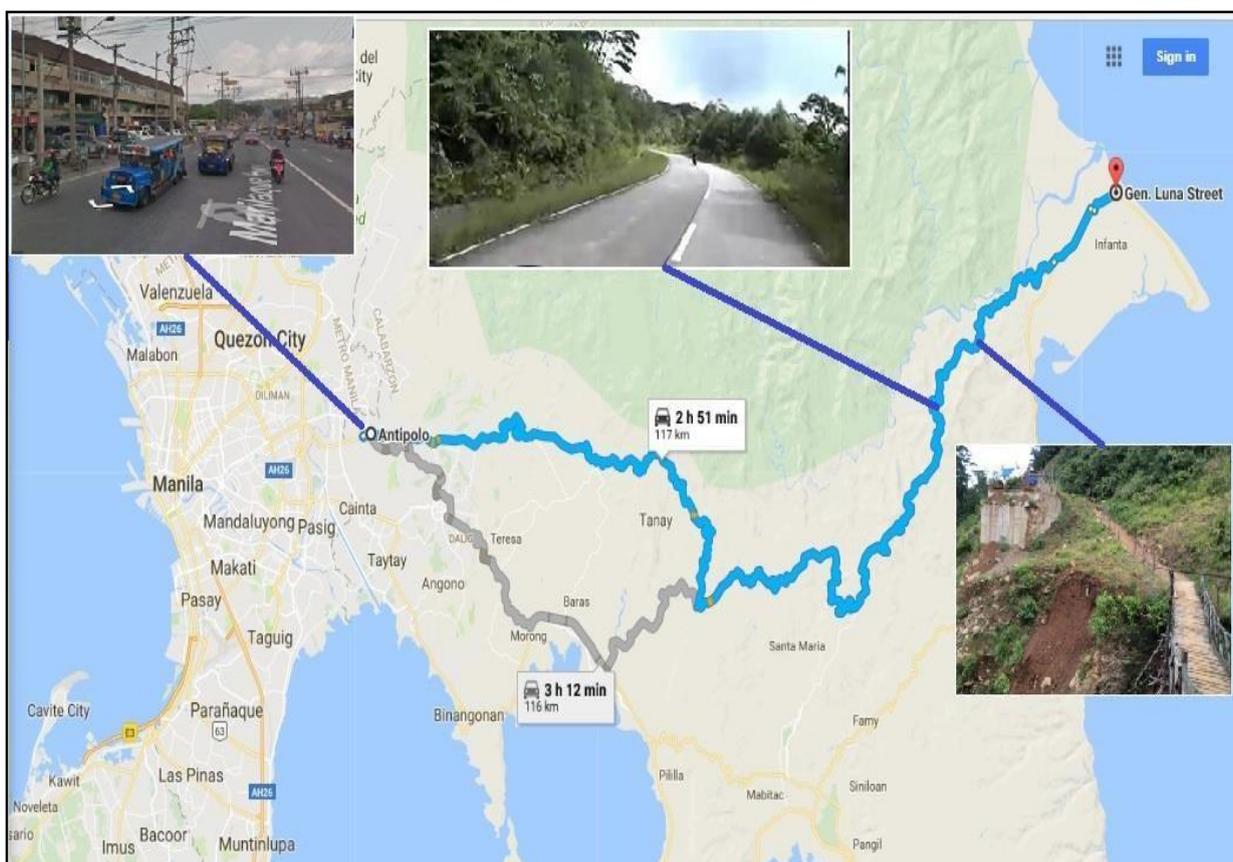


EXECUTIVE SUMMARY

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% are 18-25 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 Qerocep 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 Impacts¹ (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 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).

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

TABLE A: ROAD ELEMENT CONDITION PRE- AND POST-CONSTRUCTION²

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.	40	Some sections are non-existing.	40	25	
Vertical alignment (rise+fall) no./km	2		3			4		4	3	
Avg. Horizontal curvature deg/km	15		150		Some are just gravel road opening	500	Some are just gravel road opening	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	0 - 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																		
Geomet	Section 1 : Mostly Straight and Gently Undulating						Section 3 & 4 : Winding and Severly Undulating						Other Sections : Bendy and Severly Undulating					
	With Project			Base Case			With Project			Base Case			With Project			Base Case		
Vehicle 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 Qerocep 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

$$TTR = 7,292 - 3.721X_1 + 1.598X_2 + 137.151X_3 + 141.709X_4 + 120.204X_5 + 0.111X_6 + 0.030X_7.$$

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 Daily Traffic vehicles	0.111	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	.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

$$RPT = 2,999.649 - 1.483X_1 + 3.544X_2 - 49.047X_3 - 43.988X_4 - 43.996X_5 + 0.046X_6 + 0.020X_7$$

Where RPT, X₁, X₂...X₇ 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 maintenance² of the road.³

V LESSONS 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 available from the DPWH Regional Office. The data from the interactive GIS	It is recommended that an inter-agency portal that publishes relevant data that can be accessed by service providers of	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
<p>Application in the DPWH website is not complete.</p> <p>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.</p> <p>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.</p>	<p>the government such as consultants and contractors be established.</p> <p>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.</p> <p>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.</p> <p>Strengthening of the LGU data collection regime</p>	<p>DPWH</p> <p>DPWH Regional Office IVA</p> <p>LGUs</p>
<p>2. Regular monitoring of on-going and completed projects</p> <p>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 Qerocep Bridge could have facilitated immediate repair</p>	<p>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 typhoons is frequent.</p>	<p>DPWH Regional Office, NEDA Regional Office, RPMC</p>
<p>3. Project Development⁴</p> <p>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</p>	<p>Project identification and development should be participatory. (refer to the Appendix for summary of project development process)</p> <p>The use of technical tools in identifying projects should be validated with</p>	<p>DPWH concerned office</p> <p>LGUs</p> <p>NEDA Regional office</p>

⁴refer to the Appendix for summary of project development process

OBSERVATION	RECOMMENDATION	RESPONSIBLE AGENCY/IES
<p>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.</p>	<p>information from the ground, especially, beneficiaries.</p> <p>Baseline data collection should be part and parcel of project preparation, ideally during feasibility studies.</p>	
<p>B. SECTORAL PROGRAM</p>		
<p>1. Transport Network Development Synchronization</p>		
<p>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</p>	<p>Upgrading/development of the Infanta Port to reach its potential to serve its hinterland and generate traffic, thereby optimizing utilization of MIR</p>	<p>PPA</p>
<p>2. Road Capacity Improvement</p>		
<p>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.</p> <p>(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.)</p>	<p>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%).</p> <p>(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.</p> <p>The primary safety concern is the risk of rear-end or same-direction sideswipe accidents involving slow-moving trucks. <i>Climbing lanes may have the potential to eliminate some head-on or opposite direction sideswipe accidents.</i>)</p>	<p>DPWH</p>