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# Forecasting Regional Economic Effects of the Bien Hoa–Vung Tau Expressway

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**Abstract:** The Bien Hoa to Vung Tau Expressway is a 53-kilometre route in southern Vietnam connecting the industrial base of Dong Nai to the deep-water port area of Vung Tau, with an estimated investment of 17.8 trillion VND. Economic forecasts for the project were prepared before 2018, and the regional context has changed substantially since then. This study re-assesses the expected economic effects using current data and an integrated analytical framework with five components: accessibility analysis based on a gravity potential model, regional interaction modelling incorporating observed traffic counts on National Highway 51, industrial development potential assessment, economic corridor centrality analysis, and GRDP growth forecasting under a range of agglomeration elasticities. The analysis covers the four principal localities on the corridor, Bien Hoa, Long Thanh, Phu My and Vung Tau, together with Ho Chi Minh City, Phu My Port and Long Thanh Airport as connecting nodes, and uses 2024 as the base year. The set of nodes constitutes the complete corridor rather than a sample drawn from it. Three findings emerge. First, the expressway moves the primary node of the corridor northward: Bien Hoa overtakes Phu My in economic centrality, rising 104 per cent against 62 per cent. Second, industrial development potential rises most in Long Thanh, which combines a 5,033-hectare industrial land reserve with the largest accessibility gain. Third, growth distributes across the corridor rather than concentrating in one centre, with Long Thanh recording the largest percentage gain from the smallest economic base. Estimated GRDP growth ranges from 1.2 per cent under a conservative elasticity of 0.03 to 26.8 per cent under a strong elasticity of 0.4. For sustainable development the results point in two directions. Journey distances on the corridor fall 22.8 per cent in aggregate, and diverting through traffic from National Highway 51 relieves congestion that currently generates avoidable emissions. Freight movement to the region's principal port becomes shorter and more predictable. Against this, the project strengthens pressure to convert agricultural land, will generate induced traffic, and delivers benefits unevenly within each locality. Infrastructure of this scale shapes conditions for sustainable outcomes without securing them; the accompanying land use policy determines which outcome follows.

**Keywords:** Accessibility analysis, Economic corridor, Regional economic impact, Sustainable development

## Introduction

Transport infrastructure development serves as a fundamental catalyst for regional economic growth by enhancing market accessibility, strengthening economic synergies, and fostering industrial agglomeration (Tan et al., 2022). In the context of Vietnam's rapid urbanization and industrialization, the Bien Hoa - Vung Tau Expressway slated for operation in the coming period emerges as a strategic artery within the Southern Key Economic Region (SKER). This infrastructure project is expected to significantly bolster connectivity among major industrial and logistics hubs, most notably Bien Hoa, Long Thanh, Phu My, and Vung Tau. Figure 1 shows the alignment of the route.

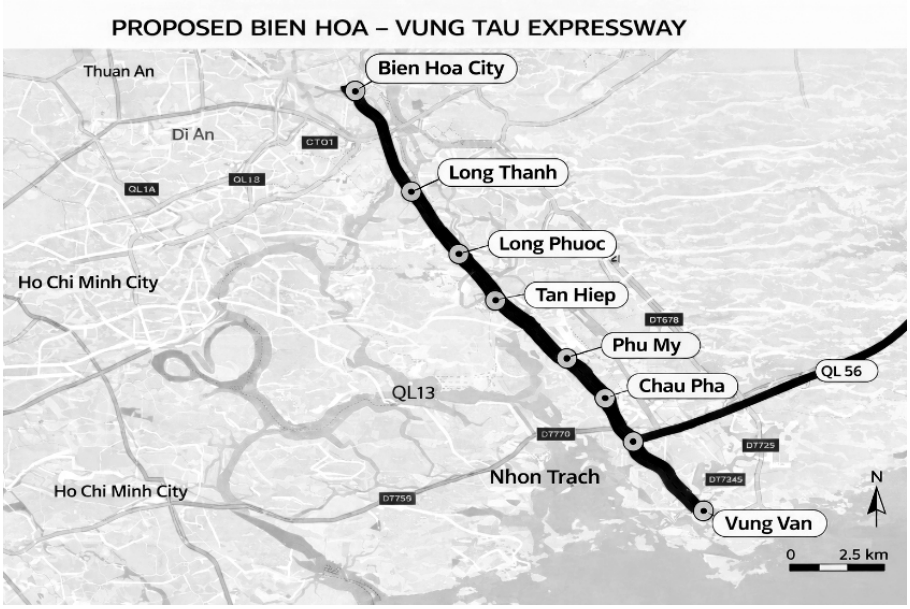



**Figure 1: Bien Hoa - Vung Tau expressway.**

*(Source: Project documents)*

The Bien Hoa - Vung Tau Expressway is a major transportation infrastructure project in the Southeast region of Vietnam, connecting Dong Nai province with the seaport area of Vung Tau. The expressway has a total length of more than 53 km and is designed with four to six traffic lanes, with an estimated total investment of approximately VND 17.8 trillion. The starting point of the route is located in Bien Hoa, where it connects with National Highway 1 and the Ho Chi Minh City - Long Thanh - Dau Giay Expressway, while the endpoint is in Ba Ria - Vung Tau province, linking with National Highway 56.

Despite its anticipated importance, there is a critical need for a quantitative assessment of the expressway's multi-dimensional impacts to inform regional planning and investment strategies. Therefore, this study aims to forecast the potential economic effects of the Bien Hoa - Vung Tau Expressway across five key dimensions: (1) shifts in economic accessibility, (2) the intensity of regional economic interactions, (3) industrial development potential, (4) the formation of an integrated economic corridor, and (5) the projected growth of regional Gross Regional Domestic Product (GRDP). By analyzing these factors, the research provides a comprehensive outlook on how this transport backbone will reshape the economic landscape of Southern Vietnam.

These five dimensions describe how the expressway reshapes economic activity. They do not by themselves establish whether that activity is sustainable. The study therefore carries the analysis a step further and asks what the estimated effects imply for sustainable development along the corridor, both in the contributions the project makes and in the pressures it creates. Section 4 takes up that question directly.

**Methodology**

Forecasting the economic impacts of a new expressway on regional development is inherently challenging due to the presence of significant uncertainties associated with future socio-economic conditions. Although such forecasts are typically conducted during the preparation of investment feasibility studies in accordance with infrastructure planning and investment regulations in Vietnam, the projections for the Bien Hoa - Vung Tau Expressway were developed prior to 2018. Since then, the regional socio-economic context has undergone substantial changes, including shifts in industrial development, population dynamics, and transport demand.

Given these changes, there is a need to re-evaluate the potential economic effects of the expressway using updated data and analytical approaches. In this study, the economic impacts of the Bien Hoa - Vung Tau Expressway are re-assessed based on the most recent available data through an integrated analytical framework consisting of five main components: (1) accessibility analysis, (2) regional interaction modeling, (3) industrial development potential assessment, (4) economic corridor analysis, and (5) GRDP growth forecasting.

**Accessibility Analysis**

To assess the potential regional economic effects of the Bien Hoa - Vung Tau Expressway, this study employs an accessibility analysis framework. Accessibility analysis measures the relative ease with which a location can reach economic opportunities and markets in surrounding regions. Improved transport infrastructure reduces travel time between locations and thereby enhances regional economic connectivity. The economic accessibility index for region $i$ is calculated using a gravity-based potential model (Hansen, 1959):

$$A_i = \sum_j \frac{GRDP_j}{T_{ij}}$$

Where:

$A_i$ : represents the economic accessibility index of region $i$

$GRDP_j$: denotes the economic scale (Gross Regional Domestic Product) of destination region $j$

$T_{ij}$: represents the travel time between region $i$ and region $j$

$j$: indicates the set of surrounding economic centers included in the analysis.

To ensure comparability across regions and to avoid scale distortion in subsequent analyses, the accessibility index is normalized as follows:

$$A_i^{norm} = \frac{A_i}{Max(A)}$$

This normalization constrains the index within the range from 0 to 1, allowing for consistent interpretation and integration with other indicators. The accessibility index is calculated for two scenarios: the current transport network and the projected network after the completion of the Bien Hoa - Vung Tau Expressway. The comparison between these scenarios enables the assessment of improvements in regional connectivity (Geurs & van Wee, 2004).

**Regional Interaction Model**

To evaluate the strength of economic linkages among regions, this study employs a regional interaction model based on the gravity principle. The gravity model is widely used in regional economics and transportation studies to estimate the intensity of economic interaction between spatial units. It assumes that the interaction between two regions increases with their economic size and decreases with travel impedance. In addition to the conventional formulation, this study incorporates observed traffic flow data collected along National Highway 51 for Quarter 4 of 2024 and Quarters 1 and 2 of 2025. These data provide an empirical representation of actual interregional movements of goods and passengers, thereby enhancing the reliability of the interaction estimates.

In this study, the intensity of economic interaction between region $i$ and region $j$ is calculated as follows (S. J. Redding & M. A. Turner, 2015):

$$I_{ij} = \sum_j \frac{GRDP_i \times GRDP_j}{T_{ij}} \times F_{ij}$$

Where:

$I_{ij}$ : denotes the intensity of economic interaction between region $i$ region $j$

$GRDP_i$; $GRDP_j$: represent the economic scales (Gross Regional Domestic Product) of regions $i$ and region $j$

$T_{ij}$: represents the travel time between region $i$ and region $j$

$F_{ij}$: represents the relative traffic flow factor derived from vehicle counts

The traffic flow factor is defined as:

$$F_{ij} = \frac{Flow_{ij}}{\max(Flow)}$$

This formulation allows the model to capture both theoretical interaction potential and observed transport demand (Tsekeris & Stathopoulos, 2006).

**Industrial Development Potential**

The study evaluates industrial development potential by combining industrial land capacity with regional accessibility. Rather than treating this indicator as a direct measure of industrial growth, the analysis uses a normalized index to compare the relative industrial development potential across regions under different transport scenarios. The Industrial Development Potential Index for region $i$ is defined as (Geurs & van Wee, 2004), (Nardo et al., 2008):

$$IP_i = \frac{Industrialarea_i}{\max(Industrialarea)} \times \frac{Accessibility_i}{\max(Accessibility)}$$

Where:
$IP_i$: represents the industrial development potential of region $i$

$Industrialarea_i$ : denotes the total industrial land area of region $i$

$Accessibility_j$ : represents the economic accessibility index of region $i$

This formulation standardizes both industrial land area and accessibility in order to avoid overestimation caused by the nonlinear effect of travel time reduction. Accordingly, the index does not represent the absolute level of industrial output, but rather the relative potential of each region to benefit from improved transport connectivity. A higher index value indicates that a region combines a larger industrial land base with stronger accessibility, and therefore has a more favorable position for future industrial expansion. In the context of this study, the Bien Hoa–Vung Tau Expressway is expected to improve accessibility and, in turn, enhance the relative industrial development potential of the study regions.

Both the industrial land area and the accessibility index are normalised against a common maximum taken across the two scenarios, so that the before and after values remain on the same scale and can be compared directly.

**Economic Corridor Analysis**

To identify the role of each locality within the regional economic network and to evaluate the potential formation of an integrated economic corridor, this study measures economic centrality based on regional interaction intensity. The centrality of region $i$ is calculated as (Freeman, 1978):

$$Centrality_i = \sum_j I_{ij}$$

Where:
$Centrality_i$: represents the economic centrality of region $i$

$I_{ij}$ : denotes the intensity of economic interaction between region $i$ region $j$

To ensure comparability across regions and consistency with previous analyses, the centrality values are normalized as follows:

$$Centrality_i^{norm} = \frac{Centrality_i}{\max(Centrality)}$$

This normalization constrains the index to the range from 0 to 1 and allows for a relative comparison of the roles of different regions within the economic network. Regions with higher centrality values are considered key nodes that facilitate economic flows and contribute significantly to regional integration. These regions are expected to play a dominant role in the formation of an economic corridor. The centrality index is calculated for both the current and post-expressway scenarios. The comparison between these scenarios allows the study to assess how improvements in transport connectivity may reshape the spatial hierarchy of the regional economic system and promote the emergence of an integrated economic corridor along the Bien Hoa - Vung Tau axis (Nardo et al., 2008).

Centrality values in both scenarios are normalised against the highest centrality observed in the post-expressway scenario, which keeps the two scenarios on a single scale.

**GRDP Growth Forecast**

The final stage of the analysis estimates the potential impact of improved accessibility on regional economic output using an elasticity-based approach. Specifically, the projected GRDP growth rate of region $i$ is expressed as a function

of changes in accessibility, assuming that improvements in transport connectivity proportionally enhance economic performance. This relationship is grounded in transport economics and regional science literature, which demonstrate that reductions in transport costs and increased accessibility lead to productivity gains and economic expansion through agglomeration effects (S. J. Redding & M. A. Turner, 2015), (Graham, 2007), (C. Melo et al., 2009). Accordingly, the growth rate is defined as

$$Growth_i = \gamma \times \Delta Accessibility_i$$

$Growth_i$: represents the projected GRDP growth rate of region $i$

$\Delta Accessibility_i$: denotes the change in the accessibility index resulting from the expressway;

$\gamma$ : is the elasticity coefficient linking accessibility improvements to economic growth.

The change in accessibility is expressed relative to the highest accessibility value observed across both scenarios, so that $\Delta A_i = (A_i \text{ after} - A_i \text{ before}) / \max(A)$. Normalising against a common denominator keeps the two scenarios comparable and prevents the very large percentage changes in the raw index from propagating directly into the growth estimates.

The future GRDP level is then estimated using a standard macroeconomic growth formulation, in which economic output evolves as a function of the current level and the projected growth rate. Accordingly, the future GRDP of region $i$ is calculated as:

$$GRDP_{future} = GRDP_{current} \times (1 + Growth_i)$$

This formulation is widely adopted in economic growth modeling and provides a consistent framework for translating accessibility gains into quantifiable economic outcomes (Mixon & Sockwell, 2007), (Barro & sala-i-martin, 2004).

## Data and results

### Data description

#### Study scope, unit of analysis and data sources

The unit of analysis in this study is the locality. Four localities along the alignment are included: Bien Hoa, Long Thanh, Phu My and Vung Tau. These are the four most important economic centres on the corridor. Bien Hoa is the northern anchor and the largest urban and industrial base at that end of the route. Long Thanh sits at the midpoint and holds the largest reserve of industrial land. Phu My is the deep-water port and heavy industry cluster. Vung Tau is the southern terminus and the coastal service centre. Together the four account for most of the population, industrial land and economic output along the expressway.

Three additional nodes enter the analysis as destinations rather than as study units: Ho Chi Minh City, Phu My Port and Long Thanh Airport. These are the most important connections for the corridor. Ho Chi Minh City is the dominant demand centre of the Southern Key Economic Region, Phu My Port handles the container and bulk traffic of the region, and Long Thanh Airport will serve as the main international gateway once its first phase opens. Leaving them out would understate the accessibility gain, because a large share of the trips the expressway serves either begins or ends at one of these three points. The accessibility index is computed over the five centres that carry a GRDP figure, namely the four study localities and Ho Chi Minh City. The port and the airport enter the corridor analysis as logistics reference nodes, since neither has a GRDP of its own.

This set of nodes is not a sample drawn from a larger population. It is the complete set of economic centres and gateway nodes on the corridor, so the analysis rests on a census rather than on a sample. Sampling error therefore does not apply, and no confidence interval attaches to the reported values. What does affect the results is the choice of model parameters, and the study addresses this through the scenario analysis in Section 3.2.5.

The database covers the period from 2015 to 2024. The year 2024 serves as the base year for all calculations because it is the most recent year with complete official data for every locality. The earlier years support trend interpretation and provide the context for the forecasting framework. Table 1 summarises the data inputs, the number of observations and the source of each input.

Table 1: Data inputs and sources

| Data input | Observations | Year | Source |
|---|---|---|---|
| Population, GRDP and GRDP per capita | 4 localities | 2024 | General Statistics Office |
| Industrial zones and industrial land area | 4 localities | 2024 | General Statistics Office |
| Travel time under the current network | 13 origin-destination pairs | 2025 | Authors' measurement |
| Travel distance via the expressway | 6 origin-destination pairs | 2025 | Bien Hoa - Vung Tau Expressway project data |
| Traffic counts on National Highway 51 | 3 quarters (Q4 2024 - Q2 2025) | 2024-2025 | Road Management Office IV.2, Road Management Area IV |
| Agglomeration elasticity | 3 scenario values | - | Published literature (Section 2.5) |

*(Source: Authors' compilation)*

This study uses socio economic, industrial, transport, and spatial data to examine the potential regional economic effects of the Bien Hoa - Vung Tau Expressway. The study area consists of four key localities along the corridor, namely Bien Hoa, Long Thanh, Phu My, and Vung Tau. The dataset is designed to support the five analytical components of the study, including accessibility analysis, regional interaction modeling, industrial development potential assessment, economic corridor analysis, and GRDP growth forecasting. The socio economic dataset includes population, GRDP, and GRDP per capita for the four study regions. Although the available database covers the period 2015 - 2024, the most recent year, 2024, is used to describe the current economic profile of the study area, while the full time series is used to support trend interpretation and the forecasting framework. Table 2 presents the main socio economic indicators of the four localities in 2024 (General Statistics Office of, 2025).

**Table 2: Socio-economic indicators of Bien Hoa, Long Thanh, Phu My, and Vung Tau in 2024**

| Region | Population | GRDP (billion VND) | GRDP per capita (million VND) |
|---|---|---|---|
| Bien Hoa | 1,157,892 | 167,899 | 145,0 |
| Long Thanh | 272,713 | 39,505 | 144,9 |
| Phu My | 287,000 | 137,760 | 480,0 |
| Vung Tau | 520,000 | 95,980 | 184,0 |

*(Source: General Statistics Office)*

Industrial development conditions are represented by the number of industrial zones and the total industrial land area in each locality. These indicators reflect the existing industrial capacity of the study regions and provide the main inputs for the industrial development potential analysis. Table 3 summarizes the industrial development indicators in 2024 (General Statistics Office of, 2025).

**Table 3: Industrial development indicators of the study regions**

| Region | Number of industrial zones | Total industrial area (ha) |
|---|---|---|
| Bien Hoa | 7 | 2510 |
| Long Thanh | 10 | 5033 |
| Phu My | 12 | 5830 |
| Vung Tau | 2 | 1011 |

*(Source: General Statistics Office)*

Transport connectivity is a core component of the study. The transport dataset includes interregional travel times under the current road network as well as projected travel distances after the completion of the Bien Hoa-Vung Tau Expressway. These variables are used to construct the accessibility index and the regional interaction model and to compare the current transport scenario with the post expressway scenario. Table 4 reports the travel time matrix under the current transport network, including the connections to Phu My Port and Long Thanh Airport, while Table 5 presents the projected transport conditions after the completion of the expressway.

**Table 4: Travel time between regions under the current transport network**

| Origin | Destination | Travel time (minute) |
|---|---|---|
| Bien Hoa | Vung Tau | 157 |
| Bien Hoa | Phu My | 120 |
| Bien Hoa | Long Thanh | 80 |
| Bien Hoa | HCM city | 60 |
| Long Thanh | Vung Tau | 160 |
| Long Thanh | Phu My | 120 |
| Long Thanh | HCM city | 60 |
| Phu My | Vung Tau | 57 |
| Phu My | HCM city | 96 |
| Vung Tau | HCM city | 150 |
| Bien Hoa | Long Thanh Airport | 90 |
| Long Thanh | Phu My Port | 80 |
| Vung Tau | Phu My Port | 70 |

*(Source: Authors' measurement)*

**Table 5: Projected travel distance after the completion of the Bien Hoa-Vung Tau Expressway**

| Origin | Destination | Distance before expressway (km) | Distance via expressway (km) |
|---|---|---|---|
| Bien Hoa | Vung Tau | 91.0 | 70 |
| Bien Hoa | Phu My | 61.8 | 47 |
| Bien Hoa | Long Thanh | 45.5 | 38 |
| Long Thanh | Vung Tau | 89 | 60 |
| Long Thanh | Phu My | 60 | 50 |
| Phu My | Vung Tau | 42.4 | 36 |

(Source: Bien Hoa - Vung Tau Expressway project data)

The traffic flow factor in the regional interaction model draws on vehicle counts collected on National Highway 51 by Road Management Office IV.2 under Road Management Area IV. The counts cover three consecutive quarters, from the fourth quarter of 2024 through the second quarter of 2025. National Highway 51 is the existing route that the expressway parallels, so its traffic record is the closest available measure of current movement between the study localities. The quarterly figures are averaged to produce a single flow value for each origin-destination pair, which is then normalised against the highest observed flow.

Taken together, these datasets provide the empirical foundation for evaluating how improvements in transport connectivity may reshape regional accessibility, strengthen interregional economic interaction, reinforce industrial development potential, support the emergence of an economic corridor, and contribute to regional GRDP growth.

## Results

### Accessibility Analysis Results

The normalized accessibility values of the study regions under both scenarios are presented in Table 6. Travel times in the post-project scenario are estimated based on an assumed operating speed of 80 km/h.

**Table 6**. Accessibility index before and after the expressway (80 km/h scenario)

| Region | Accessibility (Before) | Accessibility (After) | Change (%) |
|---|---|---|---|
| Bien Hoa | 2,253.15 | 7,122.42 | 216.1 |
| Long Thanh | 3,846.61 | 11,697.68 | 204.1 |
| Phu My | 3,412.23 | 9,371.37 | 174.6 |
| Vung Tau | 3,733.17 | 9,178.19 | 145.9 |

*(Source: Authors' calculation)*

The results indicate a substantial improvement in accessibility across all study areas following the completion of the expressway. Bien Hoa and Long Thanh exhibit the highest relative increases, suggesting that these upstream regions benefit the most from reduced travel impedance. Although Phu My and Vung Tau also experience notable gains, their lower growth rates imply that these areas already possess relatively strong baseline accessibility. Overall, the expressway significantly enhances regional connectivity and strengthens the functional integration of the study corridor.

**Regional Interaction Results**

The estimated regional interaction intensities under the current and expressway scenarios are presented in Table 7. Following the methodology, the interaction index is calculated using regional GRDP, interregional travel time, and a traffic flow factor derived from the average observed vehicle counts on National Highway 51 during Q4/2024, Q1/2025, and Q2/2025. For the post-project scenario, travel time is estimated from the projected expressway distance assuming an operating speed of 80 km/h.

**Table 7.** Regional interaction intensity before and after the expressway (80 km/h scenario)

| Origin | Destination | Interaction (Before) | Interaction (After) | Change (%) |
|---|---|---|---|---|
| Bien Hoa | Long Thanh | 55,604,541 | 82,450,123 | 48.3 |
| Bien Hoa | Phu My | 147,294,717 | 297,163,942 | 101.7 |
| Bien Hoa | Vung Tau | 78,437,979 | 194,335,238 | 147.8 |
| Long Thanh | Phu My | 36,777,814 | 57,692,658 | 56.8 |
| Long Thanh | Vung Tau | 19,217,851 | 25,879,621 | 34.6 |
| Phu My | Vung Tau | 144,259,270 | 176,294,073 | 22.2 |

*(Source: Authors' calculation)*

The results show a consistent increase in regional interaction across all region pairs following the improvement in transport conditions. The inclusion of traffic flow factors moderates the magnitude of change compared to the basic gravity model, resulting in more realistic estimates. The strongest interaction gains are observed along the Bien Hoa–Phu My and Bien Hoa–Vung Tau corridors, reflecting both reduced travel time and high observed traffic demand. In contrast, interactions involving lower-traffic segments, such as Long Thanh–Vung Tau and Phu My–Vung Tau, exhibit more moderate growth. Overall, the findings confirm that the expressway strengthens economic linkages while preserving the existing traffic hierarchy within the corridor.

**Industrial Development Potential Results**

The normalized industrial development potential index under the current and expressway scenarios is presented in Table 8. The index is calculated by combining standardized industrial land area and accessibility in order to provide a relative comparison across regions.

**Table 8.** Industrial development potential index before and after the expressway

| Region | Industrial area (ha) | IP (Before) | IP (After) | Change (%) |
|---|---|---|---|---|
| Bien Hoa | 2,510 | 0.096 | 0.304 | 216.1 |
| Long Thanh | 5,033 | 0.329 | 1.000 | 204.1 |
| Phu My | 5,830 | 0.338 | 0.928 | 174.6 |
| Vung Tau | 1,011 | 0.064 | 0.158 | 145.9 |

*(Source: Authors' calculation)*

Industrial development potential rises in every region once accessibility improves. Long Thanh reaches the highest index in the post-expressway scenario, overtaking Phu My. The two localities hold comparable industrial land reserves, 5,033 hectares against 5,830, so the ranking turns on accessibility, and Long Thanh gains more of it because of its position at the midpoint of the corridor. Phu My remains close behind at 0.928 and keeps its standing as the largest industrial land base on the route. Bien Hoa records the largest relative increase at 216 per cent, which reflects how much its connectivity improves rather than how much industrial land it holds. Vung Tau improves least, held back by an industrial land base of 1,011 hectares, about one fifth of Long Thanh's. The index measures relative position, not output, so these values indicate where industrial expansion becomes more attractive, not how much of it will occur.

**Economic Corridor Centrality Results**

The economic centrality of each region, calculated as the sum of interaction intensities with other regions, is presented in Table 9.

**Table 9.** Economic centrality before and after the expressway

| Region | Centrality (Before) | Centrality (After) | Change (%) |
|---|---|---|---|
| Bien Hoa | 0.490 | 1.000 | 104.0 |
| Phu My | 0.572 | 0.925 | 61.8 |
| Vung Tau | 0.421 | 0.691 | 63.9 |
| Long Thanh | 0.194 | 0.289 | 48.8 |

*(Source: Authors' calculation)*

The expressway shifts the centre of gravity of the corridor. Before the project Phu My holds the highest centrality at 0.572, drawing on its heavy exchange with both Bien Hoa and Vung Tau. After the project Bien Hoa takes the leading position, rising 104 per cent while Phu My rises 62 per cent. The reversal follows from where the travel time savings fall. Bien Hoa sits at the far end of the corridor and gains the most from a continuous high-standard route, whereas Phu My was already well connected to Vung Tau over a short distance and has less to gain. Vung Tau improves by 64 per cent and consolidates its position as the southern anchor. Long Thanh remains the least central node at 0.289, a consequence of its smaller economic base rather than its location. The pattern indicates that the expressway does more than reinforce an existing hierarchy. It moves the primary node of the corridor northward, towards the largest industrial and urban concentration.

**GRDP Growth Results**

According to Graham & Melo, the elasticity of economic productivity with respect to agglomeration typically ranges from 0.03 to 0.20 (C. Melo et al., 2009). This range has been widely supported in the international literature on spatial economics and the economic impacts of transport infrastructure, as also highlighted by Redding & Turner (S. Redding & M. Turner, 2015).

Based on this evidence, this study adopts a scenario-based approach with two baseline cases: a low-impact scenario ($\gamma$=0.03) and a moderate-impact scenario ($\gamma$=0.20). However, in cases where transport infrastructure connects major logistics hubs such as seaports and airports, stronger effects may occur, with elasticity reaching up to 0.4 (Gibbons et al., 2019). The projected GRDP results under these scenarios are presented in Table 10 below.

**Table 10.** Estimated GRDP growth and projected GRDP after the expressway

| Region | GRDP current (billion VND) | ΔAccessibility | GRDP future (billion VND) γ=0.03 | GRDP future (billion VND) γ=0.2 | GRDP future (billion VND) γ=0.4 |
|---|---|---|---|---|---|
| Bien Hoa | 167,899 | 0.416 | 169,996 | 181,877 | 195,855 |
| Long Thanh | 39,505 | 0.671 | 40,300 | 44,808 | 50,111 |
| Phu My | 137,760 | 0.509 | 139,865 | 151,796 | 165,832 |
| Vung Tau | 95,980 | 0.465 | 97,320 | 104,915 | 113,851 |

*(Source: Authors' calculation)*

All four regions gain under every scenario, but the spread between scenarios is wide. Under the low-impact case, $\gamma = 0.03$, growth stays between 1.2 and 2.0 per cent. Accessibility alone produces little in the short run when agglomeration effects remain weak. Under the moderate case, $\gamma = 0.2$, growth runs from 8.3 per cent in Bien Hoa to 13.4 per cent in Long Thanh. Under the high case, $\gamma = 0.4$, the range widens to between 16.7 and 26.8 per cent.

Long Thanh gains the most in percentage terms across all three scenarios because it starts from the smallest economic base, 39,505 billion VND against 167,899 billion in Bien Hoa, and records the largest accessibility improvement. In absolute terms the ranking reverses. Under the moderate case Bien Hoa adds about 14,000 billion VND while Long Thanh adds about 5,300 billion. The expressway therefore raises output across the corridor while narrowing the relative gap between its strongest and weakest local economies.

The three scenarios should be read as a range rather than as competing forecasts. The elasticity governs the outcome more than any other single assumption, and the literature does not settle on a single value.

## Discussion

### Contributions to sustainable development

The expressway carries consequences for sustainable development that run beyond the economic measures reported above.

The first is emissions. Table 5 shows that the expressway shortens every journey on the corridor. Distances fall by between 15 and 33 per cent depending on the pair, and the total distance across the six pairs drops from 390 to 301 kilometres, a reduction of 22.8 per cent. Fuel consumption and carbon emissions scale with distance travelled, so a fifth of the fuel burned on these journeys is removed by the shorter route alone.

The larger effect comes from what happens to National Highway 51. That road currently carries the full weight of freight moving between the industrial zones of Dong Nai and the deep-water port at Phu My, mixed with local traffic and passenger movements. The result is chronic congestion. Vehicles in stop-and-go conditions consume substantially more fuel per kilometre than vehicles at steady highway speed, and emit correspondingly more. Diverting through traffic onto the expressway relieves National Highway 51 and allows both roads to operate closer to their design conditions. The emissions saving from this shift exceeds the saving from shorter distances, though quantifying it would require vehicle counts and fleet composition data that fall outside the scope of this study.

The second contribution is the efficiency of freight movement to the port. Phu My Port is the principal deep-water gateway of the region. Container traffic reaching it today travels a congested single corridor. A dedicated high-standard route shortens the haul, makes arrival times more predictable, and reduces the buffer stock that shippers hold against delay. Predictability matters as much as speed here, because unreliable transit times push firms toward larger inventories and more frequent partial loads, both of which raise emissions per tonne carried.

The third contribution is the spatial distribution of growth. The centrality results in Table 9 show gains across all four localities rather than concentration in one. The growth estimates in Table 10 show the largest percentage gains accruing to Long Thanh, the smallest economy on the corridor. Infrastructure that spreads economic activity along a corridor rather than concentrating it in a single centre reduces pressure on housing and services at that centre and shortens the commuting distances of the workforce it employs.

### Challenges for sustainable development

These gains carry costs that the analysis above does not price.

Improved accessibility raises the value of land near the interchanges, and the industrial potential index makes this explicit. Long Thanh and Phu My hold more than 10,000 hectares of industrial land between them, and the expressway makes converting more land to industrial use more attractive. Land converted to industrial use is generally agricultural land, and the conversion is permanent. The index in Table 8 measures the strength of this pressure without judging whether the conversion should occur.

Faster roads also generate traffic that did not previously exist. Some of the capacity released on National Highway 51 will be absorbed by trips that were previously not made or made by another mode. This induced demand offsets part of the emissions saving described above, and the offset grows over time as land use adjusts to the new network.

The distribution of benefits within each locality is also uneven. The analysis treats each region as a single unit with one accessibility value. In practice the gains concentrate near the interchanges, and communities away from them may see little improvement while bearing the same land conversion and traffic pressure.

### Limitations

Three limitations bear on how these results should be read.

First, the post-expressway scenario uses the design speed of 80 km/h across the whole journey. Part of each trip runs on urban and national roads at either end, where speeds are lower. The estimated travel times are therefore optimistic and the accessibility gains represent an upper bound.

Second, the baseline travel times were measured under current conditions on National Highway 51, where congestion is frequent and variable. The Vung Tau to Ho Chi Minh City journey ranges from two and a half to three and a half hours depending on traffic. A single value cannot capture this variability, and the study uses the lower end of the observed range.

Third, the industrial land area of each region is held constant across the two scenarios, so the change in the industrial potential index tracks the change in accessibility exactly. The index shows where conditions for industrial expansion improve; it does not predict how much land will actually be developed.

### Directions for future research

Four extensions would strengthen this line of work. First, vehicle counts and fleet composition on both the expressway and National Highway 51 after opening would allow the emissions effect to be quantified rather than described. Second, a segmented travel time model that separates expressway running from urban approach would replace the design-speed assumption used here. Third, narrowing the elasticity range through estimation on Vietnamese data would reduce the dominant source of uncertainty in the growth forecasts. Fourth, repeating the analysis at a finer spatial scale would show how the gains distribute within each locality rather than across them.

## Conclusion

The Bien Hoa - Vung Tau Expressway will reshape the economic geography of the corridor it serves, and the effect extends beyond the movement of vehicles.

This study applied five analytical components to estimate that effect: accessibility, regional interaction, industrial development potential, economic centrality, and GRDP growth. Three findings stand out. The expressway moves the primary node of the corridor northward, with Bien Hoa overtaking Phu My in economic centrality once the route opens. It raises industrial development potential most sharply in Long Thanh, which combines a large land reserve with the largest accessibility gain. And it distributes growth across the corridor rather than concentrating it, with the smallest local economy recording the largest percentage gain.

For sustainable development the results point in two directions at once. The expressway shortens journeys on the corridor by 22.8 per cent in aggregate and relieves the congestion that currently makes National Highway 51 a source of avoidable emissions. It shortens the freight haul to the region’s principal deep-water port and makes it more predictable. Against this, it strengthens the incentive to convert agricultural land to industrial use, it will generate traffic that does not exist today, and its benefits will fall unevenly within each locality.

The magnitude of the economic effect rests on the elasticity linking accessibility to output, and that parameter remains the largest source of uncertainty. Under the conservative assumption the gains are modest. Under the strongest

assumption they approach a quarter of current output in the most affected locality. What the analysis establishes with more confidence is the direction and the distribution of the effect rather than its size.

Infrastructure of this scale does not deliver sustainable outcomes on its own. Whether the corridor develops as an integrated and efficient economic system, or as a strip of converted land generating new congestion, depends on the land use and transport policy that accompanies the road.

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