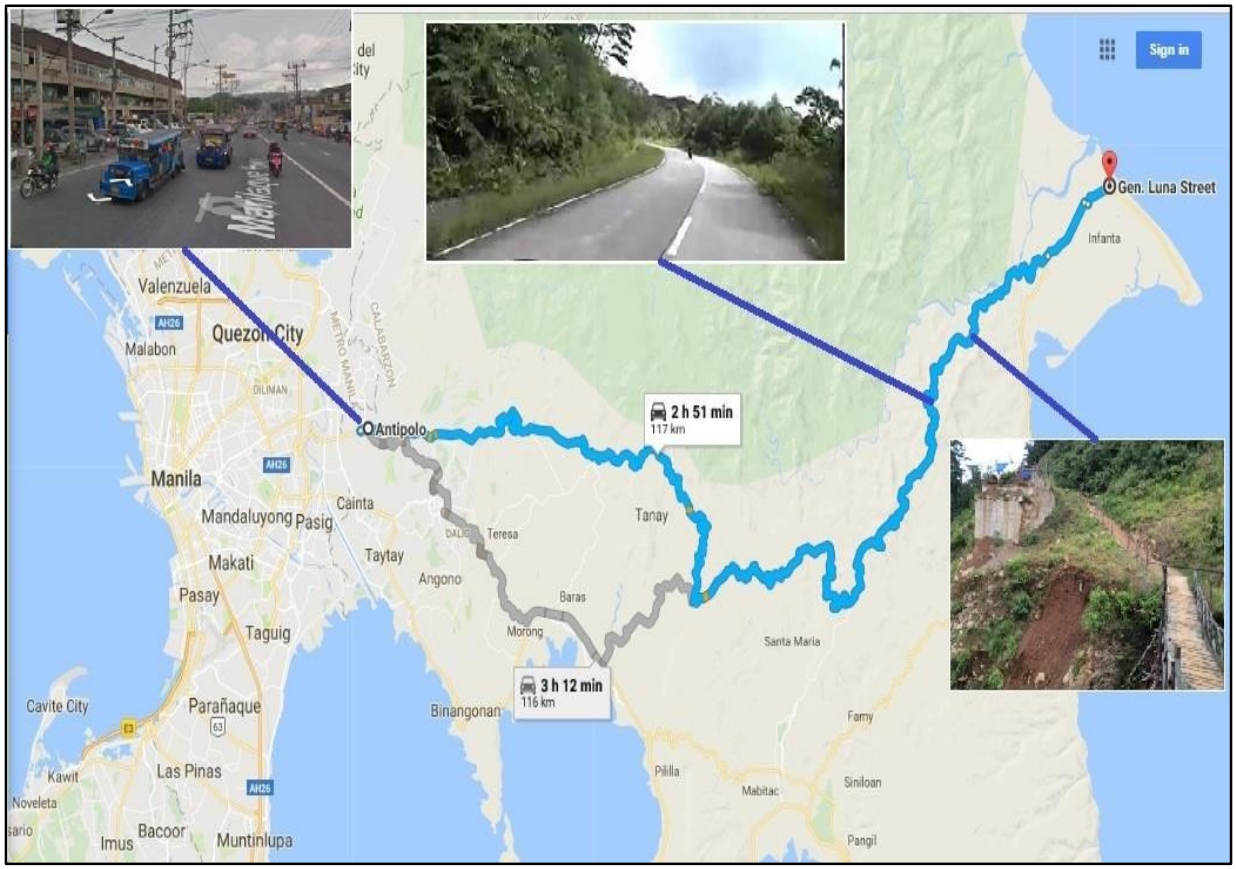
AADT	Annual Average daily traffic
CALABARZON	Cavite Laguna Batangas Rizal Quezon
DAC	Development Assistance Committee (OECD)
DENR	Department of Environment and Natural Resources
DOLE	Department of Labor and Employment
DPWH	Department of Public Works and Highways
GAA	General Appropriations Act
GDP	Gross Domestic Product
LGU	Local Government Unit
LTO	Land Transportation Office
LTFRB	Land Transportation Franchising and Regulatory Board
MARILAQUE	Manila Rizal Laguna Quezon
MIMAROPA	Mindoro (Occidental Mindoro and Oriental Mindoro), Marinduque, Romblon and Palawan.
MIR	Marikina – Infanta Road
MTPDP	Medium Term Philippine Development Plan
RDP	Regional Development Plan
PEZA	Philippine Export Processing Authority
REINA	Real, Infanta and General Nakar
SD	Single Difference
SPSS	Social Science Statistical Package
TGR	Traffic Growth Rates

EXECUTIVE SUMMARY

I BACKGROUND

The Marikina-Infanta Road Project commences at the junction of Sumulong Highway in Masinag, Antipolo City traversing the rugged terrain of Sierra Madre mountain range until it terminates at the intersection of Famy – Infanta Road (See ***Figure A***). The areas traversed by the road project contain vast tracts of land, wide forest, abundant water sources and beautiful scenic spots.

FIGURE A: DIRECT ROAD INFLUENCE AREA (RIA)



The road acts as a stimulus in the development of production areas and access to markets of produce particularly for agriculture, mining, logging, forestry and fishing. It also aims to provide infrastructure support to tourism in the coastal road network (region and project area).

II METHODOLOGY

The Study covers the period from pre-implementation before 2007 and post implementation after 2007 up to 2015 (prior to the collapse of the Querocep Bridge).

The Impact Study Team developed six hypotheses:

1. Hypothesis on relevance, effectiveness and efficiency of the road project;
2. Hypothesis on the improvement of quality of life, accessibility and mobility;
3. Hypothesis on the improvement of household socio-economic indicators;
4. Hypothesis on improvement of fiscal position of the local government;
5. Hypothesis on the impact of the project on the environment.
6. Hypothesis on the impact of the project on sustainability

Survey and Other Data Collection Methods

Data collection began in Infanta in the later part of October 2017. The survey, which separately covered households and firms/establishments, was completed in the second week of December 2017. The study team also conducted focus group discussions and key informant interviews.

Data Management

Data from the interviews were encoded using Microsoft Excel templates. The generated Excel worksheets were exported into a SPSS dataset, with variable descriptions incorporated accordingly. All computations were done in SPSS and were saved in a separate “do-file”. A do-file is a text-based file that is executed by SPSS when ran or called upon.

III STUDY RESULTS

Household Profile

- Survey covered 400 household respondents composed of 289 females (72%) and 111 males (28%)
- 366 or 92% of respondents started residence in the covered municipalities before 2011 or at pre-completion.
- 146 or 37% are more than 50 years old, 135 or 34% are between 26-40 years, 76 or 19% are 41-50 years old, 39 or 10% are18-25 years old, and 4 or<1% are less than 18 years old

- 206 respondents graduated from high school but only 106 pursued higher studies, with 19 graduating from college or vocational courses
- top five primary occupation are: (i) businessman (96 or 24%); (ii) private employee (31 or 8%); (iii) agricultural worker/farmer (28 or 7%); (iv) transport crew and skilled laborer (both at 23 or 6%); and, (v) government worker (19 or 5%)

Family Socio-Economic Profile

- On household assets: (a) 351 (88%) own the house they are residing in; (b) 245 (61%) own the lot where their house is built; (c) average distance of houses from the main road is 61.3 m; and, (d) 230 respondents (57%) own a vehicle

- On household income:

  a. Most families draw their income from: (i) salary/wages from non-farm employment of household members; (ii) business, rent, dividends, pension and remittances both local and abroad, and sales of assets; and, (iii) on-farm income from crops.
  b. At pre-completion, the overall average annual household income amounted to P101,381 while at post completion, the overall average annual income increased by 47% to P148,646

- On farm profile:

  a. 54 of the 400 households (14%) have at least a member engaged in farming for the past 12 months. Of the 54, 43% have been farming for less than 10 years, 22% are already farming from 11-20 years, while 35% are farming for more than 20 years.
  b. Land area cultivated is from less than one hectare to ten hectares with coconut, rice and bananas as the top three crops.
  c. At the time of the survey (2017), 100% of respondents who are farm workers/farmers said that they made a change in the main crops planted due to, among others: (i) climate change; (ii) increase in farm gate prices; (iii) increase in costs of farm inputs; and, (iv) increase in pest problems

Firm Profile

- Survey covered 103 respondents from an equal number of firms/establishments

- 43 firms/establishments (42%) were already in operation prior to the completion of the Marikina-Infanta Road Project in 2011, of which 9 have existed before the Project started in 1991; 42 firms/establishments (40%) were created after completion of the subject road, including 28 firms/establishments created after the collapse in December 2015 of the Querocep Bridge.
- Top five businesses where the respondents are engaged in are: (i) merchandising (19 respondents or 18%); (ii) transport services (17 or 17%); (iii) building materials (12 or 12%); (iv) traders (11 or 11%); and, (v) restaurant, and tourism related (hotel, inn, resort and other leisure) [both at 8 or 8%].
- Average number of employees in each firm/establishment, excluding the owner, is seven. Majority of the firms/establishments (81 or 79%) have 2 to 21 employees.
- About 43% of the firms/establishments has a maximum monthly income of P20,000.00. Estimated monthly expenditure was at the same level for 45% of the firms/establishments.

IV IMPACTS

1. **Intended Impacts**[1] (Relevance, Effectiveness and Efficiency of The Road Project)

   a) Relevance

   The Project remains highly relevant as it is still consistent with the current development programs, strategies and policies of the government. The project, as originally conceptualized, aimed to provide a major alternative route of transportation from the east to the west coasts of the country and specifically the twin ports of Infanta Port in the eastern seaboard facing the Pacific Ocean, and Manila Port in the Manila Bay. The CALABARZON Regional Development Plan (RDP) 2006-2010 considered the road as a major project that supports the Plan's East-West Connection Strategy, which was envisioned to stimulate growth in the area. The succeeding RDPs 2011-2016 and 2017-2022, likewise, confirmed the strategic importance of the road.

   b) Effectiveness

   The MIRP is comprised of 34% asphalt surface and 66% concrete surface. The terrain of MIRP is 75.84% mountainous, 23.78% rolling and only 0.38% is flat terrain. Since MIRP is predominantly mountainous, roadway alignment is restricted by occasional steep

1Intended impacts are identified in the feasibility study as the objectives of the road project

slopes. In mountainous sections, the slope or the longitudinal and transverse changes in the elevation of the ground are abrupt compelling passing trucks to reduce their speeds while travelling on some sections of roadway to avoid accidents. Trucks that do not reduce their speed while travelling on steep sections are prone to accident.

Decrease in traffic along the existing routes. The construction of MIRP resulted in diversion of some traffic from Manila East Road (MER) to the new road as a result of the improvement work which decongested the latter. Diverted traffic is the estimated volume of traffic presently passing the Manila East Road that diverted to the MIRP upon its opening.

Based on the Road Traffic Information Application (RTIA) 2008-2013 data of DPWH, the AADT in Manila East Road decreased while that of the Marikina – Infanta increased as shown in ***Table 4.2*** (page 15 of Main Report).

TABLE A: ROAD ELEMENT CONDITION PRE- AND POST-CONSTRUCTION[2]

ROAD ELEMENTS	SECTION 1		SECTION 2		SECTION 3		SECTION 4		SECTION 5	
	Pre	After	Pre	After	Pre	After	Pre	After	Pre	After
Length	19.66		8.3		22.15		59.51		5.46	
Carriageway width	6.7	6.7	6.0	6.7	3.35	6.0	3.35	6.0	6.0	6.0
Shoulder width	1.5	1.5	1.5	1.5	-	1.5	-	1.5	-	1.5
Drainage	Fair	Good	Fair	Good	Bad	Good	Bad	Good	Bad	Good
Slope condition (m/km)	10		25		Some sections are non-existing. Some are just gravel road opening	40	Some sections are non-existing. Some are just gravel road opening	40	25	
Vertical alignment (rise+fall) no./km	2		3			4		4	3	
Avg. Horizontal curvature deg/km	15		150			500		500	150	
Super-elevation	2.5		5			7		7	5	

The annual average daily traffic is shown in **Table B.**

TABLE B: ANNUAL AVERAGE DAILY TRAFFIC (AADT)

SECTION	SECTION LIMITS	PRE (2006)	2015	INCREASE
1	1 - 19.66	17,727	31,636	178%
2	19.66 – 27.96	2,848	4,830	170%
3	27.96 - 50.11	116	5,866	5057%
4	50.11 – 109.62	116	2,184	1883%
5	109.62 – 115.08	116	2,184	1883%

The significant increase in the AADT in Section 3, 4 and 5 were due mainly to the upgrading of the sections to concrete pavement that provided year-round and all-weather facility in the corridor to travelers.

The vehicle operating costs comparing the 'pre and post the project' (completed) are shown in **Table C**.

TABLE C: VEHICLE OPERATING COSTS

Derived Vehicle Operating Cost (VOC) from HDM4 Runs

Peso per Kilometer

Geometry	Section 1 : Mostly Straight and Gently Undulating						Section 3 & 4 : Winding and Severly Undulating						Other Sections : Bendy and Severly Undulating					
Vehicle	With Project			Base Case			With Project			Base Case			With Project			Base Case		
Type	R+F	Time	Total	R+F	Time	Total	R+F	Time	Total	R+F	Time	Total	R+F	Time	Total	R+F	Time	Total
Cars	5.45	2.26	**7.71**	5.71	2.25	**7.96**	6.97	1.26	**8.23**	5.86	3.52	**9.38**	6.29	1.71	**8.00**	5.79	2.95	**8.74**
Jeepneys	5.08	14.49	**19.57**	5.29	14.38	**19.67**	6.58	14.49	**21.07**	5.94	22.54	**28.48**	5.91	14.49	**20.40**	5.65	18.87	**24.52**
Buses	18.21	43.79	**62.00**	20.45	43.77	**64.22**	18.21	43.79	**62.00**	45.06	90.12	**135.18**	18.21	43.79	**62.00**	33.99	69.26	**103.25**
Truck 1	28.24	1.29	**29.53**	30.68	1.28	**31.96**	28.36	1.29	**29.65**	31.52	1.99	**33.51**	28.31	1.29	**29.60**	31.14	1.67	**32.81**
Truck 2	38.10	1.28	**39.38**	42.44	1.27	**43.71**	38.02	0.83	**38.85**	43.29	1.98	**45.27**	38.20	1.28	**39.48**	42.91	1.66	**44.57**
M. Cycle	4.06	0.68	**4.74**	4.17	0.68	**4.85**	4.06	0.68	**4.74**	7.93	1.36	**9.29**	4.06	0.68	**4.74**	6.24	1.05	**7.29**

The road is used for the following purposes, among others: (i) travel to/from work; (ii) travel to/from school; (iii) as public transport service; (iv) transporting farm and fish produce; (v) transporting other goods and commodities; and, (vi) other purposes. For passenger transport, the major type of vehicle used both at pre-completion and post completion is the tricycle. A marked increase of 122% in this type of transport is noted from pre-completion to post completion. Likewise, there was a huge increase of 78% in the number of vehicles used at pre-completion and post completion. As for cargo transport, the major mode of transport used at pre-completion was own vehicle (52%). At post completion, use of own vehicles almost doubled (87% increase). Most of the produce/goods are transported and sold in Metro Manila and its nearby municipalities (50% at pre-completion and 37% at post completion). The main/town market is also a venue for selling a significant part of the produce/goods (18% at pre-completion and 21% at post completion).

c) Efficiency

TABLE D: RESULTS OF BENEFIT-COST ANALYSIS USING HDM 4

SECTION	PROJECT COST (IN MILLION PESOS)	NPV (@10% SDR) (IN MILLION PESOS)
1	265.142	560.942
2	111.936	57.160
3	298.721	286.659
4	802.568	1,509.966
5	73.635	122.442
Overall	**1,552.002**	**1,748.642**

The economic returns as well as the timing of the improvements for all project sections were found to be satisfactory (economic rate of return of 28.5 percent). Even under a worst-case scenario assuming lower traffic growth and increase in costs due to the reconstruction of Querocep Bridge, the returns would have remained satisfactory (22.6 percent).

2. Accessibility and mobility

- On availability of transport: At pre-completion, 99% of respondents said that transportation is available for their travel purposes (87% available at daytime only, 11% available both on days and nights, and 1% available the whole day). At post completion, the perception is that availability of transport improved as follows: (i) available at daytime only (78%); (ii) available both day and night (17%); and (iii) available the whole day (3%).

- On safety of travel: At pre-completion, 84% said that travel is safe while 16% said it is not safe. At completion, perceived safety increased to 88%.

- On level of difficulty in traversing the road, there is a marked improvement in road satisfaction of transporters of cargo. At pre-completion, the major perception (53%) is that traversing the road is very difficult. The rest of respondents said that transporting cargo is manageable (7% not difficult and 40% somewhat difficult). At post completion, the positions were reversed with 86% saying that transporting cargo is manageable (56% not difficult and 32% somewhat difficult). Only 12% said that traversing the road is very difficult.

- The average distance from residence to the nearest market decreased from 13.25 km at pre-completion to 12.66 km. at post completion. This resulted in a travel time savings of about 15 minutes over the distance travelled, with travel time per kilometer shorter at post completion by almost a minute. However, cost per km increased by ₱0.85. Similar decreases in travel time and increases in travel cost were experienced going to other socio-economic services like hospitals, government offices or schools.

3. Impact at Household

- On household income: most families draw their income from: (i) salary/wages from non-farm employment of household members; (ii) business, rent, dividends, pension and remittances both local and abroad, and sales of assets; and, (iii) on-farm income from crops. At pre-completion, the overall average annual household income amounted to P101,381 while at post completion, the overall average annual income increased by 47% to P148,646

4. Impact on Local Government Economy and Finance

Agriculture

- 54 of the 400 households (14%) have at least a member engaged in farming for the past 12 months. Of the 54, 43% have been farming for less than 10 years, 22% are already farming from 11-20 years, while 35% are farming for more than 20 years. Land area cultivated is from less than one hectare to ten hectares with coconut, rice and bananas as the top three crops. At the time of the survey (2017), 100% of respondents who are farm workers/farmers said that they made a change in the main crops planted due to, among others: (i) climate change; (ii) increase in farm gate prices; (iii) increase in costs of farm inputs; and, (iv) increase in pest problems.

- Average crop production increased by 23% from 1.3 tons/ha. to 1.6 tons/ha. Higher input costs combined with cheaper farm gate prices resulted in a 5% decrease in the annual net income of farmers from an average of P18,130.50 at pre-completion to an average of P17,300.00 at post completion.

Tourism

- There were approximately 40,000 tourist arrivals in Infanta, of which about 5,000 stayed overnight and the rest are excursionists. Most excursionists and tourists cater to beaches and resorts. There are 39 establishments that cater to tourists needs.
- Tanay has been attracting excursionists at a rate of 3,000 a day. The surge of tourist arrival in Tanay is credited to the construction of the Project road. No information is available for the two other LGUs.

Note: Forecasting revenue from tourism may not be determined at this time due to lack of historical tourism data

5. Unintended Impacts

Impact of the project on the environment and social development

- In six environmental issues, namely: ((i) air pollution; (ii) contamination of drinking water; (iii) improper disposal of wastes; (iv) deforestation; (v) loss of wildlife; and, (vi) soil erosion, at least 42% up to a high of 77% saw no change brought about by the road project. On noise level, a huge percentage of respondents saw a change for the worse [worsened significantly (14%) and slightly worsened (40%)]. Significant worsening of the environment was seen to go no more than 5% in the other pre-identified problems.

- On social effects, particularly the issue of out-migration, some 69% of respondents saw no change. Of the remaining 31%, 4% had no comment, 12% saw slight or significant improvements, and 15% saw slight or significant change for the worse. A large number of respondents felt no change on the issue of illegal settlers (46%) and peace and order (48%). On illegal settlers, there was a divided view with improvements seen by 26% and a change for the worse felt by 20%. For land development for business, in-migration and community relationship, respondents who saw improvements outnumbered those who saw a change for the worse by at least 30% to as high as 84%.
- Based on the FGDs and KIIs, opening of MIRP yielded positive impacts like planting of trees and development of highlands. However, it also generated negative impacts like opening of protected areas, illegal logging and degradation of lowland Sta. Maria due to alteration of natural waterways, siltation, erosion, etc. Sta. Maria council deemed it necessary for DPWH to do corrective measures to the environmental damage.

6. Predictive Models

Total Tax Revenue

TTR = 7,292 -3.721X1 + 1.598X2 + 137.151X3 + 141.709X4 + 120.204X5 + 0.111X6 +0.030X7.

Where TTR, X_1, X_2...X_7 are coefficients as defined in the Table below.

Dependent variable TTR		**Total Tax Revenue**	
Coefficient	Description	Value	Interpretation (assuming all other variables are constant)
X_1	Year	-3.721	every year, the real property tax (RPT) decreases by 3.721 million assuming other factors are constant.
X_2	Pre or after project	1.598	project is present, the value of TTR increases by 1.598 million pesos
X_3	RPT of Municipality Infanta, Quezon in million pesos	137.151	TTR of Infanta is higher than the TTR increase of Antipolo by 137.151
X_4	RPT of Municipality Sta. Maria, Laguna in million pesos	141.709	TTR of Sta. Maria is higher than the TTR increase of Antipolo by 141.709
X_5	RPT Municipality Tanay, Rizal in million pesos	120.204	TTR of Tanay is higher than the TTR increase of Antipolo by 141.709
X_6	Total Average Annual	0.111	total average annual daily traffic

	Daily Traffic vehicles		(AADT) of 0.111 indicates that for every 1 unit increase in AADT, there is a corresponding 0.111 million pesos increase in TTR.
X_7	Maintenance GAA in Million Pesos	.030	A million peso Increase in the maintenance fund from GAA there is a corresponding increase in the TTR by 0.111 million pesos

Real Property Tax

RPT = 2,999.649 -1.483X1 + 3.544X2 – 49.047X3 – 43.988X4 – 43.996X5 + 0.046X6 +0.020X7

Where RPT, X_1, X_2...$X_7$are coefficients as defined in the table below

Dependent variable RPT		**Real Property Tax**	
Coefficient	Description	Value	Interpretation (assuming all other variables are constant)
X_1	Year	-1.483	Every year, the real property tax (RPT) decreases by -1.483 million for every year to the future assuming other factors are constant.
X_2	Pre or after project	3.544	project is present, the value of TTR increases by 3.544 million pesos
X_3	RPT of Municipality Infanta, Quezon in million pesos	-49.04	TTR of Infanta is lower than the TTR decrease of Antipolo by 49.04
X_4	RPT of Municipality Sta. Maria, Laguna in million pesos	-43.988	TTR of Sta. Maria is lower than the TTR decrease of Antipolo by 43.988 million
X_5	RPT Municipality Tanay, Rizal in million pesos	-43.996	TTR of Tanay is lower than the TTR decrease of Antipolo by 43.996 million
X_6	Total Average Annual Daily Traffic vehicles	0.046	Total average annual daily traffic (AADT) of 0.111 indicates that for every 1 unit increase in AADT, there is a corresponding 0.111 million pesos increase in TTR.
X_7	Maintenance GAA in Million Pesos	.020	A million peso Increase in the maintenance fund from GAA there is a corresponding increase in the TTR by 0.111 million pesos

7. Sustainability

On road maintenance, an improvement was observed by transporter of cargo at post completion vs. pre-completion. At pre-completion, the percentage of respondents that saw maintenance as not good outnumbered those who saw maintenance as good (70% vs. 30%).

At post completion, it was the reverse with ratings at 62% vs. 38% in favor of those who saw maintenance as good.

Every year, maintenance budget is secured by General Appropriations Act (GAA) from which the district engineering office staff is assured of funds for the periodic and routine maintenance[2] of the road.[3]

VLESSONS LEARNED

1. In the implementation of similar road projects which have steep side slopes and, thus, are prone to erosion and landslides, vegetation is a very desirable means of providing slope protection for reasons of availability, relatively low cost, appropriateness of installation techniques and compatibility with a rural environment. It is particularly appropriate in situations where large areas of slope are affected, a common situation on road cuttings and over unstable mountain slopes. The enhancement of road-side vegetation also has a positive effect both visually and in terms of plant diversity. Another method is the use of bio-engineering. Bio-engineering is the use of living plants such as vetiver, either alone or in conjunction with engineering structures and nonliving plant material such as coco coir, to reduce erosion and shallow-seated instability on slopes.

2. Periodic maintenance of projects is a crucial element of sustainability. Its timely performance could have prevented the collapse of the Querocep Bridge. According to residents, the bridge piers were weakened through time due to massive build-up of debris from the mountain brought by a series of typhoons. The bridge finally collapsed when floodwaters came rushing down the slopes during a weather disturbance in 2015.

VI OBSERVATIONS AND RECOMMENDATIONS

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
A. SECTORAL POLICY		
1. Data availability **There is not much data**	It is recommended that an inter-	DPWH

2The collapse of Querocep Bridge is not due to poor maintenance but by 'acts of nature' or force majeure.
3Details of maintenance regime and costs are presented in the Ex-post Evaluation Report (Appendix to this Report)

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
available from the DPWH Regional Office. The data from the interactive GIS Application in the DPWH website is not complete.	agency portal that publishes relevant data that can be accessed by service providers of the government such as consultants and contractors be established.	DPWH
Data particular to this Project such as design, cost estimates, and periodic maintenance schedules are not available. It is informed that all relevant materials were lost in a fire that gutted the building in the DPWH Regional Office IV-A. It appears that there is no electronic archive of these critical data.	The big investment from the government needed for the development of this kind of portal and level of technology, is offset by the usefulness/ready access of the data. In the short term, the field office of the DPWH may develop its own knowledge management system that includes electronic-based archive that is capable of storing data in different formats. The DPWH Information Management Service is presently enhancing the Department's knowledge management system and may be requested for assistance in this endeavor.	DPWH Regional Office IVA LGUs
Local economic and social data such as tourism arrivals and receipts which may be used for budgeting and other financial forecasting are not readily available from the LGUs.	Strengthening of the LGU data collection regime	
2. Regular monitoring of on-going and completed projects **The timely detection of presence of sediments that may cause blockage/ damming of bridge substructures could have been cleared. Case in point. The timely reporting of the collapse of Querocep Bridge could**	NEDA in cooperation with implementing agencies should conduct monthly field monitoring not only of on-going projects but also completed critical projects (like a bridge) in areas where occurrence of natural hazards like	DPWH Regional Office, NEDA Regional Office,

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
have facilitated immediate repair	typhoons is frequent.	RPMC
3. Project Development[4] **It was observed that trips are more local than the envisioned through trips from the eastern seaboard to the urbanized areas of Rizal and Metro Manila. The steep vertical alignment of the road project makes travelling difficult and unsafe such that a large number of travelers still prefer to take the longer and more congested Famy-Real-Infanta Road.** **Without baseline data, triangulation of the technical data from engineering surveys did not happen.**	Project identification and development should be participatory. (refer to the Appendix for summary of project development process) The use of technical tools in identifying projects should be validated with information from the ground, especially, beneficiaries. Baseline data collection should be part and parcel of project preparation, ideally during feasibility studies.	DPWH concerned office LGUs NEDA Regional office
B. SECTORAL PROGRAM		
1. Transport Network Development Synchronization **It has been observed that the projected traffic has not been reached because the Infanta Port which was envisioned during the feasibility study as main traffic generator has not delivered**	Upgrading/development of the Infanta Port to reach its potential to serve its hinterland and generate traffic, thereby optimizing utilization of MIR	PPA

4refer to the Appendix for summary of project development process

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
2. Road Capacity Improvement **Based on recent developments in CALABARZON and Luzon, the MIR is a critical road that can support the proposed Luzon Pacific Highway (LPH) given its proximity to the proposed highway.** **(Note: Quezon First Engineering District Office of the Department of Public Works and Highway (Q1stDEO-DPWH) is working closely on the planned construction of the 93 kilometers road of Barangay Umiray in Gen. Nakar town (eventually, Infanta, that will connect to the town of Dingalan in Aurora province. This project according to the DPWH is included in the Build Build Build Program.)**	It is recommended that remedial measures such as construction of climbing lanes be instituted to address difficulty in traversing the critical segments of the MIRP (i.e., mountainous sections with gradient greater that 2.5%). (Note: climbing lanes are lanes that allow slower travel for large vehicles, such as large trucks or semi-trailer trucks, ascending a steep grade without slowing traffic and provide ease for smaller vehicles to overtake. This is to improve road safety and speed. The primary safety concern is the risk of rear-end or same-direction sideswipe accidents involving slow-moving trucks. *Climbing lanes may have the potential to eliminate some head-on or opposite direction sideswipe accidents*.)	DPWH

1 INTRODUCTION

1.1 DEVELOPMENT STRATEGY (THEN AND NOW)

Transport affects and influences the nature and pace of economic development, population distribution, the shape of cities, energy consumption, access to markets and materials, and the pace, style and quality of life. It also contributes substantially to gross domestic product (GDP) and provides employment to people. It promotes economic activities by facilitating movements of persons and goods, which, in turn, lead to a greater demand for transport. This two-way interaction tends to relocate industries, services and labor and thereby helps shape the economic geography of a region and promote human welfare.

As has been proposed by past and present leaderships, transportation has always been in the forefront of economic development as one of the major enablers. In the PDP 2010-2016, the government pursued the completion of substantial improvement and rehabilitation of roads in line with expectations to reduce transport costs and induce economic activities, particularly in the rural areas[5].

This strategy is still being aggressively pursued as the government declared in the PDP 2011-2017 that infrastructure development is vital to enhancing the social fabric, reducing inequality, and increasing the country's growth potential.[6]In this framework, the transport sector is taken as one of the sectors that have backward and forward linkage effects on the economy.[7]

In the MTPDP 2004–2010, it is declared that the development of the country's transport infrastructure is principally aimed at the decentralization of progress and development by providing opportunities for growth, especially in regions and is as adjacent to Metro Manila. To that view the Marikina – Infanta Road Project was included in the Calabarzon Regional Development Plan (RDP) 2006-2010. This recognition illustrated the road's strategic importance as major alternative to the Manila East Road/Famy – Infanta Road corridor, as it serves as a shorter link (diversion) between major ports located in the eastern seaboard (Pacific Ocean) and Manila Bay. The road is considered as an alternate and important link from Metro Manila and eastern Rizal municipalities and central and north-western regions of the country to the northeastern towns in the Pacific coast and the REINA (Real, Infanta and General Nakar)

5Philippine Development Plan 2011-2016, Chapter 5
6Philippine Development Plan 2011-202, Chapter 19
7Asian Institute of Transport Development, Socio-economic Impact of National Highway on Rural Population, New Delhi, India, 2003

and POGI (Polilio group of islands) cluster of municipalities in the provinces of Rizal and Quezon.

1.2 OBJECTIVES OF THE ROAD PROJECT

The implementation of the project road provides the stimulus in the development of production areas and access to markets of produce particularly for agriculture, mining, logging, forestry and fishing. It also aims to provide infrastructure support to tourism in the coastal road network (region and project area).

1.3 PROJECT PROFILE

The project road commences at the junction of Sumulong Highway in Masinag, Antipolo City traversing the rugged terrain of Sierra Madre mountain range (refer to ***Figure 1.1*** for the terrain map) until it terminates at the intersection of Famy – Infanta Road.

FIGURE 1.1: GENERAL LOCATION OF THE MARIKINA-INFANTA ROAD

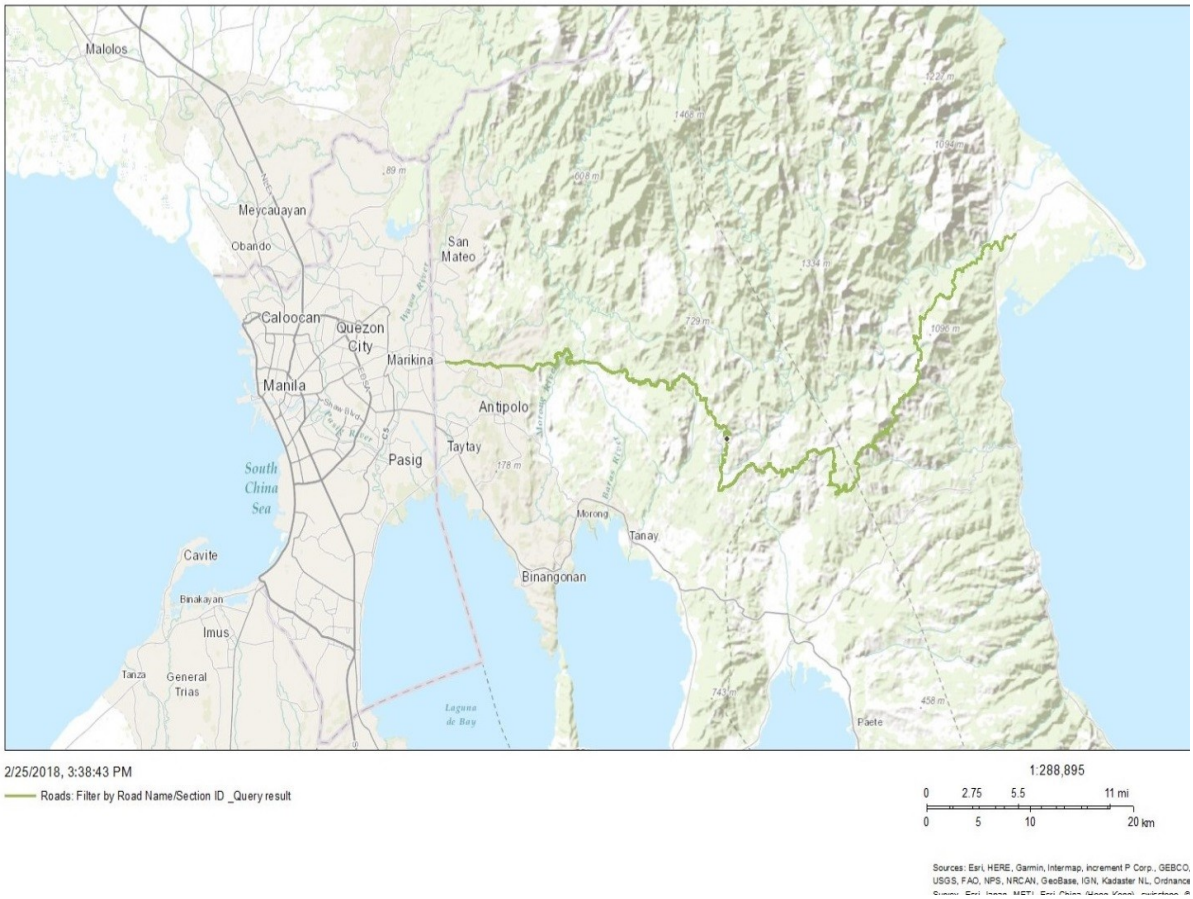
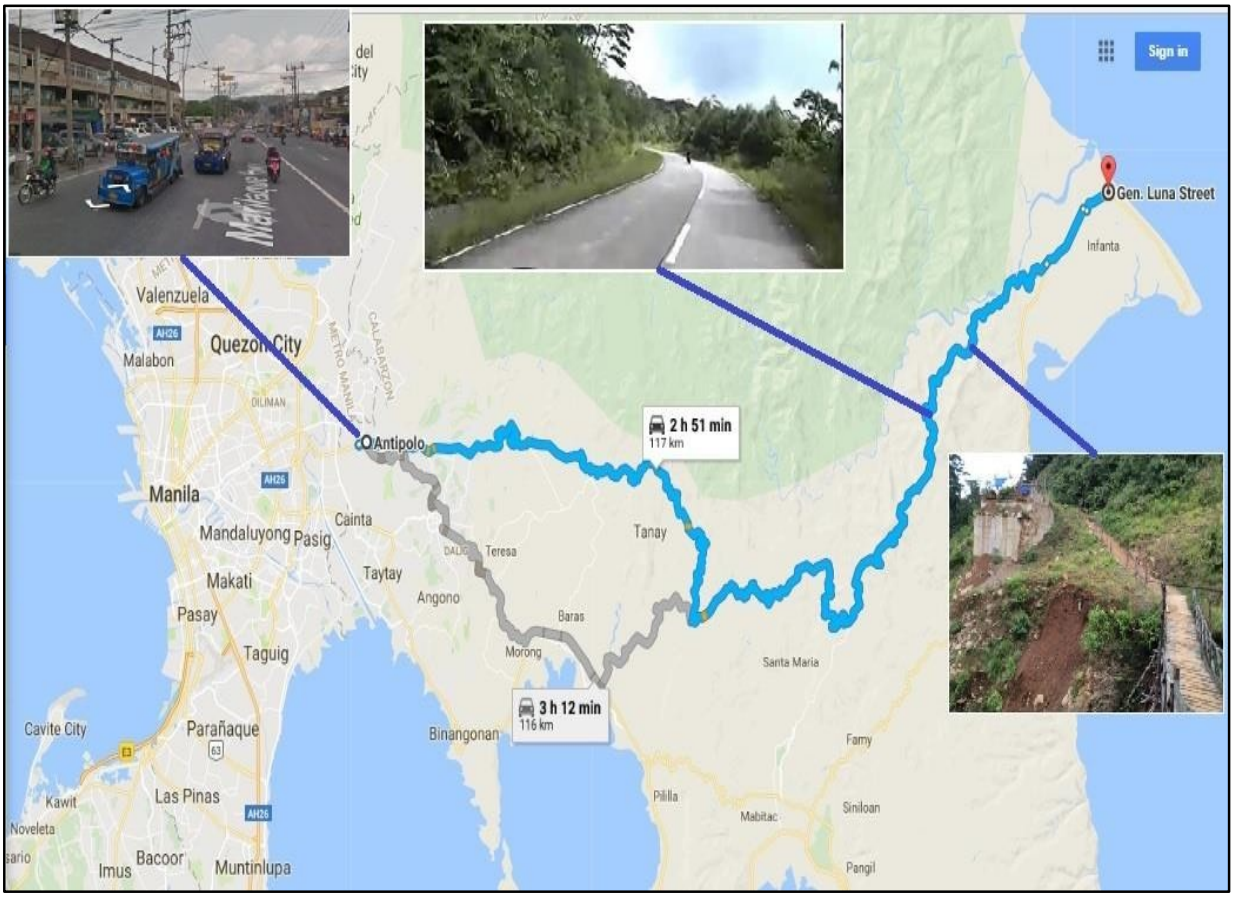


Figure 1.2 shows some of the present conditions in selected sections of the Road. The areas traversed by the road project contain vast tracts of land, wide forest, abundant water sources and beautiful scenic spots.

FIGURE 1.2: DIRECT ROAD INFLUENCE AREA (RIA)



CALABARZON, also known as Region IV-A, is located in the southwestern part of Luzon. It is bounded by the National Capital and Central Luzon Regions in the north and MIMAROPA and Bicol Regions in the South. The Marikina–Infanta Road traverses three provinces in Region IV- A, namely: Rizal, Laguna and Quezon.

Rizal. Rizal is bordered by Metro Manila to the west, Bulacan to the north, Quezon to the east and Laguna to the southeast. The province lies on the northern shores of Laguna de Bay, the largest lake in the country. It is a mountainous province perched on the western slopes of the southern portion of the Sierra Madre Mountain Range. Rizal Province is becoming an urban/industrialized province primarily due to its proximity to Metro Manila. Antipolo and Marikina are the two municipalities in Rizal with an economy based largely on commercial and industrial activities. Marikina has large scale industries engaged in local footwear manufacturing. Approximately 15% of the major establishments for the whole province of Rizal are located in Antipolo. Antipolo is in the northern half of Rizal Province. It is found on the slopes of the Sierra Madre Mountain Range. Much of the city sits on a plateau averaging 200 meters. It has the second largest area in the province with an area of 156.68 square kilometers. The northern and southern sections of the city are in the dense forest areas of the Sierra Madre.

Antipolo offers a panoramic view of Metro Manila and is the location of the Hinulugang Taktak, a water fall attraction. It is landlocked; bounded to the north by San Mateo and Rodriguez; to the east by Tanay; to the south by Angono, Taytay and Teresa; and to the west by Cainta and Marikina City in Metro Manila. Tanay is a first class municipality in the province of Rizal. It is located 57 kilometers (35 mi) east of Manila. It covers portions of the Sierra Madre Mountains and is bordered by Antipolo City in the north-west, Baras, Morong and Teresa in the west, General Nakar (Quezon Province) in the east, and Pililla, Santa Maria (Laguna province) as well as the Lake Laguna de Bay in the south.

Santa Maria, Laguna. Santa María, Laguna is a fourth class municipality in the province of Laguna and is located in the northernmost town of Laguna. Bounded by the provinces of Rizal and Quezon from the western portion up to the northern tip down northeastern part, the town has a mountainous terrain.

Infanta, Quezon. Infanta is a first class municipality in the province of Quezon. It has a land area of 130.1 square kilometers, representing 1.5% of the area of Quezon. It is located 144 kilometers (89 mi) north-east of Manila, and 136 kilometers (85 mi) north of Lucena City, the province capital. Infanta is the largest lambanog manufacturer in the province of Quezon. It is also the center of economic activity in the northern part of Quezon known as the "Gateway to the Pacific". There also tourist destinations in the municipality.

1.4 PROJECT DESCRIPTION

The road, which straddles the protected area of the mountainous municipalities of Antipolo, Boso-boso and Tanay in Rizal, Sta.Maria in Laguna and Infanta in Quezon, has a length of 115 kilometers. Alignment is winding but smooth. Road concrete surfacing is generally in good condition. The road is well drained. Slopes are protected except for some short sections in the Infanta side. All structures (bridges and culverts) are in good condition except for Querocep Bridge which collapsed in 2015 and is under reconstruction. (Refer to the straight line in **Appendix A**). Road condition, surface type and length of roads in Rizal, Laguna and Quezon are shown in ***Table 1.1.***

The road was built with a cost of P1.552 billion and was completed in 2011. Present traffic mix in the facility is composed mostly of light vehicles. The traffic volume is presented in ***Table 1.2***. The traffic volume significantly reduced after the collapse of the Querocep Bridge in the Infanta Section.

TABLE 1.1: ROAD CONDITION, SURFACE TYPE, LENGTH OF ROADS IN RIZAL, LAGUNA AND QUEZON

Region IV-A							
District Engineering Office/ Functional Classification	**Paved**		**Paved**	**Unpaved**		**Unpaved Total**	**Grand**
	Concrete	**Asphalt**	**Total**	**Gravel**	**Earth**	**Total**	
Laguna 1st DEO	**47.91**	**105.98**	**153.89**	**-**	**-**	**-**	**153.89**
Primary	0.87	14.20	15.06	-	-	-	15.06
Secondary	12.14	57.68	69.83	-	-	-	69.83
Tertiary	34.90	34.10	69.00	-	-	-	69.00
Quezon 1st DEO	**114.50**	**91.05**	**205.55**	**8.36**	**-**	**8.36**	**213.91**
Primary	-	4.11	4.11	-	-	-	4.11
Secondary	71.55	80.57	152.12	0.27	-	0.27	152.40

Tertiary	42.95	6.37	49.32	8.09	-	8.09	57.41
Rizal 1st DEO	**7.33**	**91.46**	**98.79**	**-**	**-**	**-**	**98.79**
Primary	2.14	22.50	24.64	-	-	-	24.64
Secondary	1.31	25.38	26.69	-	-	-	26.69
Tertiary	3.88	43.58	47.45	-	-	-	47.45
Rizal 2nd DEO	**21.70**	**111.80**	**133.50**	**-**	**-**	**-**	**133.50**
Secondary	-	29.87	29.87	-	-	-	29.87
Tertiary	21.70	81.94	103.64	-	-	-	103.64
Total	**919.27**	**1,510.74**	**2,430.00**	**87.66**	**-**	**87.66**	**2,517.66**
		Condition Rating					
Functional Classification	**Marikina-Infanta Road**	**Good**	**Fair**	**Poor**	**Bad**	**No Assessment**	**Total**
Collector	Total	28.87	7.56	1.06	-	0.28	37.77
	Concrete	28.87	7.56	1.01		0.28	37.72
	Asphalt			0.05			0.05
Feeder	Total	1.52	16.36	-	-	-	17.88
	Concrete		16.36				16.36
	Asphalt	1.52					1.52
Local	Total	11.34	5.92	0.60	0.29	0.64	18.79
	Concrete	1.15	0.39			0.11	1.65
	Asphalt	10.19	5.53	0.60	0.29	0.53	17.14

Source : DPWH Atlas

Traffic

The Annual Average Daily Traffic (AADT) for Marikina – Infanta Road Sections in 2013 and 2016 are shown in ***Table 1.2.***

TABLE 1.2: 2013 & 2016 ANNUAL AVERAGE DAILY TRAFFIC (MIRP)

Section ID	Engineering District	Year	AADT
S01551LZ	Quezon 1st	2013	**993**
S01551LZ	Quezon 1st	2016	**1026**
S01621LZ	Rizal 2nd	2013	**2,016**
S01621LZ	Rizal 2nd	2016	**5,613**
S01621LZ	Rizal 2nd	2013	**6,730**
S01621LZ	Rizal 2nd	2016	**7,130**
S01619LZ	**Rizal 1st**	**2013**	**6,730**

Source: DPWH Atlas

Demography

CALABARZON is the fifth smallest region in the country in terms of land area but has the largest population as of 2015 with 14.41 million people. ***Table 1.3*** shows the demographic characteristics of Region IV-A.

TABLE 1.3: DEMOGRAPHY OF REGION IV-A

Region/ Province	Land Area (sq.km.)	No. of Barangays	No. of Municipalities	No.of Cities	Population		Population Density 2015
					2010	2015	
Calabarzon	16,228.61	4,018	123	19	12,609,803	14,414,774	888.23
Cavite	1,287.55	829	16	7	3,090,691	3,678,301	2,856.82
Laguna	1,759.73	681	24	6	2,669,847	3,035,081	1,724.74
Batangas	3,165.81	1,078	31	3	2,377,395	2,694,335	851.07
Rizal	1,308.92	188	13	1	2,484,840	2,884,227	2,203.52
Quezon	8,706.60	1,242	39	2	1,987,030	2,122,830	243.82

Source: NEDA CALABARZON Profile

Region IV-A's GRDP is valued at P 1.3 Trillion and ranks 2nd in regional share as it accounts for 17.2 % of the country GDP. It ranks 1st in the share to the country's total industry output providing 31.8% and 2nd in the share to the total output of services with 9.8%. Their livelihood opportunities include: agribusiness, manufacturing and logistics; information technology business process management and creative industries; and diverse tourism, recreation, leisure facilities and infrastructure. Major infrastructures completed contributed to the high convergence of population, family income, presence of social services and investment and consumption from overseas Filipino remittances.

The region accounts for 15% of ecozones in the country and around 36% regional share of the total investments in Philippine Economic Zone Authority (PEZA). Region IV-A's employment (15 years old and over) is 8.269 Million, 8.463 Million and 8.576 Million in years 2013, 2014 and 2015, respectively. Calabarzon ranks fourth in tourist arrivals in the country (4,318,625) in 2015 with a regional share of 11.43%. Internal revenue collections of Region IV – A is P25.234 Billion in 2014 and P27.457

Billion in 2015 while the Internal Revenue Allotment (IRA) is P29.664 Billion in 2014 and P33.860 Billion in 2015.

Local Finance

The aggregate annual current operating income and total current operating expenditures of the four municipalities are ₱14,997.55 million and ₱9,516.16 million, respectively. Total fund cash balance for the past six years is P9,922.24 million see ***Table 1.4.***

TABLE 1.4: REVENUE AND INCOME OF PROJECT INFLUENCE AREA (IN ₱ MILLION)

Items	2016	2015	2014	2013	2012	2011	Total
Total Current Operating Income	3,127.87	2,790.46	2,636.67	2,131.39	2,132.78	2,178.39	14,997.55
Total Current Operating Expenditures	2,223.45	2,081.26	1,755.18	1,003.42	1,250.98	1,201.88	9,516.16
Net Operating Income/ (Loss) From Current Operations	904.43	709.20	881.49	1,127.97	881.80	976.51	5,481.40
Total Non-Income Receipts	930.41	827.74	181.10	-	41.06	54.88	2,035.19
Total Non-Operating Expenditures	171.60	373.14	243.93	192.22	265.45	275.89	1,522.24
Fund Cash Balance[8]	2,480.56	2,300.21	1,974.08	1,216.22	1,012.88	938.29	9,922.24

2 EVALUATION APPROACH AND METHODOLOGY

2.1 OBJECTIVES OF IMPACT EVALUATION

Impact[9] evaluation of a public investment project is done to assess the extent of net socio- economic benefits of the project that accrue to the population groups concerned. Typically, such analyses comprise two studies of socio-economic conditions of the concerned population group(s)

8Some items that affect the Fund/Cash Balance are not shown in the table.

9 This is based on the full definition of impact in the OECD DAC criteria for evaluating development assistance: 'The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators. The examination should be concerned with both intended and unintended results and must also include the positive and negative impact of external factors, such as changes in terms of trade and financial conditions'. http://www.oecd.org/dataoecd/42/6/49756382.pdf

– one based on baseline[10] survey data (collected pre the project is launched) and the other based on re-survey data (collected after the project has been completed). The impacts of the project are then assessed by appropriately comparing the two periods.

The measurement of the impact of an existing road or that of a road-related project – be it a new road (bypass in the case of the Marikina-Infanta Road) or widening (some section of the Project Road) or upgrading an existing one – is generally problematic as compared to soft infrastructure projects such as social projects. It is because of a number of features that a road- related project generally has. Issues generally observed in an impact evaluation of road projects and their corresponding remedies are presented in ***Table 2.1***.

TABLE 2.1: ISSUES IN IMPACT EVALUATION OF ROAD PROJECTS

ISSUES	ACTION TO BE TAKEN
1.Non-randomness/selection bias	
✓ They are placed on basis of a specific set of criteria such as level of development of the area, the geographic location or topography, and the condition of the road. ✓ This non-random placement of road may result in attribution/causality in some outcome indicators.	A review of pre-appraisal documents on how the road improvement projects were chosen based on criteria related to the area's socioeconomic characteristics (proxies by poverty rate and classified in appraisal documents as "developed" versus "less developed" areas); topography (flat, mountainous and island), which reflect in part the types of economic activities present; and condition of the road (bad, average and good, as defined in the pre-appraisal phase).
2.Intermediate and indirect benefits and effect of contemporary developments.	
✓ Impact of road improvements is intermediate and indirect – mobility and accessibility in support of other sectors such as agriculture and social ✓ Changes in outcome indicators may be due to the effects of other contemporary policies and programs of development in the area.	These indirect impacts need to be identified and measured quantitatively as well as qualitatively using various data collection techniques (household survey, focused group discussion, etc.) These contemporary confounding factors must be identified and taken into account to isolate the impact of road improvements on outcome indicators
3. Spillover and decay effects	
✓ Road improvements are likely to have geographically dispersed effects. Community-wide effects can extend beyond the community the road links up	Care must be exercised in defining road's "zone of influence".

10 No baseline survey was conducted for the Project

ISSUES	ACTION TO BE TAKEN
to.	
4. Different effects on different groups ofbeneficiaries (gainers and losers)	
✓ Gainers Groups that gain more from the effect of the road improvements such as those with greater opportunities for livelihood ✓ Losers Groups that lose traditional means of livelihood resulting from competing modern means of transport and technology	The impact evaluation has to consider a sampling design and collect data that allows analysis of how impacts vary across population groups.
5. Absence of baseline data	**Reconstruct baseline data.**

2.2 HYPOTHESIS TESTING

The Impact Evaluation Study of the MIRP aims to assess the impacts of the Road Project as a diversion road to the existing national route from Masinag, Antipolo to Infanta, Quezon via the longer route defined by a section of the Manila East Road and Famy-Infanta Road with a view to responding to the following Key Evaluation Questions (KEQ) as appreciated from the Terms of Reference.

1. Was the Project implemented according to how it was originally planned?
2. Is the project being operated according to how it was intended?
3. Were the intended economic benefits of the project realized? By how much?
4. Were the intended economic benefits such as improved quality of life, accessibility and mobility achieved?
5. Have the agriculture and tourism sectors benefited from the Project?
6. Have regional industries benefited from the Project?
7. Were there any unintended economic/financial benefits realized and costs incurred due to the Project?

Based on the list above, the Study Team developed six hypotheses:

a. Intended Impacts of the road project
   - Relevance,
   - Effectiveness and
   - Efficiency;

- Sustainability

b. Unintended
  - Improvement of accessibility and mobility;
  - Improvement of socio-economic indicators in the household;
  - Improvement of local government finance and economy
  - Impact on the environment.
  - Outcome sustainability

Table 2.2 shows indicators that were tested, and the corresponding metrics and valuation methodology employed. These specific units of measures are grouped by hypotheses for clarity and efficiency.

TABLE 2.2: IMPACT AREAS, KEY EVALUATION QUESTIONS AND CORRESPONDING INDICATORS AND MEASUREMENTS

IMPACT AREAS	INDICATORS
a) Relevance, effectiveness and efficiency	- Consistency with the development policies of the government - Traffic mix and volume - Vehicle operating cost - Economic indicators (economic internal rate of return, net present value)
i) Reduction in vehicle operating costs	- quality of road carriageway and road side elements and less road closures
ii) Increase in motorized traffic	- Motorized vehicle ownership - Modal change (non-motorized to motorized, walking to motorized)
b) Unintended Impacts	
i) Accessibility and Mobility	- Number of trips/ trip rate for work - Capita trip rate for business - Capita trip rate for education - Capita trip rate for accessing health-related services - length for trips - travel expense for trips - travel time for trips - distance travelled - frequency of goods travel - mode of travel

	IMPACT AREAS	INDICATORS
		- trip purpose - travel cost per person per km for trips involving MIR
		- Distance of house from road - Travel time - Travel Cost - source of income - Family size - House ownership - Source of income - Vehicle ownership - Business owner
	Increase Volume of Transported goods	- Vehicle ownership - Freight charges - Travel time - Road condition
	Improved Road Condition	- adjectival
	Changes in travel patterns	- estimate modal shift - trip purpose - frequency
	Facilitation of safe access, convenience and reliability	
	Road safety	
ii)	**Impact on Household-level**	
	Family income and expenditures	
	Access to socio-economic services	
iii)	**Environmental and Social Impact**	
	• Environment	- emission - noise - contamination of water - improper disposal of waste - deforestation - loss of wildlife - soil erosion
	• Social	- Illegal settlers - Land development for business - Peace and order - In-migration - Out-migration - Community relationship
iv)	**Impact on the Local Government Economy and Finance**	

IMPACT AREAS	INDICATORS
• Agriculture	
	transport of goods from agricultural and fisheries related activities - cost of production - farm gate prices - volume of production - crop mix change - change in marketing practice - transportation time to market - amount of produce to markets - use of agriculture inputs
	increases the amount of land under cultivation and production - production statistics - yields per hectare
	increases farmers' incomes - agricultural value added; and - farmer estimates
	transport of goods from agricultural and fisheries -related activities - cost of production - farm gate prices - volume of production - crop mix change - change in marketing practice - transportation time to market - amount of produce to markets - use of agriculture inputs
• Tourism	- Tourism arrival - Tourism receipts
i) Local Finance	- Operating income and expenditure
f) Sustainability	
i) Road	- Maintenance regime (routine and periodic) - Operation - Productivity • predict road deterioration, • vehicle operating costs estimation, • traffic - forecasting
ii) Outcomes	- Perception

3 STUDY RESULTS

3.1 EVALUATION DESIGN (MIXED METHODS)

Mixed approach, i.e., a combination of quantitative and qualitative methods, was used in the study. An impact evaluation that combines qualitative and quantitative methods can generate both a statistically reliable measure of the magnitude of the impact as well as a greater depth of understanding of how and why a program was or was not effective and how it might be adapted in future to make it more effective[11].

Difference in means or Single Difference (SD), the quantitative method (non-experimental) is one of the methods being used to measure the impacts in this Study. SD method estimates impacts by comparing the value of the indicator of interests for the recipients, in a point in time. It is sometimes called "pre" and "after". In design terminology, "pre" refers to a measurement being made before an intervention is introduced to a group and "after" refers to a measurement being made after its introduction. Equivalent terms for "before" and "after" are "pre" and "post".[12]

This method was used to measure the outcome variables of interest "before" and "after" the implementation of the Marikina – Infanta Road Project. The net effect of the project is estimated as the difference in the "after" and "pre" outcome measures in the road beneficiary before and after the Project. By the configuration (location and alignment) of the project, establishing a comparison project with similar characteristics is not feasible. The Study used a pre-implementation as counterfactual of outcomes of participants[13]. "Before" versus "after" scenarios were used to establish outcomes as no other factor could plausibly have caused any observed change in outcomes and attributions.[14] In other words, all other factors are stable, or there are no other cause-effect relationships than between the intervention and the observed change. Threats of validity which is inherent to 'before and post' method and in this case history threat[15] was handled to some extent by additional data collections such as focus group discussions and informant interviews that facilitate validation.

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11 Sabine Garbino and Jeremy Holland, **Quantitative and Qualitative Methods in Impact Evaluation and Measuring Results**, Issue Paper, March 2009

12 http://158.132.155.107/posh97/private/research/evaluation/Chp_3.pdf

13 Khander S.R. et al, **Handbook on Impact evaluation: Quantitative Methods and Practices**, The World Bank, Washington D.C., 2010

14 Impact Evaluation and Development, **NONIE Guidance on Impact Evaluation**, 2009, p-21

15 A "history threat" occurs when one or more events, which are not part of the intervention but could affect the outcome, takes place between the "before" and "after" measurements. Common history threats include changes in the project due to development priorities of the government such as availability of funds for implementation and operation and maintenance.

Qualitative method was used mainly for validation and to obtain true insights into the perception of beneficiaries' vis-à-vis the objectives of the project (hypothesis). Focus group discussions and key informant interviews were the method used.

3.2 DATA COLLECTION AND MANAGEMENT

Influence area was delineated using the DPWH method, which is five kilometers from the centerline on both sides by a natural barrier such as body of water or land mass. Baseline data was created from the survey and from the Feasibility Study and re-evaluation report of the Project. The only primary data collected are traffic data. These were collected using moving observer count with the aid of a dash camera mounted in a vehicle. Secondary data include data from DPWH. Data collection methods included household surveys, focus group discussions and key informant interviews, use of electronic devices such as dash camera and video camera.

MS Office Excel was used in data encoding and database creation. Detailed discussions of surveys and data management are presented in ***Annex A.***

3.3 STATISTICAL ANALYSIS

The relationship between two variables was tested using appropriate statistical tests such as one-sample T-Test, one-way ANOVA, and Chi-square test of independence, among others. The two important factors that were observed in the modeling are: (1) check for outliers; and, (2) cross-validate by conducting simple mean squared difference between the observed and predicted values to get a measure for the prediction accuracy. Cross- tabulations and Pearson's correlation coefficient were used to evaluate relationship between two variables. IBM SPSS and MS Office Suite software were used in all analyses.

Descriptive statistics/Univariate analysis was used to describe the collected data. It summarizes indicators of larger groups of data and is used to reduce large amounts of information into a few summary indicators. The Consultant employed methods that included measures of central tendency (mean) measures of dispersion (standard deviation), distribution (bar charts, histograms, frequency polygons, pie charts). Results[16] of this analysis are presented in ***Annex B***. Correlation analysis was generally used in hypothesis testing.
Aside from describing the relationships between a set of independent variables[17]and the dependent variable regression analysis was also used

16Selected results are presented in the Main text to explain conclusions
17Variables have undergone test of independence and there is least a moderately strong correlation between the two variables. A good rule of

in making predictions (modelling/forecasting). Time series analysis was used in forecasting panel data such as income and revenue of local government units.

4 FINDINGS AND RESULTS

4.1 RELEVANCE, EFFECTIVENESS AND EFFICIENCY

The Project is still relevant as it is still consistent with development policies at present. As early as in the 1990s, there was a strong need to improve road conditions such as upgrading of unpaved roads to paved, improving the temporary bridges into permanent bridges to secure an efficient, safe and reliable road network. There was a need to promote road network, which links the local towns and villages and the main arterial road network which is necessary to improve the local economy, which will reduce income disparity between residents in urban and local areas.

The average annual daily traffic[18] along the Project road is presented in ***Table 4.1***.

TABLE 4.1: MARIKINA INFANTA ROAD - AVERAGE ANNUAL DAILY TRAFFIC (AADT)

Section	2006	2018	Increase
1	17,727	31,636	178%
2	2,848	4,830	170%
3	116	5,866	5057%
4	116	2,184	1883%
5	116	2,184	1883%

Diverted Traffic

As shown in the next ***Figure 4.1***, the study area was divided into segments: MIRP in blue, Manila East Road in gray and the Tanay – Sampaloc Road in black. It is apparent that MIRP and Manila East Road are competing routes.

FIGURE 4.1: MANILA EAST ROAD AND MIRP

thumb is correlation coefficient should be at or beyond either positive or negative 0.50.

18Refer to Appendix of this report.

The construction of MIRP resulted in diversion of some traffic from Manila East Road (MER) to the new road as a result of the improvement work which decongested the latter. Diverted traffic is the estimated volume of traffic presently passing the Manila East Road that diverted to the MIRP upon its opening.

Based on the Road Traffic Information Application (RTIA) 2008-2013 data of DPWH, the AADT in Manila East Road decreased while that of the Marikina – Infanta increased as shown in ***Table 4.2***.

TABLE 4.2: 2008 – 2013 AADT OF MANILA EAST ROAD AND MIRP

Road	Annual Average Daily Traffic			
	District	Before Opening (2008)	After Opening (2012-2013)	Increase/ Decrease
Manila East Road	Rizal 1st	20, 019	20,009	-0.05%
	Rizal 2nd	10,666	10,353	-2.93%
	Laguna 1st	2,844	2,844	0.00%
	Quezon 1st	3,766	4,009	6.45%
Marikina – Infanta Road	Rizal 1st	3,674	3,860	5.06%
	Rizal 2nd	2,656	3,414	28.54%
	Laguna 1st	147	233	58.50%
	Quezon 1st	269	457	69.89%

Reduced Vehicle Operating Costs

Before the implementation of the project, the road condition was poor. The undulating vertical and horizontal alignments (see ***Figure 4.2***) caused landslides that preceded frequent road closures. There were at least nine road closures a year and these occurred mostly in sections where gradient is steep. These closures[19] last for three days to one week. With the implementation of the project, the road surface was upgraded to concrete and vertical and horizontal alignments were smoothened and massive slope protection works were implemented. Road closures do not last more

19 Based on focus group discussions (anecdotal)

than two days[20]. ***Table 4.3*** shows the road condition and number of days closed in the MIR alignment, 'pre' and 'after' the project.

Based on the elevation of the road as shown in ***Figure 4.3***, the highest point in the alignment is 789 meters above sea level. The steepest gradient is 16.5 %. This point is located close to Querocep Bridge[21], which crosses a deep ravine. Said bridge collapsed in December 2015. A more detailed elevation profile by 20-kilometer sections is presented in ***Annex C.***

FIGURE 4.2: LOCATION OF LANDSLIDES

TABLE 4.3: ROAD SURFACE TYPE AND CONDITION AND NUMBER OF DAYS CLOSED

Road Section	Pre[22] Project	After Project

20This does not include the closure of Querocep Bridge, which is still impassable to four-wheeled vehicles until now.
21According to residents, the bridge piers were weakened through time due to massive build-up of debris from the mountain brought by a series of typhoons. The bridge finally collapsed when floodwaters came rushing down the slopes during a weather disturbance in 2015.
22Pre-implementation

	Road surface type and condition	Average Number of[23] days closed per year	Road surface type and condition	Average Number of days closed per year
Cogeo – BosoBoso	AC – Fair	0	Good PCC	0
BosoBoso to Pinugay	AC – Fair to Bad	0	Good PCC	0
Pinugay to Sampaloc	AC &Gravel – Fair to Bad	7	Good PCC	0
Sampaloc to Magsaysay	Gravel – Bad	14	Good PCC	7
Magsaysay to Gumian	**Trail**	365 days per year	Good PCC	(Querocep Bridge) 2016 to present

Source: DPWH and focus group discussion

FIGURE 4.3: ELEVATION PROFILE OF MARIKINA – INFANTA ROAD

23Based on focus group discussions

Design Standards

Table 4.4 was used as a basic reference in the design of the road.

TABLE 4.4: MINIMUM DESIGN STANDARD PHILIPPINE HIGHWAYS

Table 7.5-1 MINIMUM DESIGN STANDARD PHILIPPINE HIGHWAYS								
ADT AVERAGE DAILY TRAFFIC ON	UNDER 200	200-400	400-1000		1000-2000		MORE THAN 2000	
OPENING			MINIMUM	DESIRABLE	MINIMUM	DESIRABLE	MINIMUM	DESIRABLE
DESIGN SPEED (km/h)								
FLAT TOPOGRAPHY	60	70	70	90	80	95	90	100
ROLLING TOPOGRAPHY	40	50	60	80	80	80	70	90
MOUNTAINOUS TOPOGRAPHY	30	40	40	50	50	80	60	70
RADIUS (metre)								
FLAT TOPOGRAPHY	120	180	160	280	220	320	260	350
ROLLING TOPOGRAPHY	55	65	120	220	120	220	160	280
MOUNTAINOUS TOPOGRAPHY	30	50	50	80	80	120	180	160
GRADE (percent)								
FLAT TOPOGRAPHY	6	6	5	3	4	3	4	3
ROLLING TOPOGRAPHY	8	7	6	5	5	5	5	4
MOUNTAINOUS TOPOGRAPHY	10	9	8	6	7	6	7	5
PAVEMENT WIDTH (m)	4	5.5,6.0	6.1		6.7		8.7	7.3
SHOULDER WIDTH (m)	0.5	1	1.5	2	2.5	3	3	
RIGHT OF WAY WIDTH (m)	20	30	30		30		60	
SUPERELEVATION (m/m)	0.10 (max)		0.10 (max)		0.10 (max)		0.10 (max)	
NON PASSING SIGHT DISTANCE (metre)								
FLAT TOPOGRAPHY	70	80	90	136	115	150	135	160
ROLLING TOPOGRAPHY	40	60	70	115	70	115	90	135
MOUNTAINOUS TOPOGRAPHY	40	40	40	60	60	70	70	90
PASSING SIGHT DISTANCE (metre)								
FLAT TOPOGRAPHY	420	490	490	615	560	645	615	675
ROLLING TOPOGRAPHY	270	350	420	560	420	560	490	615
MOUNTAINOUS TOPOGRAPHY	190	270	270	350	360	420	420	490
TYPE OF SURFACING	GRAVEL, CRUSHED GRAVEL OR CRUSHED STONE BIT PRESERVATIVE TREATMENT, BITUMINOUS MACADAM PAVEMENT		BITUMINOUS MACADAM PAVEMENT, DENSE OR OPEN GRADED PLANT MIX SURFACE COURSE, BITUMINOUS CONCRET COURSE		BITUMINOUS CONCRETE SURFACE COURSE		BITUMINOUS CONCRETE SURFACE COURSE, PORTLAND CEMENT COCNRETE PAVEMENT	

Source: Department of Public Works and Highways

With the upgrading of the road surface and correction of the horizontal and vertical alignments, the quality of travel has improved and an optimum speed of more than 60 kilometers per hour is attainable. The vehicle operating costs of the different vehicle types have decreased by as much as 0.70 pesos per kilometer. On the other hand, during the ocular inspection conducted at the beginning of the Study (September 2017), it was observed that some of the slope protection works were not sufficient to prevent landslides in some sections. These road closures cost 57,304Pesos/day.

TABLE 4.5: VEHICLE OPERATING AND ROAD CLOSURE COSTS PRE AND POST THE PROJECT

Vehicle group	Pre- Project			Post- Project		
	Traffic Volume	Average VOC	Cost of Road Closure	Traffic Volume	Average VOC	Cost of Road Closure
1. Cars/jeeps	1,272	8.67		1,734	7.97	
2. Jeepneys	555	24.08		846	19.57	
3. Buses	8	99.7	P 57,304	13	62	P 57,304

4. Trucks	2,069	38.61			2,843	34.46	
5. Motorcycles	908	7.07	per day		2,375	4.74	per day

Source: Consultant's Estimates

The vehicle operating costs for all vehicle types decreased and these are due to the improvement of vertical and horizontal alignments, carriageway and shoulder improvements and road surface upgrading[24].

The aggregate cost of the Project from commencement of civil works in 2007 is P1.552 Billion Pesos for the whole 115 kilometers. About 96.65 kilometers of its sections were constructed by the DPWH Region IV-A, while the remaining stretch of the road was constructed by the DPWH Central Office. The project road was completed in 2011 and became fully operational that same year.

The efficiency of the road project is measured by comparing economic costs and benefits. Benefit-cost analysis (BCA) was performed on Marikina – Infanta Road using the internationally accepted road evaluation model, i.e. the HDM-4 model version 2 system for road network analysis and evaluation. The method applied in the economic evaluation focused on the benefit assessment in the form of Road User Cost Savings (RUCs) and Maintenance Cost Savings (MCS) derived in comparing RUCs and MCS "after" and "before" the project. Generated benefits were also considered in the BCA.

The indicators being measured are net present value and economic internal rate of return. The robustness of these indicators is tested by conducting sensitivity analysis. Shown below are the cost benefit flow and the corresponding estimates of the economic indicators. Also shown are the results of the sensitivity analyses.[25]

TABLE 4.6: SUMMARY RESULTS OF ECONOMIC EVALUATION

24Based on the results of HDM4 runs
25Detailed calculations are presented in the Ex-post Evaluation Report of Marikina-Infanta Road.

Segment	Economic Indicators		SENSITIVITY ANALYSIS					
			Inc.in Cost Benefit	10% -10%	-10% 10%	20% -20%	-20% 20%	Shadow Priced
1	IRR	36.5%		31.5%	41.9%	26.9%	47.9%	34.7%
	NPV @10%	560,942		469,191	652,693	377,439	744,445	547,976
	BCR @10%	4.146		3.392	5.068	2.764	6.219	3.865
2	IRR	16.7%		14.1%	19.5%	11.7%	22.6%	15.8%
	NPV @10%	57,160		36,399	77,922	15,637	98,683	51,958
	BCR @10%	1.760		1.440	2.151	1.173	2.640	1.646
3	IRR	21.5%		18.5%	24.8%	15.7%	28.6%	20.4%
	NPV @10%	286,659		218,158	355,160	149,657	423,661	272,112
	BCR @10%	2.439		1.996	2.981	1.626	3.659	2.273
4	IRR	28.6%		25.0%	32.7%	21.7%	37.3%	27.3%
	NPV @10%	1,509,966		1,251,354	1,768,578	992,741	2,027,191	1,470,827
	BCR @10%	3.806		3.114	4.652	2.537	5.709	3.548
5	IRR	26.8%		23.4%	30.6%	20.2%	34.9%	25.8%
	NPV @10%	122,442		100,050	144,834	77,658	167,226	119,479
	BCR @10%	3.413		2.793	4.172	2.275	5.120	3.225
Overall	IRR	28.5%		26.8%	30.3%	25.2%	32.2%	27.1%
	NPV @10%	1,748,642		1,557,508	1,939,776	1,366,374	2,130,910	1,695,931
	BCR @10%	22.496		18.406	27.495	14.997	33.744	13.651

TABLE 4.7: SWITCHING VALUES

NPV in Thousand Pesos

Segment	Economic Indicators	AADT less 10% and Cost plus 20%	AADT for Sections 3 & 4 less 50% and Querocep Construction Cost included
1	IRR	28.1%	31.9%
	NPV @10%	379,785	525,285
	BCR @10%	2.775	3.455
2	IRR	13.2%	14.4%
	NPV @10%	29,529	42,115
	BCR @10%	1.327	1.467
3	IRR	17.5%	12.9%
	NPV @10%	205,573	72,027
	BCR @10%	1.860	1.301
4	IRR	24.2%	15.2%
	NPV @10%	1,197,209	375,691
	BCR @10%	2.854	1.582
5	IRR	21.8%	24.2%
	NPV @10%	94,937	117,866
	BCR @10%	2.559	2.936
Overall	IRR	24.5%	22.6%
	NPV @10%	1,408,870	1,015,801
	BCR @10%	10.034	7.813

4.2 IMPROVEMENT OF ACCESSIBILITY

Accessibility is defined as the ease with which goods can reach other places, measured in terms of time, cost, seasonality, and transport

services provided[26]. This Study combined indicators distance from road, travel time, travel costs and public transport service. Seasonality indicator was not included in the survey.

TABLE 4.8: COUNT - DISTANCE OF HOUSE FROM MAIN ROAD (IN METERS)

Distance (meters)	Infanta		Sta. Maria		Tanay		Antipolo		Total		
	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	All
< 5	35	7	19	2	46	4	56	5	156	18	174
5 – 9 m	28	2	10	1	8	0	1	0	47	3	50
10 – 19	12	2	18	3	12	1	2	0	44	6	50
20 – 49	6	1	11	1	20	0	8	1	45	3	48
50 – 99	4	0	2	0	8	0	4	0	18	0	18
100 – more	3	0	2	0	31	2	20	2	56	4	60
Total	**88**	**12**	**62**	**7**	**125**	**7**	**91**	**8**	**366**	**34**	**400**
Ave. distance	**17.58**	**5.58**	**15.02**	**13.14**	**80.88**	**109.46**	**108.52**	**142.87**	**61.38**	**60.83**	**61.33**

Surveys and validated focus groups reported a substantial reduction in the time required to access markets and services resulting from a combination of effects of the improved roads: higher frequency of road transport services, improvements in the quality of transport mean (from walking or animal-drawn cart to motorized vehicle), and access to social facilities (markets, schools, health centers) triggered by MIR.

Increase in motorized traffic

Table 4.9 shows the per capita motorized vehicle ownership per municipality. Overall, ownership of motor vehicles in the Project influence has increased. ***Table 4.10*** shows the percentage distribution of the type of vehicles owned by household, with distinction made on which vehicles were acquired at pre-completion and post completion.

Vehicle Ownership

Fifty seven percent (57%) of the households surveyed within the influence area are owners of vehicles of different types. Of the total, all except 2% are motorized transport. Households in Tanay and Infanta are better placed in this regard as compared to the two other municipalities, with 65% and 64% as vehicle owners, respectively. The relatively shorter average distance of households in Infanta to the MIR could be a reason for

26 Jerry Olsson, ***Improved road accessibility and indirect development effects: evidence from rural Philippines***, Department of Human and Economic Geography, University of Gothenburg, Sweden

the higher percentage of vehicle owners (Refer to Table 4.9.) In the case of Tanay where a change in the average distance from residence to the MIR is noticeable, the large number of vehicle owners indicates the expansion of the sphere of social and economic services arising from road completion.

TABLE 4.9: MOTORIZED VEHICLE OWNERSHIP PRE AND POST PROJECT IMPLEMENTATION IN INFLUENCE AREA

Vehicle Type	Pre-Project	Post-Project	Percentage Increase
	Volume (%)	Volume (%)	
1. Car/owner-type jeep	9	9	0
2. Jeepney as passenger public utility	1	1	0
3. Pick-up/Jeepney as commodity vehicle	1	1	0
4. Taxi/van as PUV	1	1	0
5. Van for personal use	4	4	0
6. Big bus (capacity >34 passenger)	0	0	0
7. Small bus (capacity ≤34 passenger)	0	0	0
8. 6-wheeler truck	0	0	0
9. Trailer truck	0	0	0
10. Articulated truck	0	0	0
11. Tractor	0	0	0
12. Motorized farm equipment	0	0	0
13. Motorcycle	58	59	1
14. Tricycle	24	24	0
15. Bicycle/sikad/bicycle with sidecar	2	2	0
16. Animal transport (Ex. Carabao, horse)	0	0	0
17. Other, specify ___	0	0	0

TABLE 4.10: NUMBER OF VEHICLES OWNED BY TYPE AND YEAR OF ACQUISITION (ALL 4 MUNICIPALITIES)

Type of Vehicle	Pre 2011 (%)	2011 or later (%)	Total (%)
Vehicle owner?			
Yes	57.9	52.9	57.5
No	42.1	47.1	42.5
Total	100.0	100.0	100.0
Car/owner-type jeep	9.1	5.0	8.8
Jeepney (PUJ)	1.2	0.0	1.1
Jeepney as commodity vehicle	0.8	0.0	0.7
Taxi/van as PUV	0.8	0.0	0.7
Van for personal use	3.9	0.0	3.7
Motorcycle	58.1	75.0	59.3
Tricycle	24.1	20.0	23.8
Bicycle/sikad	1.6	0.0	1.5
Pick-up truck	0.4	0.0	0.4
TOTAL	**100.0**	**100.0**	**100.0**

Trip Purpose and Mode of Transport

Some 88.3% of the respondents informed that they or any member of their household are regular users of the road. Among the purposes of road use are: (i) travel to/from work; (ii) travel to/from school; (iii) as public transport service; (iv) transporting farm and fish produce; (v) transporting other goods and commodities; (vi) travel to market; and, (vi) other purposes.

Types of Vehicle/Modes of Transport Used

For non-public transport business purposes [excludes (iii) above], particularly for passenger transport, the major type of vehicle used both at pre-completion and post completion is the tricycle. A 6% increase in the mix of this type of transport to the total vehicles used is noted from 26% at pre-completion to 32% at post completion. Motorcycles and public transport (jeepney) followed with 16% and 20%, and 21% and 17% shares at pre-completion and post completion, respectively (***Table 4.11***).

TABLE 4.11: PERCENTAGE USE OF TYPE OF VEHICLE FOR PASSENGER TRANSPORT

Type of Vehicle	To/from work			To/from school			Overall		
	Pre-	Post	Diff.	Pre-	Post	Diff.	Pre-	Post	Diff.
Car	1%	2%	1%	1%	2%	1%	1%	2%	1%
Jeepney (PUJ)	23%	20%	-3%	16%	14%	-2%	20%	17%	-3%
Jeepney as commodity vehicle	0%	1%	1%	0%	0%	0%	0%	0%	0%
Taxi/van as PUV	3%	1%	-2%	0%	0%	0%	2%	1%	-1%
Van for personal use	0%	1%	1%	0%	0%	0%	0%	1%	1%
Big bus	2%	1%	-1%	0%	0%	0%	3%	1%	-2%
Small bus	4%	2%	-2%	0%	0%	0%	3%	1%	-2%
Trailer truck	1%	0%	-1%	0%	0%	0%	0%	0%	0%
Articulated truck	1%	0%	-1%	0%	0%	0%	0%	0%	0%
Motorcycle	22%	30%	8%	7%	13%	6%	16%	21%	5%
Tricycle	15%	17%	2%	43%	48%	5%	26%	32%	6%
Bicycle/sikad	1%	1%	0%	0%	0%	0%	0%	1%	1%
Animal drawn	1%	1%	0%	0%	0%	0%	0%	0%	0%
OTHERS	26%	23%	-3%	33%	23%	-10%	29%	23%	-6%
TOTAL	**100%**	**100%**	**0%**	**100%**	**100%**	**0%**	**100%**	**100%**	**0%**

For transporting cargo, specifically farm and fish produce and other goods and commodities, the major mode of transport used at pre-completion was own vehicle (52%). Public transport (jeepney) and hired vehicle are a far second at a combined share of 32%. At post completion, the share of own vehicles in the transport mix increased by six percentage points as it remained as the major mode of transport used. Animal drawn vehicles, which was a mode of transport used at pre-completion was no longer utilized at post completion. The shift in the use ofanimal-drawn cart to motorized vehicle indicates an improvement in the quality of transport

mean. (Refer to Survey Report, Tables 15 and 15a for more details on the mode of transport used by transporters of cargo.)

On availability of transport, at pre-completion, 99% of respondents said that transportation is available for their travel purpose. Of the total, 87% said that transportation is available at daytime only, 11% said that it is available both on days and nights (11%), and 1% said that it is available the whole day. The remaining 1% said that transportation is not available. At post completion, the perception is that availability of transport improved as follows: (i) available at daytime only (78%); (ii) available both day and night (17%); (iii) available the whole day (3%); and (iv) none (2%). The perceived improvement was felt in all the municipalities surveyed except Antipolo City where transport availability at daytime only slightly increased from 96% to 99% (***Table 4.12***).

The above-cited perceptions are based, among others, on personal experience gained from frequent road usage. Majority of road users travel by day, explaining the results of the survey.

TABLE 4.12: PERCEPTION OF AVAILABILITY OF TRANSPORTATION

MUNICIPALITY	OVERALL (ALL ROAD USERS)							
	Pre-Completion				Post Completion			
	1	2	3	4	1	2	3	4
Infanta	87.3%	5.6%	4.2%	2.8%	71.3 %	12.5 %	8.8%	7.5%
Sta. Maria	94.4%	3.7%	1.9%	0.0%	84.1 %	12.7 %	1.6%	1.6%
Tanay	77.4%	21.7 %	0.0%	0.9%	63.6 %	33.9 %	2.5%	0.0%
Antipolo	96.3%	3.8%	0.0%	0.0%	98.8 %	1.2%	0.0%	0.0%
Aggregate	**87.2%**	**10.6 %**	**1.3 %**	**0.9 %**	**77.6 %**	**17.2 %**	**3.2 %**	**2.0%**

1 – Yes, daytime only; 2 – Yes, both day and night; 3 – Yes, 24 hours; 4 – No

On road safety, at post completion, perceived safety increased to 88%, up by 4%. The perceived safety ranged from 94% to 99% in Sta. Maria, Tanay and Antipolo. In contrast, satisfaction level in Infanta was only at 64%, a slight downturn of 2% from the percent satisfaction of 66% at pre-completion (***Table 4.13***). The perception of respondents from Infanta can be attributed to the terrain in the area, which is mountainous and as such the road has several curves and steep stretches. Among the factors considered in arriving at the above-cited perceptions are personal observations made in the course of road use, level of difficulty encountered/experienced in traversing the road, and sufficiency of road maintenance undertaken.

TABLE 4.13: PERCEPTION OF SAFETY OF TRAVELING

MUNICIPALI	OVERALL (ALL ROAD USERS)

TY	Pre-Completion		Post Completion	
	Yes	No	Yes	No
Infanta	66.2%	33.8%	63.5%	36.5%
Sta. Maria	90.2%	9.8%	96.8%	3.2%
Tanay	90.4%	9.6%	94.1%	5.9%
Antipolo	87.7%	12.3%	98.8%	1.3%
Aggregate	83.9%	16.1%	88.1%	11.9%

Frequency of Travel and Travel Time of Passenger Transport

The frequency of travel and travel time of workers and students are shown in ***Table 4.14*** and ***Table 4.15***, respectively. As is the norm, students use the road 5 days a week on average. On the other hand, with a number of household workers outside of the regular force, frequency of travel is less often at 4 days per week. Most students take less than 15 minutes for a one-way travel to school (76% at pre-completion vs. 71% at post completion). This takes into account average travel distances to school of 7.56 km at pre-completion and 8.13 km at post completion. Average travel times expended for the distances at pre- and post-completion are about 8.8 minutes and 8.20 minutes, respectively. Note that while the average travel distance is longer, the road allows for a faster travel speed such that there is an average time savings of about half a minute. As earlier stated, changes in the average distance from residence to destination are due to the expansion of the sphere of social and economic services arising from road completion. For workers, travel time at pre-completion was mixed with 26% reaching their destination in 1-2 hours and another 25% arriving at their destination in 15 minutes or less. At post completion, workers with travel times of 1-2 hours decreased to 17% while those with travel times of 15 minutes or less increased to 38%. This is due to an increase in the number of household workforce, particularly the doubling of the number of workers residing nearer MIR and their workstations.

TABLE 4.14: FREQUENCY OF ROAD USAGE

Frequency	Infanta	Sta. Maria	Tanay	Antipolo	Total	Infanta	Sta. Maria	Tanay	Antipolo	Total
To/from Work										
Daily	50%	65%	71%	70%	66%	64%	61%	52%	69%	61%
Twice a week	4%	5%	0%	8%	4%	6%	4%	3%	7%	5%
Weekly	8%	5%	12%	12%	10%	3%	7%	13%	13%	10%
Twice a month	4%	15%	7%	5%	7%	6%	18%	12%	7%	10%
Monthly or less often	25%	5%	2%	5%	8%	14%	4%	5%	4%	6%
Others	8%	5%	7%	0%	5%	8%	7%	15%	0%	8%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Ave. days/week	3 days	4 days	4 days	4 days	4 days	4 days	4 days	3 days	4 days	4 days
To/from school										
Daily	100%	100%	80%	100%	91%	88%	87%	65%	98%	82%

Twice a week	0%	0%	0%	0%	0%	3%	0%	1%	0%	1%
Weekly	0%	0%	11%	0%	5%	3%	3%	8%	0%	4%
Twice a month	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Monthly or less often	0%	0%	0%	0%	0%	3%	0%	0%	2%	1%
Others	0%	0%	9%	0%	4%	3%	10%	25%	0%	12%
Total	100 %	100%	100 %	100%	100 %	100%	100%	100%	100%	100 %
Average days/week	**5 days**	**5 days**	**5 days**	**5 days**	**5 days**	**5 days**	**5 days**	**4 days**	**5 days**	**5 days**

TABLE 4.15: PERCENT DISTRIBUTION OF WORKERS AND STUDENTS BY TRAVEL TIME (OVERALL)

TRAVEL TIME	TO/FROM WORK		TO/FROM SCHOOL	
	Pre-	Post	Pre-	Post
15 min or less	25.0%	37.6%	75.9%	71.3%
16-30 min	15.8%	13.9%	12.7%	17.2%
31-60 min	13.3%	11.5%	7.6%	6.9%
1-2 hours	25.8%	17.0%	3.8%	3.4%
>2 hours	20.0%	20.0%	0.0%	1.1%
Total count	100.0%	100.0%	100.0%	100.0%

Travel Time and Travel Cost of Transporters of Cargo

The number one destination of transporters of cargo is Metro Manila. For farm and fish produce which is perishable, transporting is usually done in the early part of the day whence traffic is lighter. At pre-completion, the average time of travel for said transporters was 53 minutes. This decreased to 46 minutes at completion, representing an improvement by an average of 7 minutes. For transporters of other goods and commodities, travel to Manila is done later. The average time of travel including waiting time was much shorter at post completion than at pre-completion (2.7 hours vs. 3.6 hours), with time savings of almost an hour. Meanwhile, average transport cost for both types of cargo transporters decreased by about 50% at post completion. This generated average savings amounting to P48 for transporters of farm and fish produce and P103 for transporters of other goods and commodities (***Table 4.16***).

TABLE 4.16: TRAVEL COST, TIME OF TRAVEL AND WAITING TIME

MUNICIPALITY	AVE. TRANSPORT COST (PESOS)		AVE. WAITING TIME (MIN)		AVE. TRAVEL TIME (MIN)	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Transporting Farm and Fish Produce						
Infanta	20	32	0	0	34	15
Sta. Maria		68	0	0		70
Tanay	250	44	0	0	90	60
Antipolo			0	0		
Total	97	49	0	0	53	46
Transporting other goods and commodities						
Infanta	101	91	90	97	165	106
Sta. Maria	70	69	60		120	30

Tanay	450	145			120	49
Antipolo						
Total	200	97	80	97	137	64

Level of Difficulty

Based on expressed level of difficulty experienced by transporters of cargo, it was established that at pre-completion, the major perception (53%) is that traversing the road is very difficult. The rest of respondents said that transporting cargo is manageable (7% not difficult and 40% somewhat difficult). At post completion, there is a marked improvement in road satisfaction as positions were reversed with 86% saying that transporting cargo is manageable (56% not difficult and 32% somewhat difficult). Only 12% said that traversing the road is very difficult (***Table 4.17***).

TABLE 4.17: % DISTRIBUTION OF CARGO TRANSPORTERS' RATING ON LEVEL OF DIFFICULTY

Municipality	Very Difficult		Somewhat Difficult		Not Difficult		Total	
	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post
Transporting Farm and Fish Produce								
Infanta	0	0	2	1	0	1	2	2
Sta. Maria	0	0	0	0	0	2	0	2
Tanay	0	0	1	0	0	1	1	1
Antipolo	0	0	0	0	0	0	0	0
Sub-Total	0	0	3	1	0	4	3	5
Transporting other goods and commodities								
Infanta	4	2	1	3	1	4	6	9
Sta. Maria	2	0	1	3	0	3	3	6
Tanay	2	1	1	1	0	3	3	5
Antipolo	0	0	0	0	0	0	0	0
Sub-Total	8	3	3	7	1	10	12	20
Total	**8**	**3**	**6**	**8**	**1**	**14**	**15**	**25**
% share	**53%**	**12%**	**40%**	**32%**	**7%**	**56%**	**100%**	**100%**

4.3 SOCIO-ECONOMIC CONDITION OF HOUSEHOLD

Household Assets

1. **Overall.** Some 88% of the respondents own the house they are residing in. However, only 61% own the lot where their house is built. Most of the respondents (44%) live less than 5 m from the main road. There are 15% of respondents who live farthest from the main road at 100 meters or more. Overall, the average distance of houses from the main road is 61.3 meters (***Table 4.18***). Only a small number of the houses have no electricity (8%). Most of the houses are made of either predominantly light materials (50%) or predominantly strong materials (47%). Materials used for the rest of

the houses are predominantly salvaged materials or are not specified.

TABLE 4.18: DISTANCE OF HOUSE FROM MAIN ROAD (IN % OF RESPONDENTS)

DISTANCE (METERS)	INFANTA		STA. MARIA		TANAY		ANTIPOLO		TOTAL		
	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	All
< 5	40%	58%	31%	29%	37%	57%	62%	63%	43%	53%	44%
5 – 9 m	32%	17%	16%	14%	6%	0%	1%	0%	13%	9%	13%
10 – 19	14%	17%	29%	43%	10%	14%	2%	0%	12%	18%	13%
20 – 49	7%	8%	18%	14%	16%	0%	0%	12%	12%	9%	12%
50 – 99	4%	0%	3%	0%	6%	0%	0%	0%	5%	0%	4%
100–more	3%	0%	3%	0%	25%	29%	32%	25%	15%	12%	15%
Total	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**
Ave. distance	**17.58**	**5.58**	**15.02**	**13.14**	**80.88**	**109.46**	**108.52**	**142.87**	**61.38**	**60.83**	**61.33**

2. **By Municipality.** For Antipolo City, majority of the respondents (85%) own the house they are residing in. However, only 62% own the lot where their house is built. Most of the respondents (62%) live less than 5 m from the main road. Those who live farthest from the main road at 100 meters or more comprise 22% of respondents. Only a small number of the houses have no electricity (7%). Most of the houses are made of either predominantly strong materials (54%) or predominantly light materials (42%). Materials used for the rest of the houses are predominantly salvaged materials or are not specified. With respect to ownership of a vehicle, only 39% answered yes.

   For Tanay, majority of the respondents (90%) own the house they are residing in. However, only 84 respondents (64%) own the lot where their house is built. Most of the respondents (38%) live less than 5 m from the main road. Those who live farthest from the main road at 100 meters or more comprise 25% of respondents. Only 1% of houses have no electricity. Most of the houses are made of either predominantly strong materials (53%) or predominantly light materials (44%). Materials used for the remaining houses are predominantly salvaged materials. With respect to ownership of a vehicle, 65% of respondents answered yes.

   For Infanta, majority of the respondents (90%) own the house they are residing in. However, only 60% own the lot where their house is built. About 42% of the respondents live less than 5 m from the main road. Those who live farthest from the main road at 100

meters or more comprise 3% of respondents. Eighty percent of the houses are served by electricity. Most of the houses are made of either predominantly light materials (59%) or predominantly strong materials (37%). Materials used for the remaining houses are predominantly salvaged materials. With respect to ownership of a vehicle, 63% of respondents answered yes.

For Sta. Maria, majority of the respondents (84%) own the house they are residing in. However, only 58% own the lot where their house is built. Most of the respondents (76%) live no more than 19 meters from the main road. Those who live farthest from the main road at 100 meters or more comprise 3% of respondents. Except for one, all of the houses have electricity. The number of houses built from predominantly light materials outnumbered those that used predominantly strong materials (59% vs. 39%). With respect to ownership of a vehicle, 59% answered yes.

Household Income

Both at pre-completion and post completion, most families draw their income from: (i) salary/wages from non-farm employment of household members; (ii) business, rent, dividends, pension and remittances both local and abroad, and sales of assets; and, (iii) on-farm income from crops. At pre-completion, income of 79% of households was drawn from these sources in combination. At post completion the number of households which draw income from these sources decreased to 71%. The decrease may be attributed to the large number of households (11%) that did not specify the source of their income.

At pre-completion, the overall average annual household income amounted to P101,381 (***Table 4.19***). The top two sources of income are: (i) salary/wages from non-farm employment of household members, which contributed an average amount of P59,607 (59%); and, (ii) income from business, rent, dividends, pension and remittances both local and abroad, and sales of assets, which produced an average amount of P23,288 (23%). A far third source (not considering other sources not specified) is on-farm income from forest products and other extractive resources (P3,226 or 3%). Across municipalities, the average annual income ranged from a high of P119,553 (Tanay, Rizal) to a low of P67,218 (Sta. Maria, Laguna).

At post completion, the overall average annual income increased by 47% to P148,646. Salary/wages from non-farm employment of household members; and, income from business, rent, dividends, pension and remittances both local and abroad, and sales of assets remained as the top two sources of income, with P77,320 (52%) and P43,623 (29%), respectively. A corresponding increase in the average income at the municipal level ensued as follows: (i) Infanta (from P87,694 to P95,378, or 9% increase); (ii) Sta. Maria (from P67,218 to P111,631, or 66% increase); (iii) Tanay (from P119,553 to P176,733, or 48% increase); and (iv) Antipolo (from P114,789 to P190,801, or 66% increase).

It is indicated above that the road project area has experienced improvements in household socio-economic indictors such as increase in income and diversification of its sources and asset building as well as in agriculture activity. Mobility has improved as indicated in a wider market sphere. While these improvements cannot be fully attributed to the road project, a significant number of survey respondents recognize the positive contributions of the project and categorically stated that the road project continues to help in their business.

TABLE 4.19: AVERAGE HOUSEHOLD INCOME BY SOURCE (OVERALL)

	SOURCE OF INCOME	AVERAGE ANNUAL HOUSEHOLD INCOME (OWNED LOT)									
		Infanta (100)		Sta. Maria (69)		Tanay (132)		Antipolo (99)		Total (average)	
		Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post
1	on-farm income from crops	3,334	4,232	5,109	11,949	1,994	3,254	97	0	2,397	4,193
2	on-farm income from livestock and livestock products	3,314	3,435	751	555	1,416	793	606	1,212	1,575	1,516
3	on-farm income from fish and aquatic resources and fish products	173	179	0	0	0	0	808	1,212	243	345
4	on-farm income from forest products and other extractive resources	590	450	5,409	0	2,775	642	4,970	5,394	3,226	1,659
5	salary/wages from non-farm employment of household members	50,563	52,341	42,105	64,390	68,403	74,008	69,215	115,978	59,607	77,320
6	unemployment benefits and other benefits	3	58	0	1,565	0	14	0	2,909	1	1,009
7	social assistance or other government and NGO assistance programs	866	1,375	2,097	3,861	2,018	3,967	65	331	1,260	2,401
8	income from business, rent, dividends, pension and remittances both local and abroad, and sales of assets	23,647	25,625	2,850	21,913	30,380	69,364	27,714	42,613	23,288	43,623
9	income from leasing/renting a farm, farm animals, or farm equipment and machineries	222	2,711	3,391	0	1,545	0	0	0	1,151	678
10	off-farm income from paid work for agricultural activities in another farmer's farm	1,158	1,252	409	2,254	2,148	2,730	0	0	1,069	1,603

11	Other sources	3,824	3,720	5,097	5,145	8,873	21,963	11,315	21,152	7,564	14,300
	Total	**87,694**	**95,378**	**67,218**	**111,631**	**119,553**	**176,733**	**114,789**	**190,801**	**101,381**	**148,646**

Access to Socio-Economic Benefits

The road provided easier access to various socio-economic services to include markets, hospitals, schools and government offices. It contributed to the enjoyment of benefits provided by said services. Increased travel cost was compensated by travel time savings and the accompanying travel comfort.

The average distance from residence to the nearest market decreased from 13.25 km at pre-completion to 12.66 km. at post completion. This resulted in a travel time savings of about 15 minutes over the distance travelled, with travel time per kilometer shorter at post completion by almost a minute. However, cost per km increased by ₱0.85 (***Table 4.20***). Similar decreases in travel time and increases in travel cost were experienced going to other socio-economic services like hospitals, government offices or schools.

TABLE 4.20: ACCESS TO NEAREST SOCIO-ECONOMIC SERVICES

Socio-Economic Services	Average Distance (km)	Per km Travel Time (min/km)	Total Travel Time (min)	Per km Travel Cost (Pesos/ km)	Total Travel Cost (Pesos)
Pre-					
Nearest market that you usually go to	13.249	8.44	46.76	4.76	33.76
Nearest secondary/ tertiary school that your children go to	7.295	9.00	23.21	6.91	25.76
Nearest government office that you usually go to	23.791	6.21	85.36	4.79	53.75
Nearest hospital that you usually go to	17.743	4.92	60.61	4.21	56.83
Post					
Nearest market that you usually go to	12.657	7.69	31.67	5.61	38.52
Nearest secondary/ tertiary school that your children go to	8.138	8.28	21.43	6.70	23.85
Nearest government office that you usually go to	28.204	3.34	32.40	5.21	67.27
Nearest hospital that you usually go to	15.652	3.93	43.02	5.25	62.80

4.4 ENVIRONMENTAL IMPACT

Environmental Effects

Respondents were made to comment on a pre-determined list of environmental problems that emerged because of the road project. The list includes (i) air pollution; (ii) contamination of drinking water; (iii) improper disposal of wastes; (iv) too much noise level; (v) deforestation; (vi) loss of wildlife; and, (vii) soil erosion. In all the cited issues, except noise level, at least 42% up to a high of 77% saw no change brought about by the road project. A huge number of respondents (54%) saw a change for the worse of noise level - worsened significantly (14%) and slightly worsened (40%) – which in combination redounds to an adjectival rating of slightly worsened. The slight worsening of noise level is a result of the increased number of vehicles which use the road. Significant worsening of the environment was seen to go no more than 5% in the other pre-identified problems (***Table 4.21***).

TABLE 4.21: ADJECTIVAL RATING OF ENVIRONMENTAL EFFECTS OF PROJECT

Environmental Effects	Adjectival Rating (%)					
	Worsened significantly	Slightly worsened	No change	Slightly improved	Improved significantly	Cannot decide
Air pollution	2.5	29.0	53.8	11.5	2.8	0.5
Contamination of drinking water	0.3	5.8	77.3	13.3	2.8	0.8
Improper/poor disposal of wastes from industry	4.0	16.5	50.5	26.0	1.8	1.3
Noise level (too much noise)	13.8	39.8	29.3	12.0	2.8	2.5
Deforestation	2.8	20.5	42.0	23.0	3.3	8.5
Loss of wildlife	4.0	33.3	43.0	7.3	3.5	9.0
Soil erosion	5.3	23.3	51.5	10.3	2.5	7.3

For overall rating: 1=worsened significantly; 2=slightly worsened; 3=No change; 4=slightly improved; 5=Improved significantly; 6=cannot decide

Social Effects

Respondents were made to comment on a pre-determined list of social development issues that emerged because of the road project. The list includes (i) illegal settlers; (ii) land development for business; (iii) peace and order; (iv) in-migration; (v) out-migration; and, (vi) community relationship. On the whole, the observation is that the road had no negative social effects. More specifically, on the issue of out-migration, some 69% of respondents saw no change. Of the remaining 31%, 4% had no comment, 12% saw slight or significant improvements, and 15% saw slight or significant change for the worse. In combination, these comments redound to a rating of 3 (i.e., no change) for out-migration. Similarly, a large number of respondents felt no change on the issue of community relationship (57%), illegal settlers (46%) and peace and order (48%). For

the other issues, respondents who saw improvements outnumbered those who saw a change for the worse by at least 30% to as high as 84%. In the case of land development for business and in-migration, respondents gave an overall rating of 4 or slightly improved (***Table 4.22***). On illegal settlers, there was a divided view, with improvements seen by 26.3% [24.5% seeing slight improvement and 1.8% seeing significant improvement]and a change for the worse felt by 20.3%, 2.8% seeing significant worsening and 17.5% seeing slight worsening]. The views of residents at the municipal level as far as illegal settlers are concerned are shown in ***Table 4.23***. Of the 26.3% that saw an improvement, Tanay accounts for 9.5%, Antipolo has 7.2%, while Infanta and Sta. Maria similarly account for 4.8%. On the other hand, of the 20.3% that saw a worsening, Tanay accounts for 7.3%, Infanta has 6.7%, Antipolo has 3.5%, while Sta. Maria has 2.8%.

TABLE 4.22: ADJECTIVAL RATING OF SOCIAL DEVELOPMENT ISSUES OF PROJECT

Social Development Issues	Adjectival Rating (%)					
	Worsened significantly	Slightly worsened	No change	Slightly improved	Improved significantly	Cannot decide
Illegal settlers	2.8	17.5	45.8	24.5	1.8	7.8
Land development for business	0.0	2.5	7.8	57.8	28.5	3.5
Peace and order	0.5	9.5	48.0	34.3	5.5	2.3
In-migration	0.8	7.0	16.0	55.8	16.3	4.3
Out-migration	1.5	13.3	68.8	11.5	0.5	4.5
Community relationship	0.5	5.3	57.5	27.8	7.8	1.3

For overall rating: 1=worsened significantly; 2=slightly worsened; 3=No change; 4=slightly improved; 5=Improved significantly; 6=cannot decide

TABLE 4.23: ADJECTIVAL RATING FOR THE ISSUE ON ILLEGAL SETTLERS

Municipality	Adjectival Rating (%)						
	Worsened significantly	Slightly worsened	No change	Slightly improved	Improved significantly	Cannot decide	Numerical Rating
Infanta	7.0%	20.0%	49.0%	18.0%	1.0%	5.0%	
Sta. Maria	1.4%	14.5%	55.1%	26.1%	1.4%	1.4%	
Tanay	1.5%	20.5%	38.6%	25.0%	3.8%	10.6%	
Antipolo	1.0%	13.1%	45.5%	29.3%	0.0%	11.1%	
All municipalities	2.8%	17.5%	45.8%	24.5%	1.8%	7.8%	3

The numerical rating of 3 means that on the whole, there is no change

4.5 IMPACT ON LOCAL ECONOMY AND LOCAL GOVERNMENT FINANCE

Local Economy

1. Agriculture

Fourteen percent of households have at least a member of the HH engaged in farming for the past 12 months. A breakdown of the agricultural workers/farmers shows that 43% have been farming for less than 10 years, 22% are already farming from 11-20 years, while 35% are farming for more than 20 years. Land area cultivated is from less than one hectare to ten hectares. The top three crops planted are coconut, rice and bananas.

The average land area cultivated for rice decreased by 8% from 2.6 hectares at pre-completion to 2.4 hectares at post completion. But average crop production increased by 23% from 1.3 tons/ha. to 1.6 tons/ha. Higher input costs combined with cheaper farm gate prices resulted in a 5% decrease in the annual net income of farmers from an average of P18,130.50 at pre-completion to an average of P17,300.00 at post completion (***Table 4.24***).

TABLE 4.24: FARM PROFILE WITH RICE AS MAIN CROP

Municipality	Average Area of Land Cultivated (hectares)	Average Crop Production (Tons/ha.)	Average Input Cost (Pesos)	Average Farm Gate Price (Pesos/kilo)	Average Gross Income (Pesos)	Average Net Income (Pesos)
Pre-						
Infanta	1.7	1.5	3,687.5	12.0	19,500.6	15,100.6
Sta. Maria	14.0	0.8	4,000.0	14.0	10,500.0	6,500.0
Tanay	0.4	0.0	6,000.0	12.2	60,000.0	54,000.0
Antipolo						
Total	**2.6**	**1.3**	**3,950.0**	**12.2**	**22,364.1**	**18,130.5**
Post						
Infanta	2.4	1.6	4,506.3	11.9	21,738.9	17,300.0
Sta. Maria						
Tanay						
Antipolo						
Total	**2.4**	**1.6**	**4,506.3**	**11.9**	**21,738.9**	**17,300.0**

At the time of the survey (2017), 100% of respondents who are farm workers/farmers said that they made a change in the main crops planted. Among the reasons cited for the shift in crops are: (i) climate change; (ii) increase in farm gate prices; (iii) increase in costs of farm inputs; and, (iv) increase in pest problems (***Table 4.25***).

TABLE 4.25: PERCENTAGE OF FARMERS WHO CHANGED CROPS AND REASONS FOR CHANGE IN CROPS PRODUCED

Reasons for Change in Crops Produced	Infanta	Sta. Maria	Tanay	Antipolo	Total
% who changed	100%	100%	100%	100%	100 %
Climate change	11.1	0.0	0.0	0.0	8.3
Increase in farm gate prices	0.0	50.0	0.0	0.0	8.3
Increase in cost of farm inputs	33.3	0.0	0.0	0.0	25.0
Increase in pest problem	22.2	0.0	0.0	0.0	16.7
Not specified	22.2	50.0	100.0	0.0	33.3
Switched to farming	11.1	0.0	0.0	0.0	8.3
Total	**100.0**	**100.0**	**100.0**	**0.0**	**100.0**

The marketing of farm and fish produce and other goods and commodities usually occur in five distinct places, i.e., direct from home/farm, local market (within barangay), local market (outside the barangay), main/town market, or Metro Manila/other municipalities. In this particular survey, results show that a major part of the cargo consist of rice, vegetables, bananas, manufactured food such as groceries, and household items. Most of the produce/goods are transported and sold in Metro Manila and its nearby municipalities (50% at pre-completion and 37% at post completion). The main/town market is also a venue for selling a significant part of the produce/goods (18% at pre-completion and 21% at post completion). Accordingly, with the decrease in the percentage of merchants going to Metro Manila, sales in the other venues increased (***Table 4.26***). More details are shown in ***Annex D***.

TABLE 4.26: WHERE CARGO IS SOLD (IN %)

WHERE PRODUCT IS SOLD	INFANTA			STA. MARIA			TANAY			ANTIPOLO			TOTAL		
	Pre	Post	Diff.	Pre-	Post	Diff.	Pre-	Post	Diff.	Pre-	Post	Diff.	Pre-	Post	Diff.
Direct from home/farm	20	14	-6	10	6	-4	0	0	0	25	17	-8	13	9	-4
Local market (w/in barangay	20	14	-6	0	19	19	10	27	17	0	0	0	8	16	8
Local market (outside barangay)	0	7	7	20	25	5	20	27	7	0	8	8	11	17	6
Main/Town market	10	29	19	20	13	-7	30	13	-17	12	33	21	18	21	3
Metro Manila or other municipalities	50	36	-14	50	37	-13	40	33	-7	63	42	-21	50	37	-13
Total	**100**	**100**	**0**	**100**	**100**	**0**	**100**	**100**	**0**	**100**	**100**	**0**	**100**	**100**	**0**

2. Tourism[27] and Local Economic Activity

Only the Infanta Local Tourism Office has an official record of tourist arrivals[28] as shown in the table below

TABLE 4.27: TOURISM ARRIVAL IN INFANTA, QUEZON

YEAR	TOTAL NO. OF TOURIST
2013	1,963
2014	6,207
2015	6,512

It was claimed however during KII that prior to 2016, there were approximately 40,000 tourist arrivals in Infanta, of which about 5,000 stayed overnight and the rest were excursionists. Most excursionists and tourists visit beaches and resorts. There are 39 establishments that cater to tourists.

KIIs were also conducted for the other three LGUs. Only Tanay has been attracting excursionists at a rate of 3,000 a day. Tourist arrivals in Tanay are credited to the construction of the Project road. Officials claim that there are many activities to do in Tanay like spelunking, trekking, nature appreciation (beautiful Suiseki stones, Dalisdes, etc), hunting of Suiseki, mountain climbing, etc.

FIGURE 4.4: TOURISM DESTINATIONS IN THE ROAD INFLUENCE AREA

27Period covered is between 2011-2015
28There is no data for tourism receipt in the LGUs

3. Local Government Finance

The LGUs in the influence area's operating income[29] and operating expenditure and corresponding yearly growth rate are shown in ***Table 4.28***. From CY 2009 to 2012, the growth rate of current operating income was steadily declining until it evened out in 2013. Thereafter, growth rate was erratic, i.e., increase in 2014, decline in 2015 followed by another increase in 2016. The growth rate, however is positive at 5.9 percent during the eight-year period from 2009 to 2016.For the net operating income, from 2011 to 2016, negative growth rates have been recorded except in 2013 and 2016 when the rate was at 28%. ***Figure 4.5*** shows the trends of these variables.

TABLE 4.28: TOTAL CURRENT OPERATING INCOME AND EXPENDITURES (IN MILLION PESOS)

Year	Total Current Operating Income (TCOI)		Total Current Operating Expenditures (TCOE)		Net Operating Income/ (Loss) From Current Operations (NOI)		Total Non-Income Receipts (TNIR)		Total Non-Operating Expenditures (TNOE)	
2009	1981.3		1404.4		576.8		496.1		652.1	
2010	2157.3	9%	900.7	-36%	1256.7	118%	300.2	-40%	257.9	-60%
2011	2178.4	1%	1201.9	33%	976.5	-22%	54.9	-82%	275.9	7%
2012	2132.8	-2%	1251.0	4%	881.8	-10%	41.1	-25%	265.5	-4%
2013	2131.4	0%	1003.4	-20%	1128.0	28%	0.0	22%	192.2	-28%
2014	2636.7	24%	1755.2	75%	881.5	-22%	181.1	262%	243.9	27%
2015	2790.5	6%	2081.3	19%	709.2	-20%	827.7	357%	373.1	53%
2016	3127.9	12%	2223.4	7%	904.4	28%	930.4	12%	171.6	-54%

Source: Bureau of Local Government Fund data base on financial statements of local governments

Results of the correlation analysis indicate that there is correlation between revenue and expenditure with variables such as traffic level and maintenance cost. This result implies that dependent variables income and expenditures somehow reacts to the changes in the values of these variables.

29Only operating income and expenditures as proxies to determine if there is direct correlation between revenues and expenditures and the road project

The complete financial statement of the four LGUs are Presented in ***Annex D***.

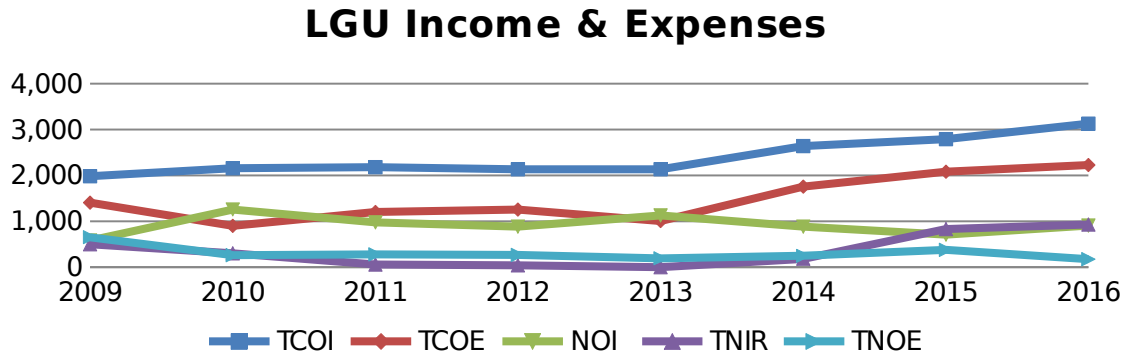

FIGURE 4.5: LGU OPERATING INCOME AND EXPENDITURES

4.6 SUSTAINABILITY

Sustainability of Outcomes

Sustainability of outcomes is determined from the satisfaction level of respondents. In all aspects of the road, i.e., physical construction, service it renders to the community or its usefulness, safety, maintenance and overall, respondents were almost equally divided in expressing complete satisfaction or non-satisfaction, with the difference in rating between 0% - 5%. The majority was either somewhat satisfied or somewhat not satisfied, in favor of the former by at least 5% for service and usefulness, to as high as 29% on road safety (***Table 4.29***).

TABLE 4.29: PERCENTAGE SATISFACTION LEVEL WITH THE ROAD PROJECT

Road Aspect	Completely Satisfied	Somewhat Satisfied	Somewhat not Satisfied	Completely not Satisfied	Cannot Decide	Total (%)
Physical construction	14.8	33.3	32.0	19.5	0.5	100 %
Service it renders to the community or its usefulness	22.0	27.5	27.8	22.5	0.3	100 %
Road safety	9.3	38.5	42.5	9.3	0.5	100

						%
Road maintenance	13.3	31.8	40.8	11.8	2.5	100 %
Overall	12.3	37.8	34.0	14.5	1.5	100 %

The bases of the above ratings are shown in ***Table 4.30***. Overall, positive comments outnumbered the negative comments. Of the positive comments, the improved road condition was cited the most (41%), with fast travel a far second (17%). For negative comments, safety is the main concern (25%). Delay in construction, and poor maintenance follow closely at 19% and 16%, respectively.

TABLE 4.30: PERCENTAGE DISTRIBUTION OF POSITIVE AND NEGATIVE COMMENTS

Comment	Antipolo	Infanta	Sta. Maria	Tanay	Total
Positive Comments					
Improved traffic condition	50%	7%	0%	43%	6%
Improved road condition	35.6%	24.0%	14.4%	26.0%	41%
Availability of public transport	16.7%	16.7%	27.8%	38.9%	7%
Fast travel	14.0%	30.2%	27.9%	27.9%	17%
Safe	12.5%	62.5%	0.0%	25.0%	3%
Convenient	22.2%	38.9%	27.8%	11.1%	7%
Help in business	15.4%	53.8%	15.4%	15.4%	5%
Others	0.0%	9.1%	27.3%	63.6%	13%
Total (%)					**100%**
Negative Comments					
No signages	41%	24%	12%	24%	15%
Not safe	10%	17%	21%	52%	25%
Involuntary resettlement	75%	0%	25%	0%	3%
Delay in construction	23%	36%	9%	32%	19%
No light	0%	50%	0%	50%	3%
Poor maintenance	0%	56%	17%	28%	16%
Congested	0%	100%	0%	0%	1%
Others	0%	5%	19%	76%	18%
Total (%)					**100%**

Aside from the satisfaction level of respondents, O&M status gathered from visual observation, and information on existing O&M policies, finances and staff amassed through interviews with appropriate officials of concerned agencies were used to determine sustainability of outcomes. Based on available information, the project outcomes are seen to be sustainable.

Sustainability of Road Structures

Every year maintenance budget is secured by General Appropriations Act (GAA) from which the district engineering office staff is assured of funds for the periodic and routine maintenance[30] of the road. [31]

4.7 PREDICTIVE MODELS

1) Total Tax Revenue

The variation of total tax revenue (TTR) is explained by the predictor variables: Maintenance GAA in Million Pesos (MIRP), Year, Regional Dummies, Average Annual Daily Traffic (Total), and Project Dummy

The predictive model is shown in Equation 1 and the summary table of predictors is shown in ***Table 4.31***.

Equation 1

TTR = 7,292 -3.721X1 + 1.598X2 + 137.151X3 + 141.709X4 + 120.204X5 + 0.111X6 +0.030X7.

TABLE 4.31: SUMMARY TABLE FOR PREDICTORS OF TOTAL TAX REVENUE

DEPENDENT VARIABLE:	TOTAL TAX REVENUE	
Predictors	**Coefficient**	**P-value**
(Constant)	7282.000	.134
Year ($X_{1)}$	-3.721	.126
After or pre-project (X_2)	1.598	.936
RPT of Municipality Infanta, Quezon (X_3) in million pesos	137.151	.005
RPT of Municipality Sta. Maria, Laguna (X_4) in million pesos	141.709	.001
RPT Municipality Tanay, Rizal (X_5) in million pesos	120.204	.001
Total Average Annual Daily Traffic (X_6) vehicles	.111	.000
Maintenance GAA in Million Pesos (X_7)	.030	.526
R-square	0.977	
Adjusted R-square	0.973	

Total Tax Revenue (TTR) is explained by the predictor variables that include maintenance GAA in million pesos, Year, municipalities TTR, total average annual daily traffic, and after/pre-project status.
The coefficient Year (-3.721) indicates that every year, the real property tax (RPT) decreases by 3.721 million pesos, assuming other factors are constant. The B value for project status indicates that the years when the project is present, the value of TTR increases by 1.598 million pesos. The B values for TTRs of Infanta, Sta. Maria, and Tanay indicate that the corresponding TTR of these municipalities are higher

30The collapse of Querocep Bridge is not due to poor maintenance but by 'acts of nature' or force majeure.
31Details of maintenance regime and costs are presented in the Ex-post Evaluation Report (Appendix to this Report)

than the TTR increase of Antipolo (P137.151 million, P141.709 million, and P120.204 million, respectively). The B value of total average annual daily traffic (AADT) of 0.111 vehicles indicates that for every 1 unit increase in AADT, there is a corresponding 0.111 million pesos increase in TTR. The R-square and Adjusted R-square values indicate that 97.7% or 97.3% of variation is explained by the predictor variables.

2) Real Property Tax

The variation in Real Property Tax is explained by the predictor variables: Maintenance GAA in Million Pesos (MIRP), Year, Regional Dummies, Average Annual Daily Traffic (Total), and presence or absence of Project. The predictive model is shown in Equation 2:

Equation 2

$$RPT = 2{,}999.649 - 1.483X1 + 3.544X2 - 49.047X3 - 43.988X4 - 43.996X5 + 0.046X6 + 0.020X7$$

Where X_1, X_2...$X_7$are coefficients (defined in the table

TABLE 4.32: CORRELATION PARTICULARS FOR PREDICTION OF REAL PROPERTY TAX REVENUE

Dependent variable:	**Real Property Tax**	
Predictors	**Coefficient**	**P-value**
(Constant)	2999.649	.285
Year (X_1)	-1.483	.291
After or pre-project (X_2)	3.544	.758
RPT of Municipality Infanta, Quezon (X_3) in million pesos	-49.047	.074
RPT of Municipality Sta. Maria, Laguna (X_4) in million pesos	-43.988	.061
RPT Municipality Tanay, Rizal (X_5) in million pesos	-43.996	.033
Total Average Annual Daily Traffic (X_6) vehicles	.046	.000
Maintenance GAA in Million Pesos (X_7)	.020	.463
R-square	0.977	
Adjusted R-square	0.974	
Model		0.000

The B value for Year (-1.483) indicates that every year, the real property tax (RPT) decreases by ₱1.483 million, assuming other factors are constant. With the project RPT increases by ₱3.544 million annually. The results of the regression analysis indicate that RPT of Infanta, Sta. Maria, and Tanay have lower RPT than Antipolo (-49.047, -43.988, and -43.996, respectively). The model predicts that for every unit increase Average Annual Daily Traffic (AADT), there is a corresponding increase of ₱0.046 million in RPT. The B value of 0.02 of Maintenance GAA indicates that per million pesos increase in maintenance, there is 0.020

increase in RPT. The constant, 2999.649, is the value of RPT when all other dependent variables are zero. The R-square and Adjusted R-square values indicate that 97.7% or 97.4% of variation is explained by the predictor variables.

5 LESSONS LEARNED

The following lessons learned may be referred to I the implementation of similar road projects in the future:

1. In the implementation of similar road projects which have steep side slopes and, thus, are prone to erosion and landslides, vegetation is a very desirable means of providing slope protection for reasons of availability, relatively low cost, appropriateness of installation techniques and compatibility with a rural environment. It is particularly appropriate in situations where large areas of slope are affected, a common situation on road cuttings and over unstable mountain slopes. The enhancement of road-side vegetation also has a positive effect both visually and in terms of plant diversity. Another method is the use of bio-engineering. Bioengineering is the use of living plants such as vetiver, either alone or in conjunction with engineering structures and nonliving plant material such as coco coir, to reduce erosion and shallow-seated instability on slopes.

2. Periodic maintenance of projects is a crucial element of sustainability. Its timely performance could have prevented the collapse of the Querocep Bridge. According to residents, the bridge piers were weakened through time due to massive build-up of debris from the mountain brought by a series of typhoons. The bridge finally collapsed when floodwaters came rushing down the slopes during a weather disturbance in 2015.

6 RECOMMENDATIONS

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
A. SECTORAL POLICY		
1. Data availability **There is not much data available from the DPWH Regional Office. The data from the interactive GIS Application in the DPWH website is not complete.** **Data particular to this Project such as design, cost estimates, and periodic maintenance schedules are not available.** **It is informed that all relevant materials were lost in a fire that gutted the building in the DPWH Regional Office IV-A. It appears that there is no electronic archive of these critical data.** **Local economic and social data such as tourism arrivals and receipts which may be used for in budgeting and other financial forecasting are not readily available from the LGUs.**	It is recommended that an inter-agency portal that publishes relevant data that can be accessed by service providers of the government such as consultants and contractors be established. The big investment from the government needed for the development of this kind of portal and level of technology, is offset by the usefulness/ready access of the data. In the short term, the field office of the DPWH may develop its own knowledge management system that includes and electronic-based archive that is capable of storing data in different formats. The DPWH Information Management Service is presently enhancing the Department's knowledge management system and may be requested for assistance in this endeavor. Strengthening of the LGU data collection regime	DPWH DPWH DPWH Regional Office IVA LGUs
2. Regular monitoring of on-going and completed projects **The timely discovery of presence of sediments that may cause blockage/damming of bridge substructures could have been cleared. Case in point. The timely reporting of the collapse**	NEDA in cooperation with implementing agencies should conduct monthly field monitoring not only of on-going projects but	DPWH Regional Office, NEDA Regional Office,

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
of Querocep Bridge could have facilitated immediate repair	also completed critical projects (like a bridge) in areas where occurrence of natural hazards like typhoons is frequent.	RPMC
3. Project Development[32] Process **It was observed that trips are more local than the envisioned through trips from the eastern seaboard to the urbanized areas of Rizal and Metro Manila. The steep vertical alignment of the road project makes travelling difficult and unsafe such that a large number of travelers still prefer to take the longer and more congested Famy-Real-Infanta Road.** **Without baseline data, triangulation of the technical data from engineering surveys did not happen.**	Project identification and development should be participatory. (refer to the Appendix for summary of project development process) The use of technical tools in identifying projects should be validated with information from the ground, especially, beneficiaries. Baseline data collection should be part and parcel of project preparation, ideally during feasibility studies.	DPWH concerned office LGUs NEDA Regional office
B. SECTORAL PROGRAM		
1. Transport Network Development Synchronization **It has been observed that the projected traffic has not been reached because the Infanta Port which was envisioned during the feasibility study as main traffic generator has not**	Upgrading/development of the Infanta Port to reach its potential to serve its hinterland and generate traffic, thereby optimizing utilization of MIR	PPA

32refer to the Appendix for summary of project development process

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
delivered.		
2. Road Capacity Improvement **Based on recent developments in CALABARZON and Luzon, the MIR is a critical road that can support the proposed Luzon Pacific Highway (LPH) given its proximity to the proposed highway.** **(Note: Quezon First Engineering District Office of the Department of Public Works and Highway (Q 1st DEO-DPWH) is working closely on the planned construction of the 93 kilometers road of Barangay Umiray in Gen. Nakar town (eventually, Infanta, that will connect to the town of Dingalan in Aurora province. This project according to the DPWH is included in the Build Build Build Program.)**	It is recommended that remedial measures such as construction of climbing lanes be instituted to address difficulty in traversing the critical segments of the MIRP (i.e., mountainous sections with gradient greater that 2.5%). (Note: climbing lanes are lanes that allow slower travel for large vehicles, such as large trucks or semi-trailer trucks, ascending a steep grade without slowing traffic and provide ease for smaller vehicles to overtake. This is to improve road safety and speed. The primary safety concern is the risk of rear-end or same-direction sideswipe accidents involving slow-moving trucks. *Climbing lanes may have the potential to eliminate some head-on or opposite direction sideswipe accidents.*)	DPWH

GLOSARRY

Accessibility **i**s the quality of travel that takes one to a destination. It focuses on travel time, travel cost, travel options, comfort, and risk.

Annual Average Daily Traffic is based on a 24-hour, two-directional count at a given location. The raw traffic data is mathematically adjusted for vehicle type, determined by an axle correction factor. The data is then statistically corrected by a seasonal variation factor that considers time of year and day of the week.

Average Cost is cost per unit of output.

Average Daily Traffic (ADT) is the unadjusted, average number of vehicles passing in both directions at a specified location of a roadway

Average Travel Cost is the average cost of travel taking all trips into account

Average Travel Time is the average time of travel taking all trips into account; also expressed as the ratio of total trips to total travel time.

Average Trip Length is the average distance traveled taking all trips in the chain into account.

Bias refers to the tendency of a measurement process to over- or under-estimate the value of a parameter

Confidence Interval is a random interval for a parameter constructed from data so that the probability of that interval contains the true value of the parameter which can be specified before the data are collected.

Confidence Level refers to the percentage of all possible samples that can be expected to include the true population parameter

Consumer Price Index is the measurement of average changes in prices paid by consumers of a fixed basket of a wide variety of goods and services

Correlation Coefficient: Given a pair of related measures (X and Y) on each of a set of items, the correlation coefficient (r) provides an index of the degree to which the paired measures co-vary in a linear fashion.

Cost-Benefit Analysis: The appraisal of an investment project which includes all social and financial costs and benefits accruing to the project. It is the technique adopted in investment appraisal in order to evaluate and decide whether a proposed project should proceed, i.e. its benefits would exceed its costs.

Critical value approach involves determining "likely" or "unlikely" by determining whether or not the observed test statistic is more extreme than would be expected if the null hypothesis were true.

Cross-section Data: A set of data which are collected at one point of time.

Database: Collection of data from which information is derived and on the basis of which decisions can be made.

Degrees of Freedom: This term is used to describe the number of values in the final calculation of a statistic that are free to vary.

Descriptive statistics is the term given to the analysis of data that helps describe, show or summarize data in a meaningful way such that patterns might emerge from the data. It does not allow conclusions to be made beyond the data that have been analyzed or reach conclusions regarding any hypotheses that might have to be made.

Direction of Travel on a roadway is northbound (NB), southbound (SB), eastbound (EB) or westbound (WB).

Dummy Variable: A binary (off-on) variable designed to take account of exogenous shifts (shift dummy) or changes of slope (slope dummy) in an econometric relationship. For instance, dummies can be used to account for seasonal influences in the data. By specifying a dummy to take on the value of unity of, say, winter months, and zero at other times, it will indicate the degree to which a relationship shifts during the winter, compared to other seasons, by augmenting the constant term of the equation. This type of variable can also be used to include qualitative factors in regression.

Effectiveness A measure of the extent to which a project attains its objectives. Evaluating the effectiveness of a project is to determine to what extent were the objectives achieved / are likely to be achieved and what were the major factors influencing the achievement or non-achievement of the objectives

Efficiency measures the outputs -- qualitative and quantitative -- in relation to the inputs. It is an economic term which signifies that the project uses the least costly resources possible in order to achieve the desired results. When evaluating the efficiency of a project, cost and time efficiency are indicators to be measured.

Elasticity of Demand: It is the proportionate change in demand due to change in price

Explanatory Variable: A variable which plays a part in 'explaining' the variation in a dependent variable in a regression analysis.

Firm: Analytical label for an institution which transforms inputs into output. Thus, a firm is viewed as an abstract entity which mainly fulfils technical role.

Fiscal Impact Analysis **is** the estimation of the net **i**mpact on government of a particular project.

Gross Domestic Product (GDP): A measure of the total flow of goods and services produced by the economy over a specified time period, normally a year or quarter. It is obtained by valuing the output of goods and services at market prices and then aggregating.

Household: A group of persons normally living together and taking food from a common kitchen.

Household Size: The total number of persons normally residing together in a household including temporary stay-away but excluding temporary visitors and guests.

Impact are the positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators. The examination should be concerned with both intended and

unintended results and must also include the positive and negative impact of external factors, such as changes in terms of trade and financial conditions.

Inferential statistics are techniques that allow the use of samples to make generalizations about the populations from which the samples were drawn

Influence Zone (Influence Area): It is the area showing significant socio-economic impact of the project on the population (for the present study, the influence zone has been delineated as an area extending up to an approach distance of 5 km on either side of the national highway).

Interval scale is one in which the actual distances, or intervals between the categories or points on the scale can be compared. The distances between the numbers or units on the scale are equal across the scale.

Measures of central tendency are ways of describing the central position of a frequency distribution for a group of data.

Measures of spread are ways of summarizing a group of data by describing the spread including range, quartiles, absolute deviation, variance and standard deviation.

Mean is the sum of a set of numbers divided by the count of numbers in the set.

Mobility is the ability and level of ease of moving goods and services.

Multivariate Analysis uses two or more variables to measure a person, place or thing. Variables may or may not be dependent on each other

Nominal Scale is a measurement that puts people, events, perceptions, objects or attributes into categories based on a common trait or characteristic. It is the lowest form of a measurement because it is used simply to categorize and not to capture additional information.

Null Hypothesis is a term that statisticians often use to indicate the statistical hypothesis tested. The purpose of most statistical tests is to determine if the obtained results provide a reason to reject the hypothesis that they are merely a product of chance factors.

Ordinal or Ranking ranks the data from lowest to highest and provides information regarding where the data points lie in relation to one another. It typically uses non-numerical categories such as low, medium and high to demonstrate the relationships between the data points. It does not, however, provide information regarding the magnitude of the difference between the data points or rankings.

Parameter is a numerical property of a population, such as its mean.

Population Mean is the mean of the numbers in a numerical population. For example, the population mean of a box of numbered tickets is the mean of the list compiled of all the numbers on all the tickets. The population mean is a parameter.

Population Standard Deviation: The standard deviation of the values of a variable for a population. This is a parameter, not a statistic.

Population: It is a collection of units being studied. The units can be people, places, objects, drugs, procedures, or many other things. Much of the statistics is concerned with estimating numerical properties (parameters) of an entire population from a random sample of units from the population.

Probability: A number between 0 and 1 which represents how likely an event is to occur. Events with probability equal to 0 never occur. Events with probability equal to 1 always occur

Relevance The extent to which the activity is suited to the priorities and policies of the government. In evaluating the relevance of a project and consider the following questions:

To what extent are the objectives of the project still valid?

Are the activities and outputs of the project consistent with the overall goal and the attainment of its objectives?

Are the activities and outputs of the project consistent with the intended impacts and effects?

Road Safety refers to the methods and measures used to prevent road users from being killed or seriously injured.

Ratio Scale categorizes the data, places the data along a continuum so that categories or data points in relation to each other, and the data points or categories are equal distances or intervals apart are examined.

Sample: A set of observations, usually taken from collection of units being studied, the population.

Sample Mean*: is t*he arithmetic mean of a random sample from a population. It is a statistic commonly used to estimate the population mean.

Sample Number: The number assigned to a household selected from the list of households.

Sample Size: The number of elements in a sample from a population.

Sampling Error: The error arising due to drawing of inference about population on the basis of a few observations (sampling). Such errors are non-existent in complete enumeration survey.

Secondary Sources: These include files, reports, maps, aerial photographs, satellite imagery, articles, journals, and books.

Standard Deviation: It is the measure of the dispersion of a series around the mean value.

Standard Error: It is the standard deviation of the values of a given function of the data (parameter) over all possible samples of the same size.

Standard Normal Variate: A variable (a set of data) that has normal distribution with mean= 0 and standard deviation = 1 is known as standard normal variate.

Statistic: A number that can be computed from data, involving no unknown parameters. As a function of a random sample, a statistic is a random variable. Statistics are used to estimate parameters and to test hypotheses.

Statistically Significant: A finding (for example, the observed difference between the means of two random samples) is described as statistically significant, when it can be demonstrated that the probability of obtaining such a difference by chance only, is relatively low.

Sustainability is concerned with measuring whether the benefits of an activity are likely to continue during operation of the project. Projects need to be environmentally as well as financially sustainable.

Time-Ordered data are data taken over time in chronological sequence**.**

Time series analysis is a statistical technique that deals with time series data, or trend analysis.

Time series data means that data is in a series of particular time periods or intervals.

Trip: It is a one-way person movement by any mode of transport having two trip ends, an origin or start of a trip and a destination or end of a trip for a specific purpose.

Travel Distance*:* It is the distance of one-way person movement between origin and destination.
Trip Purpose: It is the purpose of the one-way person movement. A trip may be made for any purpose like work, education, business, shopping, etc.

Travel Time: It is the time taken to complete one-way person movement between origin and destination.

Variance: A measure of the dispersion of a distribution from the mean. The variance of a series is the square of the standard deviation of the series, i.e. the average of the squares of the deviations of the numbers in the series from their mean.

Vehicle: A conveyance that transports people or objects.

Vehicle Classification is the type of vehicle based on DPWH classes of vehicles. For the purposes of this report, vehicle class is summarized into three groups:

Passenger Vehicles - Passenger vehicle class includes motorcycles, passenger cars, pickup and SUVs

Single-Unit Trucks - Single-unit truck class includes school buses, 2-axle, 3-axle and 4- axle single-unit trucks also called medium-duty trucks or “mediums”)

Tractor Trailer Trucks - Tractor-trailer truck class includes heavy-duty vehicles with four or more axles; a semi-tractor pulling a trailer(s), i.e. a “semi” or “18-wheeler”

Univariate analysis uses one variable to describe a person, place, or thing

Vehicular speed of travel is measured in kilometers per hour (kph)

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Annexes

APPENDIX A

PROJECT CYCLE FOR ROAD PROJECTS

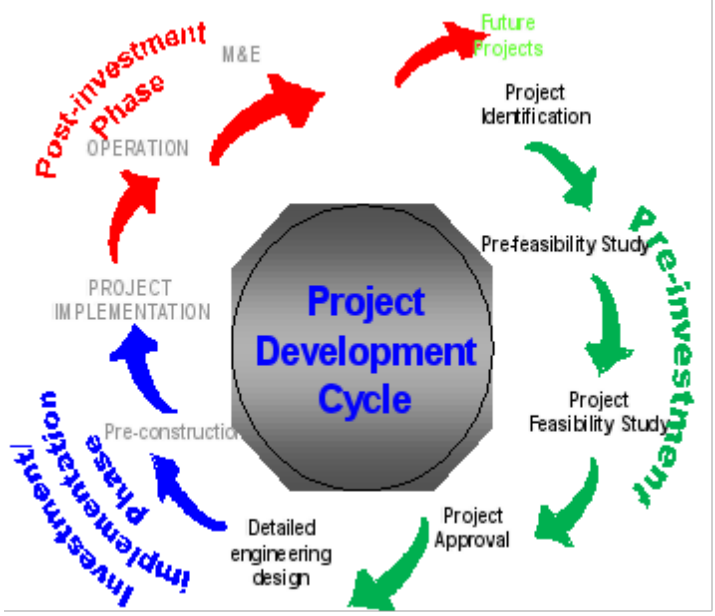

FIGURE A-1 PROJECT DEVELOPMENT CYCLE

PROJECT STAGE	INPUTS	PROCESSES	OUTPUTS	RESPONSIBLE INSTITUTION/ENTITY
A. Pre-Investment Phase				
1. Problem identification	Policy and regulatory framework Spatial framework; economic development; existing	Coarse traffic assessment; broad environmental, economic assessmen	Definition and prioritization of transport problems within regional	DPWH, other stakeholders. The involvement of the stakeholders (ideally from communities) to be impacted by

	transport system and network performance; demand forecasts	t and engineering assessment	sketch solutions	the road project is critical to the effectiveness of the project. They could provide insight especially on social issues. KIIs and FGDs are good sources of history of natural events.
2. Pre-feasibility Study (Initial identification of solutions)	Problem location (e.g. corridors identified); development; existing transport system and network performance; demand forecasts; environmental factors	Preliminary traffic and economic assessment; broad environmental and engineering assessment; preliminary costing	Identification of transport solutions that are likely to be feasible; TOR for Feasibility Study and Preliminary Engineering Design (PED) if the intention is to hire consultants	DPWH all levels
3. Feasibility Study/ Preliminary Engineering Design (Screening of solutions to preferred option) and Environmental Impact Assessment	Some solution options; development; existing transport system and network performance; demand forecasts; environmental factors	Detailed traffic, environmental, economic and engineering assessment; detailed costing	Preferred solution and recommendation for Detailed Engineering Design (DED); PED (drawings and costings) ; TOR for DED; cost in formation for budget process	DPWH District Office for intra district projects DPWH Regional Office for intra-regional projects DPWH Planning Service for inter-regional projects. Other stakeholders through consultation
4. Approval Process	Feasibility study, Environmental Assessment	Review by NEDA/ICC secretariat and endorseme	Source of financing and approval of the NEDA	ICC technical and cabinet committee NEDA Board

		nt by ICC technical board to ICC cabinet committee and endorseme nt of ICC cabinet committee to NEDA Board	Board	
B. Investment Phase				
1. Detailed Engineerin g Design	PED/route alignment	Detailed engineerin g assessmen t; preparation of working drawings and bills of quantities	FED (drawings, bills of quantities and tender/con tract documents)	Concerned DPWH administrative levels or consultants that may be engaged
2. Pre-construct ion	Specified right-of-way & DED	Implement land acquisition and resettleme nt program. Undertake tendering and contract process	Alignment ready for constructio n; appointme nt of contractors /supervisin g engineers; project manageme nt plans	Corresponding DPWH administrative level (and donor as applicable)
3. Implemen tation (construct ion)	Specified construction inputs and management	Build to design specificatio n	Completed project hand-over	Corresponding DPWH administrative level (and donor as applicable) NEDA administrative level Monitoring and Evaluation Staff
C. Post Investme nt				
1. Operati on	Completed project; Maintenance	Maintenanc e programs;	Maintenan ce of road performan	Corresponding DPWH administrative

	standards; Traffic law and regulations	Enforcement of traffic law and regulations; operation of asset by road manage	ce And availability to users	level (and donor as applicable) NEDA administrative level Monitoring and Evaluation Staff
2. Monitoring and Evaluation	Operational road	Traffic and road condition surveys; social and environmental impact surveys	Post-evaluation reports; maintenance requirements	Corresponding DPWH administrative level (and donor as applicable) NEDA administrative level Monitoring and Evaluation Staff