

वर्ष : १, अङ्क : १

पूर्वाधार

वार्षिक पत्रिका



नेपाल सरकार
पूर्वाधार विकास मन्त्रालय
विकास सहायता समन्वय तथा गुणस्तर महाशाखा
निर्माण व्यवसाय प्रवर्द्धन शाखा
बबरमहल, काठमाडौं

पूर्वाधार

PURBADHAR

वर्ष १, अङ्क १, असार २०८३

संरक्षक

श्री गोपाल प्रसाद सिग्देल

सचिव

सम्पादन मण्डल

श्री सुशील बाबु ढकाल

सहसचिव, पूर्वाधार विकास मन्त्रालय

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पूर्वाधार

प्रकाशक :- पूर्वाधार विकास मन्त्रालय

विकास सहायता समन्वय तथा गुणस्तर महाशाखा

निर्माण व्यवसाय प्रवर्द्धन शाखा

प्रकाशन :- २०८३ असार

सर्वाधिकार :- प्रकाशकमा

छपाई प्रति :- ५०० प्रति

यस जर्नलमा प्रकाशित लेखका धारणाहरु लेखकका स्वतन्त्र एवम् निजी विचार हुन्। यस प्रति सम्पादन मण्डल र प्रकाशक जवाफदेही हुने छैन । प्रकाशित लेखबारे आफ्नो प्रतिक्रिया व्यक्त गर्न चाहने पाठक वर्गलाई यस शाखाको इमेल ठेगाना:- cbps2071@gmail.com मा पठाउन अनुरोध गरिन्छ । प्राप्त प्रतिक्रियाका सम्बन्धमा सम्बन्धित लेखकलाई जानकारी दिई सम्भव भएसम्म जवाफसमेत प्रकाशित गरिनेछ ।

मा. सुनिल लम्साल
मन्त्री
पूर्वाधार विकास मन्त्रालय

पत्र संख्या: २०८२१०८३
च.नं.: ११२

नेपाल सरकार



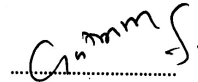
निजी सचिवालय
सिंहदरबार, काठमाडौं, नेपाल

पूर्वाधार विकास मन्त्रालय, नेपालका महत्वपूर्ण पूर्वाधारहरू सडक, रेल, जलमार्ग, रज्जुमार्ग निर्माण गर्ने, आधुनिक तथा सुविधायुक्त व्यवस्थित सफा र सुन्दर शहर तथा बस्तीहरूको विकास गर्ने र खानेपानी सरसफाइ तथा स्वच्छता कायम गर्ने नेपाल सरकारको जिम्मेवार निकायका रूपमा रहेको छ। मन्त्रालयले यस वर्षबाट पूर्वाधार तथा विकास सम्बन्धी अनुसन्धानमूलक, विप्लेषणात्मक तथा विचारमूलक मौलिक लेख रचना समावेश भएको पूर्वाधार जर्नल प्रकाशन गर्न लागेको जानकारी पाउँदा मलाई खुशी लागेको छ।

सुरक्षित, गुणस्तरीय, आधुनिक तथा दिगो पूर्वाधार संरचनाहरूको निर्माण र उपयोगमार्फत सर्वसधारण नागरीकको जीवनस्तरमा गुणात्मक सुधार ल्याउन यस मन्त्रालय लागि परेको छ। यस क्षेत्रका विज्ञहरूसँग राय, परामर्श, छलफल, अन्तरक्रिया तथा प्राज्ञिक संघ संस्थाहरूसँग विकासका क्षेत्रमा सहकार्य गर्ने मन्त्रालयको नीति रहेको छ।

मन्त्रालयले यस वर्षबाट पूर्वाधार विकास सम्बन्धी लेख रचना समावेश भएको पूर्वाधार जर्नल वार्षिक रूपमा प्रकाशन गर्न शुरु गरेकोमा यो प्रथम संस्करण तपाईंहरू माझ आएको छ। यस संस्करणमा पूर्वाधार विकास सम्बन्धी विज्ञहरूको लेख रचना नेपाली तथा अङ्ग्रेजी भाषामा प्रकाशित गरिएको छ। यी लेख रचनाहरू यस क्षेत्रमा अध्ययन, अनुसन्धान गर्न चाहने व्यक्ति तथा सम्बन्धित सरोकारवालाहरूको लागि उपयोगि हुने विश्वास लिएको छु।

अन्त्यमा यो जर्नल प्रकाशन गर्न महत्वपूर्ण भूमिका खेल्ने निर्माण व्यवसाय प्रवर्द्धन शाखा, सम्पादक मण्डल तथा लेख रचना उपलब्ध गराइ सहयोग पुर्याउनुहुने सबै महानुभावहरूलाई धन्यवाद दिन चाहन्छु।



सुनिल लम्साल

मन्त्री

पूर्वाधार विकास मन्त्रालय

माननीय सुनिल लम्साल
मन्त्री

सम्पादकीय

पूर्वाधार विकास मन्त्रालय, निर्माण व्यवसाय प्रवर्द्धन शाखाबाट यस आर्थिक वर्षदेखि वार्षिक रूपमा पूर्वाधार विकासका विभिन्न आयामहरूलाई समेटी पूर्वाधार जर्नल प्रकाशन गर्न सुरुवात गरिएको छ। पहिलो अंकको रूपमा यो जर्नल पूर्वाधार विकासको क्षेत्रमा चासो राख्ने पाठकहरू समक्ष पुर्याउन पाउँदा खुसी व्यक्त गर्दछौं।

यस वर्षदेखि प्रकाशन गर्न सुरुवात गरिएको यस जर्नलमा यातायात पूर्वाधार, जलविद्युत तथा नविकरणीय उर्जा, शहरी पूर्वाधार विकास, नविन निर्माण प्रविधि र दीगो निर्माण, विपद् जोखिम न्यूनीकरण, विकास प्रशासन तथा व्यवस्थापन र पूर्वाधार सम्बन्धी समसामयिक अन्य विषयहरूमा विभिन्न विचारमूलक तथा अनुसन्धानमूलक लेख/रचनाहरू प्रकाशन गर्ने व्यहोरा पाठक वर्गमा सूचित गर्न चाहन्छौं। यस प्रकाशनले विकास व्यवस्थापनमा चासो राख्नेहरूको थोरै भएपनि ध्यान आकर्षण गर्नेछ भन्ने विश्वास लिएका छौं।

प्रस्तुत प्रकाशनमा त्रुटी कमजोरी नहोस् भन्ने प्रयास गरेका छौं। तथापी यस्तो प्रयासका बावजुद पनि कुनै कमी कमजोरी रहन गएमा सुधारका लागि प्राप्त हुने सल्लाह र सुझावहरूलाई सदैव मार्ग निर्देशकका रूपमा स्वीकार गर्नेछौं।

यो जर्नल वार्षिक रूपमा प्रकाशित हुने भएकाले लेखकवर्गलाई आफ्ना लेख रचना समयमा नै उपलब्ध गराई सहयोग गरिदिनुहुन समेत अनुरोध गर्दछौं। यस जर्नललाई आगामी दिनमा समयसापेक्ष अझै परिष्कृत र स्तरीय बनाउन थप सुझाव, सल्लाह तथा प्रतिक्रियाको अपेक्षा गर्दछौं।

अन्त्यमा, हाम्रो अनुरोधलाई स्वीकार गरी छोटो समयमै यस जर्नलमा लेख रचना उपलब्ध गराई सहयोग गर्नुहुने लेखक, विषयविज्ञ तथा अनुसन्धानकर्ताहरू प्रति हार्दिक आभार व्यक्त गर्दछौं। यस्तो जर्नल वार्षिक रूपमा प्रकाशन गर्न मार्गदर्शन गर्नुहुने पूर्वाधार विकास मन्त्रालयका माननीय मन्त्रीज्यू, सम्पादन मण्डललाई दिशानिर्देश तथा सहजिकरण गर्नुहुने मन्त्रालयका श्रीमान् सचिवज्यू लगायत यो जर्नल सम्पादन/प्रकाशन/व्यवस्थापन कार्यमा सहयोग गर्नुहुने सबै प्रति सम्पादन मण्डल हार्दिक आभार व्यक्त गर्दछौं।

लेख रचनाका प्राथमिकताका विषयक्षेत्रहरू

- यातायात पूर्वाधार
- जलविद्युत तथा नबिकरणीय उर्जा
- डिजिटल पूर्वाधार र दुरसञ्चार
- पर्यटन पूर्वाधार
- शहरी बिकास र स्मार्ट सिटीहरू
- जलश्रोत उपयोग/व्यवस्थापन
- नविन निर्माण प्रविधि र दीगो निर्माण
- पूर्वाधार निर्माणमा गुणस्तर तथा जलवायू परिवर्तन अनुकुलता
- पूर्वाधार निर्माणमा वैकल्पिक वित्त
- पूर्वाधार निर्माणमा अन्तरतह/निकायगत समन्वय र ढाँचा
- पूर्वाधारको मर्मतसंभार र दीगो उपयोगिता सहितको व्यवस्थापन
- ठेक्का व्यवस्थापन
- एकिकृत यातायात प्रणाली
- नदीजन्य र खानीजन्य निर्माण सामग्री उद्योग
- यातायात नीति तथा सडक सुरक्षा
- विकास प्रशासन तथा व्यवस्थापन,
- पूर्वाधार सम्बन्धी समसामयिक अन्य विषयहरू ।

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नेपालमा आयोजना व्यवस्थापन र सुशासन



- बलराम रिज्याल
सहसचिव, पूर्वाधार विकास मन्त्रालय

सारांश

सार्वजनिक पूर्वाधार विकासको क्षेत्रमा नयाँ र जागरूक पुस्ताको सक्रियताले आयोजनाको व्यवस्थापनप्रति शासकीय अपेक्षा चुलिएको छ । राष्ट्रको आर्थिक समृद्धि र नागरिकको जीवनस्तर सुधारका लागि भौतिक पूर्वाधारको विकास र यसका लागि सञ्चालन गरिने आयोजना व्यवस्थापनमा अल्पकालिन र दीर्घकालिन नतिजाका लागि व्यवस्थापकीय औजारका रूपमा आयोजना सुशासनलाई लिइन्छ । आयोजना सुशासनमा निर्णय प्रक्रिया, जिम्मेवारीको किटानी, उपयुक्त सञ्चार प्रणाली, जोखिम व्यवस्थापन, संलग्न सरकोकारवालाहरूको जवाफदेहिता र सकारात्मक लक्ष प्राप्ति पर्दछन् । पूर्वाधार विकासले मुलुकको समृद्धि र विकासका लागि आधारशीला प्रदान गर्ने भएकोले आयोजनाको व्यवस्थापकीय कौशल र सुशासनद्वारा यसको छनोटदेखि सम्पन्नतासम्म पारदर्शिता र जवाफदेहिता कायम गर्नु आजको आवश्यकता हो । नेपालमा संघीय प्रणाली विकसित हुँदै जाँदा वित्तीय संघीयताको अभ्यासमा सबै तहहरू क्षमतावान र जिम्मेवार हुँदा स्थानीय तथा सानातिना पूर्वाधारका कार्य सन्तोषजनक रूपमा अघि बढिरहेका छन् । यद्यपि नेपालमा समग्र पूँजीगत खर्चको प्रवृत्ति सन्तोषजनक छैन । चालु खर्च धान्ने आन्तरिक स्रोतको न्यूनता र पूँजीगत बजेट वर्षान्ततिर केन्द्रित हुने प्रवृत्तिले आयोजना सुशासनमा सबै तह र संस्थाहरू संवेदनशील हुनुपर्ने देखिन्छ । आयोजना सुशासनका लागि चक्रीय ढाँचामा क्रमबद्ध कार्य सम्पादन गर्ने तथा कार्यान्वयनमा निष्ठा र इमान्दारिता देखाउन चुनौतीपूर्ण छ । आयोजनाको लक्षित र विशिष्ट उद्देश्य प्राप्तिसमा सुनिश्चितता ल्याउन स्पष्ट ढाँचा र चक्रमा रही कार्यान्वयनमा निष्ठा र इमान्दारिता अनुसरण गर्न, योजनामा बजेटको अनावश्यक वृद्धि र समयसीमा बढ्ने प्रवृत्ति रोक्न तथा Scope Creep को प्रभाव रोक्न आयोजना व्यवस्थापनमा सुशासनको पक्ष जोडिएको हो । विद्युतीय खरिद वा ठेक्का प्रणाली, कन्ट्र्याक्ट म्यानेजमेन्ट सफ्टवेयर र आयोजना अनुगमन सफ्टवेयर (PMIS) को पूर्ण उपयोग गर्दै पूर्वाधार विकास गर्न विशेषतः नेतृत्ववर्ग जिम्मेवार बनेमा आयोजनाको व्यवस्थापन, सञ्चालन र यसको नतिजा प्राप्ति उद्देश्यमूलक बन्न सक्छ ।

शब्द कुञ्जिका: आयोजना सुशासन र ढाँचा, आयोजना चक्र, पूर्वाधार विकास, डिजिटाइजेशन, ई-मनिटरिङ, पूँजीगत खर्च, सोह्रौं योजना, जवाफदेहिता ।

१. पृष्ठभूमि

सूचना प्रविधि र सञ्चार क्षेत्रमा भएको वैश्विक प्रगतिको झिलकोले विकासको मझधारमा वामे सदैँ गरेका देशका जनसमुदायमा व्यापक प्रभाव पारेको छ । सार्वजनिक पूर्वाधार आयोजना र विकास कार्यक्रमको व्यवस्थापनमा परम्परामा आधारित प्रक्रिया अपनाउँदै गर्दा अत्याधुनिक र सुविचारित (Advanced and Sophisticated) प्रविधिको जबर्जस्त प्रवेश अनुसरण गर्ने वर्ग र जीवन पद्धति बनाउने पुस्ताको सक्रियताले शासकीय अपेक्षा चुलिएको छ । कृत्रिम बौद्धिकता र अलगोरिदम (AI & Algorithm) को वर्तमान युगमा शासन, सेवा प्रवाह तथा विकास कार्यमा सुशासन र सर्वस्वीकार्य नतिजा प्राप्तिको माग हात्तै बढेको पाइन्छ । यद्यपि हाम्रा संरचना, संस्था, कानून, प्रक्रिया र सोचमा परिवर्तन ल्याउने विषय आशातीत रूपमा पछाडि नै छन् । प्रणालीगत विकास, मूल्यमान्यता, नैतिकताको अभ्यास र नतिजाकेन्द्रित कार्य थालनी गर्न पनि विलम्ब भैसकेको छ । विशेषगरी नेपालको पूर्वाधार विकासको पहिलीमा आयोजना सुशासनको अवधारणालाई आत्मासत गर्नु र यसलाई योजना पद्धतिमा अन्तरनिहीत गर्न आवश्यक छ ।

कुनै पनि राष्ट्रको आर्थिक समृद्धि र नागरिकको जीवनस्तर सुधारका लागि भौतिक पूर्वाधारको विकास अनिवार्य शर्त हो । नेपाल जस्तो विकासोन्मुख मुलुकका लागि सडक, विद्युत, खानेपानी र सिँचाई जस्ता पूर्वाधारहरू विकासका मेरुदण्ड हुन् । तर पूर्वाधार निर्माण हुनु मात्र ठूलो कुरा होइन, त्यसलाई कसरी व्यवस्थापन गरिन्छ र त्यहाँ सुशासनको अवस्था कस्तो छ भन्ने विषयले आयोजनाबाट प्राप्त हुने दीर्घकालीन लाभ निर्धारण गर्दछ । आयोजना सुशासन एक सामूहिक अभ्यास हो । सामूहिक कार्य वा संगठनको समग्र व्यवस्थापनले सर्वस्वीकार गरी आयोजना व्यवस्थापन र विकासचक्रलाई सुमधुर रूपमा अघि बढाउने हुँदा यसलाई एक उत्तोलकका रूपमा लिइन्छ । यस विधाले नियम वा प्रक्रिया अवलम्बन गर्ने संस्कारको विकास गराउँछ । कार्यगत अभ्यास, नीतिगत पैरवी, रणनीतिक निर्णय तथा नतिजामुखी क्रियाकलापको सञ्चालनसम्मका विषयलाई आयोजना सुशासनले समुच्चतामा हेर्दछ । लक्षित उद्देश्य हाँसिल गर्न र विकासको सोंच पूरा गर्न आयोजना बनाइन्छ । योजनाको कुशल कार्यान्वयनबाट मात्र खासमा परिणाम र नतिजा प्राप्त हुन्छ । आयोजनाको सुरुवातदेखि लाभग्राही सञ्चालनसम्म सहज व्यवस्थापकीय कौशल अपनाउने तथा प्राप्त हुने परिणाम र नतिजाको रसास्वादन गर्ने अवस्थासम्म पुर्याउन कसले, के र कसरी गर्ने भन्ने विषयमा गरिने प्रबन्धको चर्चा यस आलेखमा गरिनेछ ।

२. आयोजना सुशासनको अवधारणा

आयोजनाको अवधारणा वा सोंच निर्माणदेखि यसलाई भौतिक रूपमा ग्रहण गर्ने (Conceptualization and Materialization) सम्मका चरणलाई आयोजना व्यवस्थापन भनिन्छ । यसमा आयोजना कार्यान्वयन गर्न आवश्यक पर्ने जिम्मेवारी र भूमिकाको किटान, अधिकारको प्रयोग र सोको परिचालन तथा सञ्चालन गर्ने शासकीय प्रबन्धहरू व्यवस्थित गरिएको हुन्छ । यो कार्य सकारात्मक परिवर्तन र लक्षित विन्दुतर्फ उन्मुख रहेको हुन्छ । विकासको अनुभूति प्राप्त भएमा सुशासन कायम भएको मानिन्छ । विकासका कार्यहरू कहीं कतै अवरुद्ध भएमा वा नकारात्मक नतिजातर्फ लागेमा आम जनताले कुशासन, दुराचार वा अर्घेल्याँई भएको बुझ्दछन् । मूलतः आयोजनाको अवधारणादेखि यसको डिजाइन, व्यवस्थापन, नियमन र उत्पादनमूलक उद्देश्य प्राप्तिका लागि विविध रणनीति, निर्णयशीलता पूर्ववत् जोखिम आँकलन र निगरानी पक्ष समेटिने प्रबन्ध आयोजना सुशासन हो ।

आयोजना व्यवस्थापन निश्चित समय, लागत र गुणस्तरभित्र रही लक्ष्य प्राप्त गर्ने कला र विज्ञान हो भने आयोजनाको समग्र चक्रमा निर्णय प्रक्रियामा पारदर्शिता, जवाफदेहिता, कानुनी शासन र सरोकारवालाहरूको सहभागिता सुनिश्चित हुने अवस्था आयोजना सुशासन हो । नेपालमा ठूला आयोजनाहरू समयमा सम्पन्न नहुने, लागत दोब्बर वा तेब्बरसम्म हुने र गुणस्तरमा प्रश्न उठ्ने मुख्य कारण फितलो व्यवस्थापन र सुशासनको अभाव नै हो ।

आयोजना सुशासन परम्परागत प्रशासनिक वा व्यवस्थापकीय प्रबन्धभन्दा फरक छ किनकि यसले आयोजनाका सबै क्रियाकलापलाई कसरी, कहिले, किन र केका लागि कसले भन्ने विषय दर्पणका रूपमा प्रस्तुत गर्दछ ।

आयोजना सुशासन एक व्यवस्थापकीय औजार पनि हो । यसले मुख्यतः आयोजनाका विविध चरणमा हुन सक्ने वा सम्भावित जोखिमको पूर्ववत् निराकरण गर्दछ । संलग्न जनशक्तिको जिम्मेवारी सुनिश्चित गर्दछ । आयोजनालाई सम्पन्न गर्न र कार्यान्वयनमा लगी लाभग्राहीसम्म पहुँच पुर्याउन सघाउँछ । यसले उद्यमशील सरकारका रूपमा व्यावसायिक लक्ष्य हाँसिल गराउँछ । यसमा निर्णय प्रक्रिया, जिम्मेवारीको किटानी, जोखिम व्यवस्थापन र सकारात्मक लक्ष प्राप्त आपसमा अन्तरसम्बन्धित भएर रहन्छन् । आयोजनालाई निरन्तरता दिन र एकरूपता ल्याउन, समय समयमा आउन सक्ने परिवर्तनलाई आत्मसात गरी वान्छित नियमनमा राख्न र सरोकारवालाहरूलाई सुसूचित गर्न यसले एक रुपरेखाका रूपमा जिवन्त कार्य गर्दछ । आयोजना सुशासनमा उपयुक्त सञ्चार प्रणाली आवश्यक पर्दछ जसका कारण समयसीमाभित्रै निर्दिष्ट साधन र स्रोतमा रही परियोजना सम्पन्न

गराउँछ । यो त्यस्तो ढाँचा हो जसमा संलग्न Employer, Actor and Stakeholder हरूको जवाफदेहिता, निर्णय प्रक्रिया सुनिश्चितता र अपेक्षित नतिजा प्राप्तमा तत्परता जस्ता अवयव रहन्छन् ।

Project Management Institute का अनुसार आयोजना व्यवस्थापनमा मुख्य पाँचवटा चरणहरू रहन्छन् जसमा अवधारणागत सुरुवात, योजना तर्जुमा, योजना कार्यान्वयन, अनुगमन र नियन्त्रण तथा समापन पर्दछन् । यसैगरी आयोजना सुशासन ढाँचाभित्र सो आयोजना वा कार्यक्रम वा क्रियाकलाप व्यवस्थापनका लागि सञ्चालन ढाँचा, कार्य प्रक्रिया र कार्ययोजना कार्यान्वयन कौशल वा सीप पर्दछन् त्यसैले आयोजना सुशासनले निश्चित आयोजनाको नीति निर्देशन, प्रक्रिया र जोखिम पहिचान, निगरानी र अनुगमनको पक्षमा केन्द्रित रही यसको रणनीतिक कार्यान्वयनमा सहयोग पुर्याउँछ ।

आयोजना सुशासनको ढाँचालाई दुई वटा तहमा हेर्न सकिन्छ: पहिलो, उच्च तहबाट रणनीतिक निगरानीका माध्यमबाट समस्त योजनाको उपलब्धि, स्रोत व्यवस्थापन, अन्य आयोजनासँगको समन्वय र विकास लक्ष्यमा नीतिगत तहमा पार्ने प्रभावका बारेमा हेरिन्छ । जस्तै: राष्ट्रिय योजना आयोगबाट आयोजनाको सुशासन, प्रधानमन्त्री कार्यालयबाट आयोजनाको शासकीय सुशासन र अर्थ मन्त्रालयबाट स्रोत तथा वित्तीय सुशासनका काम गर्ने गरिन्छ । त्यसैगरी, परियोजना सञ्चालनको तहले विशेषतः आयोजना कार्यान्वयनको अनुगमन गर्ने र शीघ्र तथा विधिसम्मत रूपमा निश्चित मानक र मानदण्डमा आधारित भई कार्यान्वयन गर्ने, संलग्न जनशक्तिलाई स्पष्ट दिशानिर्देश गर्ने र नतिजा प्राप्तितर्फ सजग गराउने काम गर्दछ । क्षेत्रगत मन्त्रालय, आयोजना निर्देशनालय वा आयोजनाको अनुगमन गर्ने, जिम्मेवारीप्राप्त प्रमुखले आयोजना सुशासनको परख गर्दछन् ।

३. आयोजना सुशासनका तत्वहरू

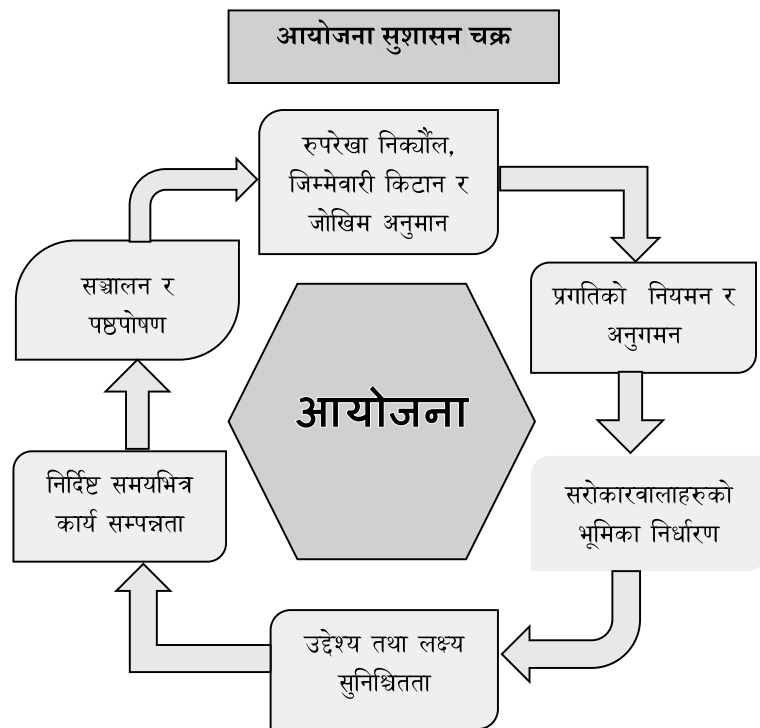
कुनै पनि निश्चित आयोजनाको जीवन्तता र प्रभावग्राह्य हुनको लागि यसको विभिन्न तीनवटा अन्तरनिहित तत्व हुन्छन् । जसमा,

- क. बनावट (Structure): यसमा स्पष्ट परिभाषित भूमिका, सबल र कार्यशील व्यवस्थापकीय ढाँचा, पदसोपान सहितको जिम्मेवारी, निर्णयाधिकार, निगरानी समिति पर्दछन् ।
- ख. जनशक्ति (People): परियोजना समूह, सरोकारवाला, जनशक्तिको क्षमता विकास तथा सही मानिस उपयुक्त पद र स्थान लगायत यसमा पर्दछन् ।
- ग. सूचना (Information): सञ्चार र सूचना आदानप्रदानको उपयुक्त सञ्चालन सुनिश्चितता, जोखिम व्यवस्थापन, प्रक्रिया सरलीकरण र निरन्तरता, निर्णयका लागि सूचना,

आर्थिक जोखिम, प्रगति विवरण तथा प्रतिवेदन प्रणाली सूचनाको समग्र कोष्ठमा समेटिन्छन् ।

४. आयोजना सुशासन चक्र

आयोजना व्यवस्थापनमा यसको अवधारणा जिम्मेवारी किटानदेखि लिएर प्रभावको अनुगमन र मूल्यांकन पर्दछन् भने सुशासनको समग्र चक्रमा यसको सञ्चालन पक्षलाई प्रधान रूपमा हेरिन्छ जसमा सरकोकारवाहरुको सहभागिता जोखिमको पूर्व आङ्कलन सम्पन्नताको सुनिश्चितता र सञ्चालनहरु पर्दछन् । यो चक्रलाई देहाय बमोजिम रेखाचित्रमा उल्लेख गर्न सकिन्छ ।



स्रोत: आयोजना सुशासनका तत्व र चरणका आधारमा स्वविश्लेषण

५. आयोजना सुशासनका चरण:

आयोजना व्यवस्थापनलाई वस्तुनिष्ठ र लक्ष्य तथा उद्देश्य अनुरूप सञ्चालन गर्न यसका सुशासनका चरणलाई देहाय बमोजिम सूचीबद्ध गरिएको छ ।

- आयोजना सञ्चालनको ढाँचा तयारी कार्य गर्ने

- आयोजना सञ्चालन गर्ने संस्था वा संयन्त्रको रणनीति र अनुगमन/निगरानीको जिम्मेवारी सुनिश्चित गर्ने
- प्रमुख निर्णयकर्ता र सरोकारवालाहरुको भूमिका र जिम्मेवारी पहिचान गर्ने
- परियोजनाको अध्यावधिक अवस्था पहिचान गर्ने र सोको प्रतिवेदन गर्ने सूचना सञ्चार प्रबन्ध सुनिश्चित गर्ने
- निर्णय सञ्चालन र जोखिम व्यवस्थापन समेत भएको परियोजनाको कार्य सञ्चालन योजना (Action Flow Chart) विकास गर्ने
- आयोजना सम्बद्ध सम्पूर्ण प्रभावी वा लाभग्राहीहरुलाई आयोजना चक्र र यसको नमूनाका बारेमा सुसूचित गर्ने
- संलग्न जनशक्तिलाई सक्षम बनाउन र उत्प्रेरित गर्न तालिम एवमं क्षमता अभिवृद्धि कार्यक्रम सञ्चालन गर्ने
- निरन्तर सुधारका लागि अनुगमन र निगरानी गर्ने
- आयोजनाको सम्पन्नता र लक्षित उद्देश्य प्राप्तिको मूल्याङ्कन र पृष्ठपोषण गर्ने
- आयोजनाको सञ्चालन एवम् नीतिगत तहमा सुधारका लागि सुझाव दिने ।

६. आयोजना सुशासनको महत्व

१. जिम्मेवारपूर्ण, पारदर्शी र तथ्यमा आधारित निर्णयका लागि आयोजना सुशासन एक महत्वपूर्ण औजार हो ।
२. आयोजना सुशासन कुनै पनि आयोजना सफलताको द्योतक हो । यसले लक्षित र विशिष्ट उद्देश्य प्राप्तिसमा सुनिश्चितता ल्याउँछ । स्पष्ट ढाँचा र कार्यान्वयन चक्र आत्मसात गर्दछ । सक्षम, उत्प्रेरित र इमान्दार जनशक्ति; सुसूचित निर्णय प्रक्रिया; बजेटको अनावश्यक वृद्धि र समयसीमा थपमा बन्देज लगाउँछ । परिणामतः शीघ्र र समयभित्रै आयोजना सम्पन्न हुन्छ । Scope Creep को प्रभाव रोकिन्छ ।
३. आयोजना सुशासनले सरोकारवाला र प्रभावित समूहको संलग्नता बढाउँछ । निरन्तर अन्तरक्रियालाई सम्भव बनाउँछ । सूचनाको स्वतन्त्र र निर्बाध लुप निर्माण हुन्छ । परियोजना चक्रका सबै चरणमा सर्वपहुँच हुन्छ । सबैलाई सुसूचित बनाउँछ ।
४. यसले पूर्ववत रूपमा नै जोखिमको पहिचान गराई निराकरणमा सहजता ल्याउँछ । सम्भावित कमजोरीको अन्त्य हुन्छ । कानूनी र आर्थिक रूपमा पर्ने असरको समयमा नै सम्बोधन हुन्छ ।

५. आयोजना सुशासनले स्रोत व्यवस्थापनमा सुधार ल्याउँछ । यसको मुल कडी नै भरपर्दो स्रोत व्यवस्थापन प्रणाली हो । स्रोतको दुरुपयोग हुनबाट जोगिन्छ । असम्बन्धित क्षेत्रमा विनियोजन हुनबाट जोगाई स्रोतको प्राथमिकीकरण गर्न सघाउ पुग्दछ ।
६. यसले जिम्मेवारी बहनमा प्रभावकारिता ल्याउँछ । जिम्मेवार तहलाई सचेत बनाउने र अपनत्वको संस्कार सिकाउने हुँदा जिम्मेवारी बोधको अभ्यास हुन्छ । यसले बेलायतका पूर्व प्रधानमन्त्री विन्स्टन चर्चिलले भनेजस्तै: The price of greatness is responsibility लाई साकार बनाउँछ ।
७. आयोजना सुशासनले तथ्यमा आधारित निर्णय प्रक्रियालाई आत्मसात गर्दछ । आयोजनाको अवधारणा निर्माण, प्राथमिकीकरण, स्रोत व्यवस्थापन, आदि जस्ता सुरुवाती कार्यमा शीघ्रता ल्याउन सघाउँछ । जोखिम व्यवस्थापन गर्ने परिपाटीको विकास भई परियोजनाको सफलता सुनिश्चित हुन्छ ।

७. प्रमुख समस्याहरू

नेपालमा आयोजना व्यवस्थापन र सुशासनमा अनुभूत गरिएका केही मुख्य समस्याहरू यस प्रकार छन्:

१. पूर्वाधारहरूको आवश्यकता र आपूर्तिबीचको बेमेल, दिगो पूर्वाधार, विकासका आयामहरूको कमजोर व्यवस्थापन एवं निर्मित भौतिक पूर्वाधारहरूको न्यून गुणस्तर आदि आयोजना विकासका मुख्य समस्या हुन् । (सोही योजना: विकासका चुनौती पृष्ठ-१४)
२. आयोजनाको कमजोर तयारी जस्तै: विस्तृत परियोजना प्रतिवेदन तयार नै नहुने, जग्गा प्राप्ति र वनक्षेत्रको समस्या समाधान नगर्ने र स्थानीय अवरोध तथा सडकक्षेत्रका वस्तु हटाउने कार्य गर्दै नगरी ठेक्का लगाउने प्रवृत्ति रहनु अर्को समस्या हो ।
३. नेपालको सार्वजनिक खरिद ऐनको प्रावधान अनुसार खरिद प्रक्रियामा विविध कमजोरी रहनु पनि समस्याका रूपमा रहेका छन् । जस्तै: सबैभन्दा कम बोलकबोल गर्नेलाई ठेक्का दिने प्रावधानका कारणले गर्दा गुणस्तर र काम छोड्ने प्रवृत्ति बढ्नु, ठेक्का तोड्ने प्रक्रिया जटिल र असम्भव प्रायः हुनु, कानूनी व्यवस्था कडा तर कार्यान्वयन अवस्था कमजोर हुँदा पनि जिम्मेवारीबाट पन्छिन सक्ने अवस्था हुनु,
४. आयोजनाको प्राथमिकीकरण, स्रोत व्यवस्थापन तथा आयोजना प्रमुखहरूको सरुवा र पदस्थापनमा राजनीतिक दबावका कारण निर्णय प्रक्रिया प्रभावित हुनु र परिणामतः

ढिलाई र अनुत्पादक आयोजनाहरूको आयतन बढ्नु, आदि ।

८. आयोजना सुशासनका चुनौतीहरू:

आयोजना सुशासनमा सैद्धान्तिक भन्दा व्यावहारिक चुनौतीहरूले बढी प्रभाव पारेका हुन्छन् । सैद्धान्तिक रूपमा यसले चक्रीय ढाँचामा क्रमबद्ध कार्य सम्पादनको माग गर्दछ । व्यावहारिक रूपमा हेर्दा कार्यान्वयनमा निष्ठा र इमान्दारिताका कसी लगाउनु नै चुनौती हुन् । यहाँ केही चुनौतीलाई देहाय बमोजिम उल्लेख गर्न सकिन्छ ।

- आयोजनाको न्यून स्रोत हुनु,
- आयोजना सुशासनको कठोर ढाँचाका कारण कार्य सम्पादन गर्न जटिलता सिर्जना हुनु,
- निर्धारित कार्य सञ्चालन योजना कार्यान्वयनमा नियमितता अपनाउन नसक्नु,
- परिवर्तनप्रति अनिच्छा र रोकावट गर्ने प्रवृत्ति हुनु र शीघ्र कारवाहीप्रति उदाशिन हुनु,
- जिम्मेवारी अल्पकालीन अधुरो र अस्पष्ट हुने गरी तोकिनु,
- सूचनाको आदानप्रदान, स्वचालित सूचना र प्रतिवेदन प्रणाली कमजोर हुनु,
- क्षमता अभिवृद्धि, तालिम र पुनर्ताजगी कार्यक्रमको अभाव हुनु या न्यूनता हुनु,
- आयोजनाको समग्र स्वास्थ्यमा असर पुर्याउने अड्डातन्त्रीय प्रक्रियामा सरोकारवालाहरूको न्यून अग्रसरता हुनु,
- आयोजना व्यवस्थापनमा दक्षता हाँसिल गर्न उच्च प्रतिफलयुक्त आयोजनामा स्रोत सुनिश्चितता गर्नु,
- आयोजना छनोट गरी अपेक्षित समय र लागतमा सम्पन्न गर्नु,
- खर्च क्षमता र प्रतिफलका आधारमा प्राथमिकीकरण गरी पूँजीगत खर्च क्षमता वृद्धि गर्नु ।

९. नेपालको सन्दर्भमा आयोजना व्यवस्थापन र सुशासनका अवस्था:

नेपालमा आयोजना व्यवस्थापनको अवस्था सिँहावलोकन गर्दा आपसी दोषारोपणको पटाक्षेपबाट विकास प्रक्रियाको बहस हुने गरेको पाइन्छ । सरकारी पक्षले निर्माण व्यवसायीको दोष देख्दछ । निर्माण व्यवसायीले स्रोत र कार्यवातावरण नभएको भनी उम्किने प्रयास गर्दछ । राजनीतिज्ञहरूले कर्मचारीतन्त्रको कार्य सम्पादन कमजोर भएको

तर्क गरेको पाइन्छ भने कर्मचारीले प्रक्रियाको झण्डा, कानूनी अवरोध र राजनीतिक हस्तक्षेपलाई कार्यसम्पादनको प्रमुख अवरोधको रूपमा लिई दोषबाट उम्किन्छन् । कतिपय अवस्थामा विकास अभियन्ताका नाममा स्वार्थ अनुकूल नभएमा स्थानीय अग्रधिकार र स्रोतको अधिकारको विषय उठाई आयोजनामा अवरोध गरेको पाइन्छ । यस्तो प्रवृत्ति आयोजना व्यवस्थापन असफल र अन्ततः रुग्ण बनाउन प्रधान वा सहायक सिद्ध हुन्छ । यी सबैको गुह्य विषय आयोजना सुशासन र व्यवस्थापकीय कौशलमा अडिएको छ । केही तथ्याङ्कगत र आयोजनागत दृष्टान्तलाई तल उद्धृत गरिएको छ ।

१. पूँजीगत खर्च विनियोजन तथा सो खर्चको प्रवृत्ति:

नेपालको विगत पाँच वर्ष अर्थात पन्ध्रौँ योजना अवधिको संघीय कूल बजेट विनियोजनमा पूँजीगत खर्च विनियोजन तथा पूँजीगत खर्चको प्रवृत्ति तलको तालिकामा देखाइएको छ । (रकम रु. करोडमा)

आर्थिक वर्ष	कूल बजेट विनियोजन	पूँजीगत तर्फ विनियोजन	विनियोजन प्रतिशत	पूँजीगत तर्फ खर्च	खर्च प्रतिशत	कैफियत
२०७६/०७७	१५३२९७	४०८००	२६।६१	१८९११	४६।३५	
२०७७/०७८	१४७४६४	३५२९१	२३।९३	२२८३०	६४।६९	
२०७८/०७९	१६३२८३	३७८१०	२३।१५	२१६३७	५७।२३	
२०७९/०८०	१७९३८३	३८०३८	२१।२०	२३३४९	६१।३८	
२०८०/०८१	१७५१३१	३०२०७	१७।२४	१९२०३	६३।५७	
जम्मा	६३९१७५	१८२१४६	२८।५०	१०५९३०	५८।१६	

स्रोत: आर्थिक सर्वेक्षण प्रतिवेदनहरू ।

यस तालिकामा देखाएको विवरणले विगत पाँच वर्षमा पूँजीगत बजेट विनियोजन क्रमशः खस्किँदो अवस्थामा रहेको देखाउँछ भने पूँजीगत बजेट विनियोजनका तुलनामा खर्चको प्रवृत्ति हेर्दा सामान्यतया बढेको देखाएको छ । यद्यपि पाँच वर्षको अवधि अर्थात पन्ध्रौँ योजनाकालमा पूँजी प्रधान क्षेत्रमा सरकारी बजेट विनियोजनको अवस्था दयनीय देखिन्छ । त्यसैगरी खर्च क्षमता समेत निराशाजनक नै भएको पाइन्छ । यस तथ्याङ्कले आयोजना व्यवस्थापन र सुशासनको अवस्थालाई सन्तोषजनक भन्न सकिने आधार सिर्जना गरेको मान्न सकिदैन ।

२. नेपालको पन्ध्रौ योजना अनुसार वार्षिक पूँजीगत खर्च आवश्यकता र प्रक्षेपण:

रकम रु करोडमा

आर्थिक वर्ष	योजनाका लागि प्रक्षेपित बजेट	पूँजीगत बजेट प्रक्षेपण	पूँजीगत खर्च	खर्च प्रतिशत	कैफियत
२०७६/०७७	१५९३२२	५८०३७	१८९११	३२।५८	
२०७७/०७८	१७७६२९	६९९४९	२२८३०	३२।६३	
२०७८/०७९	१९७३१८	८०१६२	२१६३७	२६।९९	
२०७९/०८०	२१८३८८	८९०६१	२३३४९	२६।२२	
२०८०/०८१	२४३१७६	१०४३४३	२३२१९	२२।२५	
जम्मा	९९५८३३	४०१५२५	१०९९४६	२७।३८	

नोट: प्रदेश तथा स्थानीय तहमा भएको पूँजीगत खर्च नगन्य भएको र सो विवरण यसमा समावेश छैन ।

स्रोत: पन्ध्रौ योजना र आर्थिक सर्वेक्षणहरू ।

यो तालिकामा विगत पाँच वर्ष अर्थात पन्ध्रौ योजना अवधिमा आर्थिक वर्षका आधारमा विभाजन गरिएको कूल वार्षिक एवम् आवश्यक आवश्यक पूँजीगत खर्चको प्रक्षेपण उल्लेख गरिएको छ । कूल प्रक्षेपित खर्च अनुमानका तुलनामा भएको खर्चको प्रवृत्ति क्रमशः घट्दो देखिएको छ । औसत पूँजीगत बजेट प्रक्षेपण नै करिब ४० प्रतिशत रहेको यस अवधिमा कूल प्रक्षेपित बजेटका तुलनामा करिब ११ प्रतिशत र पूँजीगत बजेट प्रक्षेपणका तुलनामा २७ प्रतिशत मात्र खर्च भएको पाइयो । यसबाट के निक्यौल निकाल्न सकिन्छ भने हाम्रो बजेट विनियोजन र खर्च क्षमताको अवस्थाले नेपालमा आयोजना व्यवस्थापनमा संरचनागत समस्या छन् । यसले निजी क्षेत्रलाई उत्साहित बनाउन र बजारमा लगानीयोग्य पूँजी निर्माणमा उत्प्रेरकको भूमिका खेल्न नकारात्मक सन्देश प्रवाह गरेको स्पष्ट हुन्छ ।

३. मेलम्ची खानेपानी आयोजना:

यो आयोजना नेपालको पूर्वाधार व्यवस्थापनमा "मिस-म्यानेजमेन्ट" को एक प्रमुख उदाहरण हो किनभने सन् १९९० को दशकमा सुरु भएको यो आयोजना सम्पन्न हुन झण्डै तीन दशक लाग्यो । यसको खास कारणमा आयोजना सुशासनको अभाव नै हो । सुरुवाती चरणमा चिनिया ठेकेदार सिएमसीसँगको विवाद र भुक्तानी

लगाएतका समस्याले काम रोकियो र पछि पटक पटक ठेक्का लगाउँदै, रोक्दै र म्याद थप गर्दा यसको समयावधि तथा लागतको गणना गरिसाध्य छैन ।

त्यसैगरी, यो आयोजना स्थानीय, प्राविधिक र बातावरणीय दृष्टिले समेत जोखिमपूर्ण रहेको पाइन्छ । स्थानीय जनता र स्रोतको अग्राधिकारको मागका कारण विभिन्न अवरोध र रोकावटले समेत यो योजना पीडित भएको हो । सरोकारवालाको माग र संलग्नतासम्बन्धी सूचनाको पहिचान र विश्लेषण गर्न नसक्नु तथा सम्भावित जोखिमको पूर्ववत् रूपमा आँकलन र व्यवस्थापन नहुनु यो आयोजनाको सुशासनका निराशाजनक पक्ष हुन् । यसैबीच सन् २०२१ मा आएको बाढीले आयोजनाको मुहान क्षेत्रमा पुर्याएको क्षतिले पूर्व तयारीमा जलवायु जोखिमको प्रयास अध्ययन नभएको हो कि भन्ने शंका समेत उब्जियो । समग्रमा आयोजना सुशासनको चक्रमा ध्यान पुर्याई यस प्रकृतिका ठूला आयोजनामा भूगर्भ र जलवायु जोखिमको गहन अध्ययन गरिनुपर्ने र सञ्चालनका विषयमा जिम्मेवारी हुनुपर्ने सन्दर्भ यो आयोजना व्यवस्थापनले सिकाएको छ ।

४. माथिल्लो तामाकोशी जलविद्युत आयोजना:

स्वदेशी लगानीमा बनेको ४५६ मेगावाट जेनेरेसन क्षमताको यो आयोजना नेपालको गौरव हो तथापि यसको व्यवस्थापनमा पनि केही चुनौती देखिएका छन् । यो आयोजनाको लागत सुरुमा ३५ अर्ब अनुमान गरिएको तर पछि बढेर झण्डै ८५ अर्ब पुग्यो र समयसीमा समेत करिब एक दशक लम्बियो । आयोजनाको अवधारणा र ढाँचा तयारी र प्राविधिक जोखिमको पूर्व अनुमान गर्न चुक्दा यसको ठूलो भार सरकारी स्रोत तथा लगानीकर्ता अंशियारहरूमा पर्न गएको छ ।

यो आयोजना भूकम्प, नाकाबन्दी र ठाडो सुरुङमा पाइप जडान गर्ने प्राविधिक समस्याका कारण समस्याग्रस्त हुँदाहुँदै पनि नेपाललाई विद्युतमा आत्मनिर्भर बनाउन र स्वदेशी व्यवस्थापकीय क्षमता प्रदर्शन गर्न महत्वपूर्ण भूमिका खेलेकोमा सफल रूपमा लिइन्छ ।

५. नेपालको पूर्वाधार विकासमा चाँदीको घेरा:

- नेपालको विकासलाई सापेक्षित र सम्यक रूपमा विश्लेषण गर्दा पूर्वाधार विकासको क्षेत्रमा देखिने गरी सुधार पनि भएका छन् । हाल १५औँ योजना भरखर समापन भई १६औँ योजना परिमाणात्मक क्षेत्र विकासका आधारमा कार्ययोजना सहित कार्यान्वयन सुरु भएको छ । पछिल्लो तथ्याङ्क अनुसार नेपालमा करिब

९८ प्रतिशत जनताले बत्ती बाल्न पाएका छन् । जडित सफा विद्युत क्षमता ३,००० मेगावाट नाघिसकेको छ यद्यपि अन्तरदेशीय विद्युत आयात निर्यात गर्ने पूर्वाधार निर्माण प्रयास मात्रामा हुन सकेको छन् ।

- सडक सञ्जालतर्फ मुलुकका सबै क्षेत्रमा सडक यातायात पुगेको छ । पूर्वदेखि पश्चिम जोड्ने एकमात्र निर्विकल्प सडक महेन्द्र राजमार्ग भएकोमा डेड दशकको अवधिमा पुष्पलाल मध्यपहाडी लोकमार्ग, हुलाकी राजमार्ग र मदन भण्डारी लोकमार्ग गरी थप तीन विशाल सडक पूर्वाधारहरू करिब निर्माण सम्पन्नको अवस्थामा पुगेका छन् । उत्तर दक्षिणका पानीढलो र राजनितिक प्रशासनिक केन्द्र जोड्न मात्र सीमित सडकहरूको विस्तार भई अहिले कोरिडोरका रूपमा समानान्तर पाँचवटा राष्ट्रिय तथा गौरवका आयोजनाहरू निर्माणको विभिन्न चरणमा पुगेका छन् ।
- आधारभूत खानेपानीको सुविधा ९६.८५ प्रतिशत तथा सरसफाइको सुविधा ९५.५ प्रतिशत पुगी अधिकांश घरपरिवारमा पुगेको छ । सिञ्चित भूमिको क्षेत्रफल बढेको छ । विविध बहुउद्देश्यीय योजनाहरू निर्माण सम्पन्नको चरणमा पुगेका छन् । एकै तर बहुउद्देश्यीय आयोजनाको व्यवस्थापनबाट सिंचाइ, खानेपानी र जलविद्युत क्षेत्रमा छिट्टै प्रचुर विकास हुने आशातीत लक्ष्यको नजिक हामी छौं ।
- हवाई पूर्वाधारको क्षेत्रमा भौतिक पूर्वाधारका दृष्टिले विशाल क्षेत्रीय तथा अन्तरराष्ट्रिय विमानस्थलहरू जस्तै: गौतम बुद्ध र पोखरा अन्तर्राष्ट्रिय विमानस्थल सञ्चालनमा आएका छन् । करिब चार दर्जन विमानस्थलहरू हाल निर्माण नै सम्पन्न भई वायुयानको प्रतिक्षामा रहेका छन् । निजी क्षेत्रको विकाससँगै ती विमानस्थलहरू सञ्चालनमा आउने वातावरण सिर्जना भएको छ ।
- नेपाल संघीय संरचनामा गएसँगै वित्तीय संघीयताको अभ्यास अब तल्ला सरकारहरूमा पनि राम्रो हुँदै गएको र क्षमताशील हुँदै जाँदा स्थानीय तथा सानातिना पूर्वाधारका कामहरू समेत देखिने गरी अघि बढिरहेका छन् । खासगरी तराईका पालिकाहरू र केही महानगरपालिकाको सडक पूर्वाधार उल्लेखनीय रूपमा निर्माण भएको अवस्था छ । यति हुँदाहुँदै पनि समग्रमा पूँजीगत खर्चको प्रवृत्ति सन्तोषजनक छैन । बजेटको ठूलो अंश साधारण खर्चका लागि व्यहोर्नु पर्ने हालको अवस्था र पूँजीगत बजेट वर्षान्ततिर केन्द्रित

हुने प्रवृत्तिले आयोजना सुशासनका सबै तह र संस्थाहरु संवेदनशील भई काम गर्नुपर्ने समय आएको छ ।

१०. सुधारका लागि सुझावहरू

आयोजना सुशासनको सैद्धान्तिक पक्ष, हाम्रो अवस्था र यसका चुनौती तथा व्यावहारिक समस्याको विश्लेषण गर्दा उपलब्ध स्रोत, साधन र क्षमताको आधारमा आयोजना व्यवस्थापन र यसको चक्रमा ध्यान पुर्याई देहायका केही उपायलाई आत्मबोध गर्न सकिएमा विद्यमान आयोजना व्यवस्थापन तथा शासकीय प्रबन्धमा सुधार भई नतिजा र उपलब्धि सकारात्मक हुने विश्वास गर्न सकिन्छ ।

- योजना र बजेटको आवद्धता कायम गर्नुपर्दछ । आवधिक योजना, त्रिवर्षीय बजेट, मध्यमकालीन खर्च संरचना र वार्षिक बजेटबीच कठोर तादात्म्यता (Hard Harmony) कायम गर्नुपर्दछ ।
- आयोजना चक्रलाई अक्षरशः पालना गर्ने कार्यविधिगत व्यवस्था गरिनुपर्दछ । निकायगत समन्वय र सम्बन्ध तथा जिम्मेवारी किटानमा द्विविधा र अमुक निकायको उच्चताभाष (Hegemony) लाई घटाउनुपर्दछ ।
- आयोजना बैंक (Project Bank) को कानूनी व्यवस्थालाई अकाट्य (Sine Qua Non) र अपरिहार्य (In extremes) बनाउनु पर्दछ । पर्याप्त अध्ययन भएका आयोजनालाई मात्र बजेट विनियोजन गर्ने परिपाटी बसाल्नु पर्दछ ।
- सार्वजनिक खरिद ऐनमा समसामयिक परिमार्जन गर्नुपर्दछ । जटिल प्रक्रिया; ठेक्का लगाउने पक्ष र लिने पक्षबीच स्वार्थमा खेल्ने प्रकृतिका व्यवस्था परिमार्जन; सहज प्रवेश र सहज निकासयुक्त व्यवस्था; गुनासो सुनुवाइ तथा सामूहिक क्षमादान तथा याचिका (Collective Bail); केवल कम मूल्यलाई मात्र आधार नबनाई प्राविधिक क्षमतालाई प्राथमिकता दिने व्यवस्था लगायतका व्यवस्था गर्न ढिला हुनुहुँदैन ।
- नतिजामा आधारित मूल्यांकन पद्धतिको विकास गरिनुपर्दछ । आयोजना प्रमुखको कार्यसम्पादनलाई आयोजनाको प्रगतिसँग जोडी पुरस्कार, प्रोत्साहन तथा दण्डको समुचित व्यवस्था गर्ने कार्य तुरुन्त थालनी गर्नुपर्दछ । आयोजना तयारी तथा बजेट विनियोजनबीच अन्तर आवद्धता, आयोजना विकास प्रणाली सुदृढीकरण, आयोजनाको विनियोजन कुशलता एवं कार्यान्वयन प्रभावकारिता अभिवृद्धि, आयोजना प्रमुखलाई जिम्मेवार बनाउने गरी आयोजना व्यवस्थापन गर्नुपर्दछ ।

- आयोजना व्यवस्थापनमा सूचना प्रविधिमा आधारित अनुगमन (डिजिटल मनिटरिङ) र जवाफदेहिता सुनिश्चित गरिनुपर्दछ ।
- डिजिटलाइजेसनको विवेकसम्मत उपयोग गर्नुपर्दछ । अनुकूलतामा ई गभर्नेन्स र प्रतिकूलतामा प्रणालीलाई दोषारोपण गर्ने प्रवृत्ति शीघ्र रोकिनुपर्दछ । प्राविधिक र पूर्वाधार विकास गर्न जिम्मेवार विभाग र निकायहरूले ठूलो राशी खर्चेर बनाएका प्रणालीगत सफ्टवेयर र डिजिटल डिभाइसको प्रयोगको उदाशीनता र बाहनालाई कानूनी दायरामा ल्याउनुपर्दछ । ईप्रोक्चुरमेन्ट, कन्ट्र्याक्ट म्यानेजमेन्ट सफ्टवेयर र आयोजना अनुगमन सफ्टवेयर (PMIS) को पूर्ण उपयोग गर्नुपर्दछ । यसमा मन्त्रालयहरूका नेतृत्वलाई जिम्मेवार बनाउनुपर्दछ ।
- पूर्वाधार विकासमा जोखिमको साझेदारीका रूपमा प्रख्यात प्रणाली सार्वजनिक-निजी साझेदारी (PPP) मोडल अपनाउनुपर्दछ । यसको कानूनी र संस्थागत व्यवस्था हेर्दा रूपमा भीमकाय तर भूमिका र काममा लिलिपुट जस्तो भएकोले यसलाई पूर्वाधार विकासको प्रचुर सम्भावना भएको हाम्रो जस्तो देशमा सुदृढ बनाई लागू गरिनुपर्दछ । विशेषतः पर्यटनका लागि केवलकार र स्तरीय सडक, यात्राका लागि द्रुतमार्ग, जलविद्युतको उत्पादन र यसको क्षेत्रीय व्यापार, कृषि प्रशोधन उद्योग र केन्द्रहरू स्थापना लगायतका क्षेत्रमा सार्वजनिक निजी साझेदारी मार्फत लगानी र विकास गर्ने प्रयास अवसर छन् ।
- सार्वजनिक क्षेत्रको पूँजीगत लगानीका उत्पादकत्व वृद्धि गर्ने गरी राज्यले सुधार गर्न खोजेका सवालहरूलाई सम्बोधन गर्न विशेषतः आयोजनाको विकास र छनोटदेखि यसको गुणस्तरीय निर्माण इमान्दार सञ्चालन र नतिजामूलक अनुगमनलाई प्रणालीबद्ध बनाउन आयोजना सुशासनलाई अंगीकार गर्नुपर्दछ ।
- हाल समग्र उत्पादन र लगानीमा ध्यान केन्द्रित गर्नु सरकारको मुख्य चुनौती भएको छ । यसर्थ, उत्पादनमूलक क्षेत्रका लागि आवश्यक पूर्वाधार निर्माण र अन्तरआवद्धताको विकास गर्न, औद्योगिक तथा व्यापारजन्य पूर्वाधार निर्माण गर्न पूर्वाधार विकासका क्षेत्रमा स्वदेशी तथा विदेशी लगानी अभिवृद्धि गर्ने कार्यक्रमका लागि आयोजना सुशासनलाई आत्मसात गरी कार्य गर्नुपर्दछ ।

११. निष्कर्ष

पूर्वाधार विकास मार्फत समृद्ध र विकसित नेपालको परिकल्पनालाई एउटा अटोटका रूपमा लिई यसलाई सरोकारवाला सबैले योगदान गर्नुपर्दछ । यसले आर्थिक क्रियाकलापलाई

चलायमान गराउनुका साथै व्यापारिक सहजता र लागत न्यूनीकरण गर्न सहयोग पुर्याउँछ । दुरदराजका उत्पादनलाई अन्तर्राष्ट्रिय बजारमा पुग्ने प्रतिस्पर्धी वातावरण सिर्जना गर्दछ । नेपालका विकट तर सुन्दर पर्यटकीय स्थलहरूमा पूर्वाधार र पहुँच बढाउनु जरूरी छ । पर्यटकको संख्या र बसाई अवधि बढाई पर्यटन प्रवर्द्धन मार्फत स्थानीय अर्थतन्त्रलाई सबल बनाउन पूर्वाधार नै अचुक र प्रथम अस्त्र हो । त्यसैगरी, उर्जा व्यापारको पूर्वाधारका रूपमा रहेको प्रसारण लाइनको निर्माणले नेपाललाई विद्युत निर्यात गर्ने राष्ट्रको रूपमा स्थापित गरी वैदेशिक मुद्रा आर्जनको सबैभन्दा ठूलो स्रोत बन्न सक्दछ । कृषिक्षेत्रको व्यावसायीकरण र सोमा आधारित साना तथा मझौला उद्योगहरूको विकास गरी औद्योगिकीकरण गर्न सकिन्छ ।

विविध पूर्वाधारको विकासद्वारा देशको आयस्रोतमा सकारात्मक योगदान पुर्याउन सघाउ पुग्ने हुँदा आयोजना सुशासनलाई आत्मसात गर्न जरूरी छ । नेपालमा आयोजनाहरू असफल हुनुको पछाडि स्रोतको अभाव भन्दा पनि व्यवस्थापकीय कौशल र सुशासनको कमी नै हो । आयोजनाको छनोटदेखि सम्पन्नतासम्म पारदर्शिता र जवाफदेहिता कायम गर्नु पर्दछ । अब विकासका लागि सुशासन र सुशासनका लागि सही व्यवस्थापन भन्ने दृढ मनोकांक्षालाई आत्मसात गर्नु आवश्यक छ ।

अन्त्यमा, नेपालको समृद्धि र विकासको साँचो पूर्वाधार विकासमा नै छ । पूर्वाधार निर्माण र सोको सञ्चालनमा उचित व्यवस्थापन र सुशासन कायम गर्न नीतिगत र संरचनागत सुधार गर्नुपर्दछ । कार्यान्वयन क्षमतामा अभिवृद्धि गर्नु पर्दछ । खासगरी विकासे मनोवृत्तिलाई आत्मसात गर्नु पर्दछ । यी नै वर्तमानका मुख्य कार्यभार हुन् ।

सन्दर्भ सामग्रीहरू

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Strategic Alignment of Nepal with SASEC Transport Strategy 2035: Pathways to Seamless, Sustainable and Regional Integration

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1. Abstract

The SASEC Transport Strategy 2035 presents a long-term vision for strengthening regional connectivity, improving logistics efficiency, and promoting sustainable transport systems across South Asia. For a landlocked country like Nepal, effective alignment with this strategy offers significant opportunities to enhance international market access, reduce trade costs, diversify transit options, and integrate more effectively into regional and global supply chains. The strategy emphasizes multimodal connectivity, resilient infrastructure, green transport solutions, digitalization, and stronger institutional coordination among member countries. This article examines how Nepal can strategically align its national transport policies and infrastructure development with the SASEC Transport Strategy 2035. It highlights key corridors, cross-border connectivity initiatives, and logistics improvements that can transform Nepal from a landlocked to a land-linked economy. The analysis further examines policy coherence between Nepal's national development frameworks and the SASEC Transport Strategy 2035, highlighting strategic priorities for corridor development, multimodal logistics integration, and climate-resilient transport infrastructure.

Box 1. Why this article matters for Nepal ?

Nepal's strategic alignment with the SASEC Transport Strategy 2035 matters because it links national transport development with regional market access, logistics modernization, and long-term economic resilience. For Nepal, the strategy is not only about roads and border points; it is about improving access to ports in India and Bangladesh, reducing trade costs, strengthening multimodal transport, modernizing border systems, and preparing for climate-resilient and lower-emission connectivity. It also opens a policy pathway for Nepal to move from a landlocked condition toward a land-linked and more regionally integrated economy.

This box is justified by the report's vision and mission for an environmentally sustainable, efficient, modern, and well-maintained transport and logistics system, supported by the strategic pillars and cross-cutting themes.

2. Keywords

Regional connectivity; Multimodal transport; Sustainable transport; Trade facilitation; Regional integration

3. Background

Regional connectivity has increasingly become a central pillar of economic development and regional cooperation in Asia. Efficient transport systems facilitate trade, reduce logistics costs, improve market access, and promote economic integration among neighboring countries. Recognizing these opportunities, the South Asia Subregional Economic Cooperation Program (SASEC) was established in 2001 by Bangladesh, Bhutan, India, and Nepal with the support of the Asian Development Bank. Over time, the program expanded to include Maldives (joined in 2014), Sri Lanka (joined in 2014), and Myanmar (Joined in 2017), reflecting a broader vision of strengthening economic cooperation and connectivity across South Asia and the Bay of Bengal region.

SASEC is a knowledge and project based partnership that aims to improve cross-border connectivity and facilitate trade among member countries. Nepal has been an active member since the program's inception in 2001, participating in various regional initiatives aimed at enhancing infrastructure connectivity, trade facilitation, and economic cooperation. The SASEC Vision aspires to transform the subregion into a major engine of growth in Asia in the twenty-first century, with transport connectivity identified as one of the most critical pillars for achieving this objective.

The economic context of Nepal further underscores the importance of regional connectivity. Nepal's economy has experienced moderate growth in recent years, with an average gross domestic product (GDP) growth rate of around 3.3 percent. At the same time, the country maintains a relatively high level of trade openness¹, approximately 56 percent indicating strong dependence on external markets for trade and economic activity. However, as a landlocked country with challenging topography, Nepal faces structural constraints in accessing international markets. High transport

1. Trade Openness= (Exports + Imports) x 100 / GDP

costs, limited transit routes, and inefficient logistics systems continue to pose significant barriers to trade competitiveness and economic diversification. Improving regional connectivity and transport efficiency is therefore essential for reducing trade costs and enhancing Nepal's export competitiveness.

Nepal's Economic Survey 2082/83 places the current growth rate somewhat lower: real GDP growth for FY 2082/83 is estimated (preliminary) at 3.85 percent, down from an actual 4.43 percent in FY 2081/82. The survey also reports that Nepal's total foreign trade grew by 13.5 percent to reach NPR 1,480.36 billion by Falgun of the current fiscal year, with exports accounting for 12.9 percent of total merchandise trade up from 12.1 percent a year earlier, underscoring the country's continued and growing dependence on external trade.

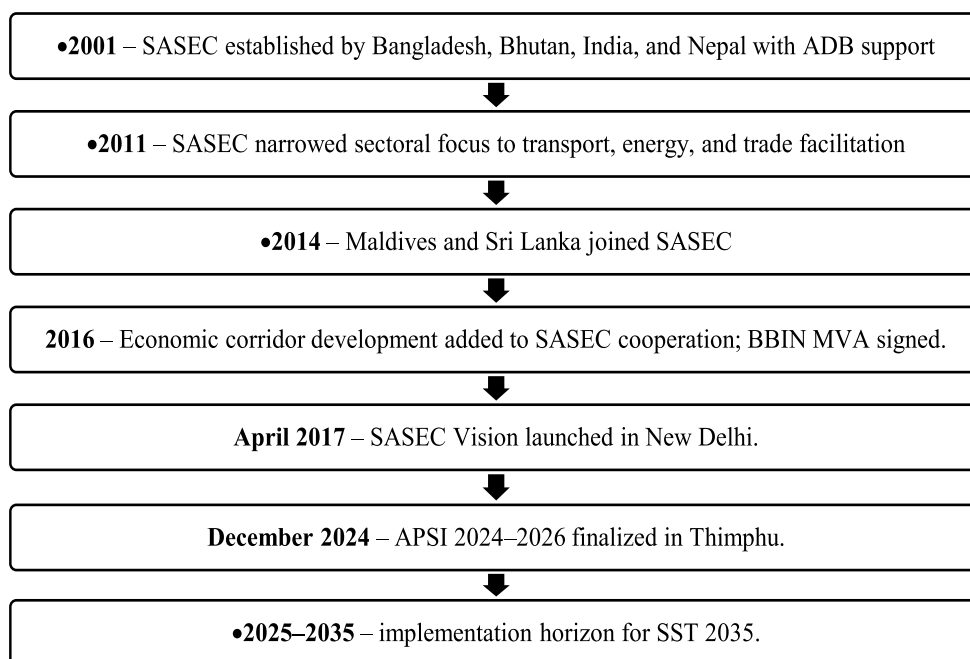
For Nepal, reliable and efficient access to seaports in neighboring countries is therefore an essential condition for economic development. In particular, improved connectivity to major ports in India and Bangladesh has become increasingly important for facilitating international trade, diversifying transit options, and strengthening integration with regional and global supply chains.

In this context, the SASEC Transport Strategy 2035 provides a comprehensive framework for strengthening regional connectivity through the development of efficient, resilient, and sustainable transport networks. The strategy emphasizes the development of key regional corridors, multimodal transport integration, improved logistics systems, and enhanced policy coordination among member countries. By strengthening road, rail, port, and inland waterway connectivity across the subregion, the strategy aims to facilitate seamless cross-border movement of goods and passengers while promoting sustainable and climate-resilient infrastructure development.

For Nepal, strategic alignment with the SASEC Transport Strategy 2035 presents a significant opportunity to transform its geographic constraints into economic advantages. By strengthening cross-border transport corridors, improving logistics efficiency, and enhancing institutional cooperation with neighboring countries, Nepal can gradually transition from a landlocked to a land-linked economy and contribute more actively to regional economic integration.

Nepal's engagement with SASEC has evolved over time through a series of regional initiatives and policy milestones that have gradually strengthened the country's integration into regional connectivity frameworks.

Timeline 1. Key Milestones Shaping Nepal's Alignment with SASEC



Nepal's engagement with the SASEC Transport Strategy 2035 is also consistent with the country's broader national development frameworks. Nepal's Sustainable Development Goals Needs Assessment, Costing and Financing Strategy estimates that achieving the SDGs will require annual investments of approximately USD 19–20 billion, with infrastructure sectors such as transport, energy, and urban systems accounting for a substantial share of this requirement. Similarly, the Sixteenth Periodic Plan (2024/25–2028/29) identifies quality infrastructure and intensive interconnectivity as a key driver of structural transformation and economic growth. The plan aims to expand national and provincial highways from 14,755 km to 36,000 km and increase household access to transport facilities within 30 minutes from 85 percent to 99 percent. In addition, Nepal's updated Nationally Determined Contribution (NDC 3.0) highlights sustainable transport systems, electrification of mobility, and climate-resilient infrastructure as essential components of the country's climate commitments. These policy priorities demonstrate that Nepal's national development agenda strongly complements the objectives of the SASEC Transport Strategy 2035.

The alignment between Nepal's national policy frameworks and the SASEC Transport Strategy 2035 can be summarized as follows.

Table 1. Alignment of SASEC Transport Strategy 2035 with Nepal's National Development Frameworks

Policy Framework	Key Targets	Relevance to SASEC Strategy
Sixteenth Periodic Plan (2024–2029)	Highways expansion 14,755 km to 36,000 km	Strengthening regional transport corridors
	Transport access within 30 minutes 85% to 99%	Improved connectivity to border points and trade routes
NDC 3.0	90% electric private vehicles by 2030	Low-carbon transport transition
NDC 3.0	Expansion of electric rail systems	Modal shift from road to rail
SDG Costing Strategy	USD 19–20 billion annual investment needs	Infrastructure financing gap addressed through regional cooperation

4. Analysis

The effectiveness of regional transport initiatives depends largely on the degree of alignment between national development strategies and regional connectivity frameworks. In Nepal's case, strong policy coherence exists between the SASEC Transport Strategy 2035 and the country's national development priorities. The Sixteenth Periodic Plan emphasizes the development of quality infrastructure and intensive connectivity as a key driver of structural transformation and economic growth. At the same time, Nepal's Sustainable Development Goals financing strategy highlights the need for large-scale investment in transport and logistics systems to support inclusive economic growth and international trade. Similarly, Nepal's Nationally Determined Contribution (NDC 3.0) identifies sustainable and low-carbon transport systems as an important component of the country's climate mitigation strategy. These policy frameworks collectively demonstrate that regional connectivity initiatives under the SASEC Transport Strategy 2035 can directly contribute to achieving Nepal's national development, climate, and sustainability goals.

4.1. Strategic Corridors and Nepal's Regional Positioning:

Regional transport corridors identified under the South Asia Subregional Economic Cooperation Program (SASEC) Transport Strategy 2035 play a critical role in strengthening connectivity between landlocked economies and regional and global

markets. For Nepal, these corridors provide the physical and institutional framework necessary to improve market access, reduce logistics costs, and enhance economic integration within South Asia and beyond. They serve not only as physical infrastructure links but also as economic development axes connecting production centers, logistics hubs, and international markets.

Nepal's strategic geographic location between two major Asian economies, India and China, creates significant potential for regional connectivity and transit development. However, realizing this potential requires efficient transport corridors linking Nepal to neighboring countries and maritime gateways.

Three major corridors are particularly important for Nepal. The **Nepal–India corridor connecting Kathmandu–Birgunj–Kolkata** remains Nepal's primary trade route, linking the country's main economic centers with major ports in eastern India such as Kolkata and Haldia. Continued improvement of this corridor through road upgrades, railway connectivity, and logistics infrastructure is essential for maintaining efficient international trade flows.



Figure 1. Nepal-India Corridor

The **Nepal–India–Bangladesh corridor connecting Kathmandu–Mechinagar–Dhaka** offers Nepal an alternative gateway to maritime ports in Bangladesh, including Chattogram and Mongla. Strengthening this corridor reduces Nepal's reliance on a single transit route and enhances resilience in regional supply chains.

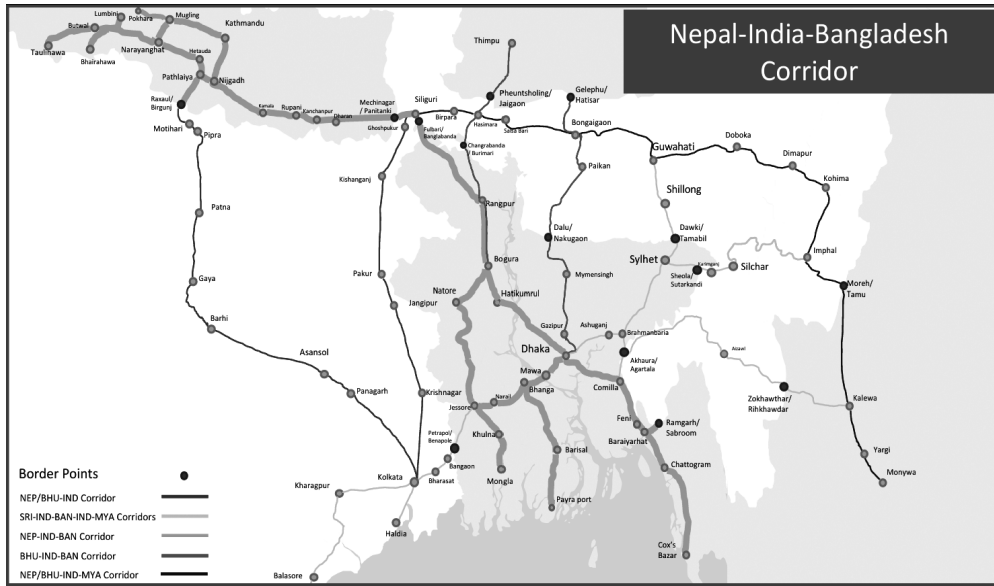


Figure 2. Nepal-India-Bangladesh Corridor

Another important linkage is the **Nepal/Bhutan-India-Myanmar corridor**, which connects the Himalayan subregion with eastern India and Myanmar and has the potential to extend Nepal's connectivity toward Southeast Asian markets.

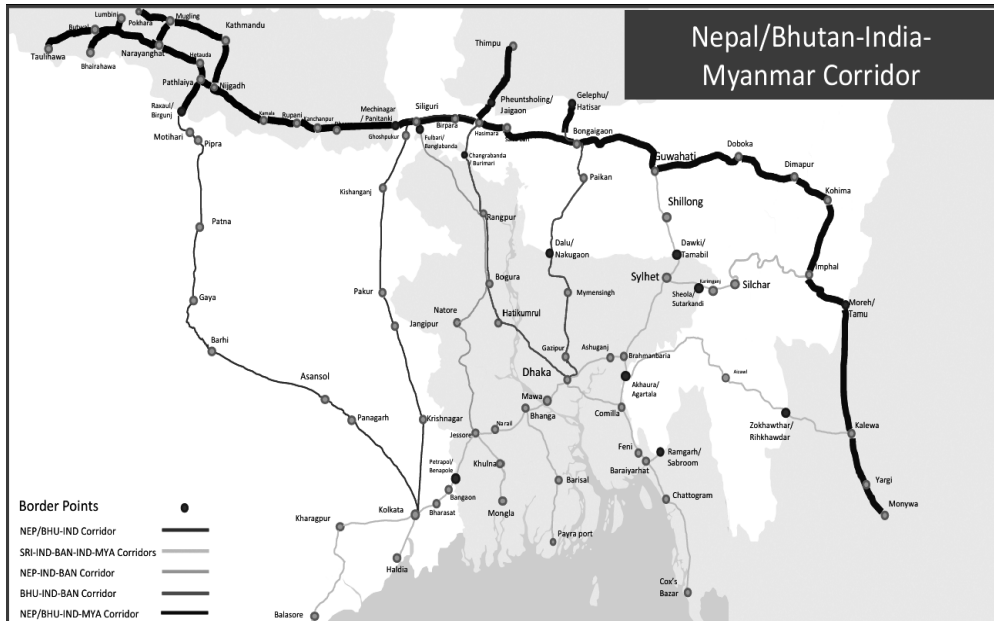


Figure 3. Nepal-India-Myanmar Corridor

The corridor structure illustrated in Figures 1–3 highlights Nepal’s evolving role within regional connectivity networks linking South Asia with the Bay of Bengal and Southeast Asia. These corridors are not merely transport routes; they function as economic development axes that connect production centers, logistics hubs, and international markets. By improving road and rail connectivity along these corridors, Nepal can reduce transit time, diversify trade routes, and enhance access to maritime gateways in India and Bangladesh. The corridor approach therefore supports the broader objective of transforming Nepal from a geographically landlocked country into a strategically land-linked economy integrated with regional supply chains.

In addition to these established corridors, the strategy recognizes the potential development of a **new strategic corridor linking Kathmandu with western Nepal and major economic hubs in western India**. The proposed route would extend from Kathmandu through western Nepal including the Dodhara Chandani area and connect to cities such as Lucknow and Delhi before reaching major maritime gateways including Mumbai and Mundra ports. Such a corridor would diversify Nepal’s access to global shipping routes and support balanced regional development within the country.

Together, these corridors form the backbone of Nepal’s regional connectivity strategy and provide a pathway for transforming the country from a geographically landlocked state into a **land-linked economy** integrated with regional markets.

Nepal’s corridor-based connectivity strategy also aligns with the priorities of the Sixteenth Periodic Plan, which emphasizes the expansion of strategic transport infrastructure to strengthen national and international connectivity. The plan targets an increase in road density from 0.63 km per square kilometer to 0.77 km, alongside a major expansion of highway networks and improved accessibility to transport services for the population. These infrastructure targets highlight the importance of regional transport corridors in connecting Nepal’s internal economic centers with international gateways and trade routes.

Economic Survey 2082/83 data further illustrate this expansion. By the end of Falgun 2082/83 (mid-March 2026), the road network built under federal and local jurisdiction had reached 36,806 km comprising 20,456 km of blacktopped, 7,602 km of gravel, and 8,748 km of earthen roads, while the density of federally-built blacktopped roads rose to 138.7 meters per square kilometer. Notable progress has also been recorded along the National Pride corridors that anchor Nepal’s regional connectivity, including the Madan Bhandari Highway (395.5 km of its 740 km blacktopped), the Kaligandaki,

Karnali, and Koshi corridors, and continued construction of the seven tunnels under the Kathmandu–Tarai/Madhesh Fast Track.

4.2. Multimodal Transport and Logistics Transformation

A central principle of the SASEC Transport Strategy 2035 is the development of **multimodal transport systems** that integrate road, rail, inland waterways, and port connectivity. Multimodal logistics networks reduce transport costs, improve freight efficiency, and enhance the reliability of regional supply chains.

Historically, Nepal's freight transport has been dominated by road transport. While roads will remain essential for domestic connectivity, greater integration with rail and water transport systems can significantly improve logistics performance.

Rail connectivity has already demonstrated important benefits for Nepal's international trade. The **Birgunj–Raxaul railway link**, connected to the Birgunj Inland Container Depot, provides direct rail access to the Indian railway network and facilitates containerized cargo movement to major ports such as Kolkata and Visakhapatnam. Similarly, the **Biratnagar–Jogbani rail link** strengthens freight connectivity in eastern Nepal.

Economic Survey 2082/83 data confirm steady progress on these rail links. Under the East West Electric Railway, 68.6 km of track-bed and 16 railway bridges had been completed on the Bardibas–Nijgadh section by Falgun 2082/83. On the Nepal–India cross-border railway, passenger service has commenced on the 52 km Jayanagar–Janakpur–Bhangaha section, while the Bathnaha–Biratnagar link is nearing readiness for cargo operations between the Indian border and the Nepal Customs Yard. Final location survey on the Raxaul Kathmandu railway has been completed and feasibility work on the Nepal–China Kerung–Kathmandu railway has also advanced, with geological investigation for the alignment about 90 percent complete.

The strategy also highlights the potential for Nepal to utilize **India's National Waterway-1 (NW-1)** along the Ganges River. Inland waterway terminals such as Sahibganj and Kalughat could enable multimodal transport connections linking river transport with rail and road networks. Such integration can reduce transport costs for bulk cargo and provide an additional route to maritime trade.

In addition to physical transport links, the development of modern logistics infrastructure including dry ports, container freight stations, warehousing facilities,

and logistics parks is essential for improving supply chain efficiency. These facilities reduce cargo handling delays, support containerization, and enable seamless cross-border trade.

The development of multimodal transport systems also contributes to Nepal's progress toward the Sustainable Development Goals. Nepal's Sustainable Development Goals Needs Assessment, Costing and Financing Strategy: An Update (2025) estimates that the country requires annual investments of approximately USD 19–20 billion to achieve SDG targets by 2030, with infrastructure sectors accounting for a major portion of this requirement. Efficient logistics systems, integrated transport corridors, and regional connectivity initiatives can therefore play a critical role in addressing infrastructure gaps while promoting inclusive economic growth and trade facilitation.

4.3. Expressway Corridors and High-Capacity Transport Infrastructure

The SASEC Transport Strategy 2035 also emphasizes the development of **access-controlled highways and expressway corridors** along major trade routes. Compared with conventional highways, expressways allow higher traffic capacity, improved safety, and more consistent travel speeds.

For Nepal, expressway development along major corridors can significantly improve transport efficiency. Faster and more reliable road connections reduce travel time, lower vehicle operating costs, and improve the competitiveness of export-oriented industries.

Constant-speed travel on access-controlled highways also contributes to environmental sustainability by reducing fuel consumption and greenhouse gas emissions compared with congested road networks. Improved road design standards and traffic management systems further enhance road safety and reduce accident risks.

Equally important is the strategy's emphasis on **preventive and routine maintenance** of infrastructure. Maintaining road quality ensures that transport corridors continue to operate at their intended performance levels and prevents deterioration that could reduce travel speeds and increase logistics costs.

High-capacity expressway corridors are also essential for improving national logistics efficiency. Nepal's ongoing infrastructure initiatives, such as the Kathmandu–Terai Fast Track, illustrate the country's gradual transition toward modern high-capacity road systems that can support regional freight movement. The Fast Track also

represents a major step toward modern transport infrastructure that can significantly reduce travel time between Kathmandu and Nepal's southern economic gateways. Such infrastructure investments are consistent with the Sixteenth Periodic Plan's objective of improving transport accessibility and strengthening economic connectivity between major urban and border regions.

Recent progress reported in the Economic Survey 2082/83 illustrates this transition. Concrete lining of the main Sisne tunnel (1,126 meters) has been completed, alongside substantial progress on its three bypass tunnels, while structural works on the Nagdhunga tunnel including lighting, ventilation, and fire-control systems have been finished. Along other strategic corridors, the Narayanghat–Butwal road has achieved blacktopping on 95.5 km of four-lane and 7.5 km of two-lane sections, and the Madan Bhandari Highway has reached 395.5 km of blacktopped surface out of its 740 km alignment.

4.4. Trade Facilitation and Soft Infrastructure

While physical transport infrastructure is essential, seamless regional connectivity also requires effective **soft infrastructure**, including policy coordination, regulatory harmonization, and streamlined border procedures.

One of the most important regional initiatives in this regard is the Bangladesh–Bhutan–India–Nepal Motor Vehicles Agreement (BBIN MVA). The agreement allows vehicles registered in one member country to operate in the territories of other member countries under defined conditions, reducing the need for costly cargo transshipment at border crossings.

For Nepal, full implementation of the BBIN MVA could significantly improve trade efficiency by enabling direct cross-border transport along routes such as Kathmandu–Dhaka and other regional corridors. The agreement also contributes to the development of **Highly Facilitated Trade Corridors**, where cargo movement becomes more predictable, time-bound, and efficient.

Supporting infrastructure such as **Integrated Check Posts (ICPs)** and **One-Stop Border Posts** plays a critical role in simplifying customs, immigration, and security procedures. By consolidating multiple border management functions within a single facility, these systems reduce delays and improve the efficiency of cross-border trade.

Effective implementation of regional connectivity initiatives also requires strong institutional coordination among participating countries. Harmonization of customs

procedures, digital trade systems, and cross-border transport regulations can significantly enhance the efficiency of regional transport corridors and facilitate smoother movement of goods and services.

4.5. Climate Resilience, Digitalization, and Sustainable Transport

Climate resilience and environmental sustainability are key priorities within the SASEC Transport Strategy 2035. Nepal's mountainous geography and fragile ecosystems make its transport infrastructure particularly vulnerable to climate-related hazards such as landslides, floods, and extreme weather events.

Integrating climate resilience into transport planning is therefore essential. Infrastructure design must incorporate slope stabilization, improved drainage systems, resilient bridge structures, and disaster risk management measures to ensure long-term reliability.

The strategy also encourages a **modal shift toward rail transport** for long-distance freight movement because rail systems generally produce lower greenhouse gas emissions than road transport.

In addition to climate resilience, **digitalization** is emerging as a key driver of modern transport systems. Electronic cargo tracking systems, paperless customs procedures, and automated border management technologies can significantly reduce border crossing times and improve transparency in trade operations.

Advanced digital tools—including geographic information systems (GIS), national spatial data infrastructures, and integrated logistics data platforms—can support more efficient infrastructure planning and logistics management. By adopting such digital technologies, Nepal can transition from traditional manual processes toward data-driven transport governance.

Climate-resilient and environmentally sustainable transport systems are increasingly important for Nepal's long-term development strategy. Under the country's updated Nationally Determined Contribution (NDC 3.0), Nepal has committed to expanding electric mobility and promoting low-carbon transport systems, including increasing the share of electric vehicles in private transport to 90 percent by 2030 and promoting the development of electric rail systems. The emphasis on multimodal transport and modal shift toward rail within the SASEC Transport Strategy 2035 can therefore directly support Nepal's climate mitigation and sustainable transport commitments.

4.6. Role of the Private Sector in Transport Development

Achieving the ambitious infrastructure and logistics goals outlined in the SASEC Transport Strategy 2035 requires substantial investment and institutional capacity. In this context, **private sector participation** plays a vital role.

Public-Private Partnerships provide an effective mechanism for mobilizing private capital and expertise in large-scale infrastructure projects. Expressways, logistics parks, dry ports, and airport management facilities are among the areas where private sector involvement can improve operational efficiency and service quality.

Private companies can also contribute to the modernization of logistics systems through digital technologies, route optimization, and innovative supply chain management solutions.

To encourage greater private investment, governments must establish transparent regulatory frameworks that ensure fair competition, effective risk-sharing, and financial viability for private investors. By creating an enabling environment for private sector participation, Nepal can accelerate infrastructure development while improving the efficiency and sustainability of its transport and logistics sector.

5. Conclusion

The **SASEC Transport Strategy 2035** offers a transformative framework for strengthening regional connectivity and promoting sustainable economic integration across South Asia. For Nepal, aligning national transport development priorities with this regional strategy presents a strategic opportunity to overcome long-standing geographic constraints and enhance its participation in regional and global markets. As a landlocked country with growing trade dependence, improved connectivity with neighboring countries particularly India and Bangladesh remains essential for reducing logistics costs, diversifying transit routes, and improving supply chain efficiency.

The analysis highlights that Nepal's effective engagement with SASEC initiatives requires a balanced approach that combines **physical infrastructure development with policy and institutional reforms**. Strategic transport corridors linking Nepal to major seaports, expansion of multimodal transport systems, and the development of high-capacity expressway corridors can significantly improve trade efficiency and economic competitiveness. At the same time, the implementation of soft infrastructure measures such as the Bangladesh-Bhutan-India-Nepal Motor Vehicles Agreement,

digital customs systems, and integrated border management will be crucial for ensuring seamless cross-border movement.

In the longer term, emerging corridor opportunities linking Kathmandu with western Nepal and major economic hubs in western India could further diversify Nepal's access to global markets and strengthen the country's strategic role in regional connectivity.

Furthermore, integrating climate resilience and environmentally sustainable transport practices will strengthen the long-term reliability of Nepal's infrastructure while contributing to regional decarbonization goals. Mobilizing private sector participation through public private partnerships can also accelerate infrastructure development and enhance operational efficiency.

Importantly, Nepal's strategic engagement with the SASEC Transport Strategy 2035 is closely aligned with national policy commitments. The infrastructure expansion targets of the Sixteenth Periodic Plan, the climate mitigation priorities of the Nationally Determined Contribution (NDC 3.0), and the investment requirements identified in the SDG financing strategy collectively reinforce the importance of regional connectivity initiatives. By integrating national development priorities with regional transport cooperation, Nepal can strengthen its transition from a landlocked to a land-linked economy.

Strengthening regional transport connectivity should therefore be viewed not only as a regional cooperation initiative but also as a strategic component of Nepal's national development agenda. By aligning national infrastructure investment priorities with regional connectivity frameworks such as the SASEC Transport Strategy 2035, Nepal can simultaneously advance its economic transformation, climate commitments, and Sustainable Development Goals.

Improved regional connectivity can also generate broader economic benefits by stimulating trade expansion, supporting industrial development along transport corridors, and encouraging the formation of regional value chains.

Ultimately, Nepal's strategic alignment with the SASEC Transport Strategy 2035 should be guided by coordinated national planning, regional cooperation, and sustained institutional commitment. By leveraging these opportunities, Nepal can gradually transition from a **landlocked to a land-linked economy**, positioning itself as an active participant in regional connectivity and economic integration across South Asia and the broader Bay of Bengal region.

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राष्ट्र निर्माणमा पूर्वाधार विकास : तुलनात्मक दृष्टिकोण



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राष्ट्र निर्माण संवैधानिक संरचना निर्माण वा राजनीतिक एकीकरणको प्रक्रिया मात्र होइन । यो नागरिकले साझा भविष्यको कल्पना गर्न सक्ने आधार निर्माण गर्ने दीर्घकालीन सामाजिक प्रक्रिया हो । पूर्वाधार विकास यही प्रक्रियाको मूर्त आधार हो किनभने यसले नागरिकलाई भौगोलिक रूपमा मात्र नभएर अनुभव र अवसरको तहमा पनि एक अर्कासँग जोड्छ । बेनेडिक्ट एन्डरसनले राष्ट्रलाई कल्पित समुदाय भनेका छन् तर त्यो कल्पना सार्थक बन्न साझा अनुभव आवश्यक हुन्छ र आधुनिक युगमा ती साझा अनुभवहरू पूर्वाधारमार्फत निर्माण हुन्छन् (एन्डर्सन, २००६) ।

युरोपेली राष्ट्र निर्माणको इतिहास हेर्दा पूर्वाधारले केन्द्रीय भूमिका निर्वाह गरेको देखिन्छ । फ्रान्समा रेल सञ्जालको विस्तारले क्षेत्रीय भाषिक र सांस्कृतिक दूरी घटाउँदै नागरिकलाई एक साझा प्रशासनिक र आर्थिक क्षेत्रमा आवद्ध गरायो । चार्ल्स टिलीले राज्य निर्माणलाई युद्ध, कर र प्रशासनिक पहुँचसँग जोडेर व्याख्या गरेका छन् जहाँ पूर्वाधार राज्यको दैनिकीमा प्रवेश गर्ने प्रमुख साधन बनेको देखिन्छ (टिली, १९९२) । यसले राष्ट्रबोधलाई केन्द्रीय सत्तासँग मात्र होइन साझा सार्वजनिक जीवनसँग पनि जोड्न सफल भयो ।

जापान र दक्षिण कोरियामा राष्ट्र निर्माणको आधुनिक चरण पूर्वाधार विकाससँग गहिरो रूपमा गाँसिएको छ । दोस्रो विश्वयुद्धपछिको पुनर्निर्माणमा ती देशहरूले पूर्वाधारलाई राष्ट्रिय आत्मसम्मान र भविष्य उन्मुख पहिचानसँग जोडेर विकास गरे । तीव्र रेल प्रणाली, ऊर्जा संरचना र औद्योगिक क्षेत्रहरूले नागरिकमा पराजयको स्मृतिलाई सामूहिक उपलब्धिको गर्वमा रूपान्तरण गरे । यहाँ राष्ट्रबोध राजनीतिक नाराबाट होइन, अनुभव गरिएको राष्ट्रिय क्षमताबाट निर्माण गरियो (जोन्सन, १९८२) ।

विकासोन्मुख राष्ट्रहरूमा पूर्वाधार र राष्ट्र निर्माणबीचको सम्बन्ध अझ जटिल देखिन्छ । अफ्रिकी र दक्षिण एसियाली धेरै देशमा पूर्वाधार विकास उपनिवेशकालीन संरचनाको निरन्तरता बनेको छ । जेम्स सी स्कटले सुभाएभैं राज्यले स्थानीय सन्दर्भ नबुझी ठूलो स्तरका पूर्वाधार योजना लागु गर्दा ती परि योजनाले राष्ट्र निर्माण होइन, क्षेत्रीयद्वन्द्व जन्माउने खतरा हुन्छ (स्कट, १९९८) । यस अवस्थामा पूर्वाधार राष्ट्रबोध निर्माणको साधनभन्दा राज्य नियन्त्रणको उपकरण बनिरहेको देखिन्छ ।

नेपालमा भारतीय अनुभव तुलनात्मक रूपमा महत्वपूर्ण छ । विशाल र विविधतायुक्त हुँदाहुँदै पनि राष्ट्रिय राजमार्ग, रेल र डिजिटल पहिचान प्रणालीले भारतका नागरिकलाई साभ्भा राज्य सञ्जालमा बाँधेको छ । यद्यपि भारतमा असमानताको खाडल अझै विद्यमान छ । यद्यपि पूर्वाधारले भारतमा राष्ट्रबोधलाई निरन्तर पुनर्निर्माण गर्ने माध्यम बनाइरहेको देखिन्छ । यहाँ राष्ट्र निर्माण स्थिर अवस्था होइन, पूर्वाधारमार्फत चलि रहने प्रक्रिया हो (चटर्जी, २००४)।

नेपालको सन्दर्भमा राष्ट्र निर्माण अझै संक्रमणशील अवस्थामै छ । राजनीतिक परिवर्तन भए पनि पूर्वाधार विकासले नागरिकलाई साभ्भा अनुभव दिन सकेको छैन । भौगोलिक कठिनाइ, योजनागत असन्तुलन र कार्यान्वयनको कमजोरीले पूर्वाधारलाई एकीकरणको सट्टा असन्तोषको स्रोत बनाएको देखिन्छ । माइकल म्यानको राज्य पूर्वाधार शक्ति अवधारणा अनुसार राज्यले आफ्नो वैधता नागरिकको जीवनसम्म प्रभावकारी पहुँच पुऱ्याउन नसके राष्ट्र निर्माण अधुरो रहन्छ (म्यान, १९८४)।

नेपालका लागि यो तुलनात्मक अनुभवले एउटा स्पष्ट सन्देश दिन्छ । राष्ट्र निर्माणको सफलताका लागि पूर्वाधार राजधानी केन्द्रित वा प्रतीकात्मक हुनुहुँदैन । यसले क्षेत्रीय समानता, सांस्कृतिक सम्मान र दैनिकीको भरोसा निर्माण गर्नुपर्छ । पूर्वाधारले नागरिकलाई राज्यको निरन्तर उपस्थिति अनुभूत गराएपछि मात्र संविधान, राष्ट्रिय पहिचान र राजनीतिक संरचना सार्थक हुन्छन् ।

यसरी पूर्वाधार विकास राष्ट्र निर्माणको आधारभूत भाषा हो । जुन राष्ट्रले आफ्ना नागरिकलाई साभ्भा भौतिक र अनुभूतिपरक संसार दिन सक्छ, त्यही राष्ट्र दिगो राष्ट्रबोध निर्माण गर्न सफल हुन्छ । नेपालमा राष्ट्र निर्माणको बहस गहिरो र दीर्घकालीन बनाउने हो भने पूर्वाधार विकासलाई राजनीतिक परियोजनाभन्दा माथि राखेर साभ्भा राष्ट्रिय परियोजनाका रूपमा पुनः परिकल्पना गर्नुपर्छ ।

नेपाल केन्द्रित राष्ट्रबोधयुक्त पूर्वाधार विकास

नेपालमा पूर्वाधार विकासको बहस प्रायः बजेट विनियोजन, आयोजना संख्या र निर्माण गतिसँग सीमित देखिन्छ । राष्ट्रबोधको दृष्टिले हेर्दा भने यो बहस अझ घनिभूत हुनु आवश्यक छ । प्रश्न कति सडक बने भन्ने मात्र होइन, ती सडकले नेपाली नागरिकलाई राज्यसँग कति जोड्न सक्थे भन्ने हो । राष्ट्रबोध आधारित पूर्वाधार विकास भनेको विकासलाई भावनात्मक राष्ट्रप्रेमसँग नभएर नागरिकको दैनिक अनुभव र आत्मसम्मानसँग जोड्ने प्रक्रिया हो (एन्डर्सन, २००६) ।

नेपालको भौगोलिक बनावटले पूर्वाधारलाई प्राविधिक विषय मात्र बन्न नदिई राजनीतिक र नैतिक विषयसमेत बनाएको छ । दुर्गम पहाड र हिमाली क्षेत्रसम्म राज्यको पहुँच पुऱ्याउनु दया होइन, राष्ट्रनिर्माणको अनिवार्य शर्त हो । माइकल म्यानको राज्य पूर्वाधार शक्ति अवधारणाले देखाएझैँ राज्य तब बलियो हुन्छ जब उसले आफ्नो प्रशासनिक र भौतिक क्षमता नागरिकको जीवनसम्म प्रभावकारी रूपमा विस्तार गर्न सक्छ (म्यान, १९८४)। नेपालमा राज्यको यही क्षमता अझै असमान देखिन्छ, यसैले गर्दा राष्ट्रबोधलाई कमजोर बनाएको छ ।

राष्ट्रबोध आधारित पूर्वाधारको पहिलो आधार भौगोलिक न्याय हो । विकासको लाभ भौगोलिक रूपमा केन्द्रित हुँदा परिधिका नागरिकले राज्यलाई आफ्नै होइन, टाढाको सत्ता ठान्न थाल्छन् । जोन रत्सले न्यायलाई सामाजिक संरचनाको आधारभूत गुण मानेभैं, पूर्वाधारको न्यायपूर्ण वितरण राष्ट्रबोधको नैतिक आधार हो (रत्स, १९७१)। नेपालमा पूर्वाधार योजना बनाउँदा आर्थिक प्रतिफलभन्दा पहिला नागरिक समानताको प्रश्न उठ्नु आवश्यक छ ।

दोस्रो आधार सांस्कृतिक संवेदनशीलता हो । पूर्वाधार विकासले स्थानीय पहिचान मेट्नु हुँदैन । सडक, सहर र सार्वजनिक संरचनाले स्थानीय संस्कृति र इतिहासलाई विस्थापित गर्दा विकासले सांस्कृतिक अभाव जन्माउँछ । चार्ल्स टेलरले पहिचानको मान्यतालाई आधुनिक राजनीति र नागरिक आत्मसम्मानको केन्द्रमा राखेका छन् (टेलर, १९९४) । नेपालजस्तो बहुसांस्कृतिक समाजमा पूर्वाधारले राष्ट्रिय एकरूपता होइन, साझा विविधता प्रतिबिम्बित गर्नुपर्छ ।

तेस्रो आधार नागरिक सहभागिता हो । पूर्वाधार परियोजना नागरिकको सहभागिताबिना अधि बढ्दा ती परियोजना राज्यको योजना मात्र बन्न पुग्छन्, साझा राष्ट्रिय परियोजना बन्न सक्दैनन् । जेम्स सी स्कटले देखाएभैं माथिबाट थोपरिएका विकास योजनाले दीर्घकालीन वैधता गुमाउने खतरा हुन्छ (स्कट, १९९८) । नेपालमा संघीय संरचना अनुसार स्थानीय तहलाई पूर्वाधारको सह(निर्माता बनाउनु राष्ट्रबोध निर्माणका लागि निर्णायक हुन्छ ।

चौथो आधार दीर्घकालीन राष्ट्रिय कल्पना हो । पूर्वाधार अस्थायी राजनीतिक चक्र अनुसार निर्माण हुँदा राष्ट्रबोध कमजोर हुन पुग्छ । एन्थोनी गिडेन्सले आधुनिक राज्यको स्थायित्व दीर्घकालीन संस्थागत दृष्टिसँग जोडिएको बताएका छन् (गिडेन्स, १९९८) । नेपालले बीस वा तीस वर्षपछिको सामाजिक र आर्थिक रूपरेखा कल्पना नगरी पूर्वाधार बनाउँदा विकास दिशाहीन बन्ने जोखिम रहन्छ ।

राष्ट्रबोध आधारित पूर्वाधार विकासको अन्तिम लक्ष्य राज्य र नागरिकबीचको भरोसाको पुनर्निर्माण हो । जब नागरिकले पूर्वाधारमार्फत राज्यलाई न्यायपूर्ण, सक्षम र संवेदनशील रूपमा अनुभूति गर्छ तब राष्ट्रबोध स्वाभाविक रूपमा बलियो बन्छ । अमर्त्य सेनको क्षमताविस्तारको दृष्टिकोण (क्यापाविलिटी एप्रोच) ले सुझाएभैं पूर्वाधारले नागरिकको वास्तविक स्वतन्त्रता विस्तार नगरेसम्म विकास अधुरो रहन्छ (सेन, १९९९)।

यसरी नेपालका लागि राष्ट्रबोध आधारित पूर्वाधार विकास कुनै अतिरिक्त नीति होइन, राष्ट्रनिर्माणको केन्द्रीय मार्ग हो । पूर्वाधार राष्ट्रको शरीर मात्र होइन, नागरिक र राज्यबीचको जीवित सम्बन्ध हो । यो सम्बन्ध न्यायपूर्ण, सहभागी र दीर्घकालीन बन्यो भने संघीय नेपालमा राष्ट्रबोध विभाजनको होइन, साझा भविष्यको आधार बन्ने निश्चित छ ।

संघीयतामा पूर्वाधार विकास र राष्ट्रबोध

नेपालमा राष्ट्रबोधको निर्माण ऐतिहासिक रूपमा केन्द्रीय सत्ता, भूगोल र सीमित पूर्वाधार क्षमतासँग गाँसिएको छ । आधुनिक राज्य निर्माणको प्रारम्भदेखि नै नेपालमा पूर्वाधार राज्यको पहुँच विस्तार गर्ने साधनका रूपमा प्रयोग भयो तर नागरिक-जीवनसँग गहिरो रूपमा जोडिन सकेन । सडक, सञ्चार र प्रशासनिक संरचना लामो समयसम्म शासकीय नियन्त्रणका उपकरणका रूपमा रहनपुगे । साभा नागरिक सुविधाका रूपमा प्रस्तुत गर्न सकिएन । यस ऐतिहासिक पृष्ठभूमिले आजको संघीय नेपालमा पूर्वाधार र राष्ट्रबोधबीचको सम्बन्ध बुझ्न महत्वपूर्ण आधार प्रदान गर्छ ।

२०६२/६३ को राजनीतिक परिवर्तन र त्यसपछि स्थापित संघीय लोकतान्त्रिक गणतन्त्रले नेपालमा राष्ट्रबोधको पुनर्संरचना सुरु गर्‍यो । संविधानले बहुस्तरीय शासन प्रणालीमार्फत राज्यलाई नागरिकको समीपमा ल्याउने परिकल्पना गर्‍यो । यद्यपि संघीयताको व्यावहारिक कार्यान्वयनमा पूर्वाधार विकासको भूमिका स्पष्ट रूपले परिभाषित हुन भने सकेन । परिणामस्वरूप, नागरिकले राज्यलाई अबै पनि प्रायः केन्द्रीय सत्ता वा अस्थायी राजनीतिक संयन्त्रका रूपमा अनुभूत गर्ने अवस्था पूर्णतः अन्त्य भएको छैन (नेपाल सरकार, २०१५) ।

नेपालको भौगोलिक विविधता पूर्वाधार विकासको सबैभन्दा ठूलो चुनौती मात्र नभएर राष्ट्रबोध निर्माणको सबैभन्दा ठूलो सम्भावना पनि हो । हिमाल, पहाड र तराईलाई समान राज्य अनुभूतिमा बाँध्न सक्ने पूर्वाधारले मात्र संघीय नेपाललाई भावनात्मक रूपमा एकीकृत गर्न सक्छ । माइकल म्यानको राज्य पूर्वाधार शक्ति अवधारणाअनुसार राज्य तब प्रभावकारी हुन्छ जब उसले आफ्नो प्रशासनिक र भौतिक क्षमता समाजको सम्पूर्ण भूभागमा समान रूपले विस्तार गर्न सक्छ (म्यान, १९८४) । नेपालमा यो क्षमता अबै असमान भएकाले राष्ट्रबोध पनि कमजोर देखिन्छ ।

संघीय संरचनापछि पूर्वाधार विकास तीन तहमा बाँडिएको छ । संघले रणनीतिक र अन्तरप्रदेशीय पूर्वाधार हेर्छ भने प्रदेशले क्षेत्रीय पूर्वाधार र स्थानीय तहले नागरिक दैनिकीसँग प्रत्यक्ष जोडिने संरचनालाई हेर्छ । यद्यपि भूमिकामा अस्पष्टता, कानुनी द्वन्द्व र स्रोतको सीमितताले यो संरचना प्रभावकारी हुन सकेको छैन । यसले संघीयताको मूल उद्देश्यमै प्रश्न उठाएको छ । पूर्वाधार अव्यवस्थित हुँदा नागरिकमा संघीयता भनेको सेवा सुधार होइन, प्रशासनिक जटिलता मात्र हो भन्ने धारणा बलियो बन्ने खतरा उब्जिएको छ (शर्मा, २०१८) ।

नेपालमा पूर्वाधार विकासको अर्को गम्भीर समस्या राजनीतिक प्रतीकवाद हो । आयोजना घोषणा, शिलान्यास र उद्घाटन राष्ट्रबोध निर्माणका प्रतीक बनाइए पनि कार्यान्वयन कमजोर हुँदा ती प्रतीक उल्टो निराशाको स्रोत बनेका छन् । बेनेडिक्ट एन्डर्सनले राष्ट्रलाई साभा कल्पनाको समुदाय भनेका छन् तर त्यो कल्पना निरन्तर असफल अनुभवले कमजोर बनाउँछ (एन्डर्सन, २००६) । नेपालमा अधुरा आयोजना र ढिलासुस्तीले राष्ट्रबोधलाई आशाभन्दा बढी अविश्वासतर्फ धकेलेको देखिन्छ ।

पूर्वाधार विकासमा क्षेत्रीय असन्तुलन राष्ट्रबोधका लागि सबैभन्दा संवेदनशील विषय हो । तराईमा यातायात र बजार पहुँच अपेक्षाकृत राम्रो हुँदा हिमाली र पहाडी क्षेत्रका नागरिकले राज्यबाट टाढिएको अनुभूति गर्छन् । जोन रत्सको न्याय सिद्धान्तअनुसार यस्तो असमानता आर्थिक मात्र नभएर नैतिक समस्या पनि हो (रत्स, १९७१) । जब नागरिकले राज्यलाई न्यायपूर्ण ठान्दैनन् तब राष्ट्रबोध औपचारिक नागरिकतामा मात्र सीमित रहन पुग्छ ।

संघीय नेपालमा राष्ट्रबोध आधारित पूर्वाधार विकासको केन्द्रमा स्थानीय तह आउनुपर्छ । नागरिकले राज्यलाई पहिलो पटक विद्यालय भवन, खानेपानी धारा, स्वास्थ्य चौकी र स्थानीय सडकमार्फत अनुभव गर्छन् । जेम्स सी स्कटले देखाएभन्ने विकास परियोजना वैध हुनका लागि स्थानीय ज्ञान र सहभागितालाई सम्मान गर्न सक्नुपर्छ (स्कट, १९९८) । नेपालमा स्थानीय तहलाई कार्यान्वयन एकाइ मात्र बनाउँनु हुँदैन । यसलाई सह निर्माता बनाउन सकियो भने सहजतापूर्वक राष्ट्रबोध निर्माण गर्न सकिन्छ ।

नेपालको सन्दर्भमा ऊर्जा र डिजिटल पूर्वाधार राष्ट्रबोधको नयाँ आधार बन्दैछन् । लोडसेडिङ अन्त्यले राज्यप्रतिको भरोसा उल्लेखनीय रूपमा बढाएको अनुभव भएको देखिन्छ । डिजिटल सेवा विस्तारले नागरिक र राज्यबीचको दूरी घटाएको छ । अमर्त्य सेनको क्षमता विस्तारको दृष्टिकोणअनुसार यस्तो पूर्वाधारले नागरिकको वास्तविक स्वतन्त्रता विस्तार गर्दा मात्र विकास अर्थपूर्ण हुन्छ (सेन, १९९९) । नेपालमा ऊर्जा र डिजिटल पूर्वाधारले राष्ट्रबोध निर्माणमा सकारात्मक सम्भावना देखाएका छन् ।

अन्ततः संघीय नेपालमा पूर्वाधार विकास राष्ट्रनिर्माणको प्राविधिक कार्यक्रम मात्र नभएर गम्भीर राजनीतिक र नैतिक परियोजनासमेत हो । पूर्वाधारले नागरिकलाई राज्यसँग जोड्ने साझा अनुभव दिन सकेन भने संघीयता प्रशासनिक संरचनामा सीमित हुन पुग्छ । पूर्वाधार न्यायपूर्ण, सहभागितामूलक र दीर्घकालीन दृष्टिमा आधारित भयो भने संघीयता विभाजनको होइन, साझा नेपाली राष्ट्रबोधको नयाँ आधार बन्न सक्छ ।

नेपालको राष्ट्रनिर्माण अब नाराबाट होइन, अनुभूत राज्यबाट अघि बढ्नुपर्छ । त्यो अनुभूति पूर्वाधारमार्फत निर्माण हुन्छ । यस अर्थमा संघीय नेपालमा पूर्वाधार विकास नै राष्ट्रबोधको सबैभन्दा ठोस भाषा हो ।

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Engineering Geological Challenges and the Way Forward for Disaster Resilient Infrastructure

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Abstract

Infrastructure development is a cornerstone of Nepal's economic growth, social transformation, and regional connectivity. Over the past two decades, Nepal has invested heavily in strategic highways, hydropower projects, tunnels, airports, transmission corridors, urban expansion, and tourism infrastructure. However, the country's unique geological setting, active tectonics, fragile mountain terrain, steep slopes, complex hydrogeological conditions, and intense monsoon rainfall, poses significant challenges to sustainable infrastructure development. These inherent geological risks are now being amplified by global warming and climate change through increased extreme precipitation, accelerated glacier retreat, expansion of glacial lakes, changes in groundwater regimes, and more frequent high-magnitude floods and landslides. Historical disasters—including the 1934 Bihar–Nepal Earthquake, the 2015 Gorkha Earthquake, the Melamchi disaster, recent Kagbeni flood and numerous monsoon-induced landslides—demonstrate that inadequate consideration of engineering geology remains one of the principal causes of infrastructure failure.

This review examines the interaction between geological hazards, hydrogeological processes, and climate change in the Nepal Himalaya. It discusses historical lessons, evaluates present infrastructure development practices, and identifies emerging risks associated with changing climatic conditions. Particular emphasis is placed on integrating engineering geology, hydrogeology, geotechnical engineering, and climate adaptation into infrastructure planning. The article concludes that sustainable infrastructure in Nepal requires a multidisciplinary, science-based approach incorporating detailed site investigations,

modern monitoring technologies, climate-informed engineering design, risk-sensitive land-use planning, and stronger institutional coordination. Such an approach will significantly improve infrastructure resilience while reducing future economic losses and disaster risks.

Keywords: Engineering geology, Nepal Himalaya, climate change, infrastructure development, landslides, earthquakes, hydrogeology, geological hazards, resilience.

1. Introduction

Nepal, located within the central Himalaya, is one of the most geologically active and environmentally sensitive countries in the world. The Himalayan mountain range continues to rise because of the ongoing convergence between the Indian and Eurasian lithospheric plates at a rate of approximately 18–20 mm per year. This tectonic activity produces frequent earthquakes, active faulting, crustal deformation, steep mountain slopes, fractured rock masses, and complex geological structures that significantly influence engineering works.

The country's physiography ranges from the low-lying Terai plains to the world's highest mountain peaks within a horizontal distance of less than 200 km. Such extreme topographic variation creates highly dynamic geomorphological processes, including landslides, rockfalls, debris flows, river erosion, flooding, glacial lake outburst floods (GLOFs), and sediment transport. These hazards pose continuous threats to infrastructure throughout its life cycle, from planning and design to construction, operation, and maintenance.

Infrastructure development has accelerated rapidly since the early 2000s. National highways, hydropower schemes, transmission lines, international airports, railway corridors, tunnels, irrigation systems, and urban infrastructure are being constructed throughout the country to support economic growth. While these developments are essential, many projects continue to encounter severe engineering geological problems that result in project delays, cost overruns, environmental degradation, and increased disaster vulnerability.

Climate change has emerged as an additional challenge. Scientific evidence indicates increasing temperatures throughout the Himalayan region, accelerating glacier retreat,

expanding glacial lakes, modifying rainfall intensity, increasing extreme weather events, and altering groundwater systems. These processes intensify existing geological hazards and create new risks that traditional engineering design standards may no longer adequately address.

Consequently, future infrastructure development in Nepal must move beyond conventional engineering approaches and incorporate engineering geological investigations, hydrogeological assessments, geotechnical analyses, climate projections, and disaster risk reduction into every stage of project planning.

2. Geological and Tectonic Setting of the Nepal Himalaya

The Nepal Himalaya represents one of the youngest and most tectonically active mountain belts on Earth. It was formed through the collision between the Indian Plate and the Eurasian Plate approximately 50 million years ago, a process that continues today. This collision has produced several major tectonic structures, including the Main Frontal Thrust (MFT), Main Boundary Thrust (MBT), Main Central Thrust (MCT), South Tibetan Detachment System (STDS), and numerous active faults and shear zones.

These tectonic features strongly control the distribution of earthquakes, slope instability, groundwater movement, and engineering behaviour of rock masses. Highly fractured metamorphic rocks, sedimentary formations, fault gouge, weathered rock, and thick colluvial deposits create difficult foundation conditions for highways, bridges, tunnels, hydropower projects, and high-rise buildings.

Hydrogeological conditions are equally complex. Groundwater occurrence depends on lithology, structural discontinuities, weathering profiles, and topographic gradients. During tunnel excavation and deep foundation construction, unexpected groundwater inflow frequently causes instability, delays, and increased construction costs.

The interaction between geology, topography, hydrology, and climate makes the Nepal Himalaya one of the most challenging environments for infrastructure development worldwide. Every engineering project must therefore consider geological conditions as a primary design parameter rather than a secondary environmental issue.

3. Historical Perspective of Geological Hazards and Infrastructure Failures

Nepal's history demonstrates that geological hazards have repeatedly affected infrastructure development and caused significant economic losses. Among these hazards, earthquakes, landslides, floods, debris flows, and river erosion have had the greatest impacts.

The 1934 Bihar–Nepal Earthquake (Mw 8.3) remains one of the most destructive seismic events in South Asia. It caused widespread destruction across eastern Nepal, Kathmandu valley and northern India, resulting in extensive damage to buildings, transportation networks, irrigation systems, and public infrastructure. For many decades, this earthquake was considered a blind megathrust event with little or no surface rupture.

However, recent paleoseismological investigations have fundamentally changed this understanding. Sapkota et al. (2013) documented primary surface ruptures extending for more than 150 km along the Main Frontal Thrust in eastern Nepal. Their study also identified evidence of the AD 1255 great Himalayan earthquake along the same fault segment, demonstrating the repeated occurrence of large surface-rupturing earthquakes in the Himalaya. Subsequently, Rizza et al. (2019) showed that rapid post-earthquake river aggradation and sediment deposition had buried much of the 1934 rupture, explaining why field evidence remained obscure for decades. These findings have profound implications for infrastructure planning. Major highways, hydropower facilities, bridges, transmission corridors, tunnels, airports, and urban developments should avoid active fault traces whenever possible. Where avoidance is impossible, detailed active fault investigations, paleoseismological studies, and fault-rupture-resistant design principles should become mandatory.

The 2015 Gorkha Earthquake (Mw 7.8) further highlighted Nepal's seismic vulnerability. Although the earthquake produced limited surface rupture, it triggered more than 25,000 landslides, severely damaging highways, rural roads, hydropower facilities, schools, hospitals, and historical monuments. The disaster demonstrated that secondary hazards such as landslides often cause greater infrastructure damage than ground shaking itself.

Monsoon-related disasters occur almost every year. The Narayanghat–Mugling Highway, BP Highway, Mid-Hill Highway, and many rural roads experience repeated landslides because of unstable slope excavation, inadequate drainage, weak geological formations, and poor maintenance practices. Similarly, the 2021 Melamchi disaster illustrated how intense rainfall combined with massive sediment transport and debris flows can devastate river valleys, destroying bridges, roads, water supply systems, and human settlements within a few hours.

Hydropower development has also revealed the importance of engineering geology. Numerous projects have encountered tunnel collapses, squeezing ground conditions, excessive groundwater inflow, rock bursts, and foundation instability caused by unexpected geological conditions. These challenges have frequently resulted in construction delays, contractual disputes, and substantial increases in project costs.

Collectively, these historical experiences demonstrate that inadequate geological investigation and insufficient consideration of hydrogeological processes remain among the principal causes of infrastructure failure in Nepal. They also emphasize that engineering geology should be integrated into project planning from the earliest stages rather than being considered only during construction.

4. Current Infrastructure Development and Engineering Geological Challenges

Nepal is currently experiencing one of the most intensive periods of infrastructure development in its history. Strategic highways, expressways, hydropower projects, international airports, transmission corridors, railway networks, irrigation systems, and urban expansion projects are transforming the country's economy. Major projects such as the Mid-Hill Highway, Pushpalal Highway, Kathmandu–Terai Fast Track, Pokhara and Gautam Buddha International Airports, numerous run-of-river hydropower schemes, and cross-border transmission lines demonstrate Nepal's commitment to economic development. However, these projects are being implemented within one of the world's most geologically fragile mountain environments, making engineering geological considerations indispensable.

One of the most significant shortcomings in current infrastructure development is the inadequate integration of engineering geological investigations during project

planning. In many projects, geological mapping, geotechnical exploration, hydrogeological investigations, and seismic hazard assessments receive insufficient attention before construction begins. Consequently, unexpected geological conditions frequently emerge during construction, leading to design modifications, cost overruns, delays, contractual disputes, and safety concerns.

Road construction remains the most widespread example of these challenges. Mountain roads are often excavated using steep cut slopes without sufficient geological characterization or slope stabilization. Improper benching, inadequate drainage, uncontrolled blasting, and disposal of excavated materials on unstable slopes accelerate weathering and reduce slope stability. These practices have contributed to recurrent landslides along major highways, including the Narayanghat–Mugling Road, BP Highway, Pasang Lhamu Highway, and many sections of the Mid-Hill Highway. Recent studies emphasize that climate-resilient road design must integrate engineering geology, bioengineering, drainage management, and slope monitoring from the planning stage onward.

Hydropower development faces equally complex engineering geological challenges. Nepal possesses enormous hydropower potential, yet many projects have encountered adverse geological conditions such as highly fractured rock masses, shear zones, fault gouge, squeezing ground, excessive groundwater inflow, rock bursts, and unstable tunnel portals. Tunnel excavation through the Lesser Himalaya and Higher Himalaya frequently intersects active groundwater systems, requiring continuous geological mapping and adaptive support systems. Inadequate geological forecasting has been one of the primary causes of construction delays in several hydropower projects.

Bridge and river-training structures are increasingly exposed to river migration, bank erosion, debris flows, and sediment aggradation. Himalayan rivers carry exceptionally high sediment loads due to rapid erosion and intense monsoon rainfall. Consequently, bridge foundations designed using historical hydrological records may no longer provide adequate safety under changing climatic conditions.

Urban expansion in Kathmandu Valley, Pokhara, Dharan, and numerous hill towns has introduced additional engineering geological challenges. Construction on old

landslide deposits, river terraces, colluvial slopes, and weak sedimentary formations has increased vulnerability to settlement, differential foundation movement, and earthquake-induced ground deformation. Rapid urbanization without adequate land-use planning further compounds these risks.

Hydrogeological conditions are equally important. Changes in groundwater pressure influence slope stability, tunnel performance, foundation behavior, and retaining structures. Poor drainage design allows rainfall infiltration into fractured rock masses and residual soils, increasing pore-water pressure and triggering slope failures during the monsoon season.

These examples clearly demonstrate that engineering geology should no longer be regarded merely as a supporting discipline but rather as a central component of infrastructure planning, design, construction, and long-term maintenance.

5. Consequences of Global Warming and Climate Change

Climate change has emerged as one of the most important factors influencing infrastructure safety in the Nepal Himalaya. The Himalayan region is warming faster than the global average, resulting in profound changes in glaciers, snow cover, precipitation patterns, hydrology, and geomorphological processes. These changes directly affect the performance and sustainability of engineering infrastructure.

One of the most visible consequences is accelerated glacier retreat. Rising temperatures have caused rapid expansion of glacial lakes throughout the Nepal Himalaya, increasing the probability of Glacial Lake Outburst Floods (GLOFs). Such events can generate catastrophic floods capable of destroying hydropower projects, bridges, highways, settlements, and transmission corridors located downstream. The recent Thame Valley GLOF and similar cryosphere-related hazards illustrate the increasing vulnerability of high-mountain infrastructure.

Climate change has also modified precipitation characteristics. Although annual rainfall may not change uniformly, rainfall intensity has increased considerably in many parts of Nepal. Short-duration, high-intensity storms now produce flash floods, shallow landslides, debris flows, and severe riverbank erosion that frequently exceed

the design capacity of existing infrastructure. Conventional drainage systems designed using historical rainfall statistics are becoming increasingly inadequate because future rainfall patterns no longer follow historical assumptions.

Longer dry periods followed by extreme rainfall create additional geological instability. During prolonged dry seasons, weathering and desiccation produce fractures within soil and rock masses. Subsequent intense rainfall rapidly saturates these materials, increasing pore-water pressure and reducing shear strength, thereby triggering widespread slope failures.

Groundwater systems are also responding to climate variability. Changes in recharge patterns influence spring discharge, groundwater availability, tunnel seepage, and slope stability. Many communities already report declining spring discharge, while engineering projects increasingly encounter unpredictable groundwater conditions during excavation.

Climate change further increases sediment production throughout mountain catchments. Enhanced erosion, landslides, and glacier melt transport large quantities of sediment into rivers, reducing reservoir storage, affecting hydropower efficiency, destabilizing bridge foundations, and increasing flood hazards.

The combined influence of tectonic activity and climate change creates cascading hazards. An earthquake may destabilize slopes that subsequently fail during heavy monsoon rainfall. Likewise, glacier retreat may increase rockfall frequency through permafrost degradation, while extreme rainfall mobilizes the accumulated debris into destructive debris flows. These interacting processes require a multi-hazard approach rather than separate assessments of individual hazards.

Recent disasters demonstrate this changing reality. The Melamchi disaster of 2021, the 2024 Thame flood, repeated monsoon-induced failures along strategic highways, and the growing frequency of flash floods illustrate that infrastructure designed solely on historical observations is unlikely to remain resilient throughout its intended service life. Future engineering design must therefore explicitly incorporate climate projections, uncertainty analyses, and adaptive management strategies.

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Institutional Transformation of Consulting Service Procurement in Nepal

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1. Background and Rationale

The involvement of private consulting firms dates back to mid-1960's and early 1970's when the international financial institutions (IFI) like The World Bank and the Asian Development Bank started their financing in the infrastructure projects with involvement of international consulting firms initially and then from early 1980' the domestic consulting firms.

The procurement of consulting services in the IFI funded projects were governed by their own procurement guidelines. Whereas, the practice of procurement of consulting services through government funded projects was not practiced at that time and mostly was governed by the financial rules and aligned with the IFIs procurement guidelines based on the individual client's experience and knowledge on that. The enactment of Public Procurement Act (PPA) (2063) and Public Procurement Regulation (PPR) (2064) are the key milestones that changed the context of procurement of consulting services and it also valued the existence of consulting firms, individual consultant and others as development partners of the infrastructure development.

The **Public Procurement Monitoring Office** (PPMO) was established in 2007 (2064) after the PPA came into enforcement as a central policy, regulatory, and monitoring authority for public procurement in Nepal under the Office of the Prime Minister and Council of Ministers. It develops procurement laws, guidelines, and standard documents for various procurement related activities like works, consulting services,

goods etc. It also operates e-GP Systems all over Nepal and currently limits it to government funded projects and in some cases for the IFIs as well.

Commission for the Investigation of Abuse of Authority (CIAA) is constitutionally established in 1990 and continued under Constitution of Nepal 2015, which is apex anti-corruption body that investigates the public abuse of the authority. In the context of consulting service, it is widely seen that it examines the abuse of authority in area of selection of consultant, manipulation of Terms of Reference and Evaluation Criteria, and also in out-of-box influence in contract award decisions by the public entities and the employees. In recent times, the over-activism of the CIAA has also had an adverse effect in the decision-making process by the government official leading to contractual disputes and slow progress of the associated works.

The **Office of the Auditor General** was first established in 1959 (2025 BS) as the apex audit institution of Nepal that performs financial audit, compliance audit and performance audit. The audits are around the process whether the procurement laws and guidelines and followed or not in the selection process, value for money, payments and deliverables, irregularities in consulting service variation orders, use of provisional sums etc. Some of the issues they have flagged are out of the contract provisions and mixing up with the national procurement regulations and IFI's procurement regulations leading to more tightening of procurement related policies and practices as observed and felt by the consulting industry of late.

National Vigilance Centre (NVC) was established in 2059 (2002) under the Office of the Prime Minister and Council of Ministers with focus on technical audits of the projects including procurement process and suggests the corrective actions in procedural compliance to be taken in future assignments. In the extreme case may also suggests for backlisting or disciplinary action through PPMO

Nepal Engineering Council (NEC) is an autonomous body established in 1999. Its objective is to regulate the engineering profession in Nepal ensuring the quality of engineering education as well as the profession. Currently, its focus is on the engineering education, where as the engineering profession is being more neglected and is not on its radar.

The establishment of **Society of Consulting Architectural and Engineering Firms (SCAEF)** in B.S. 2047 also confirms that the growing pattern and utilization of knowledge mainly the architects and engineers that can support for the collective and multi-disciplinary solutions of the infrastructure development from the early inception of the project's concept, pre-feasibility, feasibility study and detailed design and leading to preparation of detailed project reports and eventually to the construction supervision and post-construction phase.

2. Vision for Institutional Transformation

The above background and the rationale suggest that the fragmented agencies directly or indirectly involved in the policy making, governance, monitoring, over-ambitious oversights have taken the unprecedented toll to the consulting services. The standard practices of Quality and Cost Based Selection (mostly 80- Technical and 20-Financial) has forced the consultants to opt for low bidding practice in both the national and international bids. The quality has comedown and the value for money is always questioned, so are the deliverables. This is hampering the construction industry and the life cycle cost of the infrastructure is under question with such level of compromise during the procurement of consulting service.

The institutional transformation should be visioned now where a coordinated effort across multi-agencies for a favorable, healthy, transparent procurement ecosystem should be in place where each parties ensures their respective roles in procurement of consulting services in terms of policy clarity, enforcement, system integrity, quality-driven, contract management, professional standards and market development aligned with the five golden principles (GP) of International Federation of Consulting Engineers (FIDIC), and its best established practices which are; **GP1: Roles & Responsibilities; GP2: Clarity & Consistency, GP3: Risk/Reward Balance, GP4: Reasonable Time Periods, and GP5: Dispute Resolution.**

3. Institutional Diagnosis

3.1 Public Procurement Monitoring Office

The key focus of the PPMO is to act as a central body for the policy, regulatory, and monitoring authority for public procurement that includes the consulting

services as well. The 18 years of journey of PPMO has some positive impact in the procurement system with adoption systematic process in the procurement of the consulting service, but the stark reality is that it is not able to deliver the outputs as desired by the consulting industry. The introduction of e-GP in the procurement for more transparent, reliable platform has been questioned in recent times from the donors i.e. The World Bank and the Asian Development Bank itself who were instrumental in introduction of the e-GP and supported it and are reluctant to use it citing various technical, transparency and ethical issues.

The core of the problem is the staff who are deputed from the different government agencies and they stay for a limited period of time and go back to their respective organization and create a vacuum once they leave right from the top to the other hierarchical staff. The conflict of interest between the staff from the government agencies and their counterpart at the government client side is also at time hinders the performance, decisions that are to be made in time.

The governing acts, regulations, standard forms, formats, Expression of Interest (EO) templates, Request for Proposal (RfP) are overly-focused on line-to-line compliance rather than focused on the quality outcomes and value for money. These has led to the unfamiliar practice by the consulting firms more focused on getting the job and complete by any means compromising the quality. In addition, the qualification at the EOI stage is more focused on the manpower rather than the institutional and the management capacity of the firms apart from technical capacity and with the limited enforcement of the quality and cost based (QCBS) selection with lower weightage on the technical part. Further, the weak monitoring of the consulting service procurement by the Client with inconsistencies in the approach for the similar jobs or assignments is another factor that it is not delivering the right kind of outputs even after 14th amendment of the PPR.

It is now suggested that the PPMO will have to be transformed as Public Procurement Authority. As quick SWOT analysis is presented here for readers to understand the need of such transformation.

TRANSFORMING PUBLIC PROCUREMENT MONITORING OFFICE INTO A PUBLIC PROCUREMENT AUTHORITY

SWOT Analysis

STRENGTHS

- Comprehensive legal framework (PPA 2063; PPR 2064) already in force
- Fully operational national e-GP system owned and managed by PPMO
- Established use of Standard Bidding Documents and templates
- Long-standing engagement with development partners on procurement reform

THREATS

- Political economy resistance from entrenched interests
- Federal coordination challenges if roles are not clearly defined
- Risk of "name-change reform" without real autonomy or enforcement powers



WEAKNESSES

- Limited enforcement and compliance capacity of PPMO
- Weak contract management and post-award oversight
- Severe capacity gaps at provincial and local government levels
- Persistent lowest-bid culture undermining value for money
- Lack of research in Procurement

OPPORTUNITIES

- Institutional upgrade can shift focus from process compliance to performance governance
- e-GP data can support procurement analytics, market oversight, and risk monitoring
- Professionalization, accreditation, and training systems can be institutionalized

Source: SCAEF Nepal

3.2 The Client- Procuring Agencies

In general, the consulting services from the private consulting firms is required if the Client does not have its own technical expertise for prepare a pre-feasibility study, feasibility study or detail feasibility study, detail engineering design and detailed project report with the financing options as well and other similar studies that may have other forms of approaches. Then comes the drafting of the Terms of Reference (TOR) with the scope of the works, team composition and requirements, consulting services fee and the time frame for such studies. It is seen that the TOR preparation by the Client is very poor with unrealistic estimate of the inputs, the associated costs, the mix of experts and the overall cost estimation as there are not standard norms or synchronized practices across different clients including different approach for the government funded projects and the donor funded projects.

Further, it is also felt that the number of clients specially the provincial and local governments have very limited understating of the complexity that comes in

understanding the consulting services and provisions associated with the EOI and the RFP requirements. One example is that the misuse of the word DPR, which essentially is the detailed engineering design with analysis of technical and financial risks based on the financing options during the implementation, and based on the suggested options client need to look for financing options. The current practice, when you are confirmed with the financing then it should be a detailed engineering design and not the DPR.

In addition, the weak contract management of the consulting services is also seen where the Client are relatively new unaware of the provisions of the general conditions of the contract and special conditions of the contract and mixing between the PPR and the IFI's procurement guidelines and regulations. Further, it is also observed that the EOI and RFP evaluation committee of the Client at time do not represent the subject-matter experts and inclusion of the finance and legal officials in the evaluation of technical proposal is always questioned on the overall scoring system.

3.3 Oversight Agencies

The general understanding of the consulting sector is that the oversight agencies are more focused on the procedural compliance rather than the contractual provisions, the best practices in engineering, the economics of engineering and the value for money which should be above all the services rendered for the given price and the time. The very complicated technical issues are reviewed and addressed in from the yes of the administrator not from the development perspective.

These agencies audits and investigation are such that not aligned agreement between the two parties i.e. The Client and the Contractor or the Client and the Consultant. Each of the parties are been assigned with their respective responsibilities and authority that can be exercised with the boundaries of the contractual provisions. The contractual provisions should be practiced and exhausted before moving to next level of investigation and audits. The engineering issue compliance are better handled through Nepal Engineering Council and

based on the recommendation of the unethical practices by such individuals can be under the scanner of the oversight agencies.

The procurement system flaws are at times labelled as corruption, financial irregularities and above all weak accountability shown by these institutions. These undermines the effectiveness of these agencies from the eyes of the consulting firms.

3.4 Market Players - Consulting Firms

The key player in the consulting service procurement from the market perspective are the consulting firms both the national and international players. The international players are mostly within the framework of the IFI's, the bilateral agencies like Foreign, Commonwealth & Development Office, Japan International Cooperation Agency, Korea International Cooperation Agency, Export Import Bank etc. While the national payers to participate in the bids for all the IFI's and bi-lateral agencies based on the specific requirements of the particular consulting service call.

In recent times the regional firm specially from India are also bidding for the small assignments that are more tailored to the national firms but the procurement regulations of the IFI's do allow this kind of bidding. This is somewhat worrying for the national firms as the capacity of the national firms will not be increased in coming days.

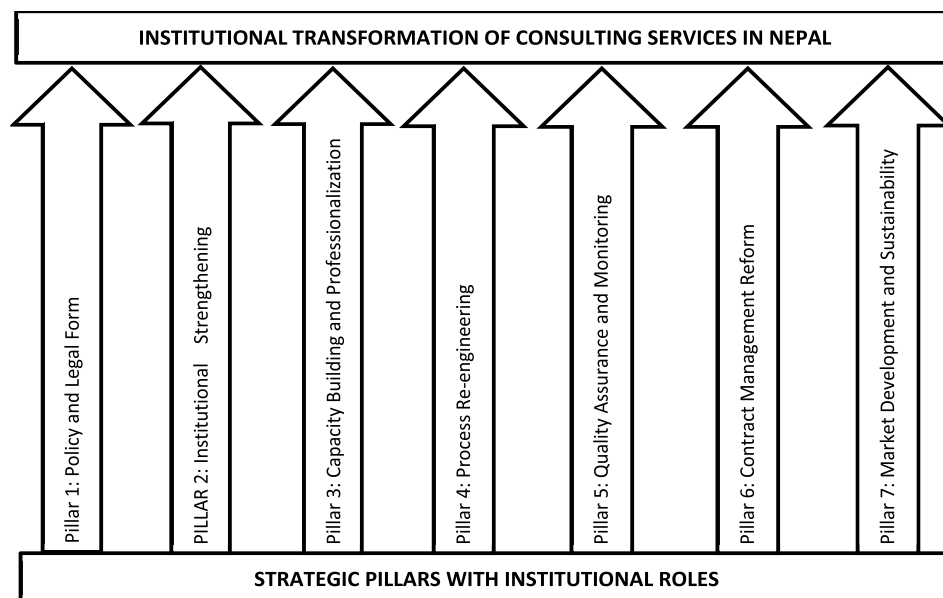
The low-cost estimate from the Client side was an issue but the key issues now has become that the national firms for the national assignments and some cases international firms are also bidding with low fees which are unsustainable in long run. The Ministry of Finance has put a cap of 5% upper budget ceiling for the consulting service in an infrastructure project and that is not aligned with the best international practices. The low fee bidding trend has led consulting as regular job that has killed introduction of innovative methods, use of IT, quality in the deliverables and is worrying for the industry towards its own existence. This has also led to the IFI's opting for hiring individuals rather than the firms for the consulting assignments.

The other key factor that is haunting the consulting industry is that of “brain drain” as the qualified mid-career engineers and architects are in shortage that is weakening the pool of experts’ availability to the consulting firms in the market.

The weak regulation from the Client side has also led to delays that are commonly attributed to inadequate experience of the firms in managing and delivering the complex engineering projects. The contract documents that are mostly oriented towards the Client side has also contributed to delays apart from the poor decisions and ambiguous procurement acts, regulations, guidelines specific to the consulting service procurement. The reliance on the international consultants has also stopped the growth of the national/domestic firms who can compete with the international firms in terms of delivering the quality and their own corporatization and institutionalization including adoption of new innovative techniques.

4. Strategic Pillars with Institutional Roles

Based on the discussion above seven pillars of institutional transformation has been identified where different agencies will have to play lead role and others supporting role for the such transformation as visioned. The details of these pillars are discussed as below in the respective section.



4.1 Pillar 1: Policy and Legal Reform

The lead role to be played for this is Public Procurement Authority (transformed PPMO) with supporting roles assigned to the Client or procuring agencies, the oversight agencies and SCAEF Nepal as key stakeholder

The key areas that are to be addressed are;

- Develop Consulting Services Procurement Guidelines to:
 - o Mandatory legal provisions for international firms to take at least one domestic firm as joint venture partners and other associate partners.
 - o Evaluate the experiences of the associate partners for the evaluating the experience gained while working with the international or local lead firm.
 - o Standardize the norms for the estimation of cost of consulting assignments based on the inputs, time frame and the complexity of the assignment.
- Rewrite procurement act, regulations, guidelines, frameworks to:
 - o Remove least cost selection practice and move towards Quality and Cost Based Selection (QCBS) with higher weightage for the technical for the simple and regular assignments to check the unsustainable fees proposed by the consultants.
 - o Mandate Quality Based Selection (QCBS) for complex consulting services
 - o Remove weightage on the manpower at the EOI stage and introduce with Management Competence with certification like member of SCAEF Nepal or any other competent authorities
- Introduce legal provisions for:
 - o Consultant registration or licensing system with a competent authority
 - o Introduction of performance evaluation system of the consultant based on the past performance in the assignments

- o Debarment for poor quality delivering consultants from the next business opportunities within the same organization and if required across the sector or the Client

4.2 Pillar 2: Institutional Strengthening

The lead role to be played for this is Client agencies and oversight roles to Public Procurement Authority (transformed PPMO).

- Strengthen the established Procurement Units with section for (a) works, (b) consulting, (c) Supply and Others
- Define clear roles and responsibilities such that;
 - o The technical units are responsible for drafting the Terms of Reference and & project deliverables with timelines, whereas,
 - o The Procurement units are for process compliance, review of conditions contracts, special conditions of contracts and with the existing procurement acts, rules, guidelines, frameworks etc.
- Strengthen PPA's (transformed PPMO) role as:
 - o regulator and technical, procurement advisory institution
 - o central repository of procurement knowledge within the nation

4.3 Pillar 3: Capacity Building and Professionalization

The lead role to be played for this is Client agencies and oversight roles to Public Procurement Authority (transformed PPMO) and SCAEF Nepal and Nepal Engineering Council.

- Introduction of national certification programs for procurement professional within the Client, Consultant and Contractor
- Certified procurement professionals to be part of the systems within the Client, Consultant and Contractor
- Mandatory and certified training for:
 - o Evaluation committee members on the procurement aligned with

national procurement act, regulations and that IFI's

- o Project director and managers in client agencies
- Joint certified training platforms at:
 - o Nepal Engineering Council
 - o SCAEF Nepal
 - o Nepal Engineers' Association
 - o Certified training center/ institutions

4.4 Pillar 4: Process Re-engineering

The lead for this pillar is to be played by PPA (transformed PPMO) and the activities to be executed by the Client Agencies.

- Standardization of:
 - o EOI templates and its digitization in the system and revised based on the past best practices through the consultation with stakeholders like SCAEF Nepal
 - o TOR templates (sector-specific and based on the simple, moderate and high complex infrastructure projects)
 - o Team experts, input estimation, and cost estimation of the services to reflect the market prices
 - o RFP documents including General Conditions of Contracts and Special Conditions of Contract aligned more industry and development friendly
 - o Scientific evaluation scoring systems both at the EOI and RFP stage and transparent and consistent across the sector
- Further strengthening of e-GP system with additional modules for:
 - o Technical evaluation transparency and system regenerated scores
 - o Consultant performance tracking including the use of Artificial Intelligence (AI) and system generated scores and based on which the

performance be evaluated at the EOI stage with lead firm taking the majority of the performance and rest partners also be made reasonably responsible for the performance

- A system generated disclosure of evaluation summaries of both the technical and financial with options for disclosure when the bidder wants detail evaluation of the technical score

4.5 Pillar 5: Quality Assurance and Monitoring

The lead for this pillar is to be played by PPA (transformed PPMO) ably supported by the Oversight Agencies. Some of the key roles under this are;

- Establish a separate Consulting Services Monitoring Unit within PPA (transformed PPMO)
- Develop sustainable:
 - o Consultant Performance Database including both the national and international firms encompassing all three level of government and that of IFI's
 - o Feedback loops from the client and IFI's
- Introduction of the third-party independent design audits for large scale infrastructure projects and technical audits for high-value consulting assignments

4.6 Pillar 6: Contract Management Reform

The lead for this pillar is to be played by Client agencies through guidance from PPA (transformed PPMO) and SCAEF Nepal. Some of the key roles under this are;

- A procedural shift from procurement focused governance to full project lifecycle management and introduction of the same in the development governance.
- Strengthen and practices on:
 - o Report approvals mechanisms (Inception, progress, monthly, quarterly,

six-monthly, draft and final through system digitalization)

- o Milestone-based payments for design projects and time-based for construction supervision projects
- o Deliverable quality checks through structured process and standard frameworks
- Adopt FIDIC-aligned contract practices with five golden principles at the help of the procurement and project governance.

4.7 Pillar 7: Market Development and Sustainability

The lead for this pillar is to be played by SCAEF Nepal with policy support from PPA (transformed PPMO). Some of the key roles under this are;

- Develop mainstream consulting fee guidelines that are recognized and adopted by the Client and IFI's
- Discourage abnormally low bids through regulatory mechanism and adoption of QCBS with higher weightage for the technical and move toward QBS selection till stabilization for the market
- Encourage and promote:
 - o Specialized firms for specific task like for surveying, geotechnical, water labs, design studios etc.
 - o Encourage Joint ventures between domestic/local and international through policy correction specially during the loan/ grant agreements with IFI's
 - o Knowledge transfer mechanisms through accredited and certified trainings
- Encourage long-term framework agreements for regular design across the sector that way specialized firms are encouraged to establish themselves.

5. Role Mapping for Institutional Transformation

The role mapping is presented in the matrix form as below for easy understanding.

Table 1: Role Mapping for Institutional Transformation specific to Consulting Sector

Institution	Core Mandate	Key Functions	Institutional Reform Measures	Accountability
Public Procurement Authority (transformed PPMO)	shift from a compliance-focused to a quality-oriented regulator and system designer	• policy and regulatory leadership • standardization and system design • monitoring and compliance enforcement • knowledge and capacity hub • data and performance management	• transformation to independent public procurement authority • induction of professional procurement experts representing engineering, legal, business, supply chain experts	• accountable to government and people • public disclosure of performance • subject to self-audit
Client Agencies (Procuring Entities)	transform from process-driven buyers to informed clients	• project definition and tor preparation • procurement execution • contract management • technical oversight and decision-making • performance feedback	• establish dedicated consulting service units • separate: • technical functions (line divisions) • procurement functions (procurement units)	• accountable for: • project outcomes (not just procurement compliance) • quality of tor and deliverables • performance linked to institutional KPIs
SCAEEF Nepal	act as the collective voice, standard setter, and technical partner of the client agencies	• policy advocacy • technical standard development • capacity building • market development • dispute resolution and feedback loop	• self-regulatory body	• accountable to member firms and broader industry • expected to maintain professional integrity and neutrality
Nepal Engineering Council	ensure professional standards, licensing, and ethical conduct of individual consultants	• licensing and accreditation of engineers in the industry • development of codes of ethics and professional conduct • participation and licensing in certification of procurement/evaluation professionals • supporting disciplinary actions for malpractice	• bridge between individual competency and institutional procurement quality • collaborate with PPA (transformed PPMO) and SCAEEF on capacity building	

Institution	Core Mandate	Key Functions	Institutional Reform Measures	Accountability
Oversight and Accountability Institutions	ensure integrity, accountability, and proper use of public funds			
Development Partners (WB, ADB, Bilateral Agencies)		• introduce global best practices (QCBS, FBC, etc.) • provide technical assistance for: ◦ legal reform ◦ e-GP enhancement • act as catalysts for reform pilots within client agencies	• shift from: ◦ pure compliance audits to performance and value-for-money audits • develop specialized frameworks for: ◦ consulting service procurement • coordinate with PPA (transformed PPMO) for data and insights	

In order to materialize the above role matrix contents a cross-institutional coordination mechanism is required where and formation of “National Consulting Procurement Coordination Platform” is proposed. At this following stakeholder are proposed based on the discussion above and the requirements.

- Public Procurement Authority (transformed PPMO) (Lead)
- Nepal Engineering Council
- Key Client Ministries
- Oversight bodies
- Development partners
- SCAEF Nepal

They are intended to engage frequently on policy level dialogues and discussion and suggested reform tacking, overcoming or resolving systematic bottlenecks while encountered during the procurement process and implementation leading to

continuous improvement of procurement practices aligned with best international practices following FIDIC’s guidelines, and IFI’s regulations.

Table 2: Role Clarity Matrix (Who Does What)

Function	PPA (PPMO)	Client Agencies	SCAEF Nepal	NEC	Oversight Agencies
Policy & Regulation	Lead	Input	Advocate	Support	Review
TOR Preparation	Guide	Lead	Support	-	-
Procurement Process	Monitor	Lead	Observe/Support	-	Audit
Evaluation Standards	Define	Apply	Support	-	Review
Contract Management	Guide	Lead	Advisory	-	Audit
Capacity Building	Lead	Participate	Co-lead	Co-lead	-
Performance Monitoring	Lead	Report	Feedback	-	Audit

6. Roadmap for Implementation

The road map for implementation is as (a) short term, (b) medium term, (c) long term as tabulated below:

Table 3: Roadmap for Implementation

Roadmap	Duration	Key Milestone
Short Term	1~2 years	• PPA (transformed PPMO) issues directive limiting low bidding • Standard EOI, TOR, and RFP templates rolled out • Training programs launched for client agencies • Legal amendments through PPA (PPMO) led reform
Medium Term	3~5 years	• Strong coordination between PPA (transformed PPMO), client agencies, oversight agencies and SCAEF Nepal • Dedicated procurement units with procurement specialist established in client agencies • Performance evaluation system operational for consultants (both national and international)
Long Term	5~10 years	• Fully integrated e-GP ecosystem • Mature consulting market with sustainable pricing

7. Risks and Mitigation

The consulting industry faces significant risks including underpriced bid competition, which often compromises quality, and a lack of specialization among domestic firms compared to regional and international firms. The bureaucratic delays frequently lead to project delays or payment issues, while a continuous “brain drain” of skilled professionals to international markets weakens the domestic talent pool, which the industry is currently facing. To mitigate these challenges, firms must prioritize capacity building and digital transformation to enhance their technical competitiveness and efficiency. The government should come up with the robust legal contracts that industry friendly as well as promotes and protects the industry internally and from externally i.e. through regional and international bidders. Furthermore, the industry needs to strengthen its professional associations like SCAEF to lobby for fairer procurement policies that value technical expertise over the underpriced bid.

Table 4: Risks and Mitigation Matrix

Risks	Mitigation Measures
PPMO resistance to expanded role	Policy mandate and capacity enhancement
Client agency inertia	Incentives and accountability mechanisms

Risks	Mitigation Measures
Skill gaps	Institutionalized training and certification
Market distortion	Enforced sustainable fee ecosystem and evaluation reforms

8. Expected Outcomes

The following are expected outcomes with the legal and institutional reforms in the given timeframe;

- Clear separation of regulatory vs operational roles for the institutions under the government umbrella
- Improved quality of TORs, transparency evaluations at EOI and RFP systems in place
- Sustainable consulting industry ecosystem
- Increased trust between government and private sector where government roles is aligned for promotion and protection rather than only regulation

9. Conclusion

Transformation hinges on clarity of roles and accountability across institutions both in the government and private sector. The reform must ensure that;

- PPA (transformed PPMO) Nepal evolves into a proactive regulator,
- Client agencies become competent buyers of knowledge, and
- The consulting industry thrives on quality and not in the underpriced bids.

BIO-ENGINEERING: CLIMATE RESILIENCY MEASURES FOR ROADS IN NEPAL

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Abstract:

Nepal is vulnerable to the disasters, such as, intense rainfall, floods and landslides. The large quantities of runoff due to intense rainfall during four months of monsoon season induce erosion, debris flow and landslides through heavy storms. Nepal is one of the most vulnerable countries in the world regarding climate change impacts. It is also affecting the stability of steep slopes of Nepalese mountains through heavy floods and believed that the impacts will worsen in future. Climate pattern study shows that precipitation patterns have changed and that there is more risk of erratic rainfall giving rise to massive erosion and heavy landslides. Climate change is causing a rapid increase in the number and size of Himalayan glacial lakes giving potential threats of glacial lake outburst floods (GLOF) affecting the rivers. The intensified floods trigger landslides in the mountain roads and flooding in the plain roads disrupting access to transport services. The earthwork excavation and filling during road constructions in mountains disturb the stable slopes. It also damage to vegetation causing various adverse environmental impacts. Despite of these challenges, the road agencies are increasingly required to respond and to mitigate the impacts of climate change. The aim is the provision of reliable access to reduce operating costs and promote to substantial growth for greater economic activity and social interaction. It is necessary to understand the climate change challenges, the adaptation and resilient measures. Proper selection of alignment, drainage capacity design and slope protection techniques are very important for low maintenance and sustainability of mountain roads. Attention is needed in careful disposal of spoil, longitudinal side drainage, cross drainage, road surface and sub-surface drainage management. Special care should be taken for selecting the type of slope stabilization measures and design during road construction stage to ensure the stability of roadside

slopes. In the climate change contest, the road transport structures should be designed to be more resilient to prevent from the increased risk of erosion, landslide and flooding. The bio-engineering techniques developed in Nepal are simple, cost-effective and provide nature-based solution (NbS) for road construction and maintenance. Nepal has started the use of road side bio-engineering during construction and maintenance of roads by introducing the engineering design norms and specifications, training manuals and policy documents. Bio-engineering procedure is labour intensive which provides employment to local community. The use of bio-engineering structures integrated with civil engineering structures in mountain roads has proved to be cost effective, environmentally friendly and resilient measures for erosion control and landslide protection.

Keywords:

Mountain roads; climate change; landslides; nature-based solution (NbS); bio-engineering, resiliency.

1. Introduction

1.1 Background

Nepal is a mountainous country located along the southern slopes of the Himalayas. The country has middle hills to high mountains in northern part and a plain land in the southern part. It is one of the most disaster-prone countries in the world and is vulnerable to many natural hazards, such as earthquakes, floods, landslides. The Himalayan mountains are young and fragile with major active faults and thrust. The mountains of Nepal are steep and unstable. The plain areas are prone to flooding and the mountains are prone to landslides. The country lies in a high earthquake intensity zone. The plains areas are highly susceptible to liquefaction and the mountain areas are susceptible to landslides. The water flowing from the mountains cause heavy damages through flooding. The weathering process of rocks and saturation of soil during monsoon causes landslides and erosion. The toe cutting of slopes by rivers are very common activities. Landslides also claim the maximum number of death per year followed by floods. The landslides, soil erosion and flooding has increased due to

degradation of forest areas. Besides, Nepal lies at the head of the Ganges basin and this unique position in the Himalayas makes it vital to work with neighbor country for addressing the adverse effects of climate change. It is estimated that the floods and other disasters take their toll at least \$23 million a year. On 25 April 2015, Nepal experienced an earthquake of 7.8 Magnitude with epicenter in 77 kilometer west of Kathmandu. The earthquake resulted in over 8,600 casualties and more than 785,000 homes were damaged. The losses were expected to be in the order of \$5 billion with widespread destruction of infrastructure, including roads and bridges.

1.2 Slope Failures

Road construction causes damage to vegetation and other negative environmental consequences. Slope stabilization needs high cost civil structures. Also, road blockages due to landslides need high maintenance costs. Road excavation in mountain creates cut slopes on the higher sides of roads, which need to be left at as steep a stable angle as possible to reduce earthworks. On the valley sides, fill slopes must be in sustainable angles while saturated during monsoon rainfall. Proper water management is very important to make mountain roads sustainable. The water induced problems along the alignment need to be carefully tackled since drainage plays vital in the performance of a road. The choice of a ridge alignment minimizes the number of culverts. Roads on upper slopes have fewer instability problems and also serve more people. The selection of alignments is subjected to economic analysis, environmental, resettlement and social impact assessment. Also, the roads require anti-seismic measures in the design of structures and road tunneling technology should be introduced in future to cope with such environment.

1.3 Climate Change Impact

The impacts of climate change in Nepal will be a rise in maximum temperature at an annual rate of 0.04 – 0.06°C. Precipitation are projected to increase for the in the range of 15-20%. The impacts will be significant warming, at higher elevations, leading to reductions in snow coverage and increase in precipitation during the

monsoon season causing floods. Current climate change events impacts and the economic costs are estimated to be 1.5 to 2% of GDP. The impact of climate change will be as below:

- Flooding by heavy rains and snow melting in the mountains will damage the roads
- Rainfall will affect road infrastructures like, drainage, bridges and pavements. It may also increase in number of landslides
- Temperature rise will cause pavement deterioration due to bitumen melting

The Himalayan ice caps are melting faster and glacial lakes are at risk of bursting their natural dams due to climate change. Nepal will also experience more intense monsoons rainfall frequency in future.

The predicted rise in maximum temperatures is annual rate of 0.04 - 0.06°C and annual mean temperatures to increase by 3°C by 2050. Rainfall are predicted to increase in the range of 15-20%. The projections is an increase in monsoon rainfall and a decrease in winter rainfall. The key impacts are likely to include significant warming at higher elevations, reductions in snow coverage and increased frequency of floods and an increase in rainfall during the wet season. Climate projection studies of Kathmandu Valley are as below:

- Increase in average maximum temperature of up to 1.85°C;
- Increase intensity of rainfall events;
- Increase in number of extreme rainfall events that now occur every 5 years are projected to occur every 2 years;
- Increase in peak monthly average flow in wet season flow on the Bagmati River is 68%;
- Greater likelihood of pooling;
- Increase in irrigation demand by up to 980mm, and
- Increase in risk and severity of flash floods during the wet season.

Many glacial lakes in Nepal are expanding at a considerable rate so that the danger they pose appears to be increasing. It is predicted that the frequency of GLOF events will increase with climate change. So, improved preparedness is necessary in road sector to cope with disaster risk due to climate change. Special care is required to ensure the stability of roadside slopes and landslide management.

2. Road Transport Sector

2.1 Road Network

Road is the dominant mode of transport in Nepal. All weather access roads contribute to the economic growth in the country contributing to the overall goal of reducing poverty. Government has given priority to the construction of Mid Hill Highway which passes through middle mountains. This highway provides access to many hill settlements and potential hydropower projects. Also, Nepal has an opportunity to promote transit trade between India and China. This needs a high class road link and additional infrastructure to attract and divert some of the present sea trade between India and China. Available statistics indicate that cross border traffic will continue to rise over the coming years with a significantly higher growth rate than normal traffic. Road will contribute to poverty reduction by bringing both direct and indirect positive impacts along with short term and long term impacts to the area. The provision of transport services, including the construction and maintenance of roads, generates demand for labor and provides income-earning opportunities for the poor. Road construction influences social sectors such as, agriculture, industry, commerce, education, health, etc. Socio-economic opportunities, environmental and social risks and a variety of other factors derived from road projects may lead to changes in lifestyles, impacts on environment and culture, involuntary displacement and resettlement and changes in systems of production. This is why roads require an environmental impact assessment to review environmental impacts and implications. The impacts associated with most criteria should be able to be mitigated well by avoiding impacts through detailed design and careful attention to the implementation of engineering controls on construction techniques. Erosion control, dust control, waste management and forest compensatory planting can be implemented during

construction. Construction materials, such as boulders, stones, gravel and sand are locally available at a reasonable distance.

The road construction in Nepal started since 1950 with the construction of Tribhuvan Rajpath connecting Kathmandu with the Indian border. The engineering techniques used in construction of roads and roadside slope management were implemented from donor's experience. The responsibility for the management and operation of all strategic roads in Nepal is with the Department of Roads (DoR). Its remit includes road planning, construction and maintenance activities. The responsibility for local roads falls under the Department of Local Infrastructure (DoLI) and local governments. A map of the strategic road network prepared by the Department of Roads is shown in Figure 1.

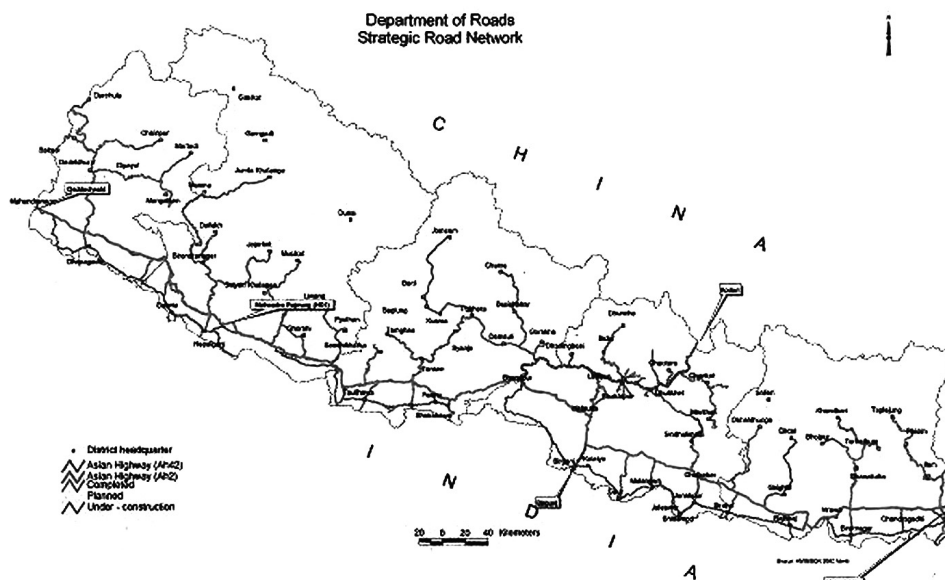


Figure 1: Strategic road network (SRN) of Nepal

Road maintenance fund is established which is managed by the Roads Board of Nepal (RBN). For the Strategic Road Network, the DOR identifies its maintenance needs through an Annual Road Maintenance Plan. The road sector development strategy provides adoption of the planned road asset management system for

sustainable, reliable and safe road transport operations through prioritized repair, maintenance, rehabilitation and reconstruction of roads and bridges.

2.2 Green Road Concept

The Green Road Concept is the road construction approach in mountains with minimum environmental damage to reduce the risks of landslides and erosion (GTZ/SDC, 1999). Mass balancing of earthworks is not always possible within the cross section alone. Sometimes the excess soil has also to be carried somewhere along the longitudinal alignment. Excess excavated material has to be properly placed and compacted at specified tipping sites. Fixing the road centre line in a Green Road is a very technical. If the centre line is not properly located it may result in massive excavation. Below are some important features of a Green Road:

- Alignment selection with geotechnical consideration to avoid risk of landslides
- Low initial design standard and geometry to minimise cost
- Well integrate into the environment and aesthetic looking
- Labour-Based approach without use of heavy equipments and blasting
- Ecological preservation of forest areas and wild life
- Preservation of natural drainage system in watersheds
- Avoid water, air and noise pollutions
- Preserve archaeological, historic, religious and cultural sites
- Minimise negative impacts such as, erosion, borrow pits etc
- Generate employment opportunities with equal rules for men and women
- Improved access to education, health, and governmental facilities

Green Roads avoid expensive civil engineering structures, promote the use of local resource and utilize excavated materials such as, stones, gravel, topsoil etc. But some gabion wire, concrete pipes and small amount of cement for culvert structures has to be procured from nearby market.

2.3 Labour-Based Approach

The labour is one of the largest resources of developing countries. By adopting labour-based construction methods, about two-third of the total expenditures on road construction can be paid to the local people. The approach is suitable if proper design and techniques are selected during planning stage. Labour-based method also requires good management. Labour should be available locally in sufficient numbers. Transporting the labour force to and from worksites can cause problems. Labours are employed from the nearby villages up to two hours walking distance and they can return back to their homes after the works. Appropriate tools and equipment are needed to achieve quality output. Local labourers may need some training to understand the method of work valuation and payment system. Construction skills learned by the local people can also be utilised for other infrastructure works. A number of district and feeder road projects in Nepal have tried labour-based construction approach with small scale retaining and drainage structures to provide employment opportunities to poor communities (RAP, 2000). Use of local resources during construction can lead to the sustainable maintenance of the road.

2.4 Staged Construction

Green Roads are for the rural areas where the traffic volumes are low. Such roads are constructed with minimal survey and design. Only typical designs of retaining structures and water management structures are used. Green Roads can be upgraded from a fair-weather earthen road to an all-weather bituminous road if the traffic volume increases to required level. Environmental and socio-economic studies will be required to justify the upgrading. Construction is done in following four phases:

- Trail along potential road alignment (1m-2.5m)
- Track with gradual widening of the trail (2.5m-4.5m)
- Road with retaining, drainage structures and bio-engineering
- Paved Road with surface drainage including bio-engineering

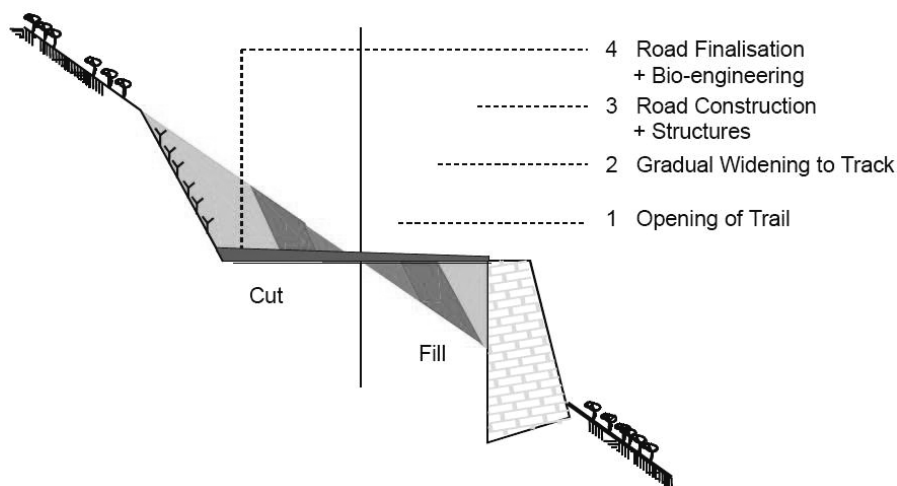


Figure 2. Staged construction approach

Its policy states a staged construction approach for feeder roads to ensure that the maximum benefits are achieved from limited initial traffic volume and limited financial resource. The design standards (DoR, 1997) provide threshold traffic levels at which upgrading should be considered with following characteristics:

- Fair-weather, single lane, earth road with a typical AADT of about 20
- All-weather gravel road with a traffic volume of about 50 AADT and above with improved geometry, widening, retaining and water management structures
- All-weather bituminous road with further improved curves, culverts and bridges, and better provision of retaining and water management structures

Further, the road alignments that are high up in the landscape tend to be more stable than alignments low down the landscape. This is because of the landslides coming down from the above and undermining from below, as the river scours away at the base of the slope.

3. Bio-engineering

3.1 Use of Vegetation and Nature-based Solution (NbS)

The bio-engineering in road construction started in Nepal 45 years ago from the Dharan Dhankuta Road, supported by the UK government. It was also applied in

the Lamosangu Jiri Road Project at the same time constructed with Swiss assistance. Before 1994, the use of bio-engineering was only restricted to only few projects working on small road sections. The bio-engineering experience is documented in a reference manual and site handbook on roadside bio-engineering in Nepal (DoR Roadside Bio-engineering, 1999). The projects which used bio-engineering in major scale in the past are named below:

- a) Dharan-Dhankuta Road: The Dharan-Dhankuta Road (50 km) was constructed between 1977 to 1983 under UK Government assistance. Extensive research work was carried out and different types of bio-engineering techniques were developed. Many bio-engineering sites were established along the road to control landslides and erosion.
- b) Lamosaghu-Jiri Road: The Lamosangu-Jiri Road (110 km) was constructed under Swiss Government's assistance in 1985. The road construction was purposely made labour-intensive to provide local employment. All main structures were executed in gabions. Bio-engineering techniques were applied to stabilise slopes along the alignment.
- c) Charnawati Rehabilitation Project: This was an effort undertaken to rehabilitate a road section heavily affected by a flood in the early monsoon season of 1987. Innovative techniques for the construction and maintenance of roads, such as anchoring, drilled subsurface drains, and flexible river protection and bio-engineering were introduced. Construction work during the project were divided into river control work, drainage work, slope stabilization work and road rehabilitation. The bare surfaces of the slides were treated with bio-engineering measures.
- d) Road Maintenance Project (RMP): Bio-engineering component under Geo-Environment Unit of DoR was supported by the British government. Outputs of the RMP Bio-Engineering Component were as below:
 - Improvement of skills in bio-engineering was done by training and demonstration.

- Expansion of the capabilities of Nepalese consultants and contractors to apply bio-engineering through training and encouragement of the private sector.
 - Introduction of bio-engineering works in programs by all Division Road Offices.
 - Provision of guidelines for roadside management with road neighbors in rural areas.
 - Development of rate analysis norms, standard specifications and technical manuals.
 - Determination of the long term management requirements for roadside vegetation
- e) Rural Access Program (RAP): RAP was implemented during 2001-08. A feeder road was constructed from Hile to Bhojpur with extensive bio-engineering and innovative methods of community participation called Road Building Groups (RBGs). The second phase of the Rural Access Programme (RAP2) commenced in October 2008 and was completed in September 2013. It focused on constructing District Roads adopting bio-engineering and the community-based construction methods. RAP3 also included the scope of Bio-engineering and tree planting activity in the down slopes to provide a safety barrier against vehicular roll-off.

The bio-engineering techniques used in the Nepal road sector are from standard international methods but adapted to local conditions emerged from the research phase. Emphasis has been given to techniques which improve slope drainage. Major trials were done on roads such as the Dharan-Dhankuta Road and a number of techniques were identified as the optimum solutions on specific sites. This was made by use of demonstration, awareness-raising, information provision, training, budget programming and provision of technical advice. The design specification of bio-engineering measures has now been established in the Nepal road sector (Section 2800 of DoR/ Standard Specification-2078).

Bio-engineering combines ecological principles, engineering techniques, and community engagement to create safe, sustainable roadside environments that support both transportation infrastructure needs and the health of surrounding ecosystems (Howell, 1999).

NbS is a sustainable approaches that utilise nature and natural systems to address various environmental challenges and provide benefits to both human well-being and biodiversity and commonly used to tackle issues such as disasters caused by natural events and climate change (IUCN, 2020). Relatively shallow and small-scale problems are usually confined to cut and fill slopes of roads and are most-suited to NbS treatment. Larger roadside landslides are usually dealt with using a combination of civil works and NbS. The NbS relies on the civil works to create geotechnical stability and through drainage management and erosion protection.

3.2 Selection of Techniques

All deeper-seated problems are first addressed by retaining walls and drainage structures and appropriate bio-engineering techniques are applied in combination. Provisions have to be made for nursery as well as collection of plants, cuttings, seeds etc. Local people are encouraged to establish nurseries by providing them required technical advice and support. Bio-engineering incorporates readily available indigenous skills and knowledge of local people including women.

Table 1. Bio-engineering techniques and their functions (DoR Reference Manual , 1999)

S N	Techniques	Engineering Functions
1	Planted grass horizontal	Armour, reinforce, reduce speed of runoff, catch debris
2	Planted grass vertical	Armour, reinforce, drain surface water, drainage
3	Planted grass diagonal	Armour, reinforce and compromise of grass line planting
4	Planted grass random	Armour, reinforce, limited function of catching debris
5	Grass seeding	Armour, reinforce, limited function of catching debris
6	Shrub and tree planting	Reinforce, anchor and support a slope

7	Shrub and tree seeding	Reinforce, anchor and support a slope
8	Bamboo planting	Reinforce and support a slope
9	Brush layering	Catch debris, armour and reinforce, slope drainage
10	Palisades	Catch debris, armour and reinforce, slope drainage
11	Live check dam	Catch debris, armour and reinforce the gully floor
12	Fascines	Catch debris, armour and reinforce the slope
13	Vegetated stone pitching	Reinforce, armour and protected gully beds

Careful site assessment with attention to detail is the key to success in selecting the techniques for slope management. Without an understanding of the exact processes at work in every part of a site, it is not possible to design effective measures to resolve the problems which occur under extreme rainfall events.

A simple and prescriptive system to determine or check the treatments required based on the site assessment is given below in Table 2 (DoR Bio-engineering Site Handbook, 1999).

Table 2. Choosing a bio-engineering technique

Start (a)	→ (b)	→ (c)	→ (d)	→ (e)	→ (f)	→ (g)
Slope angle	Slope length	Material drainage	Site moisture	Potential problems	Functions required	Technique(s)
		Good	Damp	Erosion, slumping	Armour, reinforce, drain	Diagonal grass lines
	> 15		Dry	Erosion	Armour, reinforce	Contour grass lines
	metres	Poor	Damp	Slumping, erosion	Drain, armour, reinforce	1 Downslope grass lines and vegetated stone pitched rills or 2 Chevron grass lines and vegetated stone pitched rills
			Dry	Erosion, slumping	Armour, reinforce, drain	Diagonal grass lines
> 45°		Good	Any	Erosion	Armour, reinforce	1 Diagonal grass lines or 2 Jute netting and randomly planted grass
	< 15		Damp	Slumping, erosion	Drain, armour, reinforce	1 Downslope grass lines or 2 Diagonal grass lines

	metres	Poor	Dry	Erosion, slumping	Armour, reinforce, drain	1 Jute netting and randomly planted grass or 2 Contour grass lines or 3 Diagonal grass lines
	> 15 metres	Good	Any	Erosion	Armour, reinforce, catch	1 Horizontal bolster cylinders and shrub/tree planting or 2 Downslope grass lines and vegetated stone pitched rills or 3 Site grass seeding, mulch and wide mesh jute netting
		Poor	Any	Slumping, erosion	Drain, armour, reinforce	1 Herringbone bolster cylinders & shrub/tree planting or 2 Another drainage system and shrub/tree planting
30° - 45°	< 15	Good	Any	Erosion	Armour, reinforce, catch	1 Brush layers of woody cuttings or 2 Contour grass lines or 3 Contour fascines or 4 Palisades of woody cuttings or 5 Site grass seeding, mulch and wide mesh jute netting
	metres	Poor	Any	Slumping, erosion	Drain, armour, reinforce	1 Diagonal grass lines or 2 Diagonal brush layers or 3 Herringbone fascines and shrub/tree planting or 4 Herringbone bolster cylinders & shrub/tree planting or 5 Another drainage system and shrub /tree planting
	Any	Good	Any	Erosion	Armour, catch	1 Site seeding of grass and shrub/tree planting or 2 Shrub/tree planting
< 30°		Poor	Any	Slumping, erosion	Drain, armour, catch	1 Diagonal lines of grass and shrubs /trees or 2 Shrub/tree planting
	< 15 metres	Any		Erosion	Armour, catch	Turfing and shrub/tree planting
	Base of any slope			Planar sliding or shear failure	Support, anchor, catch	1 Large bamboo planting or 2 Large tree planting

3.3 Selection of Species

Different plant species are used for the bio-engineering techniques. Abundance of pioneer colonizing species is available near the vicinity of road alignments. It is possible to use a large number of appropriate species for which seeds are available in country. Mainly, the following points should be considered during selection of species to perform the required bio-engineering functions:

- Suitable species for the environmental conditions on site
- Performance of the required functions on site
- Useful to local farmers

- Availability of species at the right place and in the right quantities
- Use of fast-growing species for rapid establishment



Figure 3. Grass plantation in mine haul road in Tokadeh, Liberia (before and after 3 months)

The final choice of species, according the technique for which they are to be used, and the site characteristics are determined by altitude and moisture. The technical part involves the selection of the right means of plant propagation, and site suitability. Examples of local species and their effective depths of rooting is given in Table-2 below.

Table 3. Species and their effective depths of rooting

S N	Plant type	Example in Nepal		Rooting depth (metre)
1	Small grass	Dubo Kikiyu	Cynodon dactylon Pennisetum clandestinum	0.10
2	Large grass	Kans Amliso	Saccharum spontaneum Thysanolaena maxima	1.00
3	Large bamboo	Mal bans	Bambusa nutans	1.00
4	Shrubs	Dhanyero Bhujetro	Woodfordia fruticosa Butea minor	1.50
5	Trees	Khayer Utis	Acacia catechu Alnus nepalensis	2.00

3.4 Integration of Climate Resilient Nature-based Solutions

Slope stabilisation requires a number of engineering functions to be fulfilled. Because of the complexities of the site both civil and bio-engineering techniques

are required to serve the purposes. Therefore, a combination of civil and bio-engineering offers the most complete solution to the roadside slope management. But the road engineers should be familiar with the principles of bio-engineering systems and civil engineering systems. Priority should be given to nature-based solutions (NbS) as far as possible. Figure-4 below shows the combination of civil and bio-engineering techniques used in BP highway and Prithivi highway in Nepal.



Figure 4. Combination of civil and bio-engineering techniques in Nepal road

The strength at various stages of life for bio-engineering and civil engineering structures is different. Vegetations take few years to reach maximum strength. As the relative strength of engineering structures decrease, the relative strength of plant structures increases. Graph compares the performance of each type of structure and not their actual strength. Jute net and grass can be used in combination to perform a catching function. The capacity of the jute net to retain soil is very high at first. With time the jute decays and weakens the net and consequently its soil-retaining capacity decreases. In contrast, the capacity of grass slips to retain soil increases as their root systems develop. As the relative strength of the jute net declines, the relative strength of the grass increases and the soil-retaining function of the jute net is handed over to the grass. To protect a slope from a shallow planar failure, a retaining wall is provided to support the toe but also requires bio-engineering measures to armour against erosion. Civil and bio-engineering structures served complementary functions on the same site. Additionally, the improvement for climate resilient road construction and maintenance can be achieved by incorporating:

- Resilient designs and better construction standards.
- Raising infrastructure works above the projected high flood level in low-lying flood prone areas.
- Ensuring faster restoration and mitigation of damage after natural disaster events through regular maintenance activities and increasing frequency of periodic maintenance.
- Increasing capacity of side drains, cross drains and embankment height.
- More resilient bridge structure should be designed with higher return periods to accommodate increased flood volumes.
- Providing additional protection works to resist erosion and scour for roads built in low land and in close proximity to adjacent rivers.
- Review of specifications for construction materials to increase their resilience to the impacts of increased rainfall, increased flows and fluctuations in temperature variations.

3.5 Maintenance and Monitoring of Bio-engineering

Bio-engineering maintenance is a part of roadside support maintenance which maximise its engineering contribution and its appearance. Routine maintenance involves protection and care of plants. It is required continuously because of environmental effect. The normal activities are weeding, mulching, grass cutting and protection from fire, grazing and theft. The length workers can carry out routine maintenance activities. Preventative maintenance is required to adapt the geophysical environment and covers all other bio-engineering activities of roadside support maintenance. Preventative maintenance is more complex than routine maintenance. The normal activities are thinning of shrubs and trees, repair of vegetation structures, vegetation enrichment and removal of unwanted shrubs and trees. The ideal bio-engineering site should maintain the following features:

- Trees with deep roots for anchorage.

- Trees should be pollard or coppiced so that their weight does not surcharge the slope.
- Shrubs forming an intermediate level shallower than the tree roots.
- Grasses to prevent erosion of the soil surface.

Monitoring of bio-engineering works includes regular site inspections and assessment of the structural performance of both the civil and vegetative structures. This involves evaluating the performance and effectiveness over time, focusing on elements like structural integrity, landslide and erosion control, and environmental benefits. This process also includes assessing plant survival rates, establishment periods and benefits under different climate scenarios. It is necessary to evaluate and quantify the saving in road maintenance budget by using bio-engineering techniques through piloting and research projects.

3.6 Case Example of Bio-engineering in Sankhu-Palubari-Nagarkot Road

The ADB funded Earthquake Emergency Assistance Project (EEAP) supported the Government of Nepal to accelerate recovery and reconstruction following the devastating earthquake of 25 April 2015. Extensive road blockages and inaccessibility for a few weeks were seen in the in the days after the earthquake. The obstructions were caused mainly by landslides, which washed out some road sections completely. About 135 km of strategic roads and about 450 km of rural roads damaged by the earthquake and landslides were rehabilitated. Project roads and bridges had built back better features for road safety and climate resilience. All outputs assured to be disaster risk resilient. The project was planned to be implemented over a three year period. The estimated cost of the project is \$232 million. The underlying principle of the government's recovery and reconstruction (R&R) policy is to build back better.

Sankhu – Palubari – Nagarkot Road (10 km) was one of the road out of 17 district being carried out for reconstruction under ADB Loan 3260: Earthquake Emergency Assistance Project (EEAP). The road alignment starts from Shankharapur Municipality Ward No. 11 of Kathmandu district and passes through Sankhu, Palubari, Kattike and finally reaches to Nagarkot of Kavre

district. This road provides access to market, education institutions, and health center and government service offices. In addition it is also a potential heritage route to religious places of Sankhu and tourist route to Nagarkot.

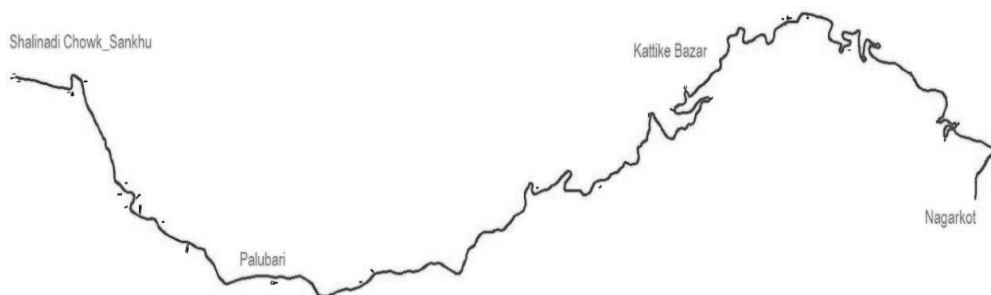


Figure 5 – Alignment of road

The road was designed for upgrading to allweather paved standard with following improvements:

- Widening of road width
- Improvement of high grade
- Provision of passing bays incertain intervals
- Cross drainage and side drains improvement
- Road geometry improvement
- Bio-engineering works

The road was designed to all weather type of district core road network standard of general width of 5.25 m with 3.75 m carriageway including 0.75 m shoulder on either side and with vehicle-passing zone at designed intervals. In order to manage the surface run-off lined drain was being carried out with cross-drainages at frequent interval focusing to be located at vertical intersection valley points. Consideration was given to safe discharge of the drainage outlets in natural gullies. Type of crossings were been determined keeping view of nature and characteristics of gullies, river, stream and spring.



Figure 6 - Bio-engineering work in Sankhu-Palubari-Nagarkot Road

Summary of civil engineering and bio-engineering works are presented in the following Table-3 and Table-4.

Table 4 – Civil engineering works

SN	Items	Cost (NRs)	Waitage (%)
1	Earthworks for widening	10,401,380	6
2	Retaining structures	52,187,440	30
3	Drainage structures	17,870,463	10
4	Pavement works	57,676,781	34
5	Others	30,909,205	20
	Total	169045269	100

Table 5 – Bio- engineering works

SN	Items	Cost (NRs)	Waitage (%)
1	Supply of plants	2,332,584	30
2	Plantation	3,545,310	46
3	Fencing	823,081	10
4	Structures	106,756	2
5	Others	885,004	12
	Total	7,692,735	100

Portion of bio-engineering work in comparison with civil engineering work in Sankhu – Palubari - Nagarkot Road was only 4.35%. The implementation of bio-engineering has already produced good results and this will improve the condition of roadside slopes reducing maintenance costs. Local people were involved during implementation to promote income generation activities. Bio-engineering techniques have shown to be reliable and cost-effective. From the experience of this road, it is recommended that a minimum of 5% of the total cost should be allocated to implement bio-engineering in road sector contracts.

4. Conclusions

The sustainability of mountain roads depends very closely on careful alignment selection and slope stabilisation. Slope stabilisation works can be made more resilient and cost effective using locally available materials and skills. Bio-engineering work is considered one of the most sustainable measures for slope protection, as it provides environmental-friendly and cost-effective. Extensive use of nature-based solutions (NbS) in road sector can reduce disaster, protect biodiversity, improve watershed management and also attract international carbon financing.

Resilient roads can be constructed by incorporating proper design, better construction standard and inclusion of bio-engineering. Bio-engineering can be combined with civil engineering structures to enhance strength, drainage and slope stability. They offer comprehensive solutions to a wide range of slope instability problems when combined with appropriate civil engineering measures. They also produce better economic and environmental results and the techniques are flexible and are able to recover from damage.

Department of Roads should prioritise on research activities to promote bio-engineering and develop a policy on disaster management and climate change adaptation for road construction and management. Improved preparedness is necessary in road sector to cope with impacts due to climate change. It is necessary to transform some changes from geotechnical strategies to bio-engineering strategies to adapt climate change impacts. The combination of live vegetation and geotechnical engineering that is strategically planned and designed together can be used to perform

a variety of useful engineering functions for the benefit of nature, people and the economy.

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Safe System Approach: Smart Mobility and Road Safety in the Workplace with a Strategic Focus on the Nepali Context

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1. The global and regional imperative of occupational road safety

The evolution of transport systems and the expansion of the global workforce have rendered road safety in the workplace a critical priority for sustainable infrastructure development and public health. Across the globe, work-related mobility is not merely a logistical necessity but a significant epicenter of occupational risk. The International Labor Organization (ILO) identifies that nearly three million workers perish annually due to work-related accidents and illnesses, with traffic incidents accounting for approximately 25% of all work-related deaths. In more specific regional contexts, such as Europe, the European Agency for Safety and Health at Work estimates that road crashes are responsible for up to 40% of all occupational fatalities. This data underscores a profound reality: for a significant portion of the global workforce, the daily journey to and from work, or travel undertaken as a formal part of job duties, represents the most hazardous period of their lives.

This crisis is disproportionately concentrated in the Asia Pacific (APAC) region. Despite serving as a global engine of economic growth and technological innovation, the region is simultaneously shadowed by a severe road safety burden. Annually, an estimated 1.19 million people die in road traffic crashes worldwide, and the Asia Pacific region accounts for a staggering 59% to 60% of these fatalities. The World Health Organization (WHO) highlights that the South-East Asia Region alone accounts for 28% of global road deaths, maintaining a fatality rate that consistently exceeds the global average. In South and South-West Asia, the fatality rate has been recorded at 20.3 per 100,000 population, while South-East Asia sits at 17.8 per 100,000—figures that are starkly higher than those in high-income economies.

The intersection of labor and road risk is particularly evident when examining the demographics of these casualties. WHO data indicates that two-thirds of all road traffic fatalities occur among individuals of working age (18 to 59 years), making road crashes the primary threat to the region’s most productive demographic. The connection is twofold: it includes travel en mission, which is essential for logistics, sales, and service industries, and travel in itinere, the daily commute. For many workers in the Asia Pacific, this vulnerability is amplified by the archetype of the “Vulnerable Worker,” an individual who occupies a dual status as a vulnerable road user (VRU)—such as a pedestrian, cyclist, or user of a motorized two-wheeler—and a member of the workforce. In many Asian nations, including Vietnam, Thailand, and Indonesia, the explosion of motorcycle ownership has placed millions of gig economy and informal sector workers on congested, often unsafe road networks, where VRUs account for up to 66.5% of all road deaths.

The economic imperative to address this issue is equally compelling. The Asian Development Bank (ADB) estimates that road crashes cost its developing member countries approximately \$96 billion annually, with the economic burden ranging from 2% to 6% of a country’s Gross Domestic Product (GDP). These costs are not abstract; they represent lost productivity, strained healthcare systems, and the descent of families into poverty following the death of a primary earner. Consequently, managing road risk is a core business responsibility that enhances operational resilience and corporate reputation while mitigating financial losses from vehicle damage and insurance premiums.

Table 1: Global and APAC Road Safety Statistics Comparison

Metric	Global Estimate	Asia Pacific Region
Annual Road Deaths	1.19 million	60% of global total
Work-Related Deaths	~3 million total	Highest global mortality (63%)
Traffic % of Work Deaths	25% (Global)	~40% (Select high-risk areas)
Working Age Fatalities	N/A	Two-thirds of all road deaths
Economic Cost	N/A	2% to 6% of GDP
VRU Fatality Share	N/A	Up to 66.5%

2. The conceptual framework of the safe system approach

The Safe System approach represents a fundamental paradigm shift in road safety management. Historically, traditional road safety models focused heavily on the individual behavior of transport users, often assigning primary blame to the driver or pedestrian when a crash occurred. The Safe System approach, which originated with Sweden's "Vision Zero" initiative, challenges this perspective by recognizing that road crashes are a consequence of inadequate or poorly designed systems rather than purely individual failure.

Fundamental principles of the safe system

The approach is built upon four core principles that dictate how a safety-centric transport environment should be designed and managed. The first is the **Principle of Fallibility**, which acknowledges that human beings are inherently prone to making mistakes. In a Safe System, the focus is not on perfecting human behavior but on designing a traffic environment that is "forgiving" of these errors. The second is the **Principle of Vulnerability**, which recognizes that the human body has a limited capacity to withstand the kinetic energy released during a crash without suffering serious injury or death.

The third principle is **Shared Responsibility**, which moves away from individual culpability and establishes that responsibility for road safety lies with everyone involved in the system: designers, builders, vehicle manufacturers, fleet managers, and road users. Employers, in particular, have a moral and legal duty to ensure that the transport tasks they mandate are conducted within a safe environment. Finally, the Principle of Comprehensive Approach or Redundancy ensures that all parts of the system—infrastructure, vehicles, speeds, and users—are reinforced so that if one part fails, the other components protect the individual from a fatal outcome.

The five pillars of action

To operationalize these principles, the Safe System approach utilizes five functional pillars. The first pillar, **Road Safety Management**, focuses on institutional capacity, inter-agency coordination, and data-driven policy making. The second, Safe Infrastructure Design, emphasizes creating road environments that naturally manage speed and separate conflicting modes of transport, such as raised crosswalks and

protective barriers. The third pillar, **Safe Vehicles**, advocates for the adoption of advanced safety technologies, such as anti-lock braking systems (ABS), airbags, and driver assistance systems (ADAS).

The fourth pillar, **Safe Road Users**, involves education, training, and strict enforcement of regulations—such as helmet use and seat belt compliance—to encourage responsible behavior within the system. The final pillar, **Post-Crash Response**, focuses on the efficiency of emergency services and medical care to minimize the severity of injuries and prevent secondary deaths after an incident has occurred. By integrating these pillars, the Safe System targets the achievement of the 2030 Agenda for Sustainable Development, which aims to halve global road deaths and injuries.

Table 2: Traditional Approach vs. Safe System/Vision Zero Paradigm

Feature	Traditional Approach	Safe System Approach
Responsibility	Primarily on the individual road user	Shared among designers, managers, and users
Human Error	Blames the user for crashes	Recognizes error is inevitable; designs for it
Primary Goal	Reducing crashes to “acceptable” levels	Elimination of deaths and serious injuries
Vehicle Design	Manufacturer/Owner responsibility	Integrated safety layer (Active/Passive)
Infrastructure	Maximizing throughput and flow	Error tolerance and speed management
Post-Crash	Variable healthcare response	Integral part of the safety system

3. Smart mobility: technologies and their impact on workplace safety

Smart Mobility refers to the strategic integration of advanced technologies, real-time data, and innovative service models into the transportation ecosystem. Its objective is to create a network that is not only efficient and sustainable but fundamentally safer for all users, particularly workers who are exposed to the road environment daily. Within the framework of the Safe System, smart mobility acts as a catalyst for risk reduction by mitigating human error through automation and data-driven insights.

Associated technologies and infrastructure

A core component of smart mobility is the development of **Intelligent Transportation Systems (ITS)**. These systems utilize sensors, cameras, and data processing to manage traffic flow in real-time, detecting incidents and proposing alternative routes to avoid hazardous congestion. For example, Japan's Vehicle Information and Communication System (VICS) has provided drivers with real-time traffic data for decades, while Singapore's system uses Artificial Intelligence (AI) to predict traffic patterns and adjust signal timings dynamically.

The **Internet of Things (IoT)** enables **Vehicle-to-Vehicle (V2V)** and **Vehicle-to-Infrastructure (V2I)** communication, creating a “cooperative awareness” where vehicles share speed and location data with each other and with road furniture. This allows for dynamic adjustments to traffic lights based on weather or traffic conditions, significantly reducing the probability of collisions. Furthermore, Autonomous Vehicles and those equipped with **Advanced Driver Assistance Systems (ADAS)**—such as **Automatic Emergency Braking (AEB)** and Lane Departure Warning—act as automated safety nets that can intervene faster than a human operator to prevent rear-end collisions or lane-change crashes.

Benefits for occupational road safety

For companies managing fleets, the implementation of **In-vehicle Telematics** provides unprecedented visibility into driver behavior. Telematics systems can detect unsafe habits such as speeding, harsh braking, or rapid acceleration, allowing for real-time feedback or targeted coaching. Companies like Shell have integrated these solutions to foster a stronger safety culture and identify risky habits before they lead to serious incidents.

Moreover, **Route Optimization** applications use predictive algorithms to calculate the safest paths, minimizing exposure to high-risk intersections and reducing the pressure on drivers to meet delivery times through risky behaviors. By smoothing traffic flow through automatic synchronization, smart mobility also helps reduce driver fatigue and psychological stress—factors that are major contributors to human error on the road.

Table 3: Core Technologies of Smart Mobility and Safety Functions

Technology Category	Specific Systems	Primary Safety Benefit
ITS	VICS (Japan), Smart Traffic (Singapore)	Urban decongestion and real-time hazard alerts
V2X Communication	V2V, V2I via IoT sensors	Cooperative awareness and intersection safety
AI/Big Data	Predictive safety analytics	Identification of blackspots and route optimization
Automated Safety	ADAS (AEB, Lane Assist, ABS)	Compensation for human error/distracted
Fleet Monitoring	Telematics and GPS tracking	Real-time behavior correction and monitoring
MaaS Platforms	Grab, GoTo, super-apps	Multi-modal integration and reduced car dependency

4. Public policies and international regulatory frameworks

The establishment of public policies and regulatory frameworks is essential for ensuring that road safety is prioritized across all sectors of the economy. International legislation provides the bedrock for national strategies, creating a standardized set of expectations for employers and governments.

The foundation of international labor standards

The International Labour Organization (ILO) provides the foundational framework through the **Convention on Occupational Safety and Health (C155)**, which establishes road safety as a core component of employer responsibility. This convention, ratified by over 60 countries, emphasizes that employers must take preventive measures to protect workers during all work-related activities, including travel. This is further detailed in **ILO Recommendation R194**, which focuses specifically on travel-related safety and is particularly relevant for nations with large informal transport sectors.

In the European Union, **Directive 89/391/EEC** mandates that companies include road safety in their occupational health and safety (OHS) programs. Additional regulations, such as **Regulation (EC) 561/2006**, set strict limits on driving and rest times for professional drivers to prevent fatigue-related crashes. Many companies worldwide are also adopting **ISO 39001**, an international standard for road traffic safety management systems, which provides a structured approach for identifying risks and implementing evidence-based interventions.

Diverse regulatory landscapes in the Asia Pacific

The Asia Pacific region presents a varied regulatory landscape, ranging from highly advanced systems to emerging frameworks. **Japan's Road Traffic and Safety Act** places clear legal responsibility on companies for the training and monitoring of employees who operate vehicles for work. Similarly, **Australia's National Road Safety Strategy 2021-2030** is rooted in the Safe System approach and sets ambitious targets for reducing road trauma through mandatory safety audits and policy implementation.

In contrast, rapidly motorizing nations like **India** have recently enacted the **Motor Vehicles Act 2019**, which establishes stringent certification requirements for professional drivers and mandates that companies develop comprehensive safety programs. South Korea has addressed the economic root causes of unsafe driving through its “**Safe Rates**” movement, recognizing that low freight rates often force truck drivers into unsustainable and dangerous working practices, such as excessive hours and speeding.

Table 4: Regional Regulatory Comparison for Occupational Road Safety

Country/Region	Primary Legislation/Strategy	Key Features for Workplace Safety
Sweden	Vision Zero / Arbetsmiljölagen	Zero-tolerance for deaths; mandatory safety plans
Australia	National RS Strategy 2021-2030	Mandatory audits; Health and Safety legislation
Japan	Road Traffic and Safety Act	Corporate responsibility for training/monitoring
Singapore	Workplace Safety and Health Act (WSHA)	Tripartite approach; risk management for all driving
South Korea	Safe Rates System	Economic mitigation of fatigue/speeding risks
India	Motor Vehicles Act 2019	Professional driver certification; safety program mandates
Colombia	Resolution 1565 of 2014 (PESV)	Mandatory Strategic Road Safety Plans for companies

5. National strategies for occupational road safety

National strategies serve as the blueprint for coordinating efforts between government agencies, the private sector, and civil society. Successful strategies must be multidisciplinary and data-driven, ensuring that interventions are tailored to the specific needs of each economic sector.

Strategic planning and coordination

A critical element of any national strategy is **Inter-institutional Coordination**. In Singapore, the **Workplace Safety and Health Council (WSHC)** operates as a tripartite body involving the government, employers, and trade unions to promote safety through guidelines and industry-specific programs. Similarly, Australia's **National Road Safety Partnership Program (NRSP)** acts as a knowledge bank, facilitating the exchange of best practices between over 50 leading companies.

National planning must also include rigorous **Risk Analysis and Blackspot Diagnosis**. Authorities in China increasingly utilize big data analytics to identify high-risk road sections, while companies in Germany are required to submit periodic reports on mobility risk factors to the Federal Road Safety Agency. These analyses allow for the implementation of targeted infrastructure upgrades and enforcement campaigns that directly benefit commercial transport safety.

Incentives and training programs

Governments use various incentives to encourage companies to invest in road safety. In Australia and New Zealand, businesses that implement robust safety management systems can access **Insurance Premium Reductions** or levy discounts. The Japanese government provides subsidies for the adoption of safety technologies, such as ADAS and telematics, while Mexico offers preferential treatment in public contracts to companies with strong road safety records.

Education and training remain fundamental pillars of national strategies. Modern programs go beyond basic licensing to include defensive driving, fatigue management, and simulations of emergency situations. In Japan, simulators are mandatory for corporate vehicle drivers, a practice that has been shown to reduce work-related crash

rates by 20%. Targeted training programs, such as the **AIP Foundation's initiatives** in Cambodia and Thailand, focus on the most vulnerable commuters, such as factory workers who rely on collective transport.

Table 5: Successful National Strategies and Reported Outcomes

Strategy Type	Exemplar Country	Reported Outcome / Benefit
Comprehensive Planning	New Zealand (Road to Zero)	Safety-first mindset across corporate sector
Inter-agency Coordination	Singapore (WSHC)	Integrated risk management across all sectors
Technology Incentives	Japan (MLIT Subsidies)	30% reduction in crashes through ADAS
Industry Benchmarking	UK (Driving for Better Business)	30% reduction in incidents for participating firms
Vulnerable Group Focus	Cambodia (AIP Foundation)	Safer factory commuting via collective transport
Economic Root Causes	South Korea (Safe Rates)	Reduced pressure for speeding and fatigue driving

6. The state of road safety in Nepal: an analysis of the crisis

Nepal faces a severe and escalating road safety crisis that has become a major barrier to its sustainable development and economic growth. Over the past 15 years, casualties from road crashes have surged by 155%, rising from 1,131 in 2008 to 2,883 in 2022. If these trends persist, annual fatalities are projected to reach 4,500 by 2030, meaning an average of 12 lives lost daily on Nepali roads. The economic toll is equally staggering, with fatalities and serious injuries costing an estimated \$3 billion in 2021—equivalent to roughly 7% of Nepal's GDP, a figure that surpasses the country's total healthcare expenditure of 5.4% of GDP.

Data discrepancies and the under-reporting issue

A fundamental challenge in addressing road safety in Nepal is the lack of reliable, standardized data. Significant discrepancies exist between official police records and estimates from international health bodies. In 2021, while official country statistics and the Global Burden of Disease reported approximately 2,000 fatalities, the WHO

estimated the figure to be near 8,000, representing a fatality rate of 28.2 per 100,000 population—well above the Asia Pacific average of 15.2.

Research utilizing the **Community Crash Recording System (CCRS)**—where local record keepers like shopkeepers document crashes visible from their premises—demonstrates the depth of this under-reporting. In a 12-month study, community record keepers documented 110 crashes, while police records for the same period and locations captured only 23. The reporting rate was particularly low for minor injuries (7.1%) and property damage (11.6%), suggesting that traditional records fail to capture the full socio-economic burden of “fringe” incidents.

Table 6: Nepal Road Safety and Infrastructure Overview

Indicator	Value / Status
Estimated Fatality Rate	28.2 per 100,000 population (WHO 2021)
Reported Fatality Rate	~6.6 per 100,000 (Official 2021)
Annual Economic Loss	~\$3 Billion (7% of GDP)
Motorcycle Crash Share	35.5% to 38%
Pedestrian Fatality Share	24.8% to 27%
Strategic Road Condition	60% in “good” surface condition
iRAP 3-Star Rating (Roads)	17% to 32% (depending on user type)
Registered Vehicles	>3.5 million motorized vehicles

7. National strategies and regulatory framework in Nepal

Nepal has committed to international goals, including the UN Decade of Action for Road Safety 2021-2030, which aims to halve road deaths by the end of the decade. To achieve this, the government has developed several policy frameworks that incorporate the principles of the Safe System.

The Nepal road safety action plan (RSAP) 2021-2030

The RSAP serves as the primary strategic document, focusing on the five pillars of the UN Global Plan. It aims to reduce annual fatalities from an average of over 2,000 to approximately 875 by 2030. Key priorities include stricter vehicle fitness tests, control

of cruising speeds for heavy transport (buses and trucks), and the enhancement of pedestrian facilities. The plan also calls for a “Paradigm Shift” in traffic law, moving from punitive enforcement toward a public-living approach centered on the Safe System.

Workplace-specific priorities within the RSAP include :

- **Driver Fatigue Management:** Promoting adherence to legal provisions that require two drivers for long-haul routes or mandatory breaks at designated locations.
- **On-Road Worksite Safety:** Under the Civil Code, leaving worksites unsecured is a criminal offense. The RSAP mandates proper fencing and signaling at all construction sites, requiring these standards to be integrated into formal contracts.
- **Post-Crash Response Training:** Prioritizing trauma-care training for medical personnel and first responders to improve the survival rates of crash victims.

The Nepal labor act 2074 (2017)

The Labor Act 2074 is the principal legislation governing occupational safety and health in Nepal, establishing clear responsibilities for employers across all industries.

- **Safety and Health Committees:** Section 74 (and 79) mandates that any establishment employing 20 or more workers must form a Safety and Health Committee. This committee is responsible for evaluating safety arrangements and notifying authorities if the employer fails to address hazards.
- **Employer Duties:** Employers must maintain a hazard-free workplace, provide necessary Personal Protection Equipment (PPE), and ensure the safe handling and transportation of dangerous substances.
- **Protections for Transport Labor:** Section 86 provides specific rules for the transport sector, including a strict prohibition on alcohol consumption for 12 hours before driving until the final destination is reached. It also mandates rotational driving for long-haul passenger vehicles.

- **Female Worker Safety:** Section 33 requires employers to provide safe transportation and security for female employees required to work before sunrise or after sunset.

Table 7: Key Safety Provisions under Nepal Labor Act 2074

Provision	Legal Requirement / Limit
Standard Working Hours	8 hours per day; 48 hours per week
Maximum Overtime	4 hours per day; 24 hours per week
Overtime Pay	1.5x the ordinary wage rate
Safety Committee	Mandatory for establishments with 20+ workers
Alcohol Rule (Transport)	Zero consumption 12 hours prior to/during duty
Accident Insurance	Rs. 7 Lakh coverage, paid by the employer
Rest Interval	30 minutes after 5 continuous hours of work

8. Smart mobility and ITS initiatives in Nepal: 2025 and beyond

Nepal is currently transitioning toward a more modern, technology-driven transport management system. While the basic infrastructure is still being developed, several key projects and trends indicate a significant shift toward smart mobility.

Intelligent traffic management and data systems

The **Kathmandu Sustainable Urban Transport Project (KSUTP)**, supported by the Asian Development Bank, is introducing a self-adaptive Intelligent Traffic System (ITS) in the capital. This system will cover 37 traffic points across 26 junctions, utilizing live CCTV video and wireless data to manage congestion and curb violations such as over-speeding and lane deviations.

To address the critical data gap, the **Road Accident Information Management System (RA-IMS)** has been deployed by the Nepal Police and DoTM. RA-IMS includes a mobile application for on-site data collection by traffic police and a centralized server for analysis, aiming to identify crash patterns and contributing factors with greater granularity than traditional paper registers.

The rapid leap to electric mobility (EV)

Nepal has emerged as a global frontrunner in EV adoption, driven by the logic of its domestic energy production. Over 90% of Nepal's electricity comes from hydropower, making EVs the most cost-efficient and logical choice for decarbonizing the transport sector.

- **Market Transformation:** In the fiscal year 2024-25, electric vehicles accounted for 73% to 76% of all newly imported passenger cars, jeeps, and vans. Even light commercial vehicles, such as small pickups and delivery vans, saw a 50% electric market share.
- **Infrastructure Depth:** As of mid-2025, over 60 public charging stations have been installed by the government and private operators, with a national network expanding along major highway routes.
- **Inclusive Transition:** The Sustainable Electric Transport for Nepal (SET4NPL) project focuses on scaling electric public transport, such as electric micro-buses (EMBs). A key element of this transition is training Safa Tempo drivers—particularly women—to operate modern electric micro-buses, ensuring that the modernization of the fleet is socially inclusive.

Table 8: Major Smart Mobility and Sustainable Transport Projects in Nepal

Project / Initiative	Implementing Agency	Core Safety/Efficiency Benefit
KSUTP ITS	MoPIT / ADB	Real-time traffic visualization and control
RA-IMS	Nepal Police / DoTM	Digitalized crash reporting and blackspot ID
SET4NPL	Mitigation Action Facility	Electrification of micro-buses; women driver training
BRT Pilot	Kathmandu Metro / MoPIT	High-capacity, safer mass transit along corridors
Fleet Telematics	Delta Tech / GeoMate	Real-time monitoring of B2B logistics fleets
Smart Card Licensing	DoTM	Improved regulation and driver identification

9. Corporate responsibility and the gig economy in Nepal

As digital platforms reshape mobility, the distinction between formal and informal employment has become a critical focal point for occupational road safety policies. Multinational corporations and digital platform companies in Nepal have introduced innovative programs to protect their workforces.

Ride-sharing safety: Pathao and inDrive

Platform-based delivery and ride-hailing services are dominant in urban Nepal. Because these workers often operate as independent contractors, they fall into a precarious middle ground with limited OSH oversight. To address this, platforms like Pathao have implemented extensive safety frameworks :

- **Mandatory Safety Training:** Riders must pass online safety assessments with a score of at least 80%.
- **Comprehensive Coverage:** The 'Pathao Benefit Program' provides income security, medical insurance, and accidental death coverage for both riders and passengers.
- **Quick Response Team (QRT):** Pathao operates a 24-hour team to investigate incidents and provide swift assistance during emergencies.
- **Helmet Distribution:** Countless helmets have been distributed to ensure both riders and passengers adhere to safety regulations.

Multinational corporate initiatives

Large-scale enterprises like **Unilever Nepal** and **Coca-Cola Beverages Nepal** integrate road safety into their core operational values. Unilever's "Drive to Zero" program focuses on six high-risk countries, utilizing technology to reduce fatalities. In collaboration with industry bodies, they developed a Commercial Vehicle Code of Conduct to improve standards among third-party logistics providers. Coca-Cola Hellenic's fleet safety policy sets safety as a primary criterion for vehicle selection and journey planning, ensuring that all company vehicles are operated within designated load limits to prevent mechanical failures.

Table 9: Comparative Analysis of Corporate Road Safety Features

Company	Sector	Key Safety Feature	Impact on Workplace Safety
Pathao	Gig Economy	QRT and Benefit Program	Income security; 24/7 incident response
inDrive	Ride-hailing	SOS button; location sharing	Passenger and rider emergency support
Unilever	FMCG	Together for Safety program	Culture of safety across manufacturing sites
Coca-Cola	Beverages	Speed governors (60 km/h)	Reduced high-speed crash risks in fleets
RichLand	Logistics	GPS and behavior coaching	Measurable gains in driver accountability
Shell	Energy	A2Z Fleet Solution	Continuous feedback loop for driver habits

10. Evaluation, monitoring, and continuous improvement

The success of any road safety strategy depends on the ability to measure its effectiveness and make data-driven adjustments over time. This process is particularly critical in the Asia Pacific, where economic conditions and mobility patterns are rapidly evolving.

Key performance indicators (KPIs) and auditing

Effective evaluation requires the use of standardized **Key Performance Indicators (KPIs)**, such as crash rates, injury severity, helmet compliance, and average driver speed. In Australia, companies are legally obligated to report these indicators annually and are often audited by NRSPP-certified external bodies to ensure compliance with the Safe System approach.

Companies like **FedEx** and **UPS** implement quarterly reviews of their telematics data, identifying risk patterns and updating training modules to address observed behaviors. In Sweden, under the Vision Zero framework, authorities review reports from companies to adjust national awareness campaigns and infrastructure policies. For Nepal, the **Community Crash Recording System** serves as a vital tool for validating official reports and identifying deficiencies in existing police data collection methods.

Infrastructure safety and worksite surveillance

Continuous monitoring also extends to the physical work environment. The **Department of Roads (DOR) 2080 Guidelines** in Nepal mandate that project directors establish OHS units to monitor construction site safety daily. These units conduct health surveillance and manage the “Permit to Work” system for hazardous machinery. Regular road safety audits, as proposed in the NRSAP, are essential for identifying engineering defects—such as the high-risk horizontal curves—before they result in casualties.

11. Nuanced conclusions and strategic recommendations for Nepal

The integration of the Safe System approach and smart mobility within the Nepali workplace requires a multifaceted strategy that addresses infrastructure deficiencies, data fragmentation, and the unique challenges of the informal economy.

Strengthening the institutional and legal framework

To overcome the inactivity of existing bodies, Nepal should establish an empowered and autonomous **National Road Safety Council** under the chairmanship of the Minister of Physical Infrastructure. The long-pending **Road Safety Bill** must be promulgated to provide a robust legal framework for enforcing safety standards across both the formal and informal sectors. This law should include provisions for a dedicated **Road Safety Fund** that covers the medical treatment and rehabilitation of crash victims, ensuring that survival does not lead to financial ruin for the worker.

Bridging the formal-informal safety divide

The government must develop innovative “Platform Responsibility” regulations that standardize the safety initiatives already introduced by companies like Pathao. This includes mandating accident insurance for all gig workers and ensuring that digital algorithms do not create time-based incentives for risky behaviors like speeding. For the informal sector—such as owner-operator truck and bus drivers—community-based training networks and NGO-led programs like the AIP Foundation’s “Vulnerable Commuter” training should be scaled up to provide essential defensive driving skills.

Maximizing the leapfrog potential of smart mobility

Nepal's rapid EV adoption provides a unique opportunity to lead the region in clean and safe transport. The electrification of public transport fleets should be accelerated through concessional financing for heavy vehicles like buses and trucks. Furthermore, the ITS initiatives in Kathmandu must be integrated with the RA-IMS data to create a "Live Visualization" of road risk, allowing authorities to dispatch emergency services within the "Golden Hour" of a crash.

By adopting the principles of fallibility, vulnerability, and shared responsibility, and by leveraging the power of hydroelectric-powered mobility and digital monitoring, Nepal can transform its transport system. The goal of a 50% reduction in road fatalities by 2030 is ambitious, but it is achievable through a comprehensive, systemic approach that prioritizes human life over cost and speed. The investment required is significant, but the dividend in protected lives and economic stability is immeasurable.

Managing Road Network Information for Asset Management in Nepal

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1. Introduction

Road Asset Management is a systematic process for maintaining, upgrading, and operating road infrastructure assets such as pavements, bridges, traffic signs, signals, and safety barriers. Its main objective is to ensure good performance of these assets while minimizing their total cost over the entire service life.

An effective road asset management system depends on a well-structured and reliable information system. Such systems are usually developed using computer-based database management tools that store and organize comprehensive information about the road network. This includes data such as road length and width, structural features, road furniture, pavement condition, traffic volumes, construction and maintenance history, and relevant climatic information. In modern practice, these databases are often spatial (GIS-based), meaning that all data are linked to specific geographic locations and the physical layout of the road network.

The main component of a road database is the road network itself, which represents a set of locations connected by roads. In mathematical terms, this network can be represented as a graph, which is a simple way of showing how different points are connected.

In this representation, each location is called a node (or vertex), similar to a point on a map. The roads connecting these locations are called edges, which are lines between the nodes. These edges can also have values assigned to them, called weights, which represent factors such as distance, travel time, or cost.

The diagram below shows an example of a small road network represented by a graph.

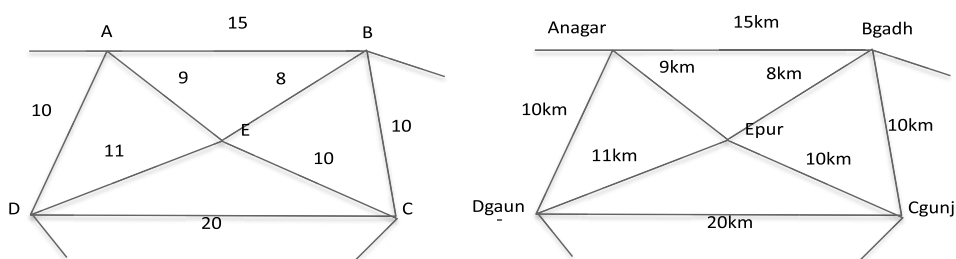


Figure 1:A Graph representing a Road Network

In a road network graph:

- Nodes represent towns or cities
- Edges represent roads
- Weights represent distance, travel time, or similar measures

In practice, information about the road network—such as its geometry, condition, traffic, and administrative details across a country—is stored in a relational database made up of interconnected tables. Together, these tables form a structured digital representation of the road network graph, which supports efficient storage, analysis, and decision-making in road asset management.

2. Road Database System of the DOR

At present, the Road Database of the Department of Roads is integrated with a computer system called the Annual Road Maintenance Plan. This system contains several data tables, and information about the road network is stored in a single table, similar to the one shown below.

Table 1: Existing Road Network Database Sample

S.N.	Road Class	Road_refno	Road name	Link Code	Link Name	link_from	Link_to	Link Length	Division	...
29	NH	NH01	East-West Highway	NH01-029	Pathlaiya-Chure	367.63	386.97	19.34	Hetauda	...
30	NH	NH01	East-West Highway	NH01-030	Chure-Ratmate	386.97	391.36	4.39	Hetauda	...
31	NH	NH01	East-West Highway	NH01-031	Ratmate-Hetauda	391.36	396.7	5.34	Hetauda	...

32	NH	NH01	East-West Highway	NH01-032	Hetauda-S. Khola	396.7	402.08	5.38	Hetauda	...
258	NH	NH09	Madan Bhandari Rajmarg	NH09-015	Pipal Madhi - Hetauda	367.57	421.84	54.27	Hetauda	...
259	NH	NH09	Madan Bhandari Rajmarg	NH09-016	Gaindakot - Damara Phant	421.84	497.82	75.98	Bharatpur	...
431	NH	NH37	Kanti Rajpath	NH37-001	Chaughada - Makawanpur Gadhi	0	11.31	11.31	Hetauda	...
463	NH	NH41	Tribhuvan Rajpath	NH41-003	Jitpur - Pathlaiya	18.47	25.36	6.89	Hetauda	...
464	NH	NH41	Tribhuvan Rajpath	NH41-004	Hetauda - Samari	25.36	28.67	3.31	Hetauda	...
...	...	...	...	...	...	...	...	...	...	...

In this system, the basic unit of the road network is called a “Link,” which represents a segment of a road, highway, or route. All information related to that link is stored in a single row.

3. Understanding the core problem

While the current database system appears adequate at first glance and has served well for several years, several problems have emerged when it is used for network analysis and planning—especially when integrating with advanced systems and performing complex queries.

Some of the key issues are outlined below:

- **Overlapping road sections**

In the example above, the road section between Pathlaiya and Hetauda belongs to two highways: the East–West Highway (NH001) and Tribhuvan Rajpath (NH041). In the existing database, to avoid duplication, the Tribhuvan Rajpath link between Pathlaiya and Hetauda is omitted.

This results in incorrect chainages—for example, Hetauda’s actual chainage along Tribhuvan Rajpath is 54.43 km, but the database shows only 25.36 km.

Similarly, overlapping sections cause incorrect road lengths. The actual length of

Tribhuvan Rajpath from Sirsiya to Tripureshwar is 186 km, but the database shows only 157 km.

- **Lack of route continuity**

A particular road or highway route consists of several links that are not continuously connected. This distorts its actual shape in visual geographical representation and other reporting documents. On the other hand, if one road is deleted to avoid duplication, the continuity of route chainage is lost, which is unacceptable for operational and maintenance purposes.

- **Misrepresentation of road alignments**

To avoid overlapping, some roads are incorrectly represented. For example, in the current system, Kanti Rajpath (NH037) starts 5 km east of Hetauda, whereas in reality it should start at Hetauda.

- **Duplicate node names for different locations**

Several junction points share the same name despite being physically different locations. For example, names such as Hetauda, Janakpur, Birgunj, Kathmandu, and Narayanghat are used for multiple nodes spread over large areas.

- **Lack of geographic coordinates for nodes**

There is no precise location information for nodes, creating confusion about where a link physically starts and ends.

- **Confusion in ownership during overlaps**

When national roads overlap with provincial or local roads, the database cannot clearly show which agency owns which pavement, leading to management and maintenance confusion.

These issues can be seen in the example of the East–West Highway (NH001), Madan Bhandari Highway (NH009), Kanti Rajpath (NH037), and Tribhuvan Rajpath (NH041), which share overlapping sections near Hetauda and Pathlaiya, as shown on the map. If each route is digitized separately with its own chainage, the shared portion is counted multiple times, resulting in an inflated total network

length.

In this example, the 29.07 km section between Pathlaiya and Hetauda is counted twice—once under NH001 (East–West Highway) and once under NH041 (Tribhuvan Rajpath). Similar overlaps occur between NH009 and NH037, and between NH001 and NH009.

- **Wrong value of distance along certain highways**

Based on the current database, is total length of Madan Bhandari Highway (i.e distance between its end points) NH009 only 1078.94 km? Or its actual length is far more than that?

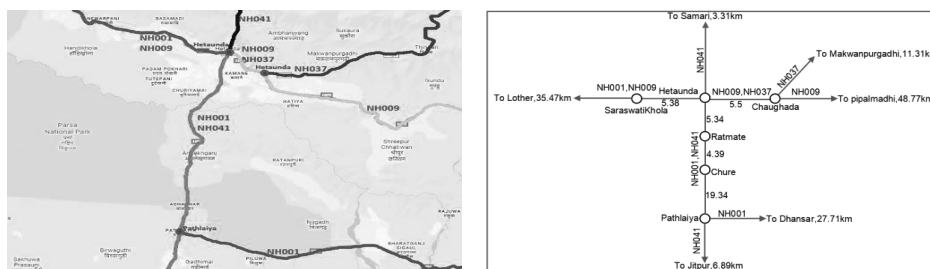


Figure 2: Sample Road Network

4. Resolving the problem

Recently, the Department of Roads (DoR) of Nepal has been improving its road information systems to support better planning, maintenance, and asset management.

The issues discussed above can be addressed through a **Road network database design** based on a **physical network model**, with references the road links from a **logical network model**. This approach can be applied to prepare a reliable road inventory within Nepal's **Road Asset Management System** framework.

The core idea of this system is that information about the physical road network is stored in two main tables: one for nodes (junctions and endpoints) and another for physical road segments (the segments are like links but we are using this word not to get confused with the concept of links as in the existing database). A third table then provides logical references linking these two tables.

In practice, the first two tables are used most frequently for data entry and updates, such as during the preparation of the **Annual Road Maintenance Plan**. The third table is mainly used to extract, analyze, and report information from the physical network without altering the underlying data.

Table 2: Physical Network vs. Logical Routes

Physical Network	Logical Routes
Represents the real pavement on the ground	Represents road names/numbers used administratively
Stored as unique segments and nodes	Stored as references over physical segments
No duplication	Can share the same segment (concurrency)

5. Physical Network Model

The physical network model consists of a system of nodes and segments. The entire road system is broken into small unique segments between nodes that have unique ID and location information. This layer represents what exists physically. Every metre of pavement appears only once in the database, regardless of how many routes pass over it.

Each segment has:

- Segment ID
- From-Node and To-Node
- True length
- Geometry

Table 3: Nodes Example

Node ID	PlaceName	Longitude	Latitude
1234	Pathlaiya	84.980744°	27.199230°
2345	Chure	84.997763°	27.357683°
3456	Ratmate	85.024213°	27.386030°
4567	Hetaunda	85.033595°	27.430890°

5678	Saraswatikhola	84.983339°	27.447384°
7890	Chaughada	85.073052°	27.404962°

Table 4: Segments Example

SegmentId	From Node	ToNode	Segment Name	Segment Length,km	Division/Authority	District	IRI	...
9876	Pathlaiya	Chure	Pathlaiya-Chure	19.340	Hetauda	Bara		
8765	Chure	Ratmate	Chure-Ratmate	4.390	Hetauda	Makwanpur		
7654	Ratmate	Hetaunda	Ratmate-Hetaunda	5.340	Hetauda	Makwanpur		
6543	Hetaunda	Saraswatikhola	Hetaunda-Saraswatikhola	5.380	Hetauda	Makwanpur		
5432	Hetaunda	Chaughada	Hetaunda-Chaughada	5.500	Hetauda	Makwanpur		

These tables represents what exists physically. Every metre of pavement appears only once in the database, regardless of how many routes pass over it.

Every year or any other time of updating the road database it is the segment table that is updated and not the route table.

5. Route Definition Using Referencing

Routes or Roads such as NH001, NH009, NH037 or NH041 are not stored as independent polylines. Instead, a route is defined as an ordered list of physical segments with measures.

Table 5:Routes Example

Road_refno	Road name	Link Code	Segment Name	From Chainage	To Chainage	Link Length	Division /Authority	District	IRI	...
NH001	East-West Highway	NH001-029	Pathlaiya-Chure	367.630	386.970	19.340	Hetauda	Bara	0	0
NH001	East-West Highway	NH001-030	Chure-Ratmate	386.970	391.360	4.390	Hetauda	Makwanpur	0	0
NH001	East-West Highway	NH001-031	Ratmate-Hetaunda	391.360	396.700	5.340	Hetauda	Makwanpur	0	0
NH001	East-West Highway	NH001-032	Hetaunda-Saraswatikhola	396.700	402.080	5.380	Hetauda	Makwanpur	0	0
NH009	M.Bhandari Highway	NH009-015	Chaughada-Hetaunda	416.340	421.840	5.500	Hetauda	Makwanpur	0	0
NH037	KantiRajpath	NH037-001	Hetaunda-Chaughada	0	5.500	5.500	Hetauda	Makwanpur	0	0
NH041	Tribhuwan Rajpath	NH041-004	Pathlaiya-Chure	25.36	44.700	19.340	Hetauda	Bara	0	0

NH041	Tribhuwan Rajpath	NH041-005	Chure-Ratmate	44.7	49.090	4.390	Hetauda	Makwanpur	0	0
NH041	Tribhuwan Rajpath	NH041-006	Ratmate-Hetaunda	49.09	54.430	5.340	Hetauda	Makwanpur	0	0

Here, several routes use the same physical segments, but their chainages differ. The pavement exists only once, yet route continuity is fully preserved.

6. How Chainage Works

Chainage is no longer stored as a permanent geometry attribute. Instead, it is derived dynamically from the route-segment mapping table. It is calculated as cumulative measures along referenced physical segments. Thus, chainage remains continuous for each route, even when overlapping with other routes.

7. Asset and Event Management

Assets and events (pavement condition, traffic volume, accidents, bridges, culverts, etc.) are stored against each segments using from-km and to-km values and extracted into routes table as required. The appearance of the table is almost similar to the one in current database with some small modifications. See tables 4 and 5.

8. Correct Calculation of Network Length

Two different metrics must be distinguished:

Metric Meaning

- Total Physical Network Length-Sum of all unique physical segments
- Total Route Length-Sum of all route chainages

The first gives the true national road length. The second is used only for route-based reporting. This distinction eliminates the long-standing confusion in Nepal about “why total length of the network keeps increasing without building new roads”.

9. Benefits for Nepal

Implementing this model will:

- Eliminate false inflation of road length.
- Provide a strong backbone for RAMS, HDM-4, and PMS.

- Ensure consistency of pavement and asset records.
- Support future ITS and navigation systems.
- Allow transparent ownership of overlapping roads.

10. Conclusion

Overlapping road sections are not a defect of Nepal's network — they are a natural outcome of historical development. The real problem lies in how the database is designed.

By adopting this improved database System with physical network segmentation and route referencing, the Department of Roads can build a modern, internationally compatible road information system that is accurate, scalable and future-proof.

This approach does not require expensive software; it requires only a change in thinking — from “roads as lines” to “roads as routes over a physical network”.

Final thoughts from this system are:

- Assets belong to segments.
- Routes are just collection of references to segments.
- Chainage is derived — not stored.

It is time for Nepal's road database to make this conceptual leap.

दिगो विकासका लागी विपद् उत्थानशील पूर्वाधार: कसरी सुनिश्चित गर्ने?

- निशान राज गौतम
प्रमुख जिल्ला अधिकारी,
रुकुम पश्चिम



पृष्ठभूमी:

सुरक्षित र दिगो पूर्वाधार मुलुकको आर्थिक गतिशीलता र सामाजिक विकासका महत्वपूर्ण आधारस्तम्भ हुन्। पूर्वाधारलाई केवल भौतिक संरचना मात्रै नभई अर्थतन्त्रको मेरुदण्डका रूपमा समेत लिने गरिन्छ। यसले मुलुकको उत्पादन र उत्पादकत्वमा अभिवृद्धि गर्न सहयोग गर्नुका साथै उत्पादन र ढुवानी लागत घटाई प्रतिस्पर्धात्मक क्षमता बढाउन र बजार पहुँच विस्तार गरेर आर्थिक वृद्धिमा महत्वपूर्ण भूमिका खेल्छ। सुरक्षित सडक/पुल, स्वच्छ खानेपानी तथा सरसफाइ, ऊर्जा, यातायात तथा दूरसञ्चार सेवाको गुणस्तर र पहुँचको अवस्थाले नागरिकको जीवनस्तर अभिवृद्धिमा प्रत्यक्ष एवं अप्रत्यक्ष योगदान पुर्याएको हुन्छ। साथै रोजगार र स्वरोजगारका अवसरमा समेत सकारात्मक प्रभाव पारेको हुन्छ।

पछिल्लो समयमा जलवायु परिवर्तन र बढ्दो प्राकृतिक विपद्का कारण पूर्वाधार संरचनामाथि अभूतपूर्व दबाव सिर्जना भएको छ। भुकम्प, बाढी, पहिरो, आँधी र चरम मौसमी घटनाका कारण पूर्वाधार सेवा अवरुद्ध हुँदा विकासको गति नै ठप्प हुने अवस्था देखिएको छ। विभिन्न क्षेत्र र भूभागअनुसार प्राकृतिक जोखिमले १० देखि ७० प्रतिशतसम्म पूर्वाधारमा क्षति पुर्याउने गरेको देखिन्छ। धेरैजसो अवस्थामा पूर्वाधारका भौतिक संरचनामा ठूलो क्षति नहुँदा पनि सेवा प्रवाह अवरुद्ध हुन्छ। सेवा अवरोधबाट हुने आर्थिक नोक्सानी प्रायः प्रत्यक्ष भौतिक क्षतिभन्दा पनि धेरै हुने गर्दछ। विश्व बैंकको एक प्रतिवेदनका अनुसार प्रत्येक वर्ष प्राकृतिक विपद्का कारण ऊर्जा र यातायात क्षेत्रमा मात्रै करिब १८ अर्ब डलरको प्रत्यक्ष नोक्सानी हुन्छ भने क्षतिग्रस्त पूर्वाधारका कारण आवागमन लगायतका क्रियाकलाप अवरुद्ध हुदाँ घरपरिवार र व्यवसायमा करिब ३९० अर्ब डलरसम्म अप्रत्यक्ष नोक्सानी हुने गर्दछ। निम्न तथा मध्यम आय भएका देशहरूमा पूर्वाधार अवरोधका कारण व्यवसाय क्षेत्रले वार्षिक ३०० अर्ब अमेरिकी डलरभन्दा बढी क्षति व्यहोर्ने गरेको प्रतिवेदनमा उल्लेख छ। न्यून तथा मध्यम आय भएका देशहरूमा वार्षिक करिब १ ट्रिलियन अमेरिकी डलर पूर्वाधारमा लगानी हुने भए पनि गुणस्तर

सन्तोषजनक छैन। मर्मतसम्भार राम्रो नहुने, बजेट पर्याप्त नहुने, कमजोर शासकीय प्रबन्ध एवं भ्रष्टाचारका कारण धेरै पूर्वाधारहरू कमजोर अवस्थामा रहेका छन्। कमजोर र अपर्याप्त पूर्वाधारका कारण लाखौं मानिसहरूले ठूलो आर्थिक र सामाजिक लागत व्यहोर्न बाध्य छन्। पूर्वाधार सेवामा आउने अवरोधले नागरिकको जीवनयापन र व्यवसायिक क्रियाकलापमा प्रत्यक्ष र अप्रत्यक्ष दुवै रूपमा असर गर्छ। विद्युत्, पानी, यातायात तथा सञ्चार सेवा अवरुद्ध हुँदा उत्पादकत्व घट्ने, सेवा ढिला हुने, लागत बढ्ने र दीर्घकालीन रूपमा आर्थिक वृद्धि सुस्त हुने गर्दछ। नेपालजस्ता विपद् संवेदनशील मुलुकहरूमा पूर्वाधारहरूको अवरोध र यसको असर अझ बढी गम्भिर हुने गर्छ। अवरुद्ध पूर्वाधारका कारण उत्पादन क्षमताको पूर्ण उपयोग हुन नसक्ने, बिक्री घट्ने, आपूर्ति श्रृंखलामा असर पुग्ने र वैकल्पिक उपाय (जस्तै जेनेरेटर, पानी भण्डारण, वैकल्पिक यातायात) मा अतिरिक्त खर्च गर्नुपर्ने अवस्था सिर्जना हुन्छ। अप्रत्यक्ष रूपमा यस्ता अवरोधहरूले लगानी घटाउने, प्रतिस्पर्धा र नवप्रवर्तन कमजोर बनाउने, श्रम—प्रधान उत्पादनतर्फ झुकाव बढाउने र प्रतिस्पर्धा क्षमतालाई घटाउने काम गर्छन्। पूर्वाधार सेवामा अवरोधका कारण घरधुरी (Households) ले पनि ठूलो क्षति व्यहोर्नुपर्ने हुन्छ। विद्युत् अवरोधले आम्दानी घटाउने, बालबालिकाको शैक्षिक उपलब्धि कमजोर बनाउने र महिलाको श्रम बजार सहभागिता घटाउने गर्दछ। पानी आपूर्तिमा समस्या हुँदा हैजा लगायतका पानीजन्य रोगको जोखिम बढ्छ। यातायात अवरोधले यात्रा समय र भीड बढाउनुका साथै स्वास्थ्य सेवामा पहुँच सीमित बनाउँछ भने दूरसञ्चार अवरोधले आपतकालीन प्रतिकार्य र आर्थिक गतिविधिमा गम्भीर असर पार्छ।

उत्थानशील पूर्वाधार भन्ने बित्तिकै विपद्जन्य घटनाको समय एवं आपतकालीन अवस्था र त्यसपछि पनि विना अवरोध निरन्तर समुदायको सुरक्षा, स्वास्थ्य, शिक्षा, पहुँच र जीविकोपार्जन सुनिश्चित गर्न सक्ने सक्षम एवं व्यवस्थित प्रणाली भन्ने बुझिन्छ। मुलुकको समृद्धिका लागि गुणस्तरीय र उत्थानशील पूर्वाधार विकास अपरिहार्य आधार हो। पूर्वाधार उत्थानशीलता भन्ने बित्तिकै बाढी, पहिरो, भूकम्प, आँधीबेहरी जस्ता विपत्तिपछि पनि पूर्वाधार र सेवाले काम जारी राख्ने क्षमता हो। विश्व बैंकको “Lifelines: The Resilient Infrastructure Opportunity” नामक प्रतिवेदनले उत्थानशील पूर्वाधारलाई केवल भवन वा सडकको विषय मात्रै नभई मानिसको शिक्षा, चेतना, स्वास्थ्य र जीविकोपार्जनसँग जोडिएको जीवनरेखा (lifeline) को रूपमा व्याख्या गरेको छ। न्यून तथा मध्यम आय भएका मुलुकहरूले उत्थानशील पूर्वाधार (Resilient Infrastructure) मा लगानी गर्दा ठूलो आर्थिक तथा सामाजिक लाभ प्राप्त गर्न सक्ने तथ्य प्रतिवेदनले उल्लेख गरेको छ। कुल पूर्वाधार लगानी आवश्यकतामा उत्थानशीलपनका लागि थप लागत करिब ३ प्रतिशत मात्र हुने देखिन्छ। उत्थानशील पूर्वाधारमा गरिएको १ डलरको लगानीबाट करिब ४ डलर बराबरको प्रतिफल प्राप्त हुने अनुमान गरिएको छ। बंगलादेश, भारत र पाकिस्तानमा विद्युत् सेवा विश्वसनीय हुँदा प्रतिव्यक्ति आय बढेको एवं महिलाको रोजगारी र

अध्ययन समय वृद्धि भएको देखिन्छ। भारतमा निरन्तरको विद्युत् पहुँचले महिलाको रोजगारी १२ प्रतिशतदेखि ३१ प्रतिशतसम्म बढाएको तथ्य उल्लेख छ। त्यसैले उत्थानशील पूर्वाधारमा लगानी गर्नु लागत—प्रभावकारी र दिगो विकासको आधार हो। उत्थानशील पूर्वाधार निर्माण भनेको केवल विपद् जोखिम न्यूनीकरणको उपाय मात्र होइन, अझ उत्पादक, समावेशी, किफायती र दिगो समाज निर्माण गर्ने दीर्घकालीन रणनीति हो। नीति, संस्था, प्रोत्साहन, निर्णय प्रक्रिया र वित्तीय व्यवस्थालाई एकीकृत रूपमा सुधार गर्दै योजना तथा डिजाइनका प्रारम्भिक चरणमै उत्थानशीलपनमा लगानी गर्नु विशेषगरी नेपालजस्ता विकासशील देशहरूका लागि सबैभन्दा प्रभावकारी र दूरदर्शी उपाय हो।

पछिल्लो दशकमा भएका विभिन्न अन्तर्राष्ट्रिय सम्झौताहरूले उत्थानशीलतालाई विकासको महत्वपूर्ण आयामका रूपमा स्थापित गरेका छन्। यी सम्झौताहरूले विपद् जोखिम न्यूनीकरण, जलवायु परिवर्तन अनुकूलन र दिगो विकासबीचको गहिरो सम्बन्धलाई औल्याएका छन्। सुरक्षित, समावेशी र दिगो भविष्य निर्माणमा उत्थानशील पूर्वाधार अपरिहार्य रहेको विषयमा जोड दिईएको छ। विपद् जोखिम न्यूनीकरणको लागी सेण्डाई कार्यढाचाँ, संयुक्त राष्ट्रसंघीय जलवायु परिवर्तन सम्बन्धी महासन्धि (UNFCCC) अन्तर्गतको पेरिस सम्झौता तथा दिगो विकास लक्ष्यले उत्थानशील पूर्वाधारको अपरिहार्यतामा जोड दिएका छन्।

नेपाल बहुजोखिमयुक्त देश भएकोले हरेक वर्ष प्राकृतिक र जलवायु—प्रेरित घटनाले मानव जीवन र सम्पत्तिमा क्षति पुर्याएको हुन्छ। २०७२ साल वैशाख १२ गतेको विनाशकारी भूकम्पका कारण ठुलो मानवीय तथा भौतिक क्षति भयो। भूकम्पमा परी ९,१२४ जनाको मृत्यु, १९५ जना बेपत्ता र २२,७४३ जना घाइते भए। साथै ७,९९,७९८ वटा घर पूर्ण रूपमा र ३,३८,११० वटा घर आंशिक रूपमा क्षति भएका थिए। यसबाहेक विद्यालय, स्वास्थ्य संस्था, पुल, सडक र अन्य पूर्वाधारहरूमा व्यापक क्षति भयो। यसबाट सामाजिक, आर्थिक र पूर्वाधार क्षेत्रमा करिब ७ खर्ब बराबर हानीनोक्सानी भएको थियो। निजी घर, शिक्षा, स्वास्थ्य एवं सांस्कृतिक सम्पदामा क्षति पुग्दा मानिसहरूको बसोबास र जीवनयापनमा नै प्रत्यक्ष असर पुग्न गयो। स्वास्थ्य पूर्वाधारमा भएको क्षतिले प्राथमिक स्वास्थ्य सेवा प्रभावित भयो भने विद्यालयहरूमा भएको क्षतिका कारण विद्यार्थीहरूको पढाई प्रभावित हुन पुग्यो। भूकम्पका कारण कृषि, उद्योग, व्यापार, पर्यटन र वित्तीय क्षेत्र प्रभावित भए। कृषि क्षेत्रको हानीनोक्सानीले किसानहरूको आय र कृषि उत्पादन प्रभावित भयो। उद्योगहरू बन्द हुदाँ उत्पादन र रोजगारीमा असर पर्यो भने पर्यटन क्षेत्र प्रभावित हुदाँ विदेशी मुद्रा र रोजगारीमा गम्भीर असर पुग्यो। वित्तीय क्षेत्रमा परेको असरले लगानी र बैंकिङ प्रणाली नै प्रभावित भयो। भूकम्पले सांस्कृतिक सम्पदा एवं ऐतिहासिक मठ—मन्दिर लगायतका संरचनाहरू पनि नष्ट भए। जाजरकोटलाई केन्द्र बनाएर २०८० कार्तिक १७ गते गएको भूकम्पबाट पनि धेरै जनधनको क्षति भयो।

वि.सं. २०८१ असोज १०-१३ गतेसम्म परेको भारी तथा अति भारी वर्षाका कारण उत्पन्न बाढी र पहिरोमा परी २४९ जनाको मृत्यु भयो भने १८ जना बेपत्ता भए। पक्की, बेलिब्रिज र झोलुङ्गे गरी डेढ दर्जनभन्दा बढी पुल बगे। सडक सञ्जालका धेरै खण्ड भासिए, बगे वा पहिरोले पूर्ण रूपमा थुनिए। देशभर यातायात नराम्रोसँग प्रभावित भयो। राजधानीमा दैनिक उपभोग्य वस्तुको अभाव हुने स्थिति बन्यो। राष्ट्रिय विपद् जोखिम न्यूनीकरण तथा व्यवस्थापन प्राधिकरणको प्रारम्भिक अध्ययनअनुसार विपद्का कारण निजी घर, शिक्षण संस्था, स्वास्थ्य केन्द्र, कृषि तथा सडक,पुललगायतका पूर्वाधारका क्षेत्रमा ४६ अर्ब ६८ करोड रुपैयाँभन्दा बढीको क्षति भएको थियो।

राष्ट्रिय आपतकालीन कार्यसञ्चालन केन्द्रले drportal.gov.np मा अद्यावधिक गरेको तथ्याङ्क अनुसार पछिल्लो १० वर्षको अवधि (२०७२ बैशाख १ गतेदेखि २०८१ चैत्र ३१ गतेसम्म) मा विपद्का ४२,८७२ वटा घटना भएका छन्। ती घटनाबाट १४,०४२ को मृत्यु, ६९० जना बेपत्ता, ३६,९९१ जना घाइते भएका छन्। विपद्जन्य घटनाबाट ८,२४,६८१ घरहरू पूर्ण रूपमा क्षतिग्रस्त भएका छन् भने ३,७९,३०५ घरमा आंशिक क्षति पुगेको छ। यस अवधिमा बाढी,पहिरो, भूकम्प, आगलागी, वन डढेलो, चट्याङ, हावाहुरी र जनावर आक्रमणजस्ता विपदले जनधन,पूर्वाधार, कृषि, पशुपालन र जीविकोपार्जनमा अरबौंको क्षति पुगेको छ। सन् २०२३ मा विश्वभरी करिब ४०० प्राकृतिक जोखिम घटनाहरूका कारण ८७ हजार मानिसको मृत्यु र करिब २०२.७ अर्ब अमेरिकी डलर बराबरको आर्थिक क्षति भएको छ। यी तथ्यले विद्यमान पूर्वाधार र बस्तीहरू पर्याप्त रूपमा उत्थानशील नभएकोले दिगो भविष्यका लागि सुरक्षित र उत्थानशील पूर्वाधार (Resilient Infrastructure) लाई विकासको केन्द्रमा राख्न अपरिहार्य छ।

उत्थानशील पूर्वाधारको सैद्धान्तिक पक्ष:

समाज र अर्थतन्त्रलाई गतिशिल बनाउने महत्वपूर्ण आधार पूर्वाधार हुन्। सडक, पुल, विद्युत्, सञ्चार, खानेपानी, ढल निकास, स्वास्थ्य तथा शैक्षिक पूर्वाधारहरूको विकास विना मुलुकको समृद्धि सम्भव छैन। तर जलवायु परिवर्तन, प्राकृतिक विपद्, जनसंख्या वृद्धि तथा तीव्र सहरीकरणका कारण पूर्वाधारहरूको दिगोपनामा गम्भिर चुनौतीहरू थपिँदै गएका छन्। यसैलाई मध्येनजर गरी पछिल्लो समय उत्थानशील पूर्वाधारको अवधारणा विकास भएको छ। संयुक्त राष्ट्रसंघीय विपद् जोखिम न्यूनीकरण कार्यालयले उत्थानशील पूर्वाधार विकासका लागि केही आधारभूत सिद्धान्तहरू अघि सारेको छ। ती सिद्धान्तहरूले पूर्वाधारलाई केवल स्थिर भौतिक संरचना नभई समयसँगै सिक्ने, सुधारिने र परिस्थितिअनुसार परिवर्तन हुन सक्ने “जीवन्त प्रणाली” का रूपमा व्याख्या गरेका छन्। उत्थानशील पूर्वाधारको पहिलो सिद्धान्त “निरन्तर

सिकाइ” (Continuous Improvement) हो। यस सिद्धान्तअनुसार विगतका अनुभव, समस्या र विपद्बाट पाठ सिकेर भविष्यमा पूर्वाधार प्रणालीलाई अझ प्रभावकारी ढंगबाट सञ्चालन हुन सक्ने गरी क्षमता विकास गर्नुपर्छ। यसको अर्थ, कुनै संरचना निर्माण भएपछि त्यसलाई स्थिर र अपरिवर्तनीय रूपमा नहेरी निरन्तर सुधार गर्दै लैजानुपर्छ। आधुनिक प्रविधि, तथ्याङ्क र अनुसन्धानको प्रयोग गरेर पूर्वाधारका सम्भावित जोखिमको पहिचान गर्न सकिन्छ। उदाहरणका लागि, कुनै सडक खण्डमा बारम्बार पहिरो जाने समस्या देखिएमा केवल सडक मर्मत गरेर समस्या समाधान हुँदैन। त्यहाँको भू-संरचना, पानीको बहाव, वर्षा तथा जमिनको हलचल जस्ता पक्षहरू अध्ययन गरी प्रविधिको प्रयोगबाट निगरानी प्रणाली स्थापना गर्न सकिन्छ। यसरी जोखिमको पहिचान गरी पूर्वतयारी गरेमा भविष्यमा हुने क्षति कम गर्न सकिन्छ। यसले पूर्वाधार प्रणालीलाई “स्मार्ट” र प्रभावकारी बनाउँछ। उत्थानशील पूर्वाधारको दोस्रो महत्वपूर्ण सिद्धान्त “सक्रिय सुरक्षा” (Proactively Protected) हो। यस सिद्धान्तले समस्या आएपछि मात्र समाधान खोज्ने परम्परागत सोचभन्दा अगाडि बढेर समस्या आउन नदिन वा सम्भावित क्षति कम गर्न अग्रिम तयारी गर्नुपर्ने कुरामा जोड दिन्छ। यस अवधारणामा “सेफ—टु—फेल” भन्ने सोच पनि समावेश हुन्छ। यसको अर्थ यदि कुनै प्रणाली असफल भइहाल्यो भने पनि त्यसले ठूलो क्षति वा मानवीय संकट सिर्जना नगर्ने गरी डिजाइन गरिनुपर्छ। उदाहरणका लागि बाढी प्रभावित क्षेत्रमा घर तथा सार्वजनिक संरचना निर्माण गर्दा तिनीहरूलाई अग्लो पिलरमा बनाउने, सुरक्षित निकास मार्ग राख्ने वा पानीको बहावलाई सहज बनाउने व्यवस्था गरिन्छ। यसरी पूर्वतयारीका उपाय अपनाउँदा पूर्वाधारको बलियोपना बढ्छ र विपद्को समयमा हुने सम्भावित क्षति न्यून हुन्छ। यसले समाजलाई सुरक्षित मात्र बनाउँदैन, दीर्घकालीन रूपमा आर्थिक तथा सामाजिक स्थायित्वमा पनि महत्वपूर्ण योगदान पुर्याउँछ।

उत्थानशील पूर्वाधारका सिद्धान्तहरूमा तेस्रो महत्वपूर्ण पक्ष “वातावरणसँग एकीकृत” (Environmentally Integrated) हुनु हो। यस सिद्धान्तले पूर्वाधार निर्माण गर्दा वातावरण संरक्षणमा जोड दिदै प्रकृतिसँग सहकार्य गर्ने दृष्टिकोणमा जोड दिन्छ। आधुनिक विकास प्रक्रियामा अत्यधिक कङ्क्रिट र सिमेन्टको प्रयोगले प्राकृतिक प्रणालीमा असर पारेको देखिन्छ। त्यसैले अहिले “हरियो—निलो पूर्वाधार” (Green—Blue Infrastructure) को अवधारणा लोकप्रिय बन्दै गएको छ। यस अवधारणाअनुसार रुख, पार्क, पोखरी, जलाशय तथा प्राकृतिक ढल प्रणालीलाई पूर्वाधारसँग जोडेर विकास गर्नुपर्छ। उदाहरणका लागि सहरमा बाढी नियन्त्रण गर्न केवल ठूलो कङ्क्रिट नाला निर्माण गर्नु पर्याप्त हुँदैन। त्यसको सट्टा वर्षाको पानी सोस्ने पार्क, खुला हरियाली क्षेत्र तथा पानी जम्न सक्ने प्राकृतिक संरचनाहरू बनाइएमा पानीको व्यवस्थापन अझ प्रभावकारी हुन्छ। यस्तो प्रणालीलाई कहिलेकाहीँ “स्पन्ज सिटी” पनि भनिन्छ, जसले वर्षाको पानीलाई सोस्ने, संचित गर्ने र आवश्यक परे पुनः प्रयोग गर्ने क्षमता राख्छ। यसले

वातावरणीय सन्तुलन कायम राख्नुका साथै दीर्घकालीन रूपमा मर्मत खर्च पनि घटाउँछ। उत्थानशील पूर्वाधारको अर्को महत्वपूर्ण सिद्धान्त “सामाजिक रूपमा संलग्न” (Socially Engaged) हुनु हो। पूर्वाधारको मुख्य उद्देश्य मानिसहरूको जीवन सहज र सुरक्षित बनाउनु हो, त्यसैले यसको योजना, निर्माण र व्यवस्थापनमा समुदायको सक्रिय सहभागिता आवश्यक हुन्छ। जब स्थानीय समुदायलाई पूर्वाधार विकास प्रक्रियामा सहभागी गराइन्छ, उनीहरूमा त्यसप्रति अपनत्वको भावना विकसित हुन्छ। यसले संरचनाको दीर्घकालीन संरक्षण र प्रभावकारी सञ्चालनमा सहयोग पुर्याउँछ। उदाहरणका लागि गाउँमा सञ्चालन हुने खानेपानी आयोजनाहरूमा उपभोक्ता समितिको गठन गरी स्थानीय बासिन्दालाई व्यवस्थापनको जिम्मेवारी दिइन्छ। यदि उनीहरूलाई आवश्यक तालिम र जानकारी प्रदान गरियो भने पाइप फुट्दा वा साना समस्या देखिँदा तत्कालै समाधान गर्न सक्छन्। यसरी समुदायलाई सशक्त बनाउँदा सरकारी निकायमा मात्र निर्भर रहनुपर्ने अवस्था कम हुन्छ। त्यस्तै “साझा जिम्मेवारी” (Shared Responsibility) को सिद्धान्तले विभिन्न संस्थाहरूबीच समन्वय र सहकार्यलाई महत्व दिन्छ। पूर्वाधारसँग सम्बन्धित सडक, विद्युत्, टेलिकम, खानेपानी तथा ढल व्यवस्थापन जस्ता निकायहरूले समन्वय र सहकार्यका आधारमा काम गर्नुपर्छ। अन्तिम सिद्धान्त “अनुकूलनशील रूपान्तरण” (Adaptively Transforming) हो। भविष्य अनिश्चित भएकाले पूर्वाधारलाई समयअनुसार परिवर्तन गर्न सकिने लचकता हुनुपर्छ। जलवायु परिवर्तन, जनसंख्या वृद्धि वा प्रविधिगत परिवर्तनका कारण आवश्यकता बदलिन सक्छ। त्यसैले पूर्वाधार डिजाइन गर्दा भविष्यमा विस्तार वा परिमार्जन गर्न मिल्ने संरचना बनाउनु बुद्धिमानी हुन्छ। उदाहरणका लागि पुल, सडक वा भवनहरूलाई “मोड्युलर डिजाइन” मा निर्माण गरिएमा भविष्यमा ट्राफिक वृद्धि वा नदीको सतह परिवर्तन हुँदा सजिलै उचाइ वा चौडाइ थप्न सकिन्छ। यसरी लचकदार र अनुकूलनशील पूर्वाधार निर्माण गर्दा दीर्घकालीन रूपमा विकास दिगो, सुरक्षित र प्रभावकारी बन्न सक्छ।

फरक प्रसङ्गमा Hallegatte et al. ले पूर्वाधार उत्थानशीलतालाई तीन तहमा व्याख्या गरेका छन्। पहिलो तहमा भौतिक सम्पत्तिको उत्थानशीलता (Physical Asset Resilience) पर्दछ। विपद् जोखिमको समाना गर्न सक्ने, बलियो र गुणस्तरीय पूर्वाधार निर्माण उत्थानशीलताको पहिलो शर्त हो। सडक, पुल, विद्युत लाइन आदि निर्माण गर्दा बलियो र गुणस्तरीय भएमा जस्तोसुकै जोखिमको सामना गर्न सक्ने, धेरै नबिग्रने र मर्मत/पुनर्निर्माणमा समेत कम खर्च लाग्ने हुन्छ। अर्को तहमा सेवा प्रणालीको उत्थानशीलता (Service System Resilience) हो। विपद्जन्य अवस्थामा कुनै एउटा पूर्वाधारको संरचना बलियो भएर मात्रै पुग्दैन, पूर्वाधारसँग जोडिएका सम्पूर्ण अवयव एवं सञ्जालहरू (network) ले आपत्कालीन अवस्थामा पनि सेवा प्रवाहलाई निरन्तरता दिन सक्ने क्षमता राख्नुपर्छ। उदाहरणको रूपमा यदि बाढीका कारण मुख्य पुल बन्द भयो भने वैकल्पिक सडक मार्गको उपलब्धता, ट्राफिक डाइभर्सनको योजना र आपतकालीन

मर्मत टोलीको तुरुन्तै सक्रियताले यातायात पूर्ण रूपमा ठप्प हुँदैन, केवल मार्ग परिवर्तन हुन्छ। यसले पुलमा भएको अवरोधका कारण अन्य क्षेत्रमा प्रभाव (Cascading effect) विस्तार हुन दिदैन। पूर्वाधार उत्थानशीलताको तेस्रो तहमा पूर्वाधार प्रयोगकर्ता अर्थात नागरिकको उत्थानशीलता (User Resilience) हो। यसले पूर्वाधार सेवा प्रयोग गर्ने व्यक्ति, घरधुरी, व्यवसाय र आपूर्ति शृंखलाले सेवा अवरुद्ध हुँदा पनि वैकल्पिक उपाय अपनाएर जीवन र काम निरन्तरता दिन सक्ने क्षमता जनाउँछ। उदाहरणको लागि बाढीका कारण तीन(३) दिन बिजुली गयो भने घरमा सोलार प्यानल वा इनभर्टर छ, सुरक्षित खानेपानी भण्डारण गरिएको छ र आवश्यक खाद्यान्न सञ्चित छ भने परिवारको दैनिक जीवन पूर्ण रूपमा प्रभावित हुँदैन। यदि भूकम्पपछि मुख्य सडक बन्द भयो भने व्यवसायले अनलाइन बिक्री प्रणाली प्रयोग गर्छ, गोदाममा पर्याप्त स्टक राखिएको छ र वैकल्पिक आपूर्ति स्रोत छ भने व्यवसाय पूर्ण रूपमा बन्द हुँदैन र आर्थिक क्षति कम हुन्छ। त्यसैले पूर्वाधार उत्थानशीलतालाई केवल पूर्वाधार संरचनाको उत्थानशीलताको रूपमा मात्रै नबुझी पूर्वाधारसंग जोडिएका समग्र प्रणाली र पूर्वाधार अवरुद्ध हुदाँ पनि वैकल्पिक रूपमा सेवा लिन सक्ने नागरिकको क्षमताको बृहत आयामबाट बुझ्नुपर्ने हुन्छ।

विपद्—उत्थानशील पूर्वाधार सुनिश्चितताका उपायहरू:

विश्वमै धेरै जलवायुजन्य जोखिम सामना गर्ने मुलुकमध्ये नेपाल पनि हो। नेपालमा भूपरिवेष्टित अवस्थिति, जटिल भू-बनावट तथा दुर्गम भौगोलिक संरचना पूर्वाधार विकासका प्रमुख चुनौतीका रूपमा रहेका छन्। भिरालो भुवनोट, दुर्गमता एवं संवेदनशील पारिस्थितिकीय प्रणालीका कारण विशेषगरी हिमाली र पहाडी क्षेत्रमा बाढीपहिरो, हिमपहिरो, तथा हिमताल विस्फोट (GLOF) जस्ता विपद्को प्रभाव अत्याधिक हुन्छ। यी जोखिमले स्थानीय समुदायमात्र होइन, तल्लो तटीय क्षेत्रसम्म सडक, खानेपानी, सिंचाई, ऊर्जा, पर्यटन, कृषि, सञ्चारलगायतका पूर्वाधारमा क्षति पुर्याउँछ। यसले यातायात आवागमन एवं विद्युत आपूर्ति अवरुद्ध हुने, खानेपानीको हाहाकार हुने, खेतीयोग्य जमिनसम्म सिंचित गर्न पुग्ने जलप्रवाह अवरोध हुने, संचारसम्पर्क विच्छेद हुने, उद्योगधन्दा तथा व्यापारव्यवसायमा असर पुग्ने अवस्था सृजना हुन्छ। फलस्वरूप उत्पादन, रोजगारी तथा अवसर गुम्न गई घरपरिवार, व्यवसायिक क्षेत्र तथा राष्ट्रिय अर्थतन्त्र नै गम्भिर रूपमा प्रभावित हुन्छ।

पूर्वाधार आर्थिक र सामाजिक मेरुदण्ड मात्र नभई जीवनरेखा (lifeline) समेत भएकाले विपद्का बेला पनि सञ्चालनमा रहन सक्ने संरचना आवश्यक हुन्छ। पूर्वाधार निर्माण गर्दा वातावरणीय प्रभाव मुल्याङ्कन गरी प्रतिवेदनले सुझाव दिए बमोजिम वातावरणमैत्री डिजाइन, संभाव्यता अध्ययन, विस्तृत सर्वेक्षण तथा नक्साङ्कन, ढलान एवं पिच गर्दा गुणस्तरीय निर्माण सामग्रीको प्रयोग, भवन आचारसंहिता तथा मापदण्डको पालना तथा स-साना विकेन्द्रित ऊर्जा, सिंचाई, खानेपानी

पुर्वाधार जस्ता कार्यले उत्थानशील पुर्वाधार निर्माणमा सहयोग गर्छन्। स्थानीय तथा आदिवासी समुदायले प्रयोग गर्दै आएका सोपान (Terrace) खेती, गहिरो जरायुक्त बोटबिरुवा र वन संरक्षणको अभ्यासले पहिरो र भु-क्षय कम हुन्छ। स्थानीय परिवेश र पर्यावरणमा आधारित यी उपायलाई इन्जिनियरिङ प्रविधिसँग जोड्दा पुर्वाधार दिगो र किफायती हुन्छ।

दुर्गम तथा पहाडी क्षेत्रमा जोखिमहरू एकआपसमा गाँसिएका हुन्छन्। जस्तै: भारी वर्षाले पहिरो, पहिरोले नदी थुनिएर बाढी निम्त्याउन सक्छ। जलवायु परिवर्तनले यी जोखिमलाई थप अनिश्चित बनाउने भएकाले बहु-जोखिम मूल्याङ्कनमा आधारित योजनाको तर्जुमा र कार्यान्वयन समेत अनिवार्य हुन्छ।

पहिरो र बाढीको सम्भावित जोखिम भएका क्षेत्रमा पहिरो-बाढी प्रतिरोधी राजमार्ग निर्माणको आवश्यकता देखिएको छ। यस्ता क्षेत्रमा उच्च, मध्यम र कम स्तरका आधारमा जोखिमको वर्गीकरण गरी जोखिम सूचित योजना बनाउनु पर्ने हुन्छ। जोखिमयुक्त क्षेत्रमा ढलान सुदृढीकरण, माटो-पर्खाल (soil nailing), ढुङ्गा बोल्टिङ (rock bolting), र अड्याउने संरचना (Anchoring) निर्माण जस्ता प्रविधिहरू प्रयोग गर्नुपर्छ। यससँगै, चेक-ड्याम, सतह कटान नियन्त्रण, नदी नियन्त्रण तथा व्यवस्थापन (river training) र उपयुक्त पानी निकासमार्फत बाढीको जोखिम कम गर्ने प्रयास गर्नुपर्छ। कुनै पनि समयमा कुनै पनि सडक खण्डमा विपद् आउन सक्ने भएकोले आपतकालीन प्रतिकार्य प्रणालीको स्थापना गर्ने, विपद् व्यवस्थापन सम्बद्ध निकायसँग समन्वय र संचार सुनिश्चित गर्ने, द्रुत उद्धार तथा मर्मतसम्भार टोली र उपकरणको व्यवस्था गर्ने, आपतकालीन निर्माण तथा मर्मत कोष स्थापना गर्ने एवं क्षतिको प्रारम्भिक, द्रुत तथा विस्तृत मूल्याङ्कन गर्ने क्षमता विकास गर्नुपर्छ। यी कार्यले समयमै अवरुद्ध पुर्वाधार सुचारु गर्न सहयोग पुग्छ। आधुनिक सञ्चार, ड्रोन र रिमोट-सेंसिङ प्रविधिहरूले राजमार्गको निगरानी र सम्भावित जोखिम पहिचानमा महत्वपूर्ण योगदान दिन सक्छ। ड्रोनमार्फत वास्तविक समय (Real Time) मा जोखिमको अवस्था पत्ता लगाउन सकिन्छ। यसले निर्णयकर्तालाई सही समयमा निर्णय लिन र प्रभावकारी जोखिम न्यूनीकरण रणनीति लागू गर्न सहयोग पुर्याउँछ। सडक मर्मतमा स्थानीय तह र समुदायलाई परिचालन गर्ने, सम्भावित जोखिमको सूचना दिन तथा अवरुद्ध पुर्वाधार सेवा सुचारु गर्ने कार्यमा first responder को रूपमा स्वयंसेवकको तयारी गर्न सकेको खण्डमा स्वामित्व र जिम्मेवारीको भावना विकास हुन्छ।

आन्तरिक स्रोतमा परेको दबाब र बढ्दो सार्वजनिक ऋणका कारण नेपालले उत्थानशील पुर्वाधारका लागि दीर्घकालीन लगानी जुटाउन चुनौतीपूर्ण बन्दै गएको छ। यस अवस्थामा सरकारको प्रयास मात्र पर्याप्त नहुने भएकाले निजी क्षेत्रको सक्रिय सहभागिता अपरिहार्य छ। निजी क्षेत्रसँग सहकार्य गर्दै पुर्वाधारको उत्थानशीलतालाई प्रवर्द्धन गर्न नीतिगत सुधार, लगानीमैत्री

वातावरण सिर्जना, नीतिगत स्थिरता, र जोखिम—प्रतिफलको न्यायोचित बाँडफाँडमा विशेष जोड दिन आवश्यक छ। उत्थानशील पूर्वाधार निर्माण महँगो हुने भएकाले सार्वजनिक—निजी साझेदारी (PPP) अवधारणाको प्रभावकारी कार्यान्वयनले निजी लगानी आकर्षित गर्न सहयोग गर्छ। यसले सरकार र निजी क्षेत्रबीच जोखिम र प्रतिफलको न्यायोचित बाँडफाँड सुनिश्चित गर्दै दीगो र प्रभावकारी पूर्वाधार निर्माणको मार्ग खोल्छ। साथै, जलवायु वित्तका उपकरण र दीर्घकालीन वित्तीय संयन्त्रको विकासमार्फत लगानी सुनिश्चित गर्ने प्रयासहरू आवश्यक छन्। पछिल्लो समय सार्वजनिक, निजी र स्थानीय समुदायको सहभागितामा आधारित जलविद्युत परियोजनाहरू सफलतापूर्वक सञ्चालन हुँदै आएका छन्। स्थानीय समुदाय, आदिवासी र सीमान्तकृत समूहको सहभागिताले पूर्वाधारप्रतिको अपनत्व बढाउँछ र न्यायोचित, दीगो समाधान सुनिश्चित गर्न मद्दत गर्छ। यसैगरी, समुदाय-आधारित विकास दृष्टिकोणले उत्तरदायित्व र सहभागिता बढाउँछ, जसले दीगो र उत्थानशील पूर्वाधार विकासमा महत्वपूर्ण योगदान पुर्याउँछ।

पूर्वाधारको दीगो र उत्थानशीलता सुनिश्चित गर्न सरकारले पनि नीतिगत र संस्थागत सुदृढीकरणमा ध्यान दिन आवश्यक छ। पूर्वाधार डिजाइन, निर्माण, मर्मतसम्भार र जोखिम न्यूनीकरण सम्बन्धी कानुन र प्रविधिको प्रभावकारी कार्यान्वयनमा सरकारको प्राथमिकता हुनु अनिवार्य छ। संघ, प्रदेश र स्थानीय तहबीच समन्वित र एकीकृत पूर्वाधार विकास दृष्टिकोण अवलम्बन गर्नुपर्छ। संघीय सरकारले दीर्घकालीन राष्ट्रिय विकास रणनीतिमा उत्थानशील पूर्वाधारलाई स्पष्ट प्राथमिकताका रूपमा समावेश गर्नुपर्छ। सामाजिक, आर्थिक तथा वातावरणीय प्रभावको समग्र मूल्याङ्कनका आधारमा परियोजनाको प्राथमिकता निर्धारण गर्नुपर्छ। राष्ट्रिय आयोजना बैंकमा परियोजना प्रविष्ट गर्दा उत्थानशीलतालाई अनिवार्य मापदण्डका रूपमा स्थापित गर्न आवश्यक छ। तथापी उत्थानशीलता केवल संरचना मजबुत बनाउने विषय मात्रै होइन। नियम कानुन थप्दै जानु अथवा नियमनलाई कडाई गर्नु मात्र पनि समाधान होइन। अनिश्चित अवस्थसँग जुध्न सक्ने मानव अनुकूलन क्षमता विकास गर्नु पनि आवश्यक छ। पूर्वाधार उपयोग गर्ने नागरिक र समुदायको क्षमता पनि उत्थानशील हुनुपर्छ।

विकास साझेदारहरूले उत्थानशील नीति तथा योजना तर्जुमा, प्राविधिक क्षमता अभिवृद्धि, अनुभव आदान—प्रदान तथा रणनीतिक मार्गदर्शनमार्फत सहयोग पुर्याउन सक्छन्। प्रदेश र स्थानीय तहले योजना कार्यान्वयनको चरणमै उत्थानशील पूर्वाधारको अवधारणालाई आत्मसात् गर्नुपर्ने हुन्छ।

पूर्वाधार जोखिम पहिचान तथा मूल्याङ्कन विधिको विकास, वैज्ञानिक तथा प्रकृतिमा आधारित समाधान (Nature-based Solutions) को लागी अध्ययन—अनुसन्धान र महत्वपूर्ण पूर्वाधारका लागि जोखिम हस्तान्तरण (जस्तै बीमा) मोडेलको पहिचान तथा तिनको लागत—प्रभावकारिता

विश्लेषण आवश्यक छ। साथै क्षमता अभिवृद्धि, ज्ञान साझेदारी र लक्षित वित्तीय योगदानमार्फत जोखिम मूल्याङ्कन प्रणालीलाई सुदृढ गरे मात्र दीगो तथा उत्थानशील पूर्वाधार विकास सुनिश्चित गर्न सकिन्छ।

निष्कर्ष:

नेपाल जस्तो बहुजोखिमयुक्त र भूपरिवेष्टित मुलुकमा गुणस्तरीय र उत्थानशील पूर्वाधार विकास दिगो आर्थिक वृद्धि, सामाजिक सुरक्षा र जीवनस्तर अभिवृद्धिको प्रमुख आधार हो। जलवायु परिवर्तन, भूकम्प, बाढी—पहिरो र चरम मौसमी घटनाका कारण पूर्वाधार सेवामा हुने अवरोधले प्रत्यक्ष भौतिक क्षति मात्र होइन, अप्रत्यक्ष रूपमा आर्थिक, सामाजिक र मानवीय पक्षमा समेत प्रभाव पर्ने गर्दछ।

पूर्वाधार उत्थानशीलताको लागी भौतिक संरचना बलियो भएर मात्रै हुदैन, यससँग जोडिएका सेवा प्रणाली र उपभोक्ता/नागरिकको क्षमता समेतको अभिवृद्धिमा जोड दिनुपर्छ। उत्थानशील पूर्वाधार निर्माणका लागि केवल सरकारी लगानी पर्याप्त छैन। निजी क्षेत्रको सहभागिता, सार्वजनिक—निजी साझेदारी (PPP), दीर्घकालीन वित्तीय संयन्त्र, र स्थानीय समुदायको सहभागिताका साथै संघ, प्रदेश र स्थानीय तहबीचको समन्वय तथा नीति, योजना र कार्यक्रमको एकीकृत कार्यान्वयनले मात्रै पूर्वाधारको उत्थानशीलता र दिगोपन सुनिश्चित गर्न सकिन्छ।

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- शिवहरी घिमिरे

महासचिव, नेपाल निर्माण व्यवसायी महासंघ



वि.सं. २०४७ साल जेठ २१ गते नेपाल निर्माण व्यवसायी संघको विधिवत् रूपमा स्थापना भएको हो । २०५४ साल मंसिर २१ र २२ गते संघको चौथो साधारण सभामा उपस्थित विभिन्न जिल्ला एवं क्षेत्रका प्रतिनिधिहरूको समेत सहमतिबाट संघको विधान २०४६ लाई संशोधन गरी नेपाल निर्माण व्यवसायी संघलाई नेपाल निर्माण व्यवसायी महासंघमा परिणत गरिएको थियो । हाल यही महासंघ नै मुलुकका ३२ हजार भन्दा बढी निर्माण व्यवसायीहरूको एक मात्र छाता संस्थाको रूपमा निर्माण व्यवसायीहरूको हक हितका लागि क्रियाशील रहँदै आएको छ । हाल मुलुकको निर्माण उद्योगले २० लाख भन्दा बढीलाई रोजगारी दिएको अनुमान छ । व्यवसायीहरूको क्षमता विकास गरी उनीहरूलाई दक्ष बनाउन समेत महासंघले समय समयमा विभिन्न कार्यक्रम संचालन गर्दै आएको छ । निर्माण व्यवसायी मैत्री ऐन कानून निर्माणका लागि महासंघले लामो समय देखि सरकारलाई सल्लाह सुझाव दिने तथा आवश्यकता अनुसार दवावमूलक कार्यक्रम समेत गर्दै आएको छ । महासंघको आन्दोलनकै कारण निर्माण व्यवसायीहरूको हक हितको पक्षमा महत्वपूर्ण निर्णयहरू पनि हुँदै आएको छ । आजको दिनमा महासंघ मुलुकको अग्रणी निजी संस्थाको रूपमा स्थापित हुनु सबै निर्माण व्यवसायी साथीहरूका लागि गौरवको विषय हो । निर्माण व्यवसायीहरूको योगदान बिना समृद्ध नेपालको परिकल्पना गर्न सकिँदैन भन्ने तथ्य बारे सरोकारवालाहरू जानकारी भइसकेको सन्दर्भमा अब हामी व्यवसायी साथीहरूको काँधमा पनि जिम्मेवारी सहित धेरै चुनौति पनि थपिएका छन् । व्यवसायीक एकताबाट मात्र त्यस्ता चुनौतिबाट पार पाउन सम्भव छ भन्ने मान्यता यस महासंघले राखेको छ ।

महासंघका प्रमुख उद्देश्यहरू देहाय बमोजिम छन् ।

- (१) निर्माण व्यवसायलाई पेसागत रूपमा अँगाली कार्य गर्ने नेपाली निर्माण व्यवसायीहरूलाई एकसूत्रमा बाँधी तिनीहरूको व्यावसायिक हितको संरक्षण, अभिवृद्धि र विकास गर्ने तथा नेपाली निर्माण व्यवसायीहरूको अभिलेख राखी स्वदेशी निर्माण उद्योगको स्तरको प्रारूप तयार गर्ने ।
- (२) निर्माण उद्योगको सम्बन्धमा नेपाल सरकारबाट समय-समयमा लागू गर्ने नीति, नियम र सिद्धान्तलाई निर्माण व्यवसायीहरूको हितमा , आवश्यक प्रतिपादन गर्न, संशोधन गर्न, कार्यान्वयन गर्न गराउन, निर्माण कार्यको सिलसिलामा तयार गरिने बोलपत्र, करारपत्र आदि दस्तावेजहरूमा अमेल एवं. एकपक्षीय सर्तहरू हटाई अन्तर्राष्ट्रिय स्तरको कायम गर्नका लागि नेपाल सरकार एवं

अन्य संघसंस्था वा निकायसमक्ष सुझाव पेस गर्ने, विभिन्न गोष्ठी, सेमिनार, छलफल आदिको आयोजना गरी यस कार्यमा प्रभावकारी भूमिका निभाउने ।

- (३) देशको सर्वाङ्गीण विकास तथा सार्वजनिक निर्माण कार्यमा निर्माण उद्योगको महत्वपूर्ण योगदान रहने हुनाले विकासका लागि बाधक तथा विकासको गतिसँग नमिल्दा तथा समयानुकूल नभएका नेपाल सरकारका कुनै पनि निर्माण कार्यसम्बन्धी नीति, नियम, कानुनलाई देशको विकासको निमित्त र निर्माण व्यवसायीहरूको निमित्त बढी सहायक र प्रभावकारी हुने गरी समयानुकूल बनाउन नेपाल सरकारका सम्बन्धित निकायहरूसँग समझदारी राखी आवश्यक सुधार वा संशोधन गराउन प्रयत्नशील रहने ।
- (४) विभिन्न देशका राष्ट्रिय, क्षेत्रीय तथा अन्तर्राष्ट्रिय स्तरका निर्माण व्यवसायी संघ संगठन एवं महासंघ, संस्था तथा निकायहरूको सदस्यता प्राप्त गर्ने, यस्ता निकायहरूसँग मैत्री सम्बन्ध कायम गर्ने र अनुभव तथा विचारको आदान-प्रदानद्वारा निर्माण व्यवसायीलाई बढी दक्ष र प्रभावकारी बनाउन एवं नेपाली निर्माण व्यवसायीहरूको समुचित विकास गर्न गहन भूमिका निभाउने ।
- (५) स्वदेशी निर्माण व्यवसायीको सीप, ज्ञान र दक्षताको अभिवृद्धि गरी विदेशी निर्माण व्यवसायीहरूसँग प्रतिस्पर्धा गर्ने क्षमता वृद्धिका लागि प्रयास गर्ने ।
- (६) नेपाली निर्माण व्यवसायीहरूलाई प्रोत्साहित गर्न, कदर गर्न तथा निर्माण व्यवसाय क्षेत्रमा योगदान पुऱ्याउने व्यक्तित्वहरूलाई उचित पुरस्कार, प्रशंसापत्र, कदरपत्र आदि प्रदान गर्ने तथा आवश्यकताअनुसार सम्बन्धित निकायमा सिफारिस गर्ने ।
- (७) देशमा आइपर्ने दैवी विपत्ति एवं प्राकृतिक प्रकोपजस्ता बेलामा तन, मन र धनले सहयोग गर्ने ।
- (८) सामूहिक रूपमा निर्माण व्यवसायीहरू र महासंघको सदस्यता प्राप्त संघहरूलाई आइपर्ने व्यवसायसम्बन्धी समस्याको समाधान गर्न प्रयत्न गर्ने ।
- (९) निर्माण व्यवसायसँग सम्बन्धित विभिन्न निकाय, वित्तीय संस्थाहरू आदिबाट नेपाली निर्माण व्यवसायीहरूलाई दिई आएका सुविधाहरू अझ बढी सरल र सुलभ तरिकाले उपभोग गर्न पाउने र थप सुविधा पाउने वातावरण सिर्जना गर्ने ।
- (१०) विभिन्न समाज सेवा एवं जनउपयोगिताका कार्य गर्ने गर्न प्रोत्साहन दिने ।
- (११) अन्तर्राष्ट्रिय स्तरमा समेत नेपाली निर्माण व्यवसायीहरूको शाखा अभिवृद्धि गरी अन्तर्राष्ट्रिय स्तरको बोलपत्रहरूमा नेपाली निर्माण व्यवसायीहरूले भाग लिई कार्य गर्न सक्षम तुल्याउन प्रयत्न गर्ने ।
- (१२) निर्माण व्यवसायीहरू र महासंघको सदस्यता प्राप्त संघहरूको पीरमर्का, गुनासाहरू सम्बन्धित निकायसम्म पुऱ्याई निर्माण व्यवसायीहरूको अधिकतम हक र हितका लागि सम्भाव्य सम्पूर्ण उपायहरू अवलम्बन गर्ने ।

- (१३) महासंघको सदस्यता प्राप्त वस्तुगत संघहरूको उन्नती र विकासका लागि आवश्यक कार्यहरू गर्ने ।
- (१४) नेपाली निर्माण व्यवसाय क्षेत्रको उत्थान एवं विकासका लागि स्वदेशी निर्माण व्यवसायीको सीप तथा दक्षता अभिवृद्धि गर्न र विभिन्न किसिमका जनशक्ति उत्पादन तथा प्रशिक्षण गर्न महासंघ आफैले वा कुनै संस्थाहरूसँग समन्वय गरी तालिम दिने संस्था स्थापना गर्ने, अन्य यस्तै सेवा प्रदायक संस्थाहरूसँग सहकार्य गरी प्रशिक्षण दिने ।
- (१५) नेपालको संविधान बमोजिम प्रदेश स्तरीय निर्माण व्यवसायी महासंघहरू, जिल्ला संघहरू, एशोसिएट सदस्यहरू, र निर्माण व्यवसायसँग सम्बन्धित वस्तुगत संघहरूलाई समेत सदस्यता प्रदान गरी संगठन विस्तार गर्ने ।

निर्माण व्यवसायीहरूको हक हित संरक्षणको कार्यको निरन्तरता :

महासंघको प्रारम्भिक उद्देश्य नै नेपाली निर्माण व्यवसायीहरूको हक हितको संरक्षण गर्ने भएको हुँदा यस सन्दर्भमा महासंघले निर्माण व्यवसायीहरूलाई पर्ने कठिनाइको निराकरणका लागि सम्बन्धित निकायसमक्ष पहल गर्नेदेखि लिएर निर्माण व्यवसायसम्बन्धी ऐन, नियमका व्यवधानहरूलाई निर्माण व्यवसायीहरूको हक हितअनुकूल तुल्याउन सरकार एवं सम्बन्धित निकायहरूमा आवश्यक सुझाव दिने, महासंघको तर्फबाट प्रतिनिधित्व गर्ने, विरोध गर्नेजस्ता विभिन्न कार्य गरिआएको छ र सो कार्यलाई भविष्यमा पनि निरन्तरता दिइनेछ । महासंघको नेतृत्वमा भएका दबाबमूलक कार्यक्रमकै कारण व्यवसायीको हक हितमा थुप्रै निर्णय हुँदै आएका छन् ।

सामाजिक सेवाका कार्यमा संलग्नता :

महासंघले व्यावसायिक हक हित संरक्षण, निर्माण व्यवसायको संस्थागत विकासमा योगदानजस्ता कार्यका अतिरिक्त विशुद्ध सामाजिक सेवामा समेत सक्रिय भूमिका निर्वाह गर्ने कार्यक्रम राखेको छ । यसका लागि महासंघले विपतमा परेका जनतालाई बेलाबखत आर्थिक एवं अन्य सहयोग गर्दै आएको छ । पछिल्लो समय महासंघले राजधानीका सुकुम्बासीहरूलाई हप्तौसम्म खाना खुवाउन दुई करोड भन्दा बढी आर्थिक सहयोग गरेको छ । २०७२ सालको महाविनाशकारी भूकम्प, कोरोना कहिरा र वर्षै पिच्छे हुने प्राकृतिक विपत्तिबाट पीडितहरूलाई विगतदेखि नै महासंघले आर्थिक सहयोग गर्दै आएको छ । यसबाहेक महासंघको कार्य समिति अन्तर्गतको सामाजिक सेवा समितिको अगुवाइमा धेरै कामहरू हुँदै आएका छन् । जिल्ला निर्माण व्यवसायी संघहरूले पनि निरन्तर सामाजिक सेवाका काममा आफूलाई समर्पित गर्दै आएका छन् ।

निर्माण व्यवसायी कोषबाट प्राप्त हुने रकमको उचित उपयोगका कार्यहरू :

निर्माण व्यवसायीहरूको बिलबाट ०.१० प्रतिशतका दरले कट्टा भई निर्माण व्यवसायी कोषमा निर्माण व्यवसाय ऐन २०५५ अनुसार रकम जम्मा हुँदै आएको भए तापनि अन्तर्राष्ट्रिय प्रतिस्पर्धात्मक बोलपत्रबाट यस कोषमा जम्मा हुन सकेको छैन । कोषमा संकलित उक्त रकम निर्माण व्यवसायको संस्थागत

विकासका लागि गरिने विभिन्न अध्ययन अनुसन्धान तथा निर्माण व्यवसायीहरूको क्षमता अभिवृद्धिका लागि आवश्यक पर्ने तालिम, प्रशिक्षण, गोष्ठी, सेमिनार, अध्ययन भ्रमण, लगायतका क्षेत्रमा खर्च गरिदै आएको छ ।

महासंघ International Federation of Asian & Western Pacific Contractors Associations (IFAWPCA) को सक्रिय सदस्य रहँदै आएको छ । महासंघ SAARC Chamber of Commerce & Industry-Construction Industry Council(SAARC-CCI-CIC) को पनि सदस्य हो । नेपाल उद्योग वाणिज्य महासंघको वस्तुगत संघ तर्फको समेत सदस्य रहेको यस महासंघको राष्ट्रिय विकास परिषद्, नेपाल व्यवसाय मञ्च, निर्माण व्यवसाय व्यवस्थापन तथा प्रवर्द्धन कार्यान्वयन समिति, निर्माण व्यवसाय विकास परिषद्, राष्ट्रिय व्यावसायिक पहल लगायतका राष्ट्रिय संस्थाहरूमा पनि प्रतिनिधित्व रहँदै आएको छ ।

निर्माण उद्योगका विद्यमान समस्या र समाधानका उपायहरू :

मध्यपूर्वमा जारी युद्धका कारण इन्धन, बिटुमिन लगायतका निर्माणका लागि अत्यावश्यक सामग्रीहरूमा अप्रत्याशित एवं अत्यधिक मूल्यवृद्धि भएको हुँदा यस्ता निर्माण सामग्रीको सहज उपलब्ध हुन नसकेकोले हाल मूल्यवृद्धि एवं निर्माण सामग्रीको अभाव रहेको छ । सार्वजनिक खरिद ऐन, (संशोधन सहित) २०६३ को दफा ५५ को प्रतिबन्धात्मक वाक्यांशमा 'सार्वजनिक निर्माण कार्य खरिद गर्दा राष्ट्रिय स्तरको बोलपत्र आह्वान भई खरिद सम्झौता भइसकेको अवस्थामा अप्रत्याशित रूपमा कुनै निर्माण सामग्रीको मूल्य साविकको मूल्यको दश प्रतिशत भन्दा बढी घटबढ भएमा त्यसरी घटेको वा बढेको रकममा दश प्रतिशत कट्टा गरी तोकिए बमोजिम मूल्य समायोजन गरिने छ' भन्ने स्पष्ट बाध्यात्मक कानूनी व्यवस्था भएकोले यस विषम परिस्थितिमा भएको अत्यधिक र अप्रत्याशित मूल्यवृद्धिलाई सम्बोधन गर्न गरिएको उक्त व्यवस्था बमोजिम सम्बन्धित सबै निकायहरूमा मूल्य समायोजन सम्बन्धी आवश्यक निर्देशन एवं परिपत्र जारी गरी १२ महिना भन्दा कमको बोलपत्रहरूमा मूल्यवृद्धिको समस्या तत्काल समाधान गरिनुपर्छ ।

मुलुकमा गत भदौको अन्तिम हप्तामा भएको जेन्जी आन्दोलन, असोज महिनाको तेस्रो सातामा आएको बाढी पहिरो, फागुन २१ गतेको निर्वाचन तथा पछिल्लो समय मध्यपूर्वको युद्धका कारण इन्धन तथा निर्माण सामग्रीमा निरन्तर भइरहेको अप्रत्याशित एवं अत्यधिक मूल्यवृद्धिले निर्माण आयोजनाहरूको लागत बढेको छ । हालको अत्यधिक र अप्रत्याशित मूल्यवृद्धि, निर्माण सामग्रीहरूको चरम अभावका कारण गम्भीर संकट एवं विषम अवस्थाको सिर्जना भई निर्माण आयोजनाहरू सम्झौता बमोजिम समयमै सकिने कुनै सम्भावना नभएकाले सार्वजनिक खरिद नियमावलीको १४औं संशोधनबाट म्याद थप भएका/नभएका, चालु अवस्थामा रहेका वा उक्त संशोधन बमोजिम म्याद थप भई म्याद समाप्त भएका वा विभिन्न कारणले रुग्ण अवस्थामा रहेका आयोजनाहरू वा विभिन्न कारणले हालसम्म म्याद समाप्त भएका कारण भुक्तानी नभएका वा नियोक्तसँग सम्झौता भई चालु अवस्थामा रहेका वा हालसम्म म्याद समाप्त नभएका र म्याद समाप्त हुन गईरहेका सम्पूर्ण आयोजनाहरूको आयोजना

प्रमुखबाट आवश्यकता अनुसार म्याद थपको व्यवस्था गरिनुपर्ने देखिन्छ ।

विगतमा बिना अध्ययन अनुसन्धान, स्रोत सुनिश्चितता नभएका आयोजनाहरू छनौट भएका कारण राज्यसँग आयोजनाहरू सम्पन्न गर्न सक्ने कुनै पनि आर्थिक स्रोत सुनिश्चितताको क्षमता नभएको सन्दर्भमा विभिन्न कारणले आयोजनाहरू रुग्ण तथा जीर्ण अवस्थामा रहेकाले नीतिगत निर्णय गरी त्यस्ता रुग्ण तथा जीर्ण रहेका म्याद थप गर्दा समेत काम हुन नसक्ने ठेक्काहरू सद्विस्ताको आधारमा तत्काल अन्त्य गरी फरफारक गरिनुपर्ने देखिन्छ । सार्वजनिक निकायको कारणले ठेक्का तोड्न परेमा सार्वजनिक खरिद ऐन २०६३ को दफा ५९को उपदफा (२)को खण्ड (ख), उपदफा (३) को खण्ड (ग), उपदफा (४) र उपदफा (५) बमोजिम सुविस्ताको आधारमा र निर्माण व्यवसायीका कारणले काम सम्पन्न हुन नसकी ठेक्का अन्त्य गर्नु परेमा सुविस्ताको आधारमा बैंक जमानत मात्र जफत हुने गरी ठेक्का अन्त्य गरिनुपर्छ । भूकम्प, नाकाबन्दी, कोभिड १९, रुस युक्रेन युद्ध र पछिल्लो समय मध्यपूर्वमा जारी युद्धका कारण निर्माण सामग्रीमा हाल भइरहेको अत्यधिक एवं अप्रत्याशित मूल्यवृद्धि तथा निर्माण सामग्रीहरूको अभावलाई मध्यनजर गरी कुनै पनि निर्माण कम्पनीलाई कालो सूचीमा नराख्ने व्यवस्था गरिनु पनि उत्तिकै जरुरी छ ।

निर्माण उद्योगमा आवश्यक निर्णयका लागि अनेकौं प्रशासनिक तहहरू पार गर्नुपर्ने बाध्यता भएकाले नीतिगत तहबाट निर्णय प्रक्रिया ढिलो हुने (Bureaucratic Delay) भई आयोजना लम्बिन पुग्ने भएकाले सो समस्या सम्बोधन गरिनुपर्छ । साथै ऐन, नियम तथा सम्झौताहरूमा आफू अनुकूल हुने गरी अस्पष्ट शब्दहरू (गर्न सकिनेछ/हुन मिल्नेछ जस्ता) राखिने गरेकाले द्विविधा उत्पन्न भई उस्तै प्रकृतिका आयोजनामा अलग अलग निर्णय आउने भएकाले सो को समेत निराकरण गरिनुपर्ने हुन्छ । बारम्बर नीति परिवर्तन भइरहने र निर्माण व्यवसायीलाई साभेदारका रुपमा नभई सहायकका रुपमा हेरिएकाले निर्माण व्यवसायीको मनोबल खस्कदै गएकोले सो समस्या सम्बोधन गरिनुको कुनै विकल्प छैन ।

लो बिडिड निर्माण उद्योगको सबैभन्दा ठूलो समस्या हो । हालको कानूनी व्यवस्थाले अत्यधिक मात्रामा घटी कबुल गर्ने र सार्वजनिक निकायले समेत घटी कबुल गर्नेलाई छनौट गर्ने बाहेक अन्य विकल्प छनौट गर्न नसक्ने भएको हुँदा यसबाट समयमा गुणस्तरयुक्त कार्य हुन नसक्ने, रुग्ण ठेक्काहरूको संख्या बढ्दै जाने भएकाले हालको व्यवस्था संशोधन गरी १५ प्रतिशत भन्दा बढी घटी हुने गरी बोलपत्र पेश भएमा स्वतः ठेक्का मूल्यांकन प्रक्रियाबाट हट्ने व्यवस्था गरिनुपर्छ । त्यस्तै १५ प्रतिशत सम्म घटी हुने गरी पेश भएका बोलपत्रहरू मध्ये औसत नजिक वा Standard Deviation हुने गरी पेश भएको बोलपत्रलाई स्वीकृत गर्ने व्यवस्था लागू गरिनुपर्छ । साथै हाल ५ प्याकेज भन्दा बढी ठेक्का सम्झौता गर्न नपाउने नियमावलीको व्यवस्थामा अन्तर्राष्ट्रिय स्तरका सबै किसिमका बोलपत्रलाई समेत गणना गर्ने गरी संशोधित ऐनमा नै समावेश गरिनुपर्छ ।

बोलपत्र आह्वान हुनुभन्दा अगाडि निर्माण स्थलबाट रुख, विरुवा, विजुलीको पोल, ढल तथा खानेपानीको पाइप, आदि हटाई जग्गाको मुआब्जा वा क्षतिपूर्ति वितरण नगरेका कारण स्थानीय स्तरमा विवाद

उत्पन्न हुने हुँदा सोको लागि समेत बजेट विनियोजन गरी प्रचलित कानून बमोजिम गर्नु पर्ने वातावरणको अध्ययन (EIA/IEE) को प्रतिवेदन स्विकृत भए पश्चात मात्र ठेक्का लगाउनु पर्ने नियम तत्काल लागु गरिनुपर्छ ।

निर्माण व्यवसायीहरूको लामो समय अधिदेखिको भुक्तानी रोकिँदा मुलुकको समग्र अर्थतन्त्रमा नै प्रतिकूल अवस्था सिर्जना भएकाले बजारमा नगद प्रवाह बढाइ अर्थतन्त्रलाई चलायमान बनाउन निर्माण व्यवसायीहरूलाई मासिक भुक्तानी (Monthly Payment) को प्रणाली स्थापना गरिनु अति आवश्यक छ ।

मिति: २०७७/०४/०५ को मन्त्रिपरिषद् बैठकबाट पारित निर्णय अनुसार विकासे मन्त्रालय तथा अर्थ मन्त्रालयसँग छलफल नगरी 'ढुंगा, गिटी तथा बालुवा उत्खनन विक्री तथा व्यवस्थापन सम्बन्धी मापदण्ड २०७७' को दफा १२ को उपदफा (७) मा 'सडक निर्माण वा विस्तारको क्रममा सडक अधिकार क्षेत्र भित्रबाट निस्कने ढुंगा, गिटी, बालुवा जस्ता निर्माण सामाग्रीहरूको विक्री मूल्य बापतको रकम सम्बन्धित गाउँपालिका वा नगरपालिकालाई बुझाएर मात्र उपभोग गर्न सकिनेछ' भन्ने व्यवस्था भएकोमा उक्त व्यवस्थाका कारण अन्ततोगत्वा राज्यलाई नै थप आर्थिक भार हुने तथा अधिकांश स्थानीय निकायसँग सधैं विवाद सिर्जना हुने गरेकाले सो Right of Way भित्रबाट निस्कने ढुंगा, ग्राभेल, माटोमा सम्बन्धित स्थानीय निकायहरूको अधिकार हुने गरी स्थानीय निकायले कर लिन नपाउने प्रष्ट व्यवस्था हुने गरी उक्त मापदण्ड संशोधन गरिनुपर्छ । साथै हाल निर्माण सामाग्रीहरू (मुख्यतया माटो, गिटी, बालुवा बिटुमिन लगायत) आवश्यक परिमाणमा प्राप्त गर्न निकै नै कठिन भएकोले ती सामाग्रीहरू सहजै उपलब्ध गराइनुपर्छ । त्यस्तै निर्माण कार्यलाई आवश्यक सब-बेस, बेस लगायत निर्माण सामाग्री गुणस्तरका कारणले (LAA, CBR Value आदि सबै ठाउँमा उपयुक्त नआउने भएकाले मूच मा उल्लेखित स्थानबाट मात्रै प्राप्त गर्नुपर्ने बाध्यता भएको र सो स्थानमा स्थानीय तहबाट बाधा अड्चन हुने गरेको, निर्माण सामाग्रीमा दोहोरो कर प्रणाली लिने व्यवस्था हटाइनु पर्छ ।

हाल Detailed Design अपर्याप्त वा नमिलेको कारणले काम गर्दा गर्दै Design Change गर्नुपर्ने अवस्था आइपर्ने र सो कार्य गरुञ्जेल उक्त संरचनाको निर्माण अधि बढाउन नमिल्ने अवस्था छ । यसरी निर्माण व्यवसायीको गल्ती नहुँदा नहुँदै पनि काम रोकिएर आर्थिक हानी हुने गरेको र काम रोकिएको वास्तविक समय बराबरकै म्याद थप पनि नहुने कारण समस्या भएकाले सो को सम्बोधन गरिनुपर्छ । त्यस्तै अपर्याप्त भौगोलिक परीक्षण र गलत इस्टिमेटका कारण हुने हानी नोक्सानी जस्तै Design मा Rigid Pavement हुनुपर्ने ठाउँमा Flexible Pavement हुँदा पहिरोले गर्ने क्षतिमा पनि निर्माण व्यवसायीलाई दोषी बनाउने प्रवृत्ति रहेकोमा निर्माण व्यवसायीलाई उपलब्ध गराइने डिजाइन तथा ड्रइङ परिमार्जन गर्न परेमा सो कार्य समयमै गर्नुपर्ने र गलत डिजाइनका कारण हुने क्षतिको जिम्मेवार डिजाइन गर्नेलाई नै बनाइनुपर्छ । नेपाल जस्तो देशमा सिमेण्टबेस निर्माण कार्यलाई विशेष प्राथमिकतामा राखिनुपर्छ ।

नेपालमा भविष्य नदेखेर दक्ष, अर्ध दक्ष तथा अदक्ष जनशक्ति विदेश पलायन हुने क्रम अत्यधिक रुपमा

बढी ब्रेन ड्रेनको स्थिति उत्पन्न भएको र सो कारणले निर्माण कार्यका लागि चाहिने जनशक्ति पाउन निकै नै कठिन भएको र कार्यरत कर्मचारीले पनि बीचमै काम छोडेर विदेश जाने प्रवृत्ति अत्यधिक बढेर कार्यको गतिमा असर परेकाले यसले भविष्यमा विकराल स्थिति उत्पन्न गर्ने हुँदा राज्यले उपयुक्त नीति तथा योजना बनाइ यस समस्याको समाधान खोज्नुपर्ने देखिन्छ ।

हिमाली तथा पहाडी क्षेत्रमा पहिरो जाने समस्याले गर्दा निर्माण कार्य ढिला हुने गरेको, निर्माण सामाग्रीको ढुवानीमा पनि भौगोलिक अवरोध आउने गरेकोले समय बढी लाग्ने गरेको र हिमपात, पहिरो, मनसुन लगायतका कारणले गर्दा वर्षमा मुस्किलले सात महिना मात्र काम गर्न सकिने ठाउँमा पनि अन्य सुगम ठाउँ सरह समय तोकी ठेक्का आह्वान गर्ने गरिएकोले सो समस्या हल गरिनुपर्छ, Landslide Clearance शीर्षकमा राखिएको दरले पहिरो पन्छाउन गरिएको वास्तविक खर्चलाई नथेग्ने र सो शीर्षकमा Variation Order गर्न पनि प्राविधिकहरूले नमान्ने भएका कारण पहाडी भूगोलमा काम गर्न खर्चिलो हुने गरेकोले सो समस्यालाई सम्बोधन गरिनु अति आवश्यक छ । Norms / Specification मा एकतर्फी हुने गरेको परिवर्तनले निर्माण कार्य समयमै गुणस्तरीय रुपमा सम्पन्न गर्न कठिन हुने गरेकाले यस्तो समस्याको पनि समाधान गर्न आवश्यक रहेको छ ।

सार्वजनिक निकायका परियोजनाहरूमा कार्यरत आयोजना प्रमुख लगायतका कर्मचारीहरूबीचमै सरुवा भई नयाँ आयोजना प्रमुख आउँदा आयोजना सम्बन्धित महत्वपूर्ण निर्णयहरूमा ढिलाइ हुने भएकाले र निर्माणस्थलको वस्तुस्थिति बुझ्न समय लाग्ने भएकाले कुनै पनि निर्माण आयोजना सम्पन्न नभएसम्म सम्बन्धित आयोजना प्रमुखको सरुवा गर्न नपाइने र सो अवधिमा आयोजनाको प्रगतिका सन्दर्भमा आयोजना प्रमुखलाई जवाफदेही बनाइनुपर्ने नियम लागू गरिनुपर्छ । अख्तियार दुरुपयोग अनुसन्धान आयोग, महालेखा परीक्षकको कार्यालय जस्ता नियमनकारी निकायले निर्माण उद्योगको वास्तविक मर्का नबुझ्दा निर्माण व्यवसायीहरू बारम्बार आर्थिक सहित मानसिक दबावमा पर्दै आएका छन् । अतः त्यस्ता निकायले पनि आफ्नो कार्य क्षेत्रमा रही निर्माण उद्योगलाई अनावश्यक दबाव दिने कार्य बन्द गर्नुपर्छ ।

हामीले विकास निर्माणका काम गर्न थालेको करीव ७ दशक भइसकेको छ । यसबीचमा विभिन्न राजनीतिक, सामाजिक र आर्थिक परिवर्तन भइसकेका छन् । सरकारी निकाय र निर्माणक्षेत्रले पनि निकै ठुलो फड्को मारेको छ । आकार र जटिलताका हिसावले ठुला आयोजनाहरू मुलुकमा संचालन भइरहेका छन् । तर हाम्रो आयोजना व्यवस्थापन क्षमता, गुणस्तर कायम गर्ने कुरा र समयसीमाको पालना गर्ने दिशामा कमी कमजोरी अबै छन् । कमजोरी सरकारी पक्ष र निर्माण व्यवसायी दुवैबाट भएका छन् । अबका दिनमा एक अर्कालाई दोषारोपण नगरी आ-आफ्नो तर्फबाट भएका कमजोरीलाई आत्मसात गर्दै सहकार्यका साथ सबैजना प्रविधिमैत्री समृद्ध नेपाल निर्माणमा जुट्नुपर्छ । वर्तमान सरकारले पूर्वाधार विकासलाई समयमै सम्पन्न गरी दिगो विकासका लागि Mission Mode / Sunset कानून लागू गर्ने तयारी गर्नु सकारात्मक पाटो हो । यो सँगसँगै सरकारले पूर्वाधारमैत्री ऐन, कानूनका लागि पनि तत्काल ठोस कदम चाल्नुपर्छ ।

सार्वजनिक सडक निर्माणमा जग्गा व्यवस्थापन सम्बन्धी सवालहरू

(Land Parcel Management Issues in Public Road Construction in Nepal)

- मनोज अर्याल र ज्योती खरेल
वातावरण निरीक्षक, सडक विभाग



लेखसार:

सार्वजनिक सडक पूर्वाधारलाई अन्य पूर्वाधार निर्माण तथा संचालनको समेत आधारको रूपमा लिइने हुँदा सार्वजनिक सडकका अन्तर्निहित समस्याहरूले अन्य पूर्वाधार निर्माणको समस्याहरू समेत आत्मसाथ गरेको हुन्छ । जग्गा प्राप्तिसंग सम्बन्धित समस्याले सडक पूर्वाधारको निर्माण, स्तरोन्नति, पुनर्स्थापना तथा स्तरवृद्धिमा पर्ने अप्ठेरोले समग्र पूर्वाधार निर्माणमा समेत समानान्तर प्रभाव पारिरहेको छ । सडक निर्माण र व्यवस्थापनलाई सहजीकरण गर्ने विभिन्न नीतिगत, कानुनी, संस्थागत र संरचनागत व्यवस्थाका बावजुद जग्गा प्राप्ति र व्यवस्थापनसंग सम्बन्धित क्षतिपूर्ति र क्षतिपूर्ति रकम व्यवस्थापन, क्षेत्राधिकार अतिक्रमण र व्यवस्थापन, वनक्षेत्रको जग्गा प्राप्ति र भोगाधिकार रकम व्यवस्थापन जस्ता समस्याहरू सतहमा देखिएका छन् । नीतिगत अन्तरविरोधको निराकरण, सडक निर्माण र व्यवस्थापनको प्रारम्भिक तयारीमै जग्गा प्राप्ति सम्बन्धी समस्याको कार्ययोजना निर्माण र कार्यान्वयन, जग्गा प्राप्तिका लागि श्रोत साधन र आवश्यक रकमको सुनिश्चितता, अन्तर निकाय कार्यगत समन्वय, दुरुस्त सडक प्रशासन जस्ता नीतिगत र प्रशासनिक उपकरणको उपयोग गरी सडक व्यवस्थापनमा जग्गा प्राप्ति विषयहरू सम्बोधन गर्न आवश्यक रहेको छ ।

शब्दकुन्जी:

सार्वजनिक सडक (Public Road), जग्गा व्यवस्थापन (Land Parcel Management), क्षतिपूर्ति (Compensation), क्षेत्राधिकार (Right of Way) ।

भूमिका:

सडक पूर्वाधारलाई विकासको मेरुदण्डका रूपमा लिइन्छ । सार्वजनिक सडक ऐन, २०३१ ले सार्वजनिक सडक भन्नाले कसैको नजी भोग चलनमा नरहेको सडक सम्झनु पर्दछ र सो सडकमा पर्ने सबै किसिमका पुल, कज्वे, कल्भर्ट, साइकल मार्ग र फुटपाथलाई समेत जनाउँछ भनी

परिभाषित गरेको छ । वर्तमानमा सार्वजनिक सडकमा सुरुङ्ग, फ्लाईओवर लगायतका संरचनाहरू समेटिन थालेकोमा सो परिभाषामा समेत यी संरचनाहरूलाई समेट्न आवश्यक छ । नेपाल सरकारले पूर्वाधार विकास र व्यवस्थापनमा सबैभन्दा धेरै बजेट विनियोजन गर्दै आएको छ र त्यसको पनि ठुलो हिस्सा सडक पूर्वाधारको विकास र व्यवस्थापनका लागि छुट्याइएको हुन्छ । सडक पूर्वाधार रेखात्मक प्रकृतिको संरचना भएकाले यसको निर्माण तथा व्यवस्थापनमा रणनीतिक रूपमा विभिन्न प्रकारका प्राविधिक र प्रशासनिक जटिलताहरू देखिने गरेका छन् । बजेट विनियोजन, पूर्व सम्भाव्यताको अध्ययन, सम्भाव्यता अध्ययन, विस्तृत योजना प्रतिवेदन तयारी, ठेक्का व्यवस्थापन, अनुगमन मूल्यांकन तथा मर्मत सम्भार सबै चरणमा सडक पूर्वाधारका क्षेत्रमा विभिन्न प्रकारका सवालहरू विद्यमान रहन्छन् । ती सवालहरू मध्ये जग्गा व्यवस्थापनको सवालहरू टट्कारो रूपमा रहेको देखिन्छ ।

सडक पूर्वाधारमा जग्गा व्यवस्थापनसंग सम्बन्धित विद्यमान कानूनी प्रावधानहरू: सार्वजनिक सडक निर्माण तथा व्यवस्थापनका लागि जग्गा प्राप्ति तथा जग्गा प्रशासनका सम्बन्धमा देहाय बमोजिमका प्रमुख कानूनी व्यवस्थाहरू तथा प्रावधानहरू रहेको पाइन्छ ।

नेपालको संविधानको धारा २५ मा सम्पत्तिको हकलाई मौलिक हकको रूपमा उल्लेख गरिएको छ । यस धाराको उपधारा (२) मा सार्वजनिक हितका लागि बाहेक राज्यले कुनै व्यक्तिको सम्पत्ति अधिग्रहण गर्ने, प्राप्त गर्ने वा त्यस्तो सम्पत्ति उपर अरु कुनै प्रकारको कुनै अधिकारको सिर्जना गर्ने छैन भनी उल्लेख गरिएको छ । त्यसै गरी, यसै धाराको उपधारा (३) मा उपधारा (२) बमोजिम सार्वजनिक हितका लागि राज्यले कुनै पनि व्यक्तिको सम्पत्ति अधिग्रहण गर्दा क्षतिपूर्तिको आधार र कार्यप्रणाली ऐन बमोजिम हुनेछ भनी उल्लेख गरिएको छ ।

सार्वजनिक सडक ऐन २०३१ प्रारम्भ हुनु अघि प्रचलित राजमार्ग (निर्माण व्यवस्था) ऐन २०२१ ले श्री ५ को सरकारले नेपाल राजपत्रमा सूचना प्रकाशन गरी निर्माण भैसकेको वा निर्माण हुन लागेको कुनै सडकलाई राजमार्ग भनी घोषित गर्न सक्ने र यस्तो सूचना टाँस भएको १५ दिन पछि त्यस्तो जग्गा राजमार्गको निमित्त स्वतः प्राप्त भएको मानिने व्यवस्थाको प्रावधान गरेको, यसपछि त्यस्तो जग्गामा जग्गाधनी वा अरु कसैको कुनै किसिमको हक कायम नरहने, त्यस्तो जग्गाको दर्तावाल जग्गाधनीको नाम सरकारी लगतबाट कट्टा गरिदिने प्रावधानको व्यवस्था गरेको, साथै कुनै व्यक्तिको घर वा पचास प्रतिशत भन्दा बढी जग्गा राजमार्ग भित्र पर्ने भएमा श्री ५ को सरकारले क्षतिपूर्ति स्वरूप जग्गा वा नगद सो व्यक्तिलाई दिने प्रावधानको व्यवस्था गरेको थियो । यस ऐनले राजमार्गको क्षेत्र भन्नाले राजमार्ग र राजमार्गको दायाँ बायाँ २५,२५ गजमा नबढाई श्री ५ को सरकारले तोकेको क्षेत्रलाई सम्झनुपर्छ भनी राजमार्ग क्षेत्रको परिभाषा गरेको पाइन्छ । राजमार्ग (निर्माण व्यवस्था) ऐन २०२१ को खारेजीसँगै लागू भएको

सार्वजनिक सडक ऐन २०३१ को दफा (३) मा सार्वजनिक सडकको वर्गीकरण र तिनीहरूको सीमा निर्धारण सम्बन्धी व्यवस्था गरिएको छ । यस दफामा (१) राजमार्ग, (२) सहायक मार्ग (३) जिल्ला मार्ग र (४) शहरी मार्ग गरी चार प्रकारका सडकहरूको बर्गिकरण गरी यी सडकको केन्द्र रेखा देखि दायाँ बायाँ दुवै तिर एकतिस मिटरमा नबढाई सडक सीमा तोक्ने छ भनी उल्लेख गरिएको छ । तर एकै किसिमको सडकको सम्पूर्ण लम्बाईमा भौगोलिक स्थिती (टोपोग्राफी) र वस्तीको कारण त्यस्तो सडक सीमा घटी बढी गर्न वा पुल तथा पुलको वरपर नदीको तटबन्ध सुरक्षाको लागि चार किल्ला समेत खोली आवश्यक सीमा तोक्न सक्ने छ भनी उल्लेख गरिएको छ । यसै ऐन को दफा (३—ख) मा सडक वर्गीकरणलाई नेपालको संविधान अनुकूल बनाउन केही नेपाल ऐनलाई संसोधन गर्ने ऐन, २०७५ मार्फत छ प्रकारका सडकहरूको थप वर्गीकरण गरिएको छ । दफा (३—क) को उपदफा (१) मा यसरी सडक सीमा तोकिएका सडकहरूको सडक सीमाको र सडक सीमा नतोकिएको सडकहरूमा सार्वजनिक सडकको किनाराबाट ६/६ मिटरमा नबढने गरी नेपाल सरकारले नेपाल राजपत्रमा सूचना प्रकाशन गरी तोकेको फासला भित्र पर्खाल बाहेक अन्य कुनै किसिमको स्थायी वनौट (स्ट्रक्चर) वा भवन कसैले निर्माण गर्न नसक्ने गरी निषेध गर्न सक्ने छ भनी उल्लेख छ । यसै उपदफामा तर नगर विकास सम्बन्धी योजना लागू भएको क्षेत्रमा तत्सम्बन्धी प्रचलित नेपाल कानूनमा व्यवस्था भए बमोजिम हुनेछ भनी समेत उल्लेख गरिएको छ । दफा (३—क) को उपदफा (२) मा निषेध गरेको फासला भित्र कसैले कुनै किसिमको स्थायी वनौट वा भवन निर्माण गरेमा त्यस्तो वनौट वा भवन सडक विभागको आदेशले भत्काउन सकिनेछ भनी उल्लेख गरिएको छ । सडक विभागले त्यस्तो वनौट वा भवन भत्काउँदा लागेको खर्च समेत सम्बन्धित व्यक्तिबाट भराउन सक्नेछ समेत उल्लेख गरिएको छ । सार्वजनिक सडक र सडक सीमाको निमित्त जग्गा प्राप्त गर्न सकिने कुरा ऐनको दफा (४) मा उल्लेख गरिएको छ जसअनुसार सार्वजनिक सडकको निर्माण, विस्तार वा सुधार गर्न वा सडक सीमाको निमित्त कुनै जग्गा प्राप्त गर्नु परेमा नेपाल सरकारले जग्गा प्राप्ति सम्बन्धी प्रचलित कानून बमोजिम जग्गा प्राप्त गर्न सक्नेछ भनिएको छ । ऐन को दफा (१४) मा सडक निर्माण, विस्तार वा सुधार गर्दा अरु अस्थायी प्रकृतिको जग्गा अधिग्रहण गर्न सकिने कुरा उल्लेख गरिएको छ भने दफा (१५) मा सो अधिग्रहण गरिएको जग्गाको क्षतिपूर्ति र त्यसको निर्धारण सम्बन्धी कुरा उल्लेख गरिएको छ । ऐनको परिच्छेद ४ मा विकास कर सम्बन्धी व्यवस्था गरिएको छ ।

गुठी संस्थान ऐन २०३३ को दफा (४२) मा नेपाल सरकारले गुठी जग्गा अधिग्रहण गरेमा सो जग्गाको मुअब्जा रकमको सट्टा जग्गा नै सोधभर्ना गर्न सक्नेछ भनी उल्लेख गरिएको छ । तर गुठी रैतान नम्बरी जग्गा अधिग्रहण गरेमा नेपाल सरकारले संस्थानलाई सो जग्गाको लाग्ने मालपोत बापत क्षतिपूर्ति दिनु पर्नेछ भनी उल्लेख गरिएको छ । सोहि ऐनको दफा

(४२—क) मा नेपाल सरकारले संस्थानको स्वामित्वमा रहेको गुठी जग्गा सामाजिक कल्याण वा सामुदायिक हितको लागि उपलब्ध गर्न वा गराउन आवश्यक देखेमा व्यवहारिकता हेरी सहूलियत मूल्यमा लिन सक्ने छ, भनी उल्लेख गरिएको छ ।

जग्गा प्राप्ति ऐन, २०३४ नेपालमा जग्गा प्राप्त गर्ने सम्बन्धी प्रमुख कानून हो । ऐनको दफा (३) मा सार्वजनिक कामको लागि जग्गा प्राप्त गर्ने नेपाल सरकारको अधिकार हुने कुरा उल्लेख गरिएको छ । नेपाल सरकारले कुनै सार्वजनिक कामको निमित्त कुनै जग्गा प्राप्त गर्न आवश्यक ठहराएमा यसै ऐन बमोजिमको मुआब्जा दिने गरी नेपाल सरकारले जुनसुकै ठाउँको जतिसुकै जग्गा प्राप्त गर्न सक्ने छ भनिएको छ । ऐनको दफा (१३) मा जग्गा प्राप्तिको मुआब्जाको किसिम र सो निर्धारण गर्ने अधिकारीको व्यवस्था गरिएको छ जस अनुसार प्रमुख जिल्ला अधिकारीको संयोजकत्वमा मुआब्जा निर्धारण समिति रहने तथा प्राप्त गरिने जग्गाको मुआब्जा नगदीमा दिइने व्यवस्था गरिएको छ । तर दफा (१४) मा मुआब्जा प्राप्त गर्ने व्यक्तिले मुआब्जा बापत जग्गा नै लिन चाहेमा ऐलानी वा नेपाल सरकारको स्वामित्व भएको वा नेपाल सरकारले प्रचलित कानून बमोजिम विक्री वितरण गर्ने व्यवस्था भएको कुनै जग्गा उपलब्ध भएमा त्यस्तो जग्गा नै सट्टामा दिन सक्ने व्यवस्था समेत उल्लेख गरिएको छ । दफा (२२) मा जग्गा प्राप्ति गरेपछि सो जग्गाको स्वामित्व नेपाल सरकारमा सार्ने कुरा उल्लेख गरिएको छ । दफा (२५) मा विशेष परिस्थितिमा जग्गा प्राप्त गर्न सकिने कुरा उल्लेख छ भने दफा (२७) मा जग्गावालासंग वार्ता गरी समेत जग्गा प्राप्त गर्न सकिने कुरा उल्लेख गरिएको छ ।

मुलुकी देवानी संहिता ऐन, २०७५ को दफा (२५) मा कानून बमोजिम सार्वजनिक हितको लागि बाहेक राज्यले कुनै पनि व्यक्तिको सम्पत्ति अधिग्रहण गर्ने, प्राप्त गर्ने वा त्यस्तो सम्पत्ति उपर अरु कुनै प्रकारले अधिकार सिर्जना गर्ने छैन भनी उल्लेख गरिएको छ । उपदफा (२) मा कानून बमोजिम बाहेक कसैको सम्पत्ति लिलाम वा जफत गरिने छैन भनी उल्लेख गरिएको छ ।

वन ऐन २०७६ को दफा (४२) मा वन क्षेत्रको जग्गा प्रयोग सम्बन्धी व्यवस्था गरिएको छ । राष्ट्रिय प्राथमिकता प्राप्त आयोजना, लगानी बोर्डबाट स्वीकृत भएको योजना, राष्ट्रिय गौरवका आयोजना संचालन गर्न वन क्षेत्रको प्रयोग गर्नु बाहेक अन्य कुनैपनि विकल्प नभएमा र प्रचलित कानून बमोजिम वातावरणीय परीक्षणबाट त्यस्तो योजना संचालन गर्दा वातावरणमा उल्लेखनीय प्रतिकुल असर नपर्ने देखिएमा नेपाल सरकारले त्यस्तो योजना संचालन गर्नका निमित्त राष्ट्रिय वनको कुनै भाग प्रयोग गर्न तोकिए बमोजिम स्वीकृति दिन सक्नेछ भनी उल्लेख गरिएको छ । यसै दफामा केहि नेपाल ऐन संसोधन गर्ने ऐन २०८२ मार्फत राष्ट्रिय प्राथमिकता प्राप्त आयोजनाका सम्बन्धमा नेपाल सरकारले नेपाल राजपत्रमा सूचना प्रकाशन गरी तोकेको

योजना वा आयोजना हुनुपर्ने गरी स्पस्टीकरण राखिएको छ । त्यस्तै वन नियमावली २०७९ को नियम (४) मा राष्ट्रिय वन क्षेत्रको भोगाधिकार उपलब्ध गराउन सकिने प्रावधान उल्लेख गरिएको छ । यसै नियमावलीको नियम (९३) मा वन क्षेत्र प्रयोग गरे बापतको भोगाधिकारको रकम वन विकास कोषमा जम्मा गर्नु पर्ने उल्लेख छ भने नियमावलीको अनुसूची (५१) मा वन क्षेत्रको जग्गा प्रयोग गर्नेले बुझाउनु पर्ने रकम उल्लेख गरिएको छ ।

सार्वजनिक खरिद नियमावली, २०६४ (छैटौँ संसोधन) को नियम (६) को उपनियम (३) मा सार्वजनिक निकायले निर्माण स्थलको व्यवस्था नभई, निर्माण स्थलबाट हटाउनु पर्ने रुख विरूवा लगायतका संरचना हटाउने सुनिश्चितता नभई, मुअब्जा वा क्षतिपूर्ति वितरण गर्नु पर्नेमा सो को लागि बजेटको सुनिश्चितता नगरी तथा प्रचलित कानून बमोजिम गर्नुपर्ने वातावरणीय अध्ययनको प्रतिवेदन स्वीकृत नगराई बोलपत्र आव्हान गर्नु हुदैन भनी उल्लेख गरिएको छ ।

सार्वजनिक सडकको व्यवस्थापन र जग्गा अधिग्रहण दिग्दर्शन, २०५९ मा सडक सीमा भित्रका जग्गाको रेखदेख, संरक्षण र व्यवस्थापनमा सहयोग गर्ने उद्देश्य सहित सडक निर्माण गर्दा जग्गा प्राप्त गर्ने प्रशासनिक प्रक्रिया तथा निर्माण सम्पन्न भएपछि सडक र सडक सीमाको दर्ता र व्यवस्थापन गर्ने कानूनी प्रावधानहरूको संगालोको रूपमा समावेश गरिएको छ । यस दिग्दर्शनले सार्वजनिक सडकको स्वामित्व र वर्गीकरण, सार्वजनिक सडकमा अवरोध रहित आवागमन, सार्वजनिक सडकको दायौँ बायौँ लगाइएका रुखहरूको स्वामित्व र व्यवस्थापन, विकास कर, सार्वजनिक सडक ऐन बमोजिम सजाय हुने कसुर सम्बन्धी मुद्दाको तहकिकात, मुद्दा दायरी, दण्ड सजाय र पुनरावलोकन लगायतका विषयवस्तुहरूको व्याख्या गरिएको छ ।

नेपाल पुल मापदण्ड, २०६७ ले कल्भर्ट, साना पुल र ठुला पुल गरी तीन प्रकारका पुलहरूको वर्गीकरण गरेको छ । ६ मिटर सम्म लम्बाई हुने कल्भर्ट, २५ मिटर स्प्यान भन्दा साना वा ५० मिटर भन्दा सानो लम्बाई हुने साना पुल र २५ मिटर भन्दा बढीको स्प्यान वा ५० मिटर भन्दा बढीको लम्बाई हुने ठुला पुल भनी उल्लेख गरिएको छ ।

नेपाल सडक मापदण्ड २०७० ले सडकहरूको प्रशासनिक तथा प्राविधिक वर्गीकरण गरेको छ । यस मापदण्डले राजमार्गको ५० मिटर, सहायक मार्गको ३० मिटर र जिल्ला सडकको २० मिटर क्षेत्राधिकार (Right of Way) हुने समेत उल्लेख गरिएको छ ।

वातावरणीय तथा सामाजिक व्यवस्थापन रूपरेखा, २०८० मा सडक तथा पुल आयोजनाको लागि आवश्यक पर्ने जग्गा प्राप्तिमा प्रचलित राष्ट्रिय कानूनी आधारहरू तथा दातृ निकायहरूका जग्गा व्यवस्थापनसंग सम्बन्धित नीति तथा प्रावधानहरू व्याख्या गरिएको छ । यस रूपरेखाले जग्गा प्रशासन सम्बन्धमा प्रचलित कानून तथा अभ्यासहरूका बारेमा स्थापित मूल्य र मान्यताहरूको व्याख्या गरिएको छ ।

दातृ निकायहरूका जग्गा प्राप्ति सम्बन्धी नीति तथा प्रावधानहरूमा सम्बन्धित आयोजनाको विस्तृत पुनर्स्थापना कार्ययोजना र पुनर्वास कार्ययोजना तयार गरी सोहि बमोजिमको व्यवस्थापन योजना अनुसार क्षतिपूर्ति र मुअब्जा निर्धारण गरी क्षतिपूर्ति निर्धारण समिति मार्फत जग्गा प्राप्ति र क्षतिपूर्ति वितरण गरिने गरिएको पाइन्छ ।

सार्वजनिक सडकमा जग्गा प्राप्ति सम्बन्धी समस्याहरू: सार्वजनिक सडकको निर्माण, स्तरोन्नति तथा स्तरवृद्धि गर्दा जग्गा व्यवस्थापन सम्बन्धी निम्न बमोजिमका समस्याहरू देखा परेका छन्:

- सबै राजमार्ग तथा सहायक राजमार्गहरूको क्षेत्राधिकार निर्धारण हुन नसक्नु तथा क्षेत्राधिकार परिवर्तन हुनु: मिति २०३४/३/२० मा राजपत्रमा सूचना प्रकाशन गरी ११ वटा राजमार्ग, २६ वटा सहायक मार्ग, २३ वटा जिल्ला मार्ग तथा यी बाहेकका सडकहरूलाई शहरी मर्गहरूका रूपमा स्थापना गरिएको थियो । सोहि सूचना मार्फत तोकिएका राजमार्ग तथा काठमाडौँ उपत्यकाको चक्रपथको केन्द्र रेखा देखि दायाँ बायाँ दुवै तिर पच्चीस पच्चीस मिटर सडक सीमा, तोकिएका सहायक मार्गको केन्द्र देखि दायाँ बायाँ दुवैतिर पन्ध्र पन्ध्र मिटर सडक सीमा, तोकिएका जिल्ला मार्गको केन्द्र देखि दायाँ बायाँ दुवैतिर दश दश मिटर सडक सीमा तथा तोकिएका अन्य सार्वजनिक शहरी सडकहरूको न्युनतम एक मिटर र अधिकतम पाँच मिटर सम्मको फुटपाथ समेतलाई सडक सीमा तोकिएको थियो । त्यसपछि मिति २०४६/१०/२३ को राजपत्रको सूचना अनुसार सगरमाथा राजमार्गको केन्द्र देखि दायाँ बायाँ दुवैतिर पच्चीस पच्चीस मिटर सडक सीमा कायम गरेकोमा मिति २०५७/१०/०२ को सूचना अनुसार सो राजमार्गको चेनेज ०+००० देखि ४५+००० सम्म सडकको केन्द्र देखि दायाँ बायाँ दुवैतिर साढे बाह्र साढे बाह्र मिटर सडक सीमा कायम गरेको थियो । मिति २०३४/०३/२० मा सिद्धार्थ राजमार्गको केन्द्र देखि दायाँ बायाँ दुवैतिर पच्चीस पच्चीस मिटर सडक सीमा कायम गरेकोमा मिति २०३६/१/१७ को सूचना अनुसार सो राजमार्गको १०५ कि.मि.९३४ मि.३ से.मि. देखि १४७ कि.मि.३१० मि.७ से.मि. सम्म भने सडकको केन्द्र रेखा देखि दायाँ बायाँ दुवैतिर ६.५ मिटर मात्र सडक सीमा कायम हुने उल्लेख गरिएको थियो । त्यसैगरी सिद्धार्थ राजमार्गको हकमा मिति २०५९/०१/१६ को सूचना अनुसार राजमार्गको १७८+१५० देखि १८०+००० सम्मको सडक सीमा १५/१५ मिटर कायम गरेको थियो । त्यसैगरी पृथ्वी राजमार्गको सन्दर्भमा मिति २०४८/०२/२७ को सूचना अनुसार सडकको केन्द्र रेखा देखि दायाँ बायाँ पच्चीस पच्चीस मिटर कायम गरेकोमा मिति २०४८/२/२ को निर्णयले सो राजमार्गको नौविसे मलेखु खण्डको केन्द्र रेखादेखि दायाँ बायाँ १५-१५ मिटर कायम रहेको सूचना प्रवाह गरेको थियो । मिति २०४९/१/२९

मा सोहि राजमार्गको नौविसे बजार देखि मुग्लिन सडकको झोलुंगे पुलको पूर्वी किनारा सम्म केन्द्र बिन्दुबाट दायाँ बायाँ १५/१५ मिटर गरी जम्मा ३० मिटर कायम गरेको थियो । त्यसै गरी जोगवेनी—धरान—धनकुटा राजमार्गको मिति २०५४/१२/३ मा तथा पोखरा बागलुंग राजमार्गको मिति २०४७/१२/११ को मितिमा राजमार्गको क्षेत्राधिकार कायम गरी समयानुकूल सो क्षेत्राधिकारमा संसोधन गरिएको थियो । त्यसपछि समेत विभिन्न राजमार्ग, सहायक मार्ग, सहायक सडकहरू लगायत निर्माण हुने-भएका राजमार्गको क्षेत्राधिकार तोकिने र परिवर्तन हुने तथा कतिपय अवस्थामा क्षेत्राधिकार तोकिन नसक्ने अवस्था देखिए । सार्वजनिक सडक अन्तर्गत स्थानीय सडकहरूको व्यवस्थापन समेत सडक विभाग मार्फत गर्नुपर्ने अवस्थाहुँदा श्रोत तथा साधनको अभाव देखियो भने यसरी तोकिएको क्षेत्राधिकारको परिपालना गर्न नसकिने अवस्थाले सार्वजनिक सडकको जग्गा प्राप्ति र व्यवस्थापनमा सडक सुशासन कायम हुन नसकेको अवस्था सिर्जना हुनु ।

- सडक क्षेत्राधिकार तोकिएका कतिपय सार्वजनिक सडकहरूमा निर्माण क्षेत्रमा मात्र सडक प्रशासन केन्द्रित हुँदा बाँकी क्षेत्रमा सडक क्षेत्राधिकारको जग्गा अतिक्रमण हुन पुग्यो । यसरी अतिक्रमित सडक क्षेत्राधिकार भित्र स्तरोन्नति, स्तरवृद्धि तथा पुनर्स्थापना गर्ने सिलसिलामा सडक विभाग र अतिक्रमणकारीहरूबिच विवाद सिर्जना भइ आयोजना कार्यान्वयन हुन नसक्ने अवस्था देखिनु ।
- क्षेत्राधिकार तोकिएका कतिपय सडकहरूमा सम्बन्धित डिभिजन सडक कार्यालयहरूले नामसारी/सेस्ता/लगतकट्टामा प्रयाप्त ध्यान नदिनु तथा लगतकट्टा भएका कतिपय सडकहरूका लालपुर्जा सम्बन्धित व्यक्तिकै नाममा हुनु ।
- नयाँ निर्माण हुने सडक पूर्वाधारहरूमा जग्गा प्राप्ति तथा संरचनाहरूको क्षतिपूर्तिका लागि अत्यधिक र अस्वाभाविक क्षतिपूर्ति रकम माग हुनु तथा क्षतिपूर्तिका नाममा संघर्ष समितिहरू गठन हुनु र आयोजना व्यवस्थापनमा अवरोध हुनु ।
- सरकारी आयोजनाहरू तथा दात्री निकाय मार्फत निर्माण र कार्यान्वयन हुने आयोजनामा जग्गा प्राप्ति तथा संरचनाहरूको क्षतिपूर्तिमा एकरूपता कायम हुन नसक्नु ।
- वातावरणीय अध्ययन (संक्षिप्त वातावरणीय अध्ययन/प्रारम्भिक वातावरणीय परीक्षण/वातावरणीय प्रभाव मूल्यांकन) प्रतिवेदनमा जग्गा प्राप्ति तथा संरचना प्राप्ति सम्बन्धी विस्तृतमा विवरण समावेश हुन नसक्नु ।
- सरकारी आयोजनाका लागि पुनर्वास योजना र पुनर्स्थापना योजना बनाइएको पाँइदैन । दातृ निकायहरूले विस्तृत रूपमा पुनर्वास योजना र पुनर्स्थापना योजना बनाई कार्यान्वयन

गराउने तथा जग्गा प्राप्ति र क्षतिपूर्तिमा बढी चासो दिने हुँदा सरकारी आयोजना र दातृ निकाय मार्फत संचालित आयोजनामा भेदभावको अवस्था सिर्जना हुनु ।

- मुअब्जा तथा क्षतिपूर्ति निर्धारण समितिको बैठकहरू समयमा बस्न नसक्नु, जग्गा तथा संरचनाको समयमा नै मूल्यांकन हुन नसक्नु तथा अनावश्यक मागहरूले बैठकहरू अनिर्णित हुनु ।
- आयोजनाहरूको जग्गा प्राप्ति र क्षतिपूर्तिका लागि आवश्यक पर्ने बजेट व्यवस्थापन हुन नसक्नु तथा समयमा क्षतिपूर्ति रकम उपलब्ध गराउन नसकिनु ।
- वन क्षेत्रको जग्गा भोगाधिकार लिने प्रक्रिया झन्झटिलो हुनु । वातावरणीय अध्ययन प्रतिवेदन स्वीकृत भएपछि मात्र वन क्षेत्रको जग्गा भोगाधिकार स्वीकृतिका लागि मन्त्रिपरिषद्को निर्णय गरिने तथा मन्त्रिपरिषद्को निर्णय पछि मात्र वन विभागसंग भोगाधिकार सम्झौता गरिने तथा भोगाधिकारको रकम वन विकास कोषमा जम्मा गरेपछि मात्र भोगाधिकार गर्न सकिने अवस्थाका कारण झन्झटिलो प्रशासनिक प्रक्रिया रहेकाले जग्गा भोगाधिकारका लागि समय लाग्नु ।
- वन क्षेत्रको जग्गाको भोगाधिकार प्राप्तिका लागि तोकिएको दर रेट धेरै हुनाले सोको लागि समेत ठूलो रकम व्यवस्थापन गर्नुपर्ने हुँदा आयोजना निर्माणमा बजेटको अभाव हुने सम्भावना रहनु ।
- सडक विकास कर संकलन तथा व्यवस्थापन हुन नसक्दा जग्गा प्राप्ति र क्षतिपूर्ति रकम व्यवस्थापनमा श्रोतको अभाव देखिनु ।
- विषयलाई राजनीतिकरण गरिने तथा समाधान गरिनुको सट्टा अलझाई र बलझाई रहने प्रवृत्ति देखिनु ।

जग्गा प्राप्ति सम्बन्धी समाधानका उपायहरू:

उपरोक्त बमोजिमका समस्याहरूको निवारणका लागि निम्नानुसारका समाधानका उपायहरू आत्मसाथ गर्न सकिने देखिन्छ:

- ✓ सार्वजनिक सडकहरूको क्षेत्राधिकार तत्काल राजपत्रमा प्रकाशन गरी क्षेत्राधिकार अनुसार जग्गा प्राप्ति गरी सडक विभागको नाममा नामसारी गर्ने । क्षेत्राधिकार तोकिएका सडकहरूमा तत्काल निर्माण/स्तरोन्नति/स्तरवृद्धि गरिने सडकको चौडाई बाहेकको क्षेत्रलाई भाडामा लगाउने वा रुख/विरुवा रोपी संरक्षण गर्ने ।
- ✓ सार्वजनिक सडक पूर्वाधारहरूको ठेक्का व्यवस्थापन गर्दा निर्माण स्थलको पूर्ण व्यवस्था,

सार्वजनिक सम्पत्तिहरूको पूर्ण व्यवस्थापन र जग्गा प्राप्ति र मुअब्जा वा क्षतिपूर्ति वितरण गर्नु पर्ने भएमा सो को पूर्ण रूपमा प्राप्ति र मुअब्जा वा क्षतिपूर्ति वितरण सम्पन्न गरेर मात्र ठेक्का व्यवस्थापन गर्नु पर्ने ।

- ✓ अत्यधिक र अस्वाभाविक क्षतिपूर्ति माग सम्बोधन गर्न तथा सरकारी आयोजना र दात्री निकायका आयोजनामा जग्गा प्राप्ति र मुअब्जा वितरणमा एकरूपता ल्याउन सरकारी दर रेट निर्धारण गरी सोहि दर रेटको आधारमा तथा मुअब्जा प्राप्त गर्नेले नेपाल सरकारलाई तिरेको करको समेत विश्लेषण गरी जग्गा र संरचनाको मूल्यांकन गर्न “राष्ट्रिय क्षतिपूर्ति मापदण्ड” तयार गरी लागू गर्ने ।
- ✓ सार्वजनिक सडक ऐनले परिकल्पना गरेको विकास कर उठान तथा व्यवस्थापन गर्नुपर्ने । सडक संचालन पछि त्यस वरपरका स्थानीय तथा संघ संस्थाहरूले सो सडक उपयोग गरी लाभ प्राप्त गर्ने हुँदा सो लाभ कर संकलन गरी जग्गा प्राप्ति र क्षतिपूर्तिमा उपयोग गर्ने ।
- ✓ सार्वजनिक सडक ऐन तथा जग्गा प्राप्ति ऐन समयानुकूल संसोधन गर्ने । जग्गा प्राप्ति तथा विकास करसंग सम्बन्धित प्रावधानहरू जग्गा प्राप्ति ऐनमा राख्ने । मुअब्जा तथा क्षतिपूर्ति निर्धारण समितिको बैठक व्यवस्थापन सम्बन्धी कार्यविधि निर्माण गरी लागू गर्नु पर्ने ।
- ✓ वातावरणीय अध्ययन तथा वन क्षेत्रको जग्गा प्राप्ति सम्बन्धी प्रक्रियागत प्रशासनिक झन्झटहरू सरलीकरण गर्नु पर्ने । सार्वजनिक सडकहरूको हकमा वन क्षेत्रको जग्गाको सट्टा भर्ना वा वन क्षेत्रको भोगाधिकारको रकम वन विकास कोषमा जम्मा गर्नुपर्ने सम्बन्धी कानुनी प्रावधानहरूमा पुनर्विचार गर्नुपर्ने ।
- ✓ पुनर्वास योजना तथा पुनर्स्थापना योजनालाई वातावरणीय अध्ययन प्रतिवेदनमा छुट्टै अध्यायका रूपमा समावेश गर्नु पर्ने ।
- ✓ नयाँ निर्माण हुने सडकमा सुरुवात देखि नै सडक क्षेत्राधिकार अतिक्रमण हुन नदिने तथा सडक सुशासन कायम गर्ने ।
- ✓ राजनीतिक नेतृत्वले यस विषयलाई राजनीतिकरण नगरी आयोजनाहरूमा समस्या समाधानको नेतृत्व लिने तथा समाधानका लागि सहमति र सहकार्य गर्ने वातावरण तयार गर्ने ।
- ✓ सार्वजनिक सडक तथा सडक सम्पत्ति सम्बन्धी तथ्यांकहरू संकलन, भण्डारण तथा अध्यावधिक गरी संस्थागत स्मरण चुस्त दुरुस्त राखी राजमार्ग व्यवस्थापन सूचना प्रणाली स्थापना गरी सडक प्रशासन व्यवस्थित गर्ने ।

निष्कर्ष:

सार्वजनिक सडक निर्माण तथा व्यवस्थापनमा जग्गा प्राप्ति, मुअब्जा वितरण तथा क्षतिपूर्ति वितरण सम्बन्धी समस्याहरूले आयोजनाहरू समयमा सम्पन्न हुन् नसकी लागत प्रभावकारीता तथा तोकिएको समयमा सम्पन्न हुन नसिकरहेको अवस्थामा सार्वजनिक सडक ऐन तथा जग्गा प्राप्ति ऐनलाई संघीय संरचना अनुरूप नयाँ स्वरूपमा जारी गर्नु अत्यावश्यक भएको छ । सार्वजनिक सडकको परिभाषामा समयानुकूल सुरंग फ्लाईओवर लगायतका अन्य संरचनाहरूलाई समाहित गरी परिभाषित सार्वजनिक सडक तथा यसका अवयवहरूमा आवश्यक पर्ने सार्वजनिक, निजी तथा वन क्षेत्रको जग्गा प्राप्ति गर्ने प्रशासनिक, आर्थिक र प्राविधिक पक्षको समायोजित र नतिजामुखी प्रणालीको विकास र कार्यान्वयन गर्दै समयमा नै आयोजना सम्पन्न गरी विकासशील राष्ट्रमा स्तरोन्नति भएर स्तरोन्नति कायम राखिरहन आर्थिक आधार सिर्जना गरी सम्वृद्धि हासिल गर्न सकिन्छ ।

