Road development reality in Dienbien province, Vietnam

Nguyen Cong Giang, Bui Thi Ngoc Lan

Abstract

DienBien province holds a particularly important position in terms of national security in the Northwest region and throughout Vietnam. Furthermore, with historical tourist areas, nature tourism and agro-forestry development, DienBien province has a lot of potential to develop services and tourism. However, because the road network in DienBien province has not been fully developed, it cannot promote socioeconomic development in the surrounding area. Many transportation development planning projects in DienBien province have been issued and completed; the development of the road network has yielded some results, but there are still many difficulties and problems. This article discusses the reality of road development in DienBien province from 2016 to 2020. Concurrently, this article demonstrates problems and obstacles in road development and proposes necessary solutions for future road development problems in DienBien province.

Key words: *Exterior RCS hybrid joint, ABAQUS software, 3D finite element, L_e length*

(1)PhD. Nguyen Cong Giang
Geotechnical Engineering and Underground Construction Department
HaNoi Architecture University
Email: giangtokyo1963@gmail.com
(2)PhD. Bui Thi Ngoc Lan
Construction Economic and Investment Department
HaNoi Architecture University
Email: lanbtn@hau.edu.vn

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Introduction

DienBien province is a mountainous province on Vietnam's northwest border that plays a critical role in national security. DienBien has a natural area of 9.541,25 km^2 and borders Lai Chau province to the north, Son La province to the east and northeast, China's Yunnan province to the northwest, Laos to the west and southwest and is approximately 462km from Hanoi. Only DienBien province in Vietnam shares a common border with Laos and China, spanning 455,573 km (in which, the Vietnam - Laos border is 414,712 km; Vietnam - China border is 40,861 km). Tay Trang international border gate, A Pa Chai entrance, Huoi Puoc main border gate, Si Pa Phin sub-border gate and Na Bung border gate are among the border gates with China and Laos. These vital border crossings provide numerous benefits in terms of socioeconomic development, promoting economic development and exchange with other countries. This is an excellent opportunity to promote international trade by developing DienBien into the main transit area on the Northern Trans-Asian road, which connects Vietnam's Northwest region with the Northern Laos region - Southwest China..

DienBien province has a diverse tourism potential, including both natural and historical tourism resources. DienBien has a diverse terrain, numerous rivers, lakes and beautiful landscapes,... Natural tourism resources are plentiful, but not in every province. DienBien also has many historical sites associated with Vietnam's construction and defense, such as national historical sites (particularly the DienBien Phu battlefield), historical relics (Ban Phu citadel, Sam Man citadel, Muong Tinh cave...), De Cat tunnel, Muong Thanh bridge and so on. Muong Phang relic site, Hill A1... They are extremely valuable assets for developing historical tourism. DienBien province, in particular, has a multi-ethnic culture with 19 major ethnic groups: Thai, H'Mong, Kinh, Dao, Kho Mu, Ha Nhi, Lao, Hoa, Khang,... Each ethnic group has distinct characteristics in terms of language, customs and culture,.... creating a colorful picture of DienBien culture and having a significant impact on tourism development.

Concurrently, DienBien province has abundant surface water resources, diverse agro-forestry product potential and favorable weather and climate for agro-forestry development and agro-forestry product processing. Demand for agro-forestry products is expected to rise; businesses are gradually shifting their investment to DienBien in the fields of agriculture and forestry, as well as rural areas with abundant land resources and a variety of mechanisms and policies to encourage and attract investment. It is undeniable that DienBien province is critical to the Northwest region's and Vietnam's economic development strategies.

With the characteristics of a mountainous border province, wide terrain and distance from major cities, the development of a road traffic is a necessary condition for socio-economic development. DienBien province must determine the construction synchronously building and developing a road traffic that plays a particularly important role, serving the needs of passenger and tourist transport, agro-forestry goods transport, promoting trade and socio-economic development, ensuring the safety of citizens.

DienBien province has prioritized road traffic development, following the resolutions of the Provincial Party Committee and the Provincial People's Committee on the organization and implementation of the socioeconomic development plan, as well as

the relevant agencies and organizations. With many specific solutions, sectors and localities have focused on leading and directing the development and implementation of the road development program. DienBien's road traffic development planning has been completed and the province's road transport infrastructure is being completed and upgraded. However, the pace of road development is slow, not synchronized, not commensurate with the potential, has not been invested in accordance with the plan and it takes a long time to travel between DienBien and other localities. There are still numerous difficulties and problems to be resolved. In order to promote the long-term development of the road traffic and the socioeconomic environment, this article examines the current state of road development in DienBien province from 2016 to 2020. Next, proposes necessary solutions to the problems and development of the road network in DienBien province.

Literature review

In appropriate contexts and locales, new roads can promote sizeable economic and social benefits. If poorly planned or implemented, however, new roads can provoke serious cost overruns, corruption and environmental impacts, while generating sparse economic benefits and intense social and political conflict [5]. The road network is thought to play an important role in the national transportation system, as well as in the process of socioeconomic development, national defense and security and improving people's living standards. When the road transport is smooth and safe, it will be easier to carry out the tasks of socioeconomic development, national defense, safety and social order. As a result, localities in general and DienBien province in particular, must develop road transport to serve economic development, create conditions for goods to circulate, reduce transportation costs, facilitate import and export, promote production, circulation, investment and development to contribute to the province's economic growth.

DienBien province is a large mountainous province in the Northwest with advantages in natural resources, soil, climate and topography, ... These conditions are ideal for the growth of industrial crops, fruit trees, specialized rice cultivation, tourism and service industries. Furthermore, they serve as the foundation for the growth of processing industries, trade, tourism, import-export and investment attraction. Besides, in planning road development, planners often face a challenge to reconcile various interests and interpretations on the ultimate goals which complicate the discussion decision-making processes [6]. DienBien province has recently focused on road transport planning in order to develop a synchronous road network, carry out socioeconomic development tasks, ensure national defense and security.

Implementation of Decision No. 44/QD-UBND dated February 4th, 2012 issued by the People's Committee of DienBien province on approving the adjustment of the Master Plan on the road network for the period 2011-2020, with a view toward 2030. After 8 years, by the end of 2020, DienBien province will have 9.568,23 km of roads, including: 06 national highways (NHs) totaling 745,43 km, 20 provincial roads totaling 604,7 km, 102 district roads totaling 1.161 km and rural roads totaling 7.927,58 km. Furthermore, 100% of communes have quality roads that allow cars to reach the commune center, with 95.3% of communes having roads to the commune center and 4.7% only being accessible by car during the dry season.

Many significant road construction projects in DienBien province have been completed, including: the rehabilitation and upgrade of NH 279; the project of renovating and upgrading NH 12, section MuongCha - DienBienPhu city; and the construction of the SiPaPhin - MuongNhe route.….[1]. However, there are numerous challenges that must be overcome in the development of the road network in DienBien province; development is not commensurate with potential and road transport infrastructure has not been invested synchronously. As a result, traveling between towns is difficult. This article discusses the reality of road development in DienBien province from 2016 to 2020. Concurrently, this article identifies problems and impediments to road development and proposes solutions to address these issues and promote socioeconomic development in DienBien in the future.

Research methodology

The development of road network in Dien Bien province is the subject of this paper's investigation. The article employed data analysis, synthesis, and treatment methods to clarify the current status, constraints, and challenges in the process of road transport development in Dien Bien province from 2016 to 2020. The research findings mostly rely on secondary data gathered from Dien Bien province reports, books, journals, and statistical yearbooks, which are then analyzed using the SWOT (strengths, weaknesses, opportunities, and threats) method to establish the best solutions.

Result research

- Regarding the reality of road network development in DienBien province:

According to the Department of Transport of Dien Bien province's report summarizing the work in 2020 and implementing the tasks in 2021, the road traffic in Dien Bien province currently has a total length of 9.568,23 km, including national highways (NHs), provincial roads, district roads, urban roads, commune roads, border patrol roads and village roads.…. [2].

ased on the data in Table 1, the article charts the scale of road types in DienBien province by the end of 2020 in Figure 1. From the chart, it is clear that the majority of roads in DienBien are commune roads, village roads and intra-field roads; there is no interchange connection with neighboring localities; and there is no freeway; the system of national highways and provincial roads has not yet developed, with national highways accounting for approximately 8% and provincial roads accounting for approximately 6% of the total length of roads in the province.

- Current situation of national highway network in Dien Bien province

National highways managed by the central government are inter-regional roads that connect externally, are important routes connecting DienBien province with key economic regions in the region and connect traffic hubs big pine.

According to the summary data of DienBien Department of Transport, the national highway (NH) system has 06 routes with a total length of 751 km in 2016, of which the cement concrete pavement has 68,2 km, the asphaltic concrete pavement has 302,7 km and the bituminous penetration macadam pavement has 380,1 km (of which, The Directorate for Roads of Vietnam has entrusted the Department of Transport with the management of 620,9

km). DienBien province upgraded and expanded 160 km of national highway surface from 2016 to 2020 to ensure smooth traffic (especially on national highways) [3].

NH 12, NH 6, NH 279, NH 279B, NH 279C and NH 4H currently connect DienBien province to neighboring provinces. In which, the NH 12 section through DienBien province, running along Dien Bien Phu city through Muong Cha district to MuongLay town, has a length of 188,63 km of grade IV mountain road; the extended NH 12 has a length of 84,03 km of grade VI mountain road.

NH 6 runs through DienBien province, passing through Tuan Giao, Tua Chua, Muong Cha and Muong Lay districts, about 112 km long, with 95 km of grade VI mountain road and 17 km of grade IV mountain road.

NH 279, section through Dien Bien province, 130,3 km long, grade IV Dien Bien – rural road, running through Tuan

Table 1: Road classification in Dien Bien province based on pavement layer [2]

No.	Road network	Unit	Quantities	Scale
1	National highways	Km	745,43	100%
1.1	Cement concrete pavement	Km	68,20	9,15%
1.2	Asphaltic concrete pavement	Km	335,64	45,03%
1.3	Bituminous penetration macadam pavement	Km	341,59	45,82%
2	Provincial roads	Km	604,70	100%
2.1	Cement concrete pavement	Km	46,40	7,67%
2.2	Asphaltic concrete pavement	Km	17,40	2,88%
2.3	Bituminous penetration macadam pavement	Km	335,10	55,42%
2.4	Aggregate pavement	Km	156,80	25,93%
2.5	Earth road	Km	49,00	8,10%
3	District roads	Km	1.161,00	100%
3.1	Cement concrete pavement	Km	206,30	17,77%
3.2	Asphaltic concrete pavement	Km	9,60	0,82%
3.3	Bituminous penetration macadam pavement	Km	447,80	38,57%
3.4	Aggregate pavement	Km	240,10	20,68%
3.5	Earth road	Km	257,20	22,15%
4	Urban roads	Km	216,40	100%
4.1	Cement concrete pavement	Km	55,90	25,83%
4.2	Asphaltic concrete pavement	Km	67,80	31,33%
4.3	Bituminous penetration macadam pavement	Km	75,10	34,70%
4.4	Aggregate pavement	Km	1,80	0,83%
4.5	Earth road	Km	15,80	7,30%
5	Commune roads	Km	2.859,80	100%
5.1	Cement concrete pavement	Km	727,10	25,42%
5.2	Bituminous penetration macadam pavement	Km	214,90	7,51%
5.3	Aggregate pavement	Km	480,90	16,82%
5.4	Earth road	Km	1.436,90	50,24%
6	Border patrol routes	Km	74,20	100%
6.1	Cement concrete pavement	Km	74,20	100%
7	Village roads	Km	2.395,70	100%
7.1	Cement concrete pavement	Km	812,90	33,93%
7.2	Bituminous penetration macadam pavement	Km	27,40	1,14%
7.3	Aggregate pavement	Km	162,40	6,78%
7.4	Earth road	Km	1.393,00	58,15%
8	Intra-field roads	Km	1.511,00	100%
8.1	Cement concrete pavement	Km	48,30	3,20%
8.2	Bituminous penetration madacam pavement	Km	15,60	1,03%
8.3	Aggregate pavement	Km	22,30	1,48%
8.4	Earth road	Km	1.424,80	94,29%

Source: DienBien Department of Transport, 2020

Giao district, Muong Ang district, Dien Bien Phu city and Dien Bien district to Tay Trang border gate. NH 279B is 11,5 km long and has a grade VI mountainous road, while NH 279C is 68,2 km long and has a grade V mountainous road.

NH 4H, section through DienBien province, running along Muong Cha, Nam Po and Muong Nhe for 190.2 km, grade V mountain roads, 02 national highways 4H1 for 13,2 km and 4H2 for 37 km, grade VI mountain roads.

In general, the national highway system in Dien Bien province has invested in basic arterial roads reaching grade IV in mountainous areas. The main arteries connecting DienBien province to neighboring provinces and the capital Hanoi are relatively easy to navigate. However, because the topography of Dien Bien province is high mountainous, building transportation infrastructure is especially difficult, so the density of national highways over 100 km2 is the lowest in the country.

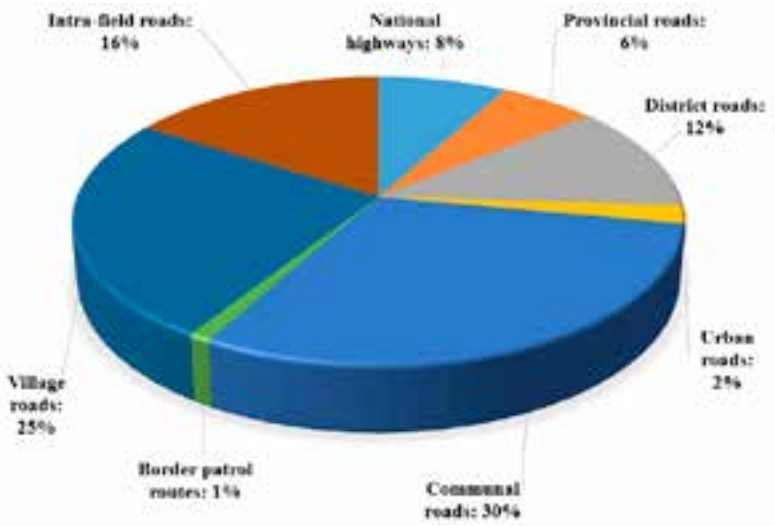

Figure 1. Road type scale in DienBien province by 2020
Source: DienBien Department of Transport, 2020

- The current condition of locally managed roads

Internal traffic routes managed locally include provincial roads, district roads, urban roads, commune roads, village roads and so on. In which, the provincial road (PR) system serves as internal roads connecting localities, while some routes serve as radial axes, ring roads and so on. DienBien provincial road system currently has 06 roads, the Department of Transport manages 140 km of routes (including lines PR 139, PR 140, PR 141, PR 142, PR 143, PR 150) and 17 districts manage 467,8 km of routes.

Although not yet heavily invested in, Dien Bien province's provincial road system has ensured relatively stable and convenient transportation and travel demand.

Regarding the current state of rural transport routes: To develop the rural transport system in the province, in accordance with the motto of the State and the people to collaborate, in difficult capital source conditions, the situation of rain and floods. difficult developments..... In recent years, the rural transportation system has grown in both quantity and quality, with a total length of 7.927,58 km, of which 2.509,9 km are concrete and asphalt roads and the road surface is distributed. The remaining distance is 4.511,9 km on the ground. The number of communes with car roads to the commune center is 129/129 communes, with 123/129 communes, wards and townships having a car road to the commune center that can travel in all seasons of the year, accounting for 95,3% and the remaining 6 communes having roads that can only be accessed by car in the dry season, accounting for 4,7%. (Hang Lia, Tia Dinh, Phu Hong, Sa Dung, Muong Khong and Nam Chua communes) [1].

Figure 2. The current state of national highways in DienBien province
Source: DienBien Department of Transport, 2020

- The current state of the road surface structure of major transport routes

Based on the data from the report summarizing the work in 2020 and implementing the tasks in 2021 of the DienBien province Department of Transport, Figure 5 shows the percentage of road surface structures in DienBien province by the end of 2020.

The chart above (Figure 5) shows that, while the road transport system of DienBien

province has been invested and developed to meet people's travel needs, the quality of the road surface structure is still backward, has not been invested synchronously, the technical scale is not up to standard and the majority of them are grade IV and VI roads with low quality road surface (mainly asphalt, graded and dirt roads); It is still very difficult to travel in many remote and remote areas, especially during the rainy season and especially in some communes that do not have access to villages. One of the factors affecting DienBien province's socioeconomic development is its underdeveloped road transportation system.

Discussion

- Limitations and difficulties

The most significant constraint and difficulty in developing the road transport system in DienBien province is a lack of investment capital for road construction, upgrading and renovation, which leads to inter-regional and intra-regional connectivity still face numerous challenges. DienBien province will require tens of thousands of billions of dong to invest in, upgrade and renovate projects in order to develop the road transportation system. The total capital demand anticipated to implement road planning is 51.696 billion VND (of which, in the period of 2020 - 2030, it is 28.483 billion VND) [1].

However, a number of national highways under the Ministry of Transport's public investment plan for the 2016-2020 period have yet to be invested according to the approved plan. A number of national highway construction projects are underway but have yet to be completed due to a lack of capital allocation and disbursement, forcing the projects to halt construction, resulting in unfinished construction and traffic disruptions; traffic safety difficulties and potential hazards. The majority of local roads, such as provincial roads, district roads, commune roads and village roads have not been invested, or have been invested but not in accordance with the scale of planning approved by the competent authority, due to the province of DienBien's lack of investment capital.

Table 2. SWOT analysis of Dien Bien province's road network development

Strengths (S)	Weaknesses (W)
(1) Dien Bien province has land exchange conditions with China and Laos via the A Pa Chai opening (Yunnan, China); Tay Trang international border gate (Phong Saly, Laos); Huoi Puoc main border gate (Luong Pha Bang, Laos); and Si Pha Phin and Na Bang secondary border gates (Phong Saly, Laos) (2) The development of intra-provincial and inter-regional road transport is aided by cultural, historical and sightseeing tourism resources. (3) Dien Bien province land fund for efficient growth of road traffic, lowering the cost of site clearance compensation	(1) The topography is difficult, severely fractured, with steep hills and mountains covering a significant region. (2) Weak infrastructure, particularly the transportation system, is not commensurate with the potential for development. Particularly in some sections of the national highway, such as NH 12, the Pom Lot - Chieng So section, NH 4H, NH 6, provincial roads and district roads have low density and poor quality road networks, making it difficult to connect urban areas and other regions of the province. (3) Because the industry has not yet developed, it cannot serve as a driving force for the advancement of transportation in general and road transport in particular. (4) DienBien province currently has a very low road density of 0.95 km/100 km^2, which is lower than the provinces in the Northwest region and the entire country. The provincial road density per 1000 population is also lower than the national and Northwest region averages. (5) The grades of provincial and district roads are low, making them vulnerable to the effects of climate change, such as natural disasters, floods, storms, landslides and due to heavy vehicle traffic. The running portion of the roadbed is extremely narrow. In many places, the road pavement structure is unsafe. (6) There are numerous aggregate pavement and earth roads that have not been hardened.
Opportunities (O)	**Threats (T)**
(1) Connect to a variety of economic development corridors (2) Modes of transportation that work well together, increase the capacity of road transportation. (3) Technology, science and technology are becoming more advanced in the service of road traffic construction. (4) There is a great opportunity to establish the region's trucking service center. (5) There are prospects for economic development in tourism, trade, agriculture and forestry as road traffic routes to A Pa Chai open up.	(1) Climate change causes landslides on slopes, which are hazardous to vehicles and road users. (2) Provincial and district road grades are poor and readily ruined by heavy truck loads. (3) Industrial development is slow, road upgrades and renovations fall short of expectations. (4) When district and commune roads are upgraded, the safety of forest resources is likely to suffer. (5) Production establishments, small firms, poor and near-poor residents continue to dominate, making it difficult for the state and people to collaborate on road traffic construction. (6) The state's construction money will not endure forever and the province's income is insufficient to pay for road traffic development on its own.

The second difficulty stems from DienBien province's complex mountainous terrain. Road traffic projects primarily pass through mountainous areas with complex geology in unpredictable weather conditions, such as heavy rains and floods, which have a direct impact on the work. Engineering design is relatively large, construction policies frequently change and raw material prices fluctuate, resulting in slow construction progress.

- The cause of the limitations

Because of the small economic scale of DienBien province, which is backward and one of the poorest provinces in Vietnam, commodity production is slow to develop, so attracting non-budget investment is still limited. Inadequate specific mechanisms and policy breakthroughs to encourage and create an environment and conditions for mobilizing resources, attracting investment and constructing a road transportation system. While resources are dependent on the central budget, there is a lack of investment capital, infrastructure development is not synchronized, the technical level remains low and socialization of resources for investment in transportation network development has not been implemented.

The mismatch between the allocated capital and the demand for consultancy has an impact on the investment in building the information interface; most projects' capital plans are delayed, resulting in the project's cancellation. are stretched and delayed in completion, reducing capital investment efficiency. Specifically, from the end of 2019 to the present, due to the complicated development of the Covid-19 pandemic, climate change, unusual weather, prolonged rain and floods, as well as the rapid increase in modes of transportation, many vehicles carry a large load, which makes road construction difficult.

The paper conducts a SWOT analysis based on the collected road transport development systems to identify strengths and weaknesses and to seek knowledge and opportunities to develop the road network in DienBien province.

- Solutions for road network development in DienBien province

DienBien is a disadvantaged province with significant socioeconomic development challenges, DienBien is ranked fifth from the bottom of Vietnam in terms of economic development. As a result, in order to foster socioeconomic development, Dien Bien province must focus on developing the road transport system in order to connect commercial and cultural exchange with the Northwest area and the entire territory of Vietnam.

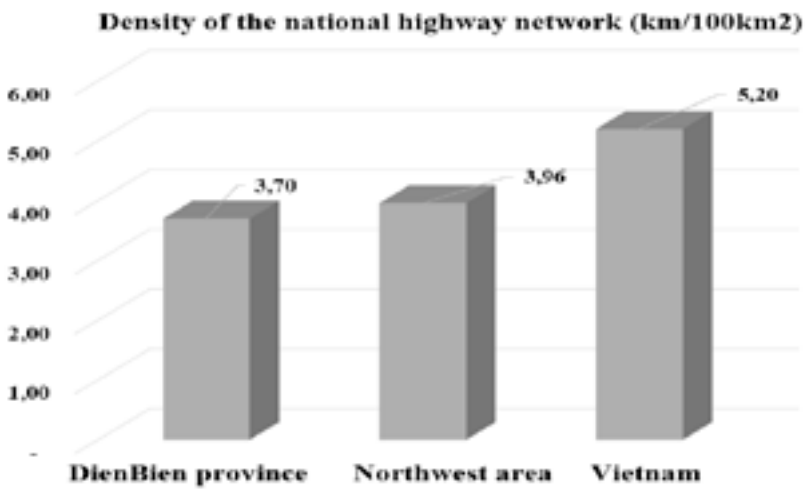

Figure 3. The density of the national highway network in DienBien province in comparison to the region and the entire country
Source: DienBien Department of Transport, 2020

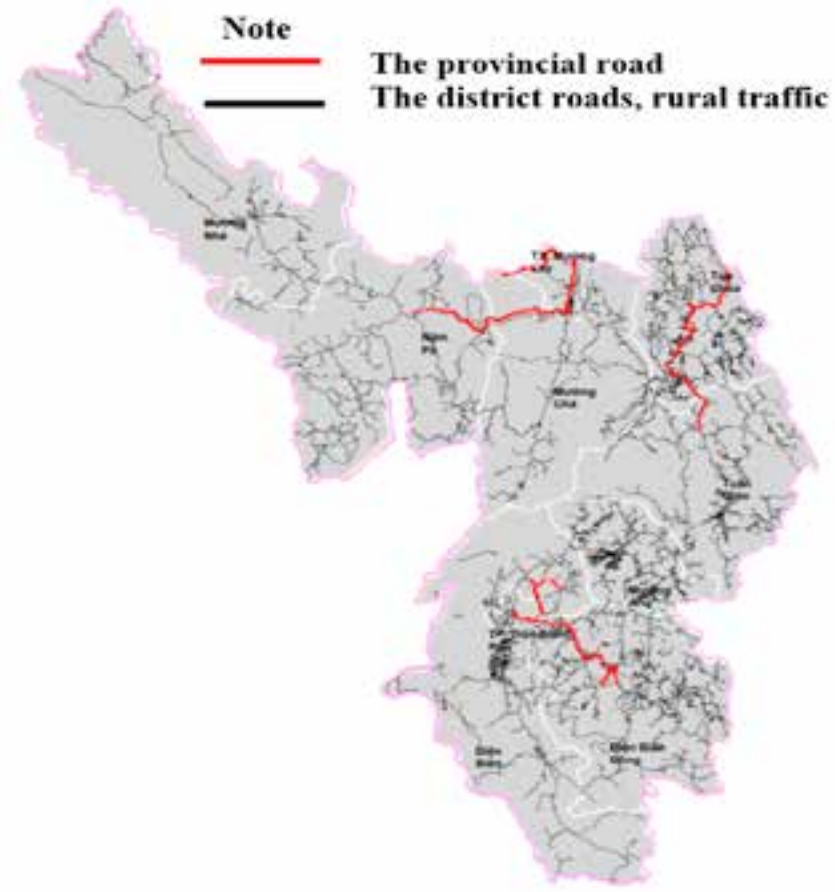

Figure 4. The current state of provincial road in DienBien province
Source: DienBien Department of Transport, 2020

Firstly, strengthen inter-sectoral coordination among state agencies, particularly in planning and devising policies for the growth of the road transport system in line with the transportation infrastructure development strategy. Priority projects for investment include the development of information interface infrastructure, the construction of new roadways, the improvement of national highways and

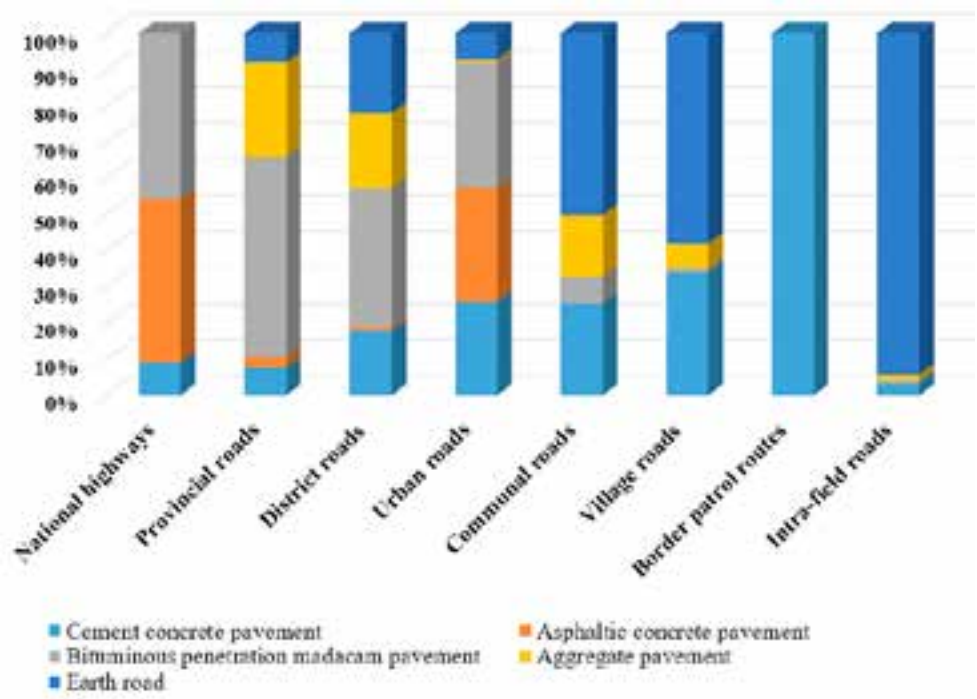

Figure 5. DienBien province's percentage of road surface structure types by 2020
Source: DienBien Department of Transport, 2020

provincial roads. Some noteworthy projects are given special consideration, including: (i) To build a highway network connecting Tuan Giao - Muong Ang - Dien Bien Dong - Dien Phu city - Tay Trang border gate connecting Son La; It is proposed to build the Dien Bien - Son La route before 2030 with a minimum scale of grade III, 2 lanes serving socioeconomic development and laying the groundwork for the completion of the Dien Bien - Son La expressway; (ii) Extending the national highway and provincial road network, to strengthen highway connectivity and links between cities, production hubs and border gates; (iii) Proposal to establish a high-speed line connecting with Lai Chau province to increase connectivity; proposal to construct a bridge linking Tua Chua to Lai Chau.

Secondly, taking advantage of land exchange conditions with China and Laos via openings, border gates....to create a comprehensive plan for connecting international road traffic with China and Laos, to take advantage of the two countries' markets and expand bilateral trade. Create a plan to update the national highway in order to connect the expressway on time, to connect interregional national routes with locations after 2030. Complete the goal of restoring and modernizing provincial roads that connect the region between Dien Bien Phu city and Muong Lay town, as well as districts throughout the province. Prioritize the achievement of the goal of upgrading the provincial national highway system by 2025, largely conform to grade IV road specifications, Provincial highways have steadily been finished, upgraded and improved to meet grade V and VI criteria and rural roads to be upgraded, renovated and concretized, concrete is used on all district roads and 70% of commune-level roads. At the same time, several districts are prioritizing investment in new rural roads linking with recently divided communes and to construct, renovate, upgrade routes linking with historical relic places in order to capitalize on the province's historical tourism development potential.

Thirdly, emphasize the critical role that the military plays in securing national security, abundant tourism resources and excellent opportunity to establish a regional transportation service hub. To promote investment, to ask for and benefit from the central government's investment in national highways, which are lifelines and are especially important for socioeconomic development and security guarantee - national defense in the province, such as the renovation and improvement of NH 6, NH 12, NH 279 and NH 279B, which connects the provinces of SonLa and LaiChau; in which NH 6 is a clear route that plays an important role in improving connectivity with the capital of Hanoi. Implement strategies to effectively promote internal resources and increase investment promotion from a variety of legal capital sources (for example, PPPs, from official development aid (ODA), primarily from the World Bank, ADB, JICA and the others), in order to gradually develop the road transport infrastructure approved during the planning period 2021-2030, including: (i) Upgrading 87 km of segment PR 139 of the Muong Nha-Sa Dung, grade V mountain road; (ii) Upgrading 77 km of the PR 139B Keo Lom-Sam Kha segment (SonLa province, Sop Cop district), grade V mountain road; (iii) Additional 49 km of Huoi So-Ta Phin route, grade V mountain road under PR 140; (iv) Additional 34,5 km of Deo Gio - Ta Sin Thang route, grade V mountain road under PR 140B; (v) Upgrading 68 km of the Quang Lam-Nam Khum Ban route (Km169+550/ NH.4H) grade V mountain road under PR 145E.

Conclusion

The road transport system is an important factor that contributes significantly to the economic development of each country, area and location. It is a powerful tool

for promoting economic, cultural and social growth. Furthermore, increasing road network has a great influence on the natural environment, society and the economy. The requirements for provinces and countries are to research and direct the development of road transport in a socioeconomically sustainable and effective manner. The article's study findings were based on a SWOT analysis to identify strengths and weaknesses, as well as challenges and possibilities for developing the Dien Bien province's road transport system. After that, offer some solutions to to overcome the flaws, enhance the strengths and possibilities for local road network development. It can be stated that the above solutions, if implemented properly, will contribute to the development of road network and create circumstances for the socioeconomic development of Dien Bien province./.

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Study on a novel exterior RCS hybird joint by ABAQUS

(tiếp theo trang 78)

- The numerical results were in good agreement with the experimental ones, both in terms of initial stiffness and ultimate loads.

- The numerical analysis by ABAQUS can be a reliable method to predict the exterior RCS hybrid joint behaviorin monotonic loading.

- For anchorage length beyond 80cm, the joint stiffness, the plastic bending moment and the initial stiffness remain unchanged.

- The joint resistance improves with higher concrete class for anchorage length below 80cm. The latter remain unchanged for the anchorage length greater than 80cm. The plastic bending moment is not much affected by the difference of the concrete class while the joint initial stiffness dependent on the concrete class./.

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