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## Book of Abstracts

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# Generative Adversarial Network for Audio Compression

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## Abstract:

There has been a massive increase in the volume of data produced. New sorts of data are being created, such as genomic data, VR data, 3D data, 360-degree autonomous driving data, and cloud data. In order to create excellent compressors, a lot of human effort is put into examining the statistics of these new data formats. Signal compression is a useful technique for lowering transmission expenses and extending the life of the signal produced. To simplify signal compression an audio compression system based on a generative adversarial network (GAN) is presented here. The audio signal is processed to convert into the frequency domain and the audio signal spectrum is converted into Mel-spectrogram which is fed into an encoder that produces the latent vector. The latent vector representing the compressed signal is supplied into a generator network that has been trained to create high-quality signals that minimize the target of the objective function. Non-uniformly quantized optimum latent vectors are discovered by back-propagation using the optimization method iteratively to efficiently quantize the compressed signal. Subjective and objective evaluations including PESQ and MUSHRA are used to evaluate the Proposed signal compression method's performance compared with BPGAN, CELP and Opus techniques.

## Keywords:

ADMM, Back Propagation, GAN, Latent Vector Encoding, Signal Compression

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# Machine Learning Based Unified Framework for Slope Stability Prediction

*Milan Aryal<sup>a</sup>, Indra Prasad Acharya<sup>b</sup>*

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## Abstract:

The major objective of this research is to evaluate and enhance nine machine learning (ML)-based techniques for establishing slope safety parameters. Various algorithms are employed during the development of ML models, including multiple linear regression (MLR), artificial neural network (ANN), gradient boosting classifier (GBC), support vector classification (SVC), logistic regression (LR) classifier, Naive Bayes (NB) classifier, decision tree (DT) classifier, and random forest (RF) classifier. In-depth data-sets are prepared for the use of artificial intelligence techniques using well-known limit equilibrium-based slope stability techniques such as Fellenius, Bishop's, Janbu, Morgenstern-Price, and Spencer's approaches. A total of 4208 data-sets, including 3366 training and 842 testing data-sets with varying geometric properties of slope and soil properties are used to train the prediction model. Statistical indicators like the coefficient of determination ( $R^2$ ), mean absolute error (MAE), accuracy, precision, recall, and F-1 score are used to evaluate the effectiveness of the predictive model. The DT, ANN, and SVC models of classification outperform other classification models according to the score awarded to each model based on their ranking in performance metrics, with their total scores of 25, 21, and 20 respectively. With coefficients of regression of 0.966 and 0.973 for training and testing datasets, respectively, Spencer's approach to the ANN model predicts most accurately for both training and testing datasets. In all circumstances of regression algorithms, the prediction performance of the ANN model built for all approaches outperforms that of the MLR model. The equation for prediction from MLR can be used in slope stability problems for similar slopes in future.

## Keywords:

Slope Stability, Machine Learning, Factor of Safety, Limit Equilibrium Analysis

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# Numerical Study and Simulation of Heat Pipe Embedded Phase Change Material Based Passive Battery Thermal Management System for Electric Vehicles

*Aashish Adhikari<sup>a</sup>, Subodh Kumar Ghimire<sup>b</sup>*

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## Abstract:

In this study, for a prismatic lithium-ion battery module with a passive cooling system is developed using phase change material and heat pipes, and a three-dimensional numerical and thermal model are created. This cooling system is particularly well-suited for battery module or pack of electric vehicles. The energy balances for the battery cells and the PCM with a heat generating source are the foundation of the developed model. The battery pack is investigated during different C-rate discharge processes (0.25C, 0.5C, 0.75C, 1.0C, 1.5C and 2C) and during FTP-75 drive cycle with the aid of the designed model, and the impact of the urban driving patterns and operating factors on the battery temperature is reported and discussed. Results show that the use of D-type heat pipe embedded phase change materials in the battery pack reduce the maximum battery temperature to 34.76°C and the use of wavy-type heat pipe embedded phase change material reduces the maximum temperature by 4.1°C compared to the earlier configuration. The maximum temperature of the batteries can be lowered to 30.66°C and the thermal management performance of the integrated passive system can be considerably improved by improving the airflow around the storage system. The thermal model is again simulated using FTP-75 drive cycle as system input. The temperature of battery pack is maintained between 20.25 – 33.85°C and hence the heat pipe embedded phase change material based passive cooling is also suitable for FTP-75 drive cycle conditions.

## Keywords:

Battery thermal management system, Heat pipe embedded phase change material, Federal Test Procedure -75 drive cycle, Electric vehicle

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# Seismic Fragility of RC Bridge considering Multiple Aftershocks

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## Abstract:

Significant aftershocks follow a major earthquake within a very short period and thus making a real case for considering number of aftershocks to make the performance assessment of any structure, rather than only mainshocks. Therefore, the purpose of this study is to contrast the fragilities of the RC bridge caused by the mainshock only (MS) against mainshock aftershock sequence (MSAS). Nonlinear model of a typical two span RC bridge is modeled using OpenSees. Incremental dynamic analysis (IDA) was carried out using by linearly scaling four real mainshock and aftershock ground motion records and results were presented through the development of fragility curves. The findings demonstrate that the performance goals established during the design are not fully met and that the fragility of bridges is underestimated when fragility curves are computed solely utilizing mainshock data.

## Keywords:

Fragility curve, Mainshock aftershock analysis, Nonlinear Incremental dynamic analysis (IDA), Park- Ang damage index, Reinforced Concrete Bridge

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# Techno-Economic Analysis of Grid Connected Rooftop Solar PV System at Head Office of Nepal Bank Limited

*Siddhant Dutta<sup>a</sup>, Nava Raj Karki<sup>b</sup>, Akhileshwar Mishra<sup>c</sup>*

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## Abstract:

Grid tied rooftop solar photovoltaic (PV) is an economical, clean and reliable source that generates electricity at the organization for its regular consumption and surplus amount gets injected into the grid thereby generating revenue for the organization. The grid dependency of organization is also reduced. Moreover, as the power generated don't have to travel longer distances, which happens in conventional hydropower supply system, the losses and voltage drop occurring in the utility grid feeder are greatly minimized. The proposed grid tied rooftop solar PV system has the DC capacity of 179.58kWp and the AC capacity of 160kW. For the PV system analysis, simulation was done in PVSyst software from which it was seen that after the proposed rooftop solar PV installation there was yearly saving of NRs. 32,43,759.4 by reducing yearly import of 2,68,718 units from the grid and exporting surplus 9,153 units to the grid. The financial analysis of the proposed system was done in excel sheet which showed that Internal Rate of Return (IRR) was 20.61%, Net Present Value (NPV) was NRs. 51,61,724.78, Levelized Cost of Electricity (LCOE) was NRs. 4.98 per unit and the payback period was 7.5 years. To study the impact of the proposed installation on the grid feeder, Time Domain Load Flow (TDLF) analysis in Electrical Transient Analyzer Program (ETAP) was done, which showed that the yearly losses occurring in the feeder was minimized by 4.6MWh. As the power is generated locally, the voltage drop occurring in the grid feeder is also minimized. The results showed that the rooftop solar PV generation is worthy for commercialization in the country for improving reliability of power supply, increasing energy mix and energy security of the country.

## Keywords:

Rooftop Solar PV, Grid Conencted, Time Domain Load Flow, ETAP, PVSyst, Financial

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# Assisting Soccer Game Summarization via Audio Intensity Analysis of Game Highlights

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*Dinesh Baniya Kshatri*<sup>d</sup>, *Pål Halvorsen*<sup>e</sup>

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## Abstract:

In association football, the development of multimodal summaries is of great importance to both broadcasters and spectators since a large number of viewers choose to follow just the soccer game highlights. The fundamental drive for the development of summarization systems is the requirement to manage huge amounts of data in different formats. By highlighting the most pertinent facts and limiting or omitting unnecessary aspects, summarization helps avoid "information overload." The properties of the audio signals during a particular event can be used to calculate excitement around that event and filter events based on their importance. A root-mean-square (RMS) analysis of audio events was carried out to analyse the excitement across the events in the SoccerNet dataset. It was clearly seen that important events with excitement have a high and distinguishable RMS audio intensity. It was also observed that the generated noise of the crowd was significantly different across various events and if it happened for the home or away team. The intensity was higher for events related to the home team. Likewise, as the wavelet has the benefit of integrating a wave with a specific period, Morlet wavelet analysis was performed for various event types, and the power of the signal across various wavelet scales was analyzed. A distinct signature across various wavelet scales was observed for different events.

## Keywords:

association football, audio signal, soccer game highlights, summarization

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# Seismic Response Modification Factor Estimation of Vertically Mixed Structure (Reinforced Cement Concrete and Steel)

*Subodh Panthi<sup>a</sup>, Gokarna Bahadur Motra<sup>b</sup>*

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## Abstract:

To design a building which is able to withstand earthquake load without undergoing any kind of deformation would be uneconomical. The goal of making the building structure economical and achieve life safety has resulted in the adaptation of a certain factor that is used to significantly reduce the lateral load experienced by the building, known as seismic response modification factor or response reduction factor. Practice of constructing buildings with lower RCC and upper steel structural elements has increased since the 2015 Gorkha earthquake. For performance evaluation and comparison of such buildings, a total of forty-two building models consisting of twenty-eight vertically mixed buildings, seven pure concrete buildings and seven pure steel buildings of two, three, four, five, six, seven and eight stories are analyzed. Monotonic pushover analysis is performed to obtain force-deformation curve and calculation is done to obtain ductility factor, redundancy factor, overstrength factor and finally response reduction factor. The study showed the value of five, as provided in IS 1893 2016 for special moment resisting frame to be suitable for the selected vertically mixed models of regular configuration.

## Keywords:

mixed, response modification factor, response reduction factor, ductility, overstrength, redundancy

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# Effect of Earthquake Components on Seismic Response of RC Moment Resisting Frames

*Rupesh Uprety<sup>a</sup>, Rajan Suwal<sup>b</sup>*

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## Abstract:

When an earthquake occurs, it is recorded in three particular direction by the seismic instruments viz. X, Y and Z. The coupled response due to multiple components of an earthquake on reinforced concrete structures can be different compared to single component only. In this research, the coupled inelastic behavior of RC structure is studied under multiple earthquake excitation. A 3 stories RC frame is taken into consideration and uni-directional, bi-directional and tri-directional analysis is done. Global and local response parameters are then studied. In global response parameter, base shear is studied and in local response parameter, axial force variation is studied. The results show that transverse component of an earthquake have significant impact in increasing the base shear and the vertical component of an earthquake is associated with increase in the axial force variation in columns.

## Keywords:

RC structure, nonlinear time history, earthquake components, fiber section, distributed plasticity

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# Modeling, Simulation and Performance Analysis of Large Scale Solar Power Plant in Nepal Under Single and Double Axis Tracking Systems

*Gaurab Shreesh<sup>a</sup>, Debendra Bahadur Raut<sup>b</sup>, Sushil Khadka<sup>c</sup>*

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## Abstract:

Nepal Electricity Authority intends to establish an energy mix that consists of 15% solar energy and 85% hydropower energy. Nepal has huge solar potential but has limited land area as compared to larger countries. Solar power plant with capacity greater than 1 MW or large-scale grid-tied solar power plant with a tracking system, therefore, has greater potential in Nepal. This study compares and analyzes the technical and economical evaluation of large-scale grid-connected PV projects in five different locations of Nepal. PVSyst software is used to undertake a thorough technical and economic study based on annual energy output, payback period, and Levelized cost of energy. The simulated results is validated by analytical calculations using different formulas. A 6.6 kW vertical single-axis and double-axis tracking system consisting of 20 solar modules of 330 W is designed and its motor selection is also done. The results of this study show that PV plants are technically and economically feasible for all five locations. Jumla is the most feasible location with the highest annual generation of 18,222 MWh, the highest capacity utilization factor of 24.47%, the lowest cost of energy of 3.82 NRs/kWh, and the shortest payback period of 4.96 years for fixed-tilt orientation. Similarly for vertical single-axis tracking and double-axis tracking the annual energy output for Jumla is 22,115 MWh and 24,969 MWh respectively. In average for all location, a vertical single-axis tracking system generates an average of 15.74% more energy annually than a fixed-axis system, while a double-axis tracking system generates 23.9% more energy annually as compared to fixed-axis system. The analytical result validates the simulation results as it shows around 22.9% energy gain from double-axis tracking when compared to fixed-axis tracking.

## Keywords:

energy mix, PVSyst, tracking sytem, capacity utilization factor

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# Parametric study of Twin tunnel interaction in Soft ground

*Sushmita K.C.<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## **Abstract:**

The demand of multiple tunnel construction has been growing extensively for cities like Kathmandu built on limited space but densely populated. Construction of such underground structures however on an already built up spaces poses imminent risk to the adjacent structures. In the present study finite element method is employed to carry out the parametric study on the interaction between tunnels and ground surface. The interaction is assessed based on the ground displacement and internal lining forces on tunnel due to the construction of second tunnel. The influencing parameters selected are geotechnical parameters such as cohesion and angle of friction, construction methodology involving volume loss and the distance between the tunnel. Results showed that with the increase of volume loss, displacement at ground increases while inverse holds true for increase in geotechnical parameters such as cohesion and distance between tunnel while angle of friction doesn't influence the displacement. Similarly the construction of second tunnel near an already existing tunnel with significant changes are quantified based on the parameters mentioned.

## **Keywords:**

Twin Tunnel, FEM, Ground Displacement, Internal lining forces

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# Modeling Generalized Cost of Travel for Rural Bus Users: A Case Study of Phidim - Birtamode Road Section

*Samiksha Adhikari<sup>a</sup>, Anil Marsani<sup>b</sup>*

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## Abstract:

Public transportation allows individuals to connect and access local services more cheaply, and is the most efficient way to move large numbers of commuters into and out of cities and communities. Generally, there is a wide variation in the values associated with travel time and discomfort level. Every monetary value of travel time and discomfort level is driven by the socioeconomic character for users in rural Nepal. This research is aimed to estimate the generalized cost of travel for trip makers traveling along the bus route Phidim-Birtamode road section of Mechi Highway. The attributes to develop the model are associated with travel time, travel cost and discomfort level. At first, the pilot study was conducted to find out whether the research is feasible to study or not and later on, SP Survey was conducted to find out the values related to attributes along the study route. For the estimation of utility equation, data were coded in R software using package “mlogit” and multinomial logit model was used to estimate the coefficient of each attribute. Based on utility equations, values for travel time and comfort level are estimated. Finally, the estimated value of travel time is NRs. 257.67 per hour and the value of discomfort level is NRs. 43.50 per journey for total trip . The modeled values obtained in the current work are generally consistent with the limited evidence available and thus require refinement in the model with addition of more attributes like safety and reliability.

## Keywords:

Generalized Cost (GC), Travel time, Travel Cost, Discomfort Level, Stated Preference (SP), Logit Model

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# Thermal Comfort Performance in a Residential Building of Subtropical Climate of Nepal – A case study of Hetauda

*Sujata Nepal*<sup>a</sup>, *Sushil B. Bajracharya*<sup>b</sup>

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## Abstract:

The thermal sense of the environment is referred to as thermal comfort. Thermal comfort is influenced by two main environmental variables, including air temperature and relative humidity. Up to 90 percent of people's time is spent inside of buildings. Buildings should therefore take into account the bioclimatic conditions of the location where they are built in order to raise the living standards of their inhabitants. Today's Modern residential buildings in the country are designed and built without considering climatic factors. The study area is carried out in Hetauda Padam pokhari Sub-metropolitan in the Makwanpur District of Bagmati Province in central Nepal. The main objective is to assess thermal performance for thermal comfort of modern residential buildings of Hetauda incorporating its improvement in design strategies for thermal comfort with comparison with modern residential building with other types of building in terms of U-value, materials, temperature etc. to incorporate design strategies for the improvement of thermal comfort performance in upcoming modern residential buildings. This research adopts the post positivism paradigm. The objective set lead towards quantitative research as well as a qualitative research method. The indoor and outdoor temperature of the different nine types of the residential house like modern, hybrid and traditional residential building of Padampokhari for 7 days summer has been collected in the field, which has been compared with each other investigated houses of case area. The summer comfort temperature of padampokhari, Hetauda has been calculated using Nicol's adaptive thermal comfort model, which has been also compared with the assessed temperature of investigated residential house. The findings based on calculations and regression analysis shows that the investigated traditional residential house maintains 1-2.2°C indoor temperature in summer. Finally proposed design strategies for the newly constructed modern residential building has been suggested according bioclimatic chart and Mahoney table and recommendations at different levels has been provided for future study.

## Keywords:

Thermal comfort, residential buildings, subtropical region, Air temperature, Humidity

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# Assessment of Carbon Tax Rate for Decarbonising the Power Grid of Bimstec Region and its Impact on Electricity Price

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## Abstract:

The power sector is one of the significant contributors to the global greenhouse gas, so decarbonization of the power grid is one of the ways to meet the Paris Agreement commitment. However, the developing countries with rapidly growing energy demand in the "Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)" region have unevenly distributed resources and demand. Meeting the energy demand while decarbonizing the power grid is a massive challenge for countries in this region. This paper focuses on identifying the pathways for decarbonizing the power grid of member countries India, Bangladesh, Bhutan, Myanmar, Nepal, Thailand and Sri Lanka through energy collaboration and emerging technologies like Clean Hydrogen and Carbon Capture and Storage. A spatially disaggregated capacity expansion model is developed to minimise the total power system cost up to 2050 using IBM CPLEX Optimization studio. Policy scenarios are designed to restrict the emission in 2050. The simulation shows that renewable resources - wind, hydro, PV, and nuclear will be the primary power sources, effectively reducing the current usage of coal and natural gas under the emission restriction scenario. Also, hydrogen storage technology and NaS battery storage can significantly affect short and long-term duration in the resource deficit regions and balance the grid. An appropriate carbon tax rate per tonne of CO<sub>2</sub> released was identified for six different emission reduction scenarios developed. Ultimately, it was identified that carbon tax rate of about \$100 needed to be imposed to completely decarbonise the power-grid of BIMSTEC region by 2050. Meanwhile the electricity price would increase upto 167% in the nodes because of the additional cost burden of decarbonisation.

## Keywords:

BIMSTEC, Capacity expansion model, Decarbonization, Carbon Tax, Electricity price

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# Quality Assessment of Temporal and Spatial Input Data for Water Resources Modelling

*Koshish Raj Maharjan<sup>a</sup>, Utsav Bhattarai<sup>b</sup>, Pawan Kumar Bhattarai<sup>a</sup>*

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## Abstract:

Performance of hydrological, hydraulic and other water resources models is largely dependent on the quality of the temporal and spatial input data. That is why quality assessment of these data during the pre-processing is extremely important. In this study, we applied the Standard Normal Homogeneity Test and Pettitt's Test to assess the homogeneity of the precipitation and temperature observations from the climate stations in the Kaligandaki River Basin as a case. The precipitation series for the selected stations were found to be homogeneous in most of the cases except for Musikot. On the other hand, only half of the selected temperature stations were found to be homogeneous. The Digital Elevation Model (DEM) is the most important spatial data required for modelling. Therefore, vertical accuracy of five freely available space-borne DEMs (ASTER, SRTM, Copernicus, AW3D30 and NASA) were assessed by comparison with the DEM generated using contour and spot heights from the Department of Survey, Government of Nepal. Based on visual comparison and statistical analysis, AW3D30 DEM was found to be the most accurate in the Kaligandaki River Basin. The applicability of this study is beyond the selected area and shall be useful for data quality control for hydro-meteorological modelling in Nepal.

## Keywords:

Quality assessment, Standard Normal Homogeneity Test, Pettitt's Test, Vertical Accuracy, Digital Elevation Model

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# Prediction of Squeezing Condition of Tunnel: A Case Study of Tamakoshi V Hydroelectric Project, Nepal

*Abhishek Pokhrel<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## Abstract:

This paper is focused in the assessment of squeezing potential of 8.1Km headrace tunnel (HRT) of Tamakoshi V Hydroelectric Project (TKV). The tunnel length was divided into 41 section at the interval of 200m each and subsequently squeezing assessment was done. Probability of squeezing was checked with the Empirical Methods: Singh et al. (1992), Goel approach (1994), Jimenez and Recio (2011), Farhadian et al (2020); Semi-analytical Method: Jethwa et all (1984), Barla (1995), Hoek and Marinos (2000); Analytical Method: Convergence Confinement Method (Carranza-Torres and Fairhurst, 2000) and Numerical Method (NM): *Phase*<sup>2</sup>. Since rock mass characterization is approximation, to get vivid understanding of the rock squeezing behavior three possible cases was evaluated with minimum value of RMR and Q as case I, with computed average value of RMR and Q as Case II and Maximum value of RMR and Q as case III from the available range of values for particular section. Rock mass parameters those not available were estimated from the empirical equations proposed by different scholar. After analysis approximate length of tunnel that may face squeezing were estimated. Without support installation about 50% to 55%, 10% to 20% and 0% to 5% of the tunnel section were estimated to have probability of different degree of squeezing for case I, case II and case III respectively.

## Keywords:

Rock Squeezing, HRT Tunnel, Squeezing prediction , *Phase*<sup>2</sup>

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# Evaluation of Seismic Resilient Characteristics of Traditional Stone Masonry in Mud Mortar Houses

*Sital Parajuli <sup>a</sup>, Hari Darshan Shrestha <sup>b</sup>*

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## Abstract:

Stone Masonry in Mud Mortar (SMM) is one of the oldest construction technique in Nepal with dominant practice in construction both pre and post Gorkha earthquake, 2015. The structural properties and seismic strength of these rural vernacular constructions have not been investigated in detail. This study aims to verify the hypothesis that “Traditional Stone Masonry in Mud Mortar (SMM) Buildings in Nepal followed earthquake resilient features as per provisions of code”. The study is also intended to compare damage pattern in SMM houses based on their satisfactory level to codal provisions. For the analysis, dimensional data of SMM houses of Sindhupalchowk was collected and their intensity of damage were determined. IBM SPSS Version 25 was used to compare observed and standard criteria set forth in building code. The study showed that 80.9% of SMM houses satisfied the dimensional criteria of code NBC 202:1994 and NBC 203:2015 showing that traditional SMM houses comply with structural earthquake resilient characteristics of code. However, the use of timber bands was seen only in 23.5% of SMM houses. The comparative study of SMM houses satisfying and not satisfying codal criteria showed that width of masonry pier in between opening, distance of opening from corners and height to length ratio is also an important parameter in out of plane stability of masonry wall. The observation indicated that vertical crack at intersection of walls is dominant in SMM houses even with presence of bands. Hence, retrofitting technique for strengthening of wall corner should be given importance.

## Keywords:

stone masonry in mud mortar, seismic, damage pattern

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# Daylighting in Energy Efficiency: A Case of Office Building in Kathmandu

*Bimala Basnet<sup>a</sup>, Sanjaya Uprety<sup>b</sup>*

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## Abstract:

Architecturally, light and design is a collective term where light illuminates the form, space, texture, color and vibe of the space. It is the only medium to perceive object, which can be in the form of both daylighting and artificial lighting. Office buildings are operated for 7 to 8 hours daily on weekdays where light is most to carry out any type of work. Several researchers have found daylighting is beneficial to human psychologically and in reducing the active energy consumed by the building for illumination. The office buildings of Kathmandu are turned spaces and rarely designed while the designed ones are with deep floor plates or with glass curtain wall which results in visually uncomfortable indoor environment. The research aimed to investigate the passive strategies for illuminating space maintaining visual comfort and at the same time reducing the use of active energy. Using the climate data from the Department of Hydrology and Meteorology, an office building floor was simulated in Velux Daylight Visualizer 3, with varying window wall ratio (WWR) ranging from 10 percent to 100 percent and Autodesk Ecotect software, 2011 to analyze daylighting level and energy consumption respectively with respect to WWR to deduce the best WWR required to meet the required optimum illumination in the office building while reducing energy consumption which is a quantitative analysis. The result showed that 30 percent window wall ratio is optimum for the office building of Kathmandu which holds clerical work as a prime task. The lighting energy is reduced by 66.92 percent with changed WWR and window configuration. The research concludes that the daylighting findings will be helpful to designers in the early design phase, academic researchers and also to prepare guidelines, policy maker to create visually and functionally friendly space.

## Keywords:

Daylighting, artificial lighting, visual comfort, energy consumption, simulation

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# Development of Road Upgradation Plan to Support Agricultural Production in Dhanusha

*Shalini Jha*<sup>a</sup>, *Rojee Pradhananga*<sup>b</sup>

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## Abstract:

There is widespread agreement in the literature that a region's transportation infrastructure and economic development are intertwined. This idea of economic growth with efficient transportation of people and products from one location to another can only be realized if there is a reliable transportation system. In this research, a methodology is proposed such that the place having high economic potentiality is linked with market centre's and existing link is already present then the network links are upgraded on the basis of production served by each link with budget constraint. Dhanusha district of Nepal is chosen for the application of this method. The main objective of this research is to develop an optimal road network maximize the production served considering agricultural development potential and Market centers of Dhanusha district with budget constraints. Agricultural potential of each local level units of Dhanusha in economic terms was used for finding production served by each link connecting to market centre based on which road upgradation plan of such transport linkages that can be done with budget constraint is obtained. This research was predominantly based on secondary data sources published by Government of Nepal (GoN) and other authentic and relevant publications related to Dhanusha. It is believed that the results of this research will be applicable in more inclusive transport planning of the district and the methodology shall be applicable in other districts of Nepal.

## Keywords:

Transport Linkage, Backbone Network, Production Maximization, Road Upgradation Model

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# Aesthetics and Building Appearance on Urban Commercial Street- A Case of NGO Road in Narayangarh

*Rachana Dahal<sup>a</sup>, Sudha Shrestha<sup>b</sup>*

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## Abstract:

The urban environment is changing as the development of urbanization takes place and the common parameters of urban environment are also being transformed. Today's urban environment incorporates a number of components that influence the quality of life, have an emotional affect on citizens as well as the architecture of buildings and constructions. Narayangarh is an emerging city and NGO Road is one of the most used streets in Narayangarh and the urbanization has also impacted in the buildings of this commercial street. This research is an attempt of in-depth study of the aesthetics and building appearance of NGO road in Narayangarh. The focus of the research lies in studying the building facades elements and its appearance from the direct observations, questionnaire survey and interviews. The methodology applied for the study is case-study methodology and the method applied is mixed i.e. qualitative and quantitative. The study is limited to observation of building frontage while the other three sides and interior space of buildings are not considered. Study concludes that there is the diversity in building facade elements as well building type, material, construction, height, color, etc. The use of modern building materials reflects the modern aesthetics, while the rectangular forms, horizontal and vertical lines, shading devices in facade indicate the adaptation of site-specific design. In the case of people's perception, the result shows majorities of respondents are not satisfied with the existing condition of the building fronts and its appearance thus, prefers an active, satisfied and pleasing environment.

## Keywords:

Aesthetics, Buildings, Building Frontage, Facade Elements, Urban Commercial Street

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# Quantitative Exploration on Ecologically Responsive Architecture Guideline(ERAG)of SONA

*Samiksha Adhikari <sup>a</sup>, Sushil B. Bajrachrya <sup>b</sup>*

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## Abstract:

Modernization and expansion of many countries have been expedited by the industrial revolution in the developed world and developing world. Humans now require housing in order to survive, and they also want to increase their level of comfort. With the increase in economic development and economic status of people in developing countries, demands for architectural resources like land, buildings or building products, energy and other resources augments too. Also in case of Nepal there is less or no planning in case of green & sustainable. There is no proper system to check sustainable parameters in Nepal. However, some guidelines are considered for architectural development which is purposed by society of Nepalese architects. This paper seeks to explore on Ecologically Responsive Architecture Guideline (ERAG)- purposed by SONA, done by closed ended questionnaire survey. To explore upon ERAG, 20 numbers of questionnaire survey were done with sustainable practicing architects & with senior architects involved in ERAG. Initially found out the reason on not continued of ERAG, maximum architects agree upon quantifying sub points is better options to continue ERAG. This paper explains about sub points to quantify ERAG based on 2 elements of Panchatattoo air & water, which I am looking upon environmental & economical perspectives. This research may be useful to SONA and sustainable practicing architect.

## Keywords:

Air, water, environmental, economical, quantify

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# Achieving Thermal Comfort through Passive Design Strategies in Energy-Efficient Rammed Earth Building

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## Abstract:

Rammed earth is an ancient technological marvel that has been constructed in various parts of the world and refined for better mechanical performance and sustainability with a low carbon footprint. In recent years, rammed earth investigations point out its cheap nature, durability, low embodied energy, and high thermal mass. In the context of Nepal, rammed earth construction is slowly growing in numbers despite some skepticism about its thermal and mechanical performance compared to modern concrete structures. This study highlights the thermal comfort based on the thermal performance of two energy-efficient rammed earth structures, namely, Mato-Ghar and Madan Puraskar Pustakalaya in the warm temperate climate of Nepal during the winter season. Both of these buildings incorporate modern passive design strategies. The comparison between the indoor thermal comfort of traditional houses, modern houses, and energy-efficient rammed earth buildings showed that both Mato-Ghar and Madan Pustakalaya appear warmer than the historic and contemporary structures in Kathmandu, with Matoghar being the warmest of all of them. Mato-Ghar structure is atleast 1-2°C warmer than the other structures. Moreover, it requires less energy to maintain thermal comfort in rammed earth structures than in other contemporary structures.

## Keywords:

Rammed earth, Thermal comfort, Thermal Performance, Comfort Temperature, Passive design strategies

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# Optimization of Firefighting capacity using Network Analysis: Case Study of Kathmandu Valley

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## Abstract:

Despite the fact that fire is the most common and economically costly disaster, fire response and preparedness appear to be significantly limited, particularly in the Kathmandu valley. Only four operational fire stations, excluding army and aviation authorities, are presently responding to fire disasters in the valley. Due to this, it is impossible for these firefighters and fire brigades to arrive at the accident scene on time. This research studies about the current response time capacity of the fire station inside Kathmandu valley using service area of network analysis in an open-source program, QGIS. Furthermore, the minimum optimal number of locations for fire stations required is calculated using open-source model, Allagash method using python programming. The result of this research shows that the valley is severely lacking in maintaining the response time of 10 minute due to lack of number of fire station. At least 56 number of fire station or fire truck at several locations is required to serve population optimally inside Kathmandu Valley.

## Keywords:

Firefighting, Kathmandu Valley, Optimization, Response time, Network Analysis, Fire, Brigade, Station

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# Problems in Residential Space facing Occupancy Change and Developing a Template for Qualitative Risk Assessment: A Case Study of Butwal City

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## Abstract:

The occupancy changes in many countries including Nepal are prevalent. Residential areas are frequently vulnerable to land use changes because of local characteristics, accessibility, renting/business concerns, and governmental legislation. This study aims to explore physical and environmental problems in the building attributes and neighbourhood premises associated with the conversion of residential buildings into mixed-use. It helps to identify factors associated with alterations based on functional, cultural and technical aspects of building attributes and neighbourhood and risks followed by such alterations, as well as rank their impacts. For the problem exploration and findings, checklist is prepared for location and building attributes on basis of literature study, and revised on basis of inspection of buildings and interviews in mixed-use settlements. The checklist prepared for the initial assessment is known as 'The Veto Criterion' and then for further assessment, the checklist prepared is known as 'The Gradual Criterion'. For the process, sample houses with mixed-use are taken and firstly, veto criterion is used for inspection if buildings are facing problems due to conversion and if it's happening then further gradual inspection is done. The possible risks are analyzed based on the three main factors: functional, cultural, and technical criteria. The major findings show the impact of identified problems on health and environment and provide enhancement measures for possible risks. Altogether, this research provides a template/framework, that can be useful for the assessment of problems due to occupancy change, and can be useful in future for creating a guideline for understanding and evaluating risks within the house.

## Keywords:

Disaster Risk Management, Ministry of Urban Development, Environmental Impact Assessment, National Building Code

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# Potential of Energy Retrofit Implementation in Non-Residential Existing Buildings

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## Abstract:

The building industry's most important service right now is sustainability. From the other perspective, the contract administrator does not openly embrace or comprehend the sustainability initiatives in the facilities management sector. As a result, the building industry is the biggest global source of greenhouse gas emissions. Energy retrofitting is a sensible alternative to demolishing every existing structure because doing so would be unfeasible. However, very few individuals use energy-saving strategies.

In this research, two different primary case studies have been taken. Hospital building are chosen for case study research among non-residential existing structures since they consume more energy than other non-residential existing building categories. One of the case studies is the hospital of Trondheim, Norway. The purpose of this case study was to comprehend the energy retrofit measures and its economic benefits. In addition, this case study served as a basis for the proposal for the second case study, which was carried out in Kathmandu, Nepal. The objective of the second primary case study, which is also a hospital, is to determine whether or not the building's energy retrofit would be financially viable.

The focus of this paper is the notion of energy retrofitting as a potential remedy. Through the use of a questionnaire, an interview with a key individual, an energy audit, and a case study, the study explores whether or not existing non-residential buildings can be retrofitted in an economically effective way that will result in a reduction in the amount of electricity they consume. The results show that this is possible, despite the fact that the term "economically efficient" is subjective. Green technologies used in the energy retrofit process that could be suggested for a future project could be the subject of further investigation in this study.

## Keywords:

Energy retrofit, Energy efficient building, Sustainable reimbursement

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# Fragility function generation for masonry residential building for a pilot site in Hetauda

*Lalit Bhatt<sup>a</sup>, Kshitij Charana Shrestha<sup>b</sup>*

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## Abstract:

Fragility function is an essential component for seismic risk assessment and its determination plays a vital role in predicting the earthquake damage and preparation for post-earthquake scenario. Although many researches have been done in the field of fragility function in Nepal post 2015 Gorkha earthquake, it has been concentrated in Kathmandu valley. This paper is focused on developing fragility function for building typologies for masonry residential buildings of a site in Hetauda which can be considered as a basis for further work across the country. Non-linear static pushover analysis has been done for evaluating the capacity of selected structure. It is observed that for unreinforced masonry structure, the probability of exceedance of life safety limit state increases considerably as the number of story increases. It is quite obvious result considering the fact that unreinforced masonry structures are prone to earthquake hazard.

## Keywords:

Non-linear pushover analysis, Masonry Residential Building, Capacity Spectrum Method, Fragility Curve

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# Numerical Study on Seismic Performance of Stone Masonry Building in Cement Mortar

*Sabin Ban*<sup>a</sup>, *Kshitij Charana Shrestha*<sup>b</sup>, *Subash Bastola*<sup>c</sup>

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## Abstract:

Stone masonry buildings, on their own, without seismic provisions are found vulnerable during earthquakes. Hence, various seismic provisions such as inclusion of different horizontal bands and vertical reinforcements are proposed by several national/international guidelines for the strengthening of the structure to resist seismic action. This thesis focuses on the analytical methodology of seismic performance assessment of those stone masonry buildings with cement mortar through a case study of building prototype presented in Department of Urban Development and Building Construction (DUDBC) catalogue. The work analyzes the effectiveness of several strengthening components of masonry model with comparison to simple unreinforced masonry model. Stepwise procedures of seismic assessment are analyzed through non-linear pushover analysis in DIANA FEA and fragility functions are generated to define the vulnerability level of the studied buildings. The fragility analysis highlights the vulnerability of the unreinforced buildings over the reinforced counterparts.

## Keywords:

Stone Masonry, Finite Element, Fragility

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# Socio-cultural Dimension of House Form of Magar Community: A case of Thabang village, Rolpa

*Manisha Yogi<sup>a</sup>, Sanjay Uprety<sup>b</sup>*

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## Abstract:

Thabang is a village which carries deep and strong political and social history. Previous studies were more focused in its political development and agricultural knowledge. Other aspects of this settlement are not given much attention. Thabang has unique settlement pattern and dwellings. The ecological factors of temperature, nature and environment helped shape the traditional architecture of Thabang. In addition to analyzing the effects of modernization processes on Thabang villages from the perspectives of geographical region, cultural spirit, socio-economic condition, and time dimension, it is necessary to discuss how the traditional social structure of Thabang village is reflected in the spatial distribution of dwellings. Finally, it is important to summarize the importance of the spatial environment and architectural spatial structure of Thabang traditional settlements. Magar settlement is a bounded ecological system where missing a single element will break this chain. Festival is one of the most important elements of this ecosystem. Festival is a thread which connects tangible and intangible aspects along with the elements of ecosystem of Thabang village. The major objective is to study magar settlement as an ecological system. Examine the socio-cultural practice of magar community with respect to house form and festivals. The research method combined a qualitative approach with a descriptive interpretative strategy. Through observation, interview, literature review, and conversation with resource people, primary and secondary data collection was carried out. Thirty respondents were purposively selected for questionnaire survey. Questionnaire survey was conducted for data collection. For qualitative analysis interview was conducted. Desired direction for transformation of the settlement needs to be in ecologically responsive architecture which is inspired from its traditional surrounding architecture. Keeping rural people involved in transforming and managing the landscape. A community's streets, sidewalks, parks, buildings, and other public spaces can all be improved through place creation. This includes both private and public locations.

## Keywords:

Traditional architecture, Festival, Society, Culture

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# A General Review on Application of GNSS for Structural Deformation Monitoring

*Digvijaya Paudel <sup>a</sup>, Bikash Sherchan <sup>b</sup>, Krishna Prasad Bhandari <sup>c</sup>*

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## **Abstract:**

Engineering structures need to be timely monitored for identifying any sort of deformation. Conventionally employed surveying techniques such as Total Station survey, Precise leveling are more labor intensive and computationally tedious. In recent times, GNSS based positioning method has been identified as a major substitute of conventional techniques in order to monitor both horizontal as well as vertical displacement of engineering structures even in real time. However, various modes within GNSS positioning and other factors limits the attainable accuracy level in deformation monitoring. Therefore, in this article a comparative study on different modes and other alternative techniques is made and aims to summarize the key concepts, historical experiments and current innovative trends within GNSS based deformation survey.

## **Keywords:**

deformation monitoring, GNSS

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# Effect of Brick Dust on Soil and Strength Improvement with the use of Plastic Waste

*Susan Paudel<sup>a</sup>, Bhim Kumar Dahal<sup>b</sup>*

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## Abstract:

In the age of rapid development, massive civil engineering structures are being built on top of the soil. Soil properties varies from one location to the other. Many of them show problematic behavior such as swelling, poor drainage, low strength that can lead to catastrophic failure of the structure built above it. This paper focuses on the effect of brick dust and plastic waste as a alternative way to improve soil properties. The study performed were Atterberg's limit, Compaction properties and unconfined compressive strength (UCS). Soil has been tested with addition of brick dust in ratio of 10%, to 50% by weight. Plastic waste is added on each brick dust ratios of 30%, 40% and 50% in the amount of 0.25%, 0.5% and 1% to test the compressive behavior of soil at different curing periods. It is concluded that the addition improves the soil behaviour by decreasing its plasticity index, increases the compaction index and also improves the geotechnical parameters.

## Keywords:

Soil stabilization, Brick Dust, PET plastic, Atterberg's, UCS

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# The notion of Ageing in Place and Age-Friendly Housing in Core Urban Area of Lalitpur

*Shreejana Maharjan<sup>a</sup>, Ashim Ratna Bajracharya<sup>b</sup>*

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## Abstract:

This paper aims to study the notion of ageing in place amongst the active elders in the core urban area of Lalitpur and focuses on elders living alone or with spouse. Furthermore, this study also aims to identify the current condition of housing structure that is imperative for an age-friendly city and analyze whether the current city is able to promote independent and active ageing amongst the older population. This study conducted descriptive analysis on data collected through a structured questionnaire and interviews with 112 active elders using snowball-sampling technique. The findings of the study established that the elderly citizens residing in core urban area of Lalitpur had a strong notion of ageing in place, with majority feeling attached to their locality and refraining from migrating to any other area. However, the study revealed that the current housing and building structure of the area do not meet the requirements of age-friendly housing. The factors like easy access to dwelling, ease of walkability, mobility within the house, access to basic needs like toilet and bedroom, and access to sufficient sunlight and natural ventilation in their building were particularly challenged. The study concluded that Lalitpur and other rapidly urbanizing areas should devise a housing guideline to facilitate active ageing.

## Keywords:

Active Ageing, Age Friendly Housing, Ageing in Place, Built Environment, Core urban area

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# Numerical and Experimental Investigation of Exhaust Flow from Convergent-Divergent Nozzle

*Santosh Ranabhat <sup>a</sup>, Kamal Darlami <sup>b</sup>, Sudip Bhattarai <sup>c</sup> Nischal Shrestha <sup>d</sup>*

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## Abstract:

Convergent-Divergent (CD) nozzle is a simple cross section varying tube and used extensively in almost all high speed propulsion systems. Exhaust flow from the nozzle have significant characteristics for the prediction of nozzle performance and hence proper understanding and investigation technique of nozzle flow and exhaust plume is worthwhile. The flow characteristic of fluid through CD nozzle vary significantly according to the pressure difference between inlet and exhaust ambient pressure. Critical pressure ratio producing sonic flow at the throat and higher pressure difference is responsible for the formation of normal shock wave within the diverging section and it travels from throat to outlet region as the pressure gradient increases due to the effect of back pressure. Further increase in pressure difference causes under-expanded, over-expanded or perfectly expanded flow according to the ambient pressure. Theoretically, there is no any formation of oblique shock for perfectly expanded condition and parallel and streamline exhaust exit flow is most efficient for optimum thrust development. A specific planar nozzle geometry with exit Mach 2 is designed and key thermodynamic parameters are calculated at various sections. Computational Fluid Dynamics is used with well posed boundary conditions, numerical simulations are run for different operating nozzle pressure ratios. A setup of flow visualization with Optical Schlieren Imaging System is established and monochrome Schlieren image of exhaust flow from the designed nozzle is captured for the validation of simulation flow results. analysed.

## Keywords:

Compressible Flow, Isentropic Relation, Convergent-Divergent Nozzle, Normal and Oblique Shock Waves, Schlieren Imaging

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# Ensemble Learning Approach for Diabetes Mellitus Prediction

*Sujeet Kumar Jha <sup>a</sup>, Nanda Bikram Adhikari <sup>b</sup>*

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## Abstract:

Diabetes is one of the most common non-curable metabolic disorders, affecting approximately 10 million people each year, according to recent reports. So far, researchers have used a variety of data mining techniques to assist healthcare professionals in determining whether a person is diabetic or not. The prediction is generated by analyzing patient data from the data repository. Logistic Regression, K-Nearest Neighbors, and Decision Tree were the classifier algorithms that were tested. Based on performance parameters (accuracy, precision, recall, and F1-score), the three best classifiers were chosen and nominated for ensemble classification via a voting mechanism. In this paper, the main contribution is parameter selection for the Hyperparameter optimization are:- 'voting': 'soft', 'weights': ([0.753144, 0.852332, 0.805268]). The voting options were Hard/Majority voting and Soft voting. Soft voting with a weighted average outperformed other algorithms with an accuracy of 87.8 percent, precision of 88, recall of 87.0 percent, and f1 score of 87.5 percent.

## Keywords:

Diabetes, Ensemble, Intelligent healthcare, BRFSS Dataset

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# Utilization of Plastic Wastes to Improve the Properties of Bitumen in Road Construction in Nepal

*Nabin Poudyal<sup>a</sup>, Iswar Man Amatya<sup>b</sup>, Anil Marsani<sup>c</sup>*

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## Abstract:

Waste plastics are very common in world. Plastics, being easy to carry, are extensively popular in every type of profession. But in the environmental point of view it poses alarming threat to the nature as they are non biodegradable. In the present scenario, waste disposal methods that are adopted have not been able to completely eradicate the plastic wastages which have a negative impact on the environment and health of human. Due to varied application of the plastic, the plastic related waste production cannot be completely eliminated rather it can be reduced and recycled and reused in different sectors through technological innovations. One of promising options to utilize the waste plastic is to mix the waste plastic to modify the bituminous mixes used for paving roads. In this study Low Density Polyethylene (LDPE) plastic waste is used for modification of bitumen. From municipal solid waste, plastic waste is separated. The plastic wastes (LDPE) were cleaned and were cut into 2.36 mm to 4.75 mm conformed from previous research. Bitumen was then heated to 160 to 170°C and plastic waste in shredded form was slowly added in equal proportion. The comparative properties of bitumen and plastic waste modified bitumen in terms of penetration value, ductility value, softening point value, viscosity value, flash and fire point values tests showed the decrement in penetration and ductility value and increment in softening point and viscosity as the proportion of plastic waste percentage by weight of bitumen is increased. Flash and fire point value observed was almost the same nature even with increase in plastic waste content. The results from this study showed the addition of plastic waste to the normal bitumen improves the characteristic properties and strength as well as stiffness, temperature susceptibility and consistency of bitumen.

## Keywords:

Bitumen, Low density polyethylene, Plastic waste modified bitumen, Plastic waste

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# Effectiveness of Environmental Impact Assessment (EIA) Implementation in Major Airports of Nepal

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## Abstract:

Environmental Impact Assessment is a management tool which is used to identify and evaluate potential environmental impact caused by the proposed project to help in decision making and environmental management. Performance evaluation of EIA study in sectoral development of international airport infrastructure is needed because such infrastructures are considered as national pride projects in Nepal. EIA study reports might lack further guidelines and monitoring and could fail to win public support and neglecting the development of project alternatives as well as they are incompetent with lack of political will and inadequate preparedness on the part of government. In this study, three types of EIA effectiveness (procedural, transactive and substantial) was evaluated for major airports of Nepal. The procedural effectiveness index (PEI) was determined through a mathematical relation which included procedural and transactive effectiveness of EIA study. The weightage coefficient for each variable of relation was determined using AHP (Analytical Hierarchy Process) method. For the substantial effectiveness of EIA, compliance check of mitigation measures proposed during EIA study was evaluated for physical environmental parameters. It was observed that the PEI value of both Pokhara Regional International Airport (PRIA) and Gautam Buddha International Airport (GBIA) was 78% and that for the proposed Nijgadh International Airport (NIA) was 65%. The substantial effectiveness of EIA during construction stage at PRIA and GBIA was 79% and 54% respectively. The compliance during operation stage at GBIA was 57%. These values indicated that the EIA study of those airports could not succeed to fully comply with environmental safeguard. Hence, a strategic environmental assessment of plan should be conducted followed by follow-up study for sustainable development with better environmental management.

## Keywords:

Analytical Hierarchy Process, EIA effectiveness, International airports of Nepal, Procedural Effectiveness Index

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# Effect of Secondary Factors (fare type, crowding, door location) on Dwell Time of Public Buses in Kathmandu Valley

*Roshan Pathak<sup>a</sup>, Pradeep Kumar Shrestha<sup>b</sup>*

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## Abstract:

Dwell time, the additional delay that the public transport mode user has to suffer in comparison to that of private mode user and covered greater portion of travel time. Variability of which greatly influences punctuality of public transport mode and ultimately hindered the public transportation system reliability pushing public mode users toward private mode. Therefore, development of accurate dwell time estimation model and analysis of different contributing factors for longer dwell time becomes necessary. With the help of multiple linear regression model and using collected video recording data, model estimation for public bus as well as impact of contributing factors of dwell time such as cash fare payment, in-vehicle crowding condition and vehicle door position were able to establish. Cash fare payment has found to be increased both boarding and alighting time by 1.392 s/pax and 1.177 s/pax respectively in comparison to pre-paid fare. Similarly, both boarding and alighting time has found to be gradually increased as the in-vehicle crowding condition increases. Large bus with central door position was found to be more efficient than front door for the purpose of dwelling.

## Keywords:

Dwell time, public bus, multiple linear regression, cash fare payment, in-vehicle crowding, door position

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# Accessibility in Public Buildings for People with Disability: A Case of Patan, Nepal

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## Abstract:

Nowadays, there is growing local, national, and international awareness about the enormously widespread worldwide problem of disability. As a result, accessibility in built environments is crucial for a variety of reasons. Today, not every person can enter a building or an office successfully. The United Nations' policy that states "No piece of the developed condition ought to be defined in a way that rejects certain groups of individuals based on their incapacity or frailty" is logically inconsistent with the situation in question. The objectives of the study are to investigate the current status of accessibility in the public buildings of the historic urban core of Patan, Nepal. It is based upon detailed observations of accessible provisions through site analysis and photography with a focus on the access audit of new and old public buildings. The aim is to evaluate a specific environment's performance in terms of usability and accessibility for a wide variety of potential customers, including those with disabilities, and also to recommend accessibility enhancements. The gaps in implementation of the urban design guidelines are revealed by the access audit. The access audit demonstrates the compliance of various public infrastructures with the accessibility guidelines provided by the UN Design Manual. The study's findings suggest that the majority of the public structures under study do not meet the accessibility requirements for people with disabilities to the same extent as they should, as no one of them registered full compliance with the guidelines. Overall, it is indicated that accessibility is not well-integrated into older public facilities whereas a few newer constructions have incorporated accessibility into their designs. The public space's performance elements fell between 56.18% and 14.71% short of guideline requirements. Based on these findings, the local administration and the community need to work more to provide more public infrastructures which are suitable for people with disabilities. The findings of this study could be a road map for managers, planners, architects and engineers for safe and inclusive built environment.

## Keywords:

Disability, Accessibility, Universal design, Public space, Urban design, Social inclusion

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# Effect of Orientation of Arches and Hangers in Tied Arch Bridge System

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## Abstract:

This paper presents an attempt to compare between parallel, cross (spider) and infinite orientation of arches with vertical, network and fan-type arrangement of hangers. The comparison criteria set up were arch moment, arch thrust, tie moment, axial force in hangers and fatigue stress in hangers. Bridges were modeled for different span range, altogether 81 models were studied in this research. For 51.45 m span, we used standard data of Bijuli-Bazar tied arch bridge, Dhobi khola, Kathmandu. For other span length, empirical design values were used. This study gave some interesting findings which can be useful for design of tied arch bridge. It was found that, for vertical arrangement of hangers, cross (spider) orientation will give lower value of arch moment, arch thrust, tie moment and axial force in hangers than parallel (conventional) orientation of arch. But, for network type of arrangement of hangers, it was found that conventional orientation will result lower member forces than cross orientation. However, in fan type orientation of hangers, it was found that for small span range, cross orientation will show better performance than parallel orientation. For all the arrangement of hangers, infinite orientation resulted higher value of arch moment, tie moment, axial force in hangers (except arch thrust) than cross and parallel orientation of arches. In addition, when fatigue was the design criteria it was found that conventional system will show better performance than cross and infinite orientation for all arrangement of hangers.

## Keywords:

parallel (conventional) orientation, Cross (spider) orientation, infinite orientation, vertical hangers, network hangers, fan-type hangers

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# Effectiveness of GI Wire Mesh on Performance of Stone Masonry Buildings with Mud Mortar

*Pradip Pokharel<sup>a</sup>, Hari Ram Parajuli<sup>b</sup>*

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## **Abstract:**

Stone masonry houses with mud mortar are the most common type of houses found in hilly and mountainous regions of Nepal. These structures are highly vulnerable during earthquakes resulting maximum number of casualties. It is necessary to improve the seismic performance of existing and new SMM buildings. Therefore, a simple, affordable, replicable and economical method is introduced to make such houses earthquake resistant. A typical SMM building is numerically modeled in ANSYS software with and without GI wire mesh. Pushover analysis is performed to determine the performance of both models. The capacity of building is evaluated in terms of base shear versus roof displacement plot. The performance of the building is also determined by plotting the capacity curve and demand curve in the same graph using FEMA 356. The results show that the performance of SMM building reinforced with GI wire mesh is effective in preventing collapse during earthquake and can save human lives.

## **Keywords:**

SMM, GI wire mesh, Pushover Analysis, Capacity Curve

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# Non-Linear Soil Amplification Factor Zonation of Kathmandu Valley

*Mousam Mainali*<sup>a</sup>

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## Abstract:

Because of Nepal's location on the ridge where the Indian and Eurasian tectonic plates meet, earthquakes happen there frequently. In addition, the Kathmandu Valley is a basin formed by sediments from an old lake that are composed of silt, clay, sand, and gravel in uneven strata with varying ages that are several hundred meters deep. The geology of a particular region and the subsoil properties significantly affect the characteristics of ground motion, as evidenced by the differences in structural damage in the basin observed during earthquakes compared to the exposed rock surrounding it or even within the basin itself from location to location. There is a chance that during an earthquake, the increased frequencies may induce a resonance with the valley's numerous low-rise to medium-rise buildings, historically significant locations, and monuments, potentially resulting in the collapse of structures. Therefore, it is crucial to establish the amplification factor, particularly in soft soils. This work used ground motion data from the Gorkha earthquake to perform 1D ground response analyses utilizing an equivalent Linear and Non-Linear analytic approach for a number of sites. According to the study's findings, northern deposits have a larger amplification factor than southern ones. Therefore, site soil conditions must be taken into account while building structures that are earthquake-resistant or when preparing to minimize the scope of potential damage that earthquakes could generate.

## Keywords:

Linear Analysis, Non-Linear Analysis, Amplification factor, Kathmandu valley, Earthquake, Local Geology

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# Identifying and Evaluating the Criteria in Planning the Excavation Support System in Basement Construction using Analytical Hierarchy Process

*Manish Thapa<sup>a</sup>, Naba Raj Neupane<sup>b</sup>, Pawan Chhetri<sup>c</sup>*

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## **Abstract:**

With increase in urbanization and parking issues in the Pokhara Metropolitan City, the basement construction practice has been popular among builders and house owner in this city. Basement building involves the deep excavation during construction of foundation. Proper planning are required during the selection of support system which helps in successful completion of project within the budget and time. The objective of this paper is to identify the criteria in planning the excavation support system in basement construction in Pokhara Metropolitan City. Direct field investigation with questionnaire for key informants of the under construction basement building permitted by Pokhara Metropolitan City was done to know existing scenario of temporary protection measure and identify the criteria in the selection of excavation support system. Through field survey and expert consultation, five main criteria and twelve sub criteria along with seven protection measures during excavation were identified. The pairwise comparison of the criteria was carried. The total of 16 experts from academic, consultant, contractor and government officer were formed to administer comparison between the criteria. The result of this research is weightage for each criteria and sub criteria using AHP analysis through super decision software. Safety criterion is regarded as the main criteria in this issues followed by soil condition, constructability, environment impacts and cost. The protection of adjacent buildings is most important factor to be considered before excavation work. Based on the rank scale questionnaire, providing setback from all side of the building is the best performing option for excavation support followed by shoring, slope cutting and diaphragm wall during basement construction in the context Pokhara Metropolitan City.

## **Keywords:**

Basement construction, Excavation support system, Analytical Hierarchy Process, Rank Scale Questionnaire

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# A Study on the Factors Influencing Red Light Violation Behavior of Pedestrians in Kathmandu Valley

*Deepak Raj Shah<sup>a</sup>, Rojee Pradhananga<sup>b</sup>*

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## **Abstract:**

One of the most critical reasons for pedestrian fatalities in signalized urban intersections is their risk taking behavior and tendency to run red lights. The current study is an attempt at assessing the factors influencing red light violation behavior of Nepalese pedestrians. Binary logistic regression has been conducted on a total of 600 pedestrians. The logit model results show that Age, carrying a child/heavy load, traffic volume, pedestrian speed, number of pedestrians waiting at the crosswalk and group crossing, significantly affect pedestrians' decision to commit red light violation or wait until green. Parameters such as Gender and Number of active violators were not found to be significant predictors. The accuracy of the developed logit model in predicting red light violation behavior was 90.7% while the overall accuracy of the model was 82.2%.

## **Keywords:**

Red Light Violation, Logit Model, Pedestrian Safety, Road Crossing Behavior

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# Analyzing Willingness to Shift to Proposed Metro Rail System for Work Trips: A Case of New Baneshwor and Radhe Radhe

*Subina Shakya<sup>a</sup>, Ashim Ratna Bajracharya<sup>b</sup>*

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## Abstract:

With the increasing population in Kathmandu, there seem to be challenging mobility issues. Low occupancy and unregulated services of public vehicles have resulted in more private vehicles on the road. As such, in the last few decades, the number of new vehicles in the city has tripled, adding to the traffic volume and traffic congestion. Thus, the city is in dire need of efficient and reliable public transportation: one that would encourage walkable communities and transit-oriented development while lowering fuel consumption, reducing dependency on private vehicles, and reducing traffic congestion and pollution. To solve these problems, various studies on Mass Rapid Transit (MRT) are being conducted. This study seeks to examine the rarely studied yet crucial element—the perspective of potential users. Using the Stated Preference survey, the willingness to shift of 200 respondents in the proposed metro station location at New Baneshwor and Radhe Radhe was conducted through direct interviews. The results suggest that about two-thirds of the respondents were willing to shift to the metro. The study has discovered some intriguing relationships between willingness to shift and factors including income, distance, mode of transportation, and origin and destination. Findings from the study revealed that the respondents willing to shift were mainly those with trip distance more than 2 km; high and medium-income groups; commuting by ride-sharing, private, and public vehicle users; while those unwilling to shift were those commuting less than 2 km; low-income group; and those commuting on foot or on cycle. Although there were significant differences in the settlement patterns of the two-study area, the responses were indifferent to spatial patterns. Hence the study concludes that there is a need for MRT in the city as the current public transport infrastructure has failed to meet the needs of the commuters.

## Keywords:

Willingness to Shift, Mass Rapid Transit, Metro Station, Stated Preference

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# Rock excavation and support for an underground powerhouse cavern at Super Dordi Kha Hydropower Project, Nepal

*Shuvam Adhikari*<sup>a</sup>, *Chhatra Bahadur Basnet*<sup>b</sup>, *Ghan Bahadur Shrestha*<sup>c</sup>

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## Abstract:

Super Dordi Kha Hydropower Project is located in Lamjung, Nepal. It is located in a foliated banded gneiss rockmass. Many underground structures have been implemented in the project such as tunnels, desander caverns and pressure shafts and surge shafts. However, this paper is limited to discussing the rock excavation and support of the powerhouse cavern only. Rock engineering assessment of the study area was carried out through extensive fieldwork. The input parameters were established based on the constructed geological model, various laboratory tests, empirical formulas and stress analysis by construction of valley model. Numerical model of the underground cavern was established based on the rock excavation sequence and support used in the site.

## Keywords:

Himalyan Geology, Numerical model, Powerhouse cavern, Underground Structures

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# Evaluation and Comparison of Performance of Solar PV panel with and without External Plane Mirror as well as with External Plane Mirror Subjected to Air as a Cooling Medium

*Subash Wagle<sup>a</sup>, Rajesh Kaji Kayastha<sup>b</sup>*

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## Abstract:

This research paper proposes an unique originating design for generating more power by using plane mirror reflection of light propagating towards solar cells of solar photovoltaic systems and usage of air cooling to the PV cells when solar PV cells cross optimal temperature limit. This study provides novel methods for justifying this type of framework outline as well as preliminary findings about the use of a uni-directional reflectance function. In this study, the advantages of employing a plane mirror as a reflector for photovoltaic applications are quantified, as is the usage of a plane mirror in conjunction with solar PV cells that are exposed to air as a cooling medium. Shade, the sun's sporadic nature, and dust reduce the total quantity of incoming radiation on a PV panel, which affects the panel's efficiency. The impact of the aforementioned problems was minimized by the employment of a plane mirror, which ultimately increases radiation to the solar cells. When solar PV cells are exposed to both direct and reflected light at the same time, their temperature crosses the optimal temperature threshold and efficiency begins to decline. By using a cooling medium, efficiency may be increased once again. The performance of a silicon polycrystalline PV module with a mirror reflector and a solar cell with a plane mirror exposed to air as a cooling medium is experimentally measured, and its performance with and without the mirror are contrasted. The efficacy of solar PV cells with plane mirrors and solar PV cells with plane mirrors exposed to air as a cooling medium was evaluated by experimental observation.

## Keywords:

PV; PTRS; Cooling Medium; Power Output, Performance Enhancement, Tracking system

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# Explanation-Driven Deep Learning Model for Diagnosis and Prediction of Lungs Diseases using Chest X-ray Images

*Sabita Dahal <sup>a</sup>, Sashidhar Ram Joshi <sup>b</sup>*

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## Abstract:

Research on COVID-19 has been an important topic as it has negative impacts on economics of the globe. Although many researchers have built classification model with large accuracy, we have observed a strong gap for Explanation based classification and diagnosis model for the interpretation of the model's prediction. So, this study purposed an Explanation based computer aided diagnosis system (CADx) based on deep learning using an Convolutional Neural Network, model for four categorical classification of lungs diseases (COVID-19, non-COVID pneumonia, tuberculosis and healthy) based on chest x-ray images. We used SHAP and LIME as different Explainable AI algorithms for the interpretation of different types of lungs diseases predicted by model. This purposed model used clinician dataset of Nepal for the validation purpose. A total of 105 Chest x-ray images belonging to different classes are collected for validation which are further augmented to increase the amount. We have got an overall validation of 85% and Test set accuracy of 91%. The f1 score of 86.75% is obtained. To show how the model performs locally, LIME builds sparse linear models around each prediction. When interpreting the results, we employed SHAP to assure consistency and local accuracy because Shapely values look at all future predictions using all potential input combinations. The shapley value of the SHAP method helps to determine the category of the x-ray image, and the output of the LIME algorithm displays the region of the lungs used for categorization.

## Keywords:

COVID-19, CADx, CNN, Data augmentation, Deep learning, Explainable AI, Grad CAM, LIME, ROC curve, SHAP, Transfer Learning

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# The Project Manger's Strategic Leadership Attributes for Effective Construction Project Performance in Nepalese Context

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## Abstract:

Demand for construction project performance is skyrocketing in construction industry around the globe; Construction project performance challenges are becoming more severe than ever before. Since, construction industry plays an important role in the national economy of the country, construction project influence long-term socioeconomic development in developing countries, the Construction projects are expensive and technically demanding, the poor performance of projects has severe implications for the nation and its citizens but the Project performance is one of the most critical challenges for all grassroots, national and international development of construction industry. A project manager , a critical resource in the project performance since,the project teams in construction industry is large and diverse, a project manager as leader ; only the person that has the overall responsibility for the successful initiation, planning, design, execution, monitoring, controlling and closure of each and every aspect of project activities in construction industry, only the person that could motivate and influence all the allied subordinates and followers to achieve the specific goals and objectives of the organization for success by executing the project within project performance constraints such as time, cost, and quality, achieving project objectives and beneficiary satisfaction towards making the project success , so greater attention and emphasis must be given for the adoption and application of project manager's strategic leadership attributes as per established regression model and its respective parameters to be considered in priority and preference as per relative importance index(RII) and Rank value from study for effective each construction project performance constraints/indexes as required for the project manager's strategic leadership attributes and parameters for effective construction performance in Nepalese Context.

## Keywords:

Project Manager, Strategic, Leadership, Construction Industry, Responsibility, and Project Performance.

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# Modelling of Pedestrian Walking Behavior at Foot over Bridges

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## Abstract:

The paper aimed to develop the model of pedestrian speed at foot over bridge considering five site of the New road area of Kathmandu Metropolitan city. Videography survey was done for data collection. Speed variation in each category of pedestrian speed was determined based on gender, age, mobile use, luggage carrying condition and group size. Macroscopic (speed, flow & density) and microscopic parameter (age, gender, mobile use, luggage condition & group size) along with physical dimension of the foot over bridge was taken into consideration for model development. Multiple linear regression analysis was done for model formulation using SPSS. Independent variables gender (female), age (11-20), age (21-40), age ( $\geq 60$ ), mobile use (no), luggage (yes), group size ( $G \leq 2$  &  $G > 2$ ) and average pedestrian density were found to be significant. MAPE and Pearson correlation coefficient was determined for model validation. Hence, the model was found to predict well for pedestrian speed.

## Keywords:

Foot over bridge, Pedestrian speed, Multiple linear regression, Correlation analysis, Speed variation

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# Effect of carbonation Induced Corrosion on Seismic Vulnerability of RC buildings

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## Abstract:

The properties of constituent materials influence the seismic performance characteristics of RC structures. The mechanical and geometrical properties might change as a result of exposure to adverse environmental conditions. Carbonation induced reinforcement corrosion is one of the major factors causing deterioration of reinforced concrete structure. This paper aims to develop the effect of carbonation induced corrosion of reinforcement on overall seismic performance of a RC building .The fragility curves are derived at the various time periods for different limit states. The results show an overall decrease in seismic capacity and increase in seismic vulnerability over time due to corrosion indicating the significant effect of deterioration due to corrosion effects on structural behavior.The capacity of the structure is reduced by 8% after 60 years and 29% after 100 years due to reinforcement corrosion. The corrosion of reinforcement degrades the mechanical properties of the materials in a reinforced concrete which decreases the stiffness of building and thus leads to decrease in capacity and increase in fragility of the building.

## Keywords:

Carbonation, Corrosion, Seismic vulnerability, Time dependent fragility curves

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# Seismic fragility assessment of RC framed structure under varying ground motion duration

*Seema KC<sup>a</sup>, Prem Nath Maskey<sup>b</sup>*

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## Abstract:

Earthquakes are considered as the major unpredictable natural phenomenon often resulting in major disasters. Here in this study, the effect of the duration is isolated from other parameters related to ground motion like amplitude, and response spectral shape by assembling spectrally equivalent long and short duration pairs of records using Seismomatch and Seismosignal. The performance of buildings constructed in accordance with Nepal's National Building Codes of Practice in relation to seismic design is carried out. Incremental dynamic analysis is performed using SAP2000. From results, it shows that the lateral story displacements increase with the increase in duration. The collapse prevention state for 4-story buildings is attained at higher values of PGA compared to 7-story buildings with a decrement in value of PGA at collapse by 8.8% and 29% respectively for long-duration motions. The fragility curve shows the increase in the probability of collapse by 40% and 60% at 0.5g and 0.44g and there is an increase of 14% and 19% in collapse capacity ratio respectively for 4 and 7 -story building when significant duration value increased from 2 to 4 times. So, it is concluded that longer-duration earthquakes have significant effects on seismic responses of the structure.

## Keywords:

Long duration motion, Fragility Curve, Collapse Capacity, Incremental Dynamic Analysis

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# Seismic Response of Soft Story RC Building

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## Abstract:

Nepal is one of the seismic prone country and many of city is growing haphazardly which have so many buildings are soft according to achieving their demand like basement parking, shopping complex etc. The main objective of this thesis is to briefly describe about analytical seismic performance evaluation for RCC frame building with masonry infill through non linear static pushover analysis. The building is designed by response spectrum analysis using IS1893:2016 and seismic behavior is evaluated using pushover analysis. For pushover analysis, defining hinges by ASCE 41 code with auto defined for beam and column and for equivalent strut hinges are defined manually. The performance point is obtained after analysis and it has been seen that the performance point is increasing upward when the location of softness is shifted upward in both Push X and Push Y loading case. The evaluation of Base shear, time period, displacement, story drift and hinges properties at the performance level of the building in different location of soft storey cases in both direction. The lateral stiffness and strength of the building is increasing with masonry infill which reduces the top displacement but lateral forces are heavily increased.

## Keywords:

Seismic evaluation, performance point, Pushover analysis, Equivalent strut, Soft stories, IS1893:2016

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# Use of scutoid inspired geometry in curved surface of revolution

*Prashanta Dhimal<sup>a</sup>, Hikmat Raj Joshi<sup>b</sup>*

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## Abstract:

Scutoid is a shape that is reminiscent to both a frustum and a prismatoid. These shapes are found in naturally occurring epithelial cells in animal bodies and are often exposed to variety of forces that mimic the loads experienced by a structure in its lifetime. This paper focuses on using bio-inspired scutoid shapes to use millenia of evolution to our advantage by creating geometry to place straight frame elements in a curved surface. Curved surfaces of revolution were generated using 3 points to form an arc . By varying the position of middle point, different curves of linearly varying curvature were generated. A number of random seed points were placed in the curve and was assymetrically scaled and transformed to facilitate the formation of scutoids by the use of voronoi diagrams. The models without scutoids contain fructums as the basis for position of straight frame elements. Three different load cases namely Self weight, Ramp time history load to simulate impact load and 100kN load distributed on all outside joints to simulate roof load were chosen for the analysis and was applied in linear range to both the scutoid and non-scutoid models. The results show varying degree of efficiency in deflection with minimal increase in material usage and models with smaller absolute values curvatures were shown to be effective for the chosen 3 load cases.

## Keywords:

Scutoid, Straight frame in curved surface, Bio-mimicry, Shells of revolution

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# Bridge Deck Quality Indexing based on Non-Destructive Tests

*Umesh Pant <sup>a</sup>, Jagat Kumar Shrestha <sup>b</sup>*

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## Abstract:

This paper presents the use of non-destructive tests (NDT) for the assessment of the structural condition of Reinforced Concrete (RC) bridges. Typical damages to in-service concrete bridges include corrosion of rebar, void formation delamination, cracks, wear, and surface blemishes. Detection of the damages is very important to plan a repair and rehabilitation of the bridges to prevent catastrophic failures. In-service RC bridges are selected on the basis of the life served. NDTs, namely the Ultrasonic Pulse Velocity Test (UPVT), rebound hammer test, and electrical resistivity test are used for the determination of structural health i.e. degradation of strength of concrete, the extent of the corrosion, determination of potential voids, cracks, determination of modulus of elasticity. For pilot testing, one of the selected bridges was tested. Based on the different NDT parameters and outputs, a bridge deck quality index is proposed for assessing the condition of RC in-service bridges.

## Keywords:

Bridges, Non-Destructive Tests, Structural Health

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# An assessment of Pedestrian Compliance on Using Foot Over Bridge: A Case Study of Kathmandu Valley

*Rajja Shilpakar <sup>a</sup>, Padma Bahadur Shahi <sup>b</sup>*

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## Abstract:

A Foot Over Bridge (FOB) is a type of grade-separate crossing facility that is constructed above the roadway and has a profound role in the road network. It is one of the safest road crossing facilities that eliminates conflict between pedestrians and vehicles plying on the road while crossing. Yet, the usage rate of FOB seems to be low as most pedestrians try to cross the road through the road itself. This study focused on determining significant factors affecting the use of FOB and perception of pedestrian toward FOB. Eight FOB locations within the Kathmandu valley were chosen as the study area to fulfill the objectives of the study. The detailed data collected from these locations were analyzed and used in developing Multiple Linear Regression (MLR) models through Statistical Package for Social Sciences (SPSS) using a stepwise method, and the best models were predicted. Furthermore, a set of structured questions was prepared and a questionnaire survey was conducted in these locations in order to determine the behavior and attitude of pedestrians toward FOB. Traffic volume, vehicle speed and road width are found to be significant factors affecting the use of FOB. Similarly, the result from questionnaire survey shows that time saving is the prime reason for not using FOB whereas safety is the prime reason for using FOB.

## Keywords:

Pedestrian, Foot Over Bridge, Pedestrian Compliance, Pedestrian Perception, Multiple Linear Regression, Grade Separated Crossing

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# Climate change Impact due to Hydrological Alteration in Kaligandaki River Basin in Nepal

*Maheshwor Dahal<sup>a</sup>, Mukesh Raj Kafle<sup>b</sup>, Aditya Dhakal<sup>c</sup>*

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## Abstract:

Climate changes, particularly those related to temperature and precipitation, can have a negative impact on the region's hydrological regime. In our study, we modeled how climate change might affect the hydrological regime and water balance of the snow-dominated Kaligandaki Basin. Based on SSP245 and SSP585 of the ensemble General Circulation Model (GCM) outputs from CMIP6, the HEC-HMS model was used to estimate changes in the hydrological regime of the Kaligandaki basin in the future. According to the study, climate change is causing a rise in the river's annual average discharge. Under both SSP245 and SSP585, seasonal variation in river flows is anticipated to decline solely during the post-monsoon season. However, under scenarios SSP245 and SSP585, monthly variation in river flows is anticipated to grow in most months and decrease in September, October, and November during the course of the NF, MF, and FF. In general, the rising trend of river discharge increases the likelihood of future natural disasters such as floods, landslides, and soil erosion. Our findings are anticipated to contribute to a better understanding of the hydrological characteristics of the Kaligandaki River, future benefits associated with an increase in the river's average annual discharge, such as increased hydropower production and irrigation opportunities, as well as adaptation strategies that can lower risks associated with an increase in the river's hydrological flow.

## Keywords:

HEC-HMS, CMIP6, Climate Change, Kaligandaki River Basin

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# Effective Strategies to Reduce the Impacts of Inflation in the Construction Industry of Nepal

*Suman Rai<sup>a</sup>, Dipendra Gautam<sup>b</sup>*

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## **Abstract:**

This research examines the impact of inflation in the construction industries of Nepal during the time period of 2012 to 2020 and identifies the key strategies used and suggested by the experts, engineers and contractors. During this time the price of construction materials have raised significantly which has put various impacts upon construction industries causing direct threat to the important construction projects. Also, there is strong likelihood of increase in the future too. Incorporating evidence from various literature, personal experiences, interviews, publications, this study demonstrates that advanced procurement, lean construction, robust communications, price adjustment clause in the contracts, risk sharing, redesign of the structural elements, rescheduling of the construction works, proper workmanship, planning with advanced software like BIM, leveraging warehouse storage and the subsidization from government if not covered by contract laws are the key strategies to reduce the impacts due to inflation highlighting cost overrun, labour productivity, scheduled delays, supply chain disruptions and defects in construction. Structured session during FGD were conducted with 15 participants followed by online/offline survey to determine the importance of the strategies using RII analysis. Statistical analysis of the key construction materials was used for the inflation modelling and the calibration and validation of the model generated using paired sample T-test. The statistical model firmly agrees with the inflation model. The proposed formulations developed in this study are calibrated duly with the actual cost-based estimations for various years. The construction cost of the buildings in Nepal will be linearly increasing in coming years. The model can be best utilized by the designers, contractors and estimators during various claims settlements.

## **Keywords:**

Inflation, FGD, RII Analysis, Inflation Modelling, Key Construction Materials, Calibration, Validation

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# Analysis of MRT compliant buildings as per NBC 105:2020

*Nisha Sthapit<sup>a</sup>, Hari Darshan Shrestha<sup>b</sup>*

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## **Abstract:**

From 1970 to 2015, there has been a rapid growth in construction of Reinforced Concrete Cement (RCC) buildings in Kathmandu valley. Ready to use dimensions and details provided in Mandatory Rule of Thumb (MRT) issued in 1994 was primarily used for up to three storey ordinary residential buildings. These MRT were designed to meet the Nepal Building Code: NBC 105:1994's minimum seismic safety requirements.

The minimum dimensions and detailing were updated in the draft code of MRT in 2012 which was still based on NBC 105:1994. Later in 2020, NBC 105 code for seismic design of buildings in Nepal was revised.

This paper studies the deficiencies in RCC buildings that has been constructed on the basis of different MRT guidelines. Since the seismic code has been updated and no retrofitting or strengthening guidelines have been issued for the existing MRT complaint buildings, it has become the need of hour to analyze these structures and identify its deficit structural members. This paper examines if the dimensions of frame components and their detailing of MRT compliant buildings is sufficient as per seismic design code NBC 105:2020. Structural analysis of three samples with detailing as per NBC 205:1994, NBC 201:1994 and NBC 205:2012 were done as per NBC 105:2020.

## **Keywords:**

MRT, Analysis, Detailing, NBC

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# Impact of Social and Technological Distraction on Pedestrian Crossing Behavior at Signalized Crosswalks: A Case Study of Baneshwor Intersection

*Sudip Luitel<sup>a</sup>, Rojee Pradhananga<sup>b</sup>*

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## Abstract:

The study of pedestrian mobility is critical while designing pedestrian facilities, especially in urban areas. Although various studies associated with pedestrian crossing behavior have been carried out in the past, the potential impacts of distraction on pedestrian crossing behavior have not been comprehensively studied. Observational field study of 804 pedestrians was conducted at a signalized crosswalk of Baneshwor intersection. Multiple linear regression (MLR) model was developed to analyze the general walking speed of pedestrians. In addition, binary logistic regression model was developed to analyze the probability of distraction among pedestrians. Several demographic and distraction-based variables were found to be significantly associated with the walking speed and odds of distraction among pedestrians. The results obtained could be implemented by planners to incorporate the pedestrians' distraction behavior while designing pedestrian signals at crosswalks.

## Keywords:

distraction, signalized crosswalk, regression

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# Structural Response of Panel Bridges For Different Configurations:A Comparative Analysis

*Ranjan Sujakhu <sup>a</sup>, Jagat Kumar Shrestha <sup>b</sup>*

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## Abstract:

This work presents a numerical comparative structural analysis of Panel bridges for different panel member configurations as well as panel arrangement, in which the main objective is to evaluate the effects of Panel shapes and Panel arrangement on structural response of Panel bridges. Panel bridges are modular bridge systems composed of steel panels connected together by pins and flexible in their behavior. These flexible systems of the panel bridges are more susceptible to dynamic loading. Four panels of different member configurations were modeled and pushover analysis has been carried out in order to determine the collapse load capacity of each panel. Also, different real scale bridges have been modeled considering different panel member configurations as well as for different panel arrangement. In order to compare the maximum structural responses as function of the main variations considered, time history analysis is performed for all the structures considering dynamic loading.

## Keywords:

Panel Bridges, Dynamic loading, Pushover Analysis, Time history Analysis

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# Comparative Study of Landslide Susceptibility Mapping Along Mountainous Road Using Statistical and Machine Learning Approach

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## Abstract:

Hilly and mountainous parts of Nepal are most vulnerable to earthquake and landslide-related risks. Every year during monsoon these area encounters highway blockage due to landslides but the concerned authority has not performed any kind of study along this highway to date. This study tends to find the best landslide susceptibility model in these mountainous terrains using statistical (Frequency Ratio) and machine learning (Random Forest) approaches. A total of 239 landslides were mapped using historical landslides, satellite images, and field surveys then these landslides were split into 80% training dataset and 20% testing dataset. Landslide susceptibility mapping was performed based on 12 landslide conditioning parameters under four groups mainly topographic factors (Slope, Aspect, Elevation, Profile curvature, Plan curvature), hydrological factors (Proximity to stream, Precipitation, Topographic wetness index), geological factors (Lithology, Fault line), and other factors (Proximity to road, Land use Land cover). The Landslide susceptibility map produced using both methods was classified into five classes very low, low, moderate, high, and very high. The validity and accuracy were tested by calculating the areas under the curve (AUC) value of the receiver operating characteristic (ROC) curve. The result illustrates the performance of both models where the RF model (AUC=0.902) performed better than the FR model (AUC=0.812). The final landslide susceptibility maps can be used for disaster risk reduction, land use planning, and early warning systems.

## Keywords:

Landslide, Machine Learning, Mountainous Road, Statistical, Susceptibility

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# Dynamic Behavior Of Skewed Bridge Compared to Normal Bridge

*Ajay Thapa<sup>a</sup>, Bharat Mandal<sup>b</sup>*

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**Abstract:**

Highway bridges are among the most crucial elements of the transportation system, therefore continuous operation is required even in the wake of strong to major earthquakes. When the mass and geometry of a bridge are constant, a skewed bridge is more susceptible to higher damage compared to a normal bridge. This paper presents the effects of skew in the multi-span continuous concrete bridge. Nonlinear behavior is concentrated at the top and bottom of pier because the pier is the most important component of the bridge. A Series of non-linear static (Pushover) analyses is performed to compare median values for bridges bridge for different damage states established by (Hazus MH 2.1, 2003). The paper presents variation of the the displacement, drift capacity, and displacement ductility of the bridge for different skew angles.

**Keywords:**

skew bridge, pushover, damage states, drift capacity, displacement ductility

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# A 3D CNN Approach for Hyperspectral Image Classification

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## Abstract:

Recently, hyperspectral image (HSI) classification using deep learning methods has become popular and has shown improved performance over traditional machine learning methods. Moreover, convolutional neural network (CNN) has been widely used for automatic feature extraction than manual feature engineering. However, training the deep learning model for the HSI classification task is challenging due to the high dimensionality and few training samples. Furthermore, better extraction of spatial-spectral information from HSI data is also needed for good classification. In order to overcome these challenges, an HSI classification method that uses Factor Analysis (FA) for dimensionality reduction followed by 3D CNN for spatial-spectral feature extraction has been proposed. The proposed method also has relatively less trainable parameters. Finally, evaluation was done using two real datasets: Indian Pines and Salinas. Using only 10% Indian Pines and 5% Salinas data as training samples, the overall accuracy, average accuracy, and cohen's kappa were 97.32%, 96.96%, and 96.95% for Indian Pines and 99.34%, 99.27%, and 99.55% for Salinas respectively.

## Keywords:

hyperspectral, 3D CNN, classification

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# An Analysis Of Nepali News Classification Using GRU, Bi-GRU and BERT

*Prabin Pathak<sup>a</sup> Shashidhar Ram Joshi<sup>b</sup>,*

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## Abstract:

News classification is the process of classifying the news texts or articles automatically to a set of predefined classes of the news categories with the confidence obtained from the training set. Precise classification of texts along with generation of good word embedding has been a long faced challenge for Nepali language due to the limited amount resource. This study aims to classify the news to the respective category using the Recurrent neural networks: Gated Recurrent Unit and Bi-directional Gated Recurrent Unit and a transformer model, BERT. NPVec1's Word2vec pre-trained model was used for word embedding which is the largest word embedding for Nepali language recently developed using 279 million word tokens and another publicly available Nepali Word2Vec embeddings trained on comparatively lesser data was used for its comparison and analysis. News classification was done to a dataset with predefined set of 10 categories of news labels. Classification accuracy, confusion matrix and classification report is used for the evaluation of the performance of our models. The NPVec1 embeddings showed better results for the classifier models with Gated Recurrent Unit showing the highest classification accuracy of 88%.

## Keywords:

Gated Recurrent Unit, Bi-directional Gated Recurrent Unit, BERT, Word Embedding

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# Seismic Performance of Typical Low Storey RC frame Building with Consideration of Masonry Infill

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## Abstract:

Nepal National Building code (NBC) forms an essential form of resources for checks of buildings submitted to municipalities so as to ensure safer building construction. NBC 205 has been prevalent in most areas due to its ready to use guidelines. But National Building Code has been revised in 2020 but NBC 205 is still prevalent since its update has not been published. So, in this paper effort has been made so as to check a municipal drawing submitted to municipality constructed with current prevalent building construction practice as per NBC 205 with column size of 300mm X 300mm. Moreover, effects of masonry infill is considered with separate model considering equivalent strut as per IS 1893:2016. The results displayed a substantial changes in time period of the building along with noticeable observation in eccentricity and drift ratios. Non-Linear Pushover analysis was performed on the building and overstrength and ductility factors were determined. For preparation of fragility curves, Hazus earthquake model was used to develop fragility curve for building. Damage state thresholds were used as proposed by barbat et al(2008). With the analysis it can be recommended that the current standard provisions as stated in NBC 205 cannot be fully entrusted to ensure full compliance as per NBC 105 and some additional checks and considerations needs to be done. The buildings were found to have increased strength but ductility of the building was reduced after consideration of masonry infill.

## Keywords:

Low Storey Buildings, Nepal National Building Code (NBC), Time Period, Linear analysis, Non Linear analysis

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# Transformation over time in Kochila/Saptariya Tharu Architecture: A case of Baswalpur, Saptari, Nepal

*Niru Chaudhary<sup>a</sup>, Sudha Shrestha<sup>b</sup>*

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## Abstract:

Tharus are one of Nepal's major ethnic groups, and Tharu architecture is an excellent example of ethnic architecture with an ecologically responsive design. However, as a result of urbanization, many tharu settlements are shifting to fit modern demands, and traditional houses have been modified, with contemporary appliances, new spaces, and domestic life added that bear little resemblance to the original. This study presents an exploration of the transformation of the built form in traditional settlements of Kochila tharu community. A survey of traditional settlements of the southeastern part of Nepal i.e., Baswalpur village of Saptari district is undertaken in order to extract an urban pattern or a rationale from what may appear as capricious disorder. The objectives of this research are to investigate the paradoxical phenomenon of the house transformation in this village; to determine the extent of the impact of the transformation; to identify the factors that contributed to it. To investigate the effects of changing physical configuration on the values and meanings of traditional homes, field observations were made at a few houses chosen using the purposive sampling technique, and interviews were conducted. With the identification of these factors, it is anticipated that this study will serve as a reference on house transformation and offer a reasonable perspective for community and government to take development measures on the transformation of traditional homes in Baswalpur village.

## Keywords:

Urbanization, Modernization, Housing Transformation, Traditional Kochila Tharu settlement, Urban influence

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# Conservation of Heritage: A Study of Reconstruction of Mahalaxmi Temple at Balambu

*Rasana Shrestha<sup>a</sup>, Sudha Shrestha<sup>b</sup>*

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## Abstract:

The conservation works in Nepal can be dated back to times long before the introduction of Ancient Monuments Preservation Act in 2013 B.S. that marked the provision of modern concept of heritage conservation in Nepal. In case of Nepal, often architectural heritage is closely linked to cultural heritage of the people due to which conservation of heritages has been deemed important and carried out by the people through institutions such as guthis even before the establishment of a conservation administration. Currently there are different stakeholders in the conservation arena in Nepal such as the Department of Archaeology, municipality, community and international actors that pursue widely divergent approaches. For this study the Mahalaxmi temple at Balambu is taken as the subject of the research. The temple was recently reconstructed through the joint efforts of the Department of Archaeology and a committee of local community known as Mahalaxmi Purnanirman Samiti. The conservation of the temple is studied through the analysis of the recent reconstruction of the temple. The objective of this research is to analyze the issues related to the reconstruction of Mahalaxmi temple. To study the reconstruction of the temple field observations were done in addition to interviews of key informants. This study provides a reference for a current conservation project and further organization needed for better results in future projects. Hence this study is expected to provide suggestions for future conservation works.

## Keywords:

Conservation, reconstruction, cultural heritage, temple

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# Risk Management in Building Construction Projects (A case study of Chitawan)

*Manil Khanal<sup>a</sup>, Santosh Kumar Shrestha<sup>b</sup>*

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## Abstract:

Risk management in building construction projects is recognized as a very important process in order to achieve the objectives of project within predetermined time, cost and standard in terms of safety and environmental sustainability. The main objectives of this study are to evaluate the level of risks in building construction projects and to suggest measures for managing risks in building construction projects. Physical risks, construction risks, financial risks, design risks, political risks, legal risks and environmental risks are found to occur in building construction projects. Financial risks are found to be the most vulnerable. The level of risks is high in most of the financial risks. Physical and building hazards are the next most sensitive ones after financial risks. For the extreme risk, a thorough action or plan is needed. While senior management's attention is required for high risk situations. For low level risks, standard methods can be used to manage them. Specific management is responsible for managing risks at a moderate level. The second goal of the study has been accomplished with the achievement of this outcome. Finally, various measures to manage risks in building construction projects were identified that are; application of risk management by contractors, application of risk management strategies, development of contingency plans and ensuring adequacy of project funding.

## Keywords:

Risk Management, Financial Risk, Extreme risk

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## Changing pattern in Santhal Architecture: Case of Satar Village, Morang

*Kanchan Bhattarai<sup>a</sup>, Sudha Shrestha<sup>b</sup>*

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### Abstract:

Nepal is poor and developing country but rich in cultural context. The Santhal is one of indigenous community with rich in cultural practices. Due to result of modernization Santhal identity are diminishing so study on this vernacular architecture is essential. Thus, detail study of architecture of Santhal architecture is needed in order find out the different attributes like social, cultural that shapes their architecture and changing pattern of architecture. As it can be seen that the houses in this locality are changing from green to grey it not only diminishes architecture but also kills the social cultural practices which ultimately result to diminishes of their identity. It shows the necessity of study in this topic as study of vernacular architecture focus on use of local materials and resources, which are relatively energy efficient and sustainable so study of this architecture is very essential, as exploration on this architecture is very limited in Nepal. This study sought to examine the changing pattern of Santhal architecture of satar village of Morang district both from primary as well as secondary source. The results of this study show that the traditional Santhal houses are changing from temporary structure with single room dwelling to today's modern RCC structure. The most of Santhal traditional house is based on courtyard planning the courtyard is used for several socio-cultural and religious purpose. Similarly, verandah spaces are present in every house for multi-functional use. The change from public space to private space also stems from the culture and customs of these regions. Thus, it can be concluded that Santhal architecture has been changing from cave dwelling to today's modern RCC structure. Thus, integrate study of such vernacular architecture is very essentials.

### Keywords:

Modernization, Santhal architecture, Courtyard planning, Transformations, Vernacular architecture

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# Seismic Performance of Unreinforced Brick Masonry Buildings Considering Plan Irregularities

*Alisha Siwakoti<sup>a</sup>, Prem Nath Maskey<sup>b</sup>*

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## Abstract:

The present study deals with the seismic evaluation of unreinforced masonry buildings with plan irregularities (re-entrant corners). This study mainly focuses on comparison of seismic performance of unreinforced masonry buildings with plan irregularities based on fragility curves. The development of fragility curves for estimating the probability of damage of a building for a given damage state usually requires ground motion records. Here, three real earthquake ground motion records are selected for the development of fragility curves. These ground motion data are imposed on a set of unreinforced masonry buildings consisting of nine building models (with 2, 3 and 4 stories each for L-shaped, T-shaped and Regular Square shaped). Linear time history analyses are performed on SAP 2000 v20 to evaluate the dynamic response of the structures. Following that, top roof displacement, maximum drift ratio and base shear are determined from the analysis for each model and fragility curves are developed for four damage states (slight, moderate, extensive and complete) using the three earthquake time histories. This study also compares the fragility of L-shaped and T-shaped buildings with the regular ones.

## Keywords:

Fragility Curve, Unreinforced Brick Masonry, Seismic Performance

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# Application of Deep Learning to Account For Geometric and Material Non-Linearity in Thin Circular Cylindrical Shell Structures

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## Abstract:

This paper has attempted to abstract out patterns hidden in the complicated non-linear equations governing the behavior of shell structures subjected to large deformations and loads well beyond their elastic limit. 119 thin shell models with varying input parameters were run in ANSYS. The results' validation was done in linear range using MATLAB code as given by (A. Mandal and H.R. Joshi, 2020). The stress and strain results obtained from ANSYS were then normalized and fed to a neural network containing varying number of hidden layers and trained. 80% of data was used to train the network and remaining 20% to train. The number of hidden layers and number of nodes per layer was changed until the deviation between results given by ANSYS and predicted by neural net was minimized. After training it was found the the network was capable of predicting the results within the margin of 8% as given by ANSYS.

## Keywords:

ANSYS, MATLAB, Thin Shell, Neural Network, Normalization

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# Energy Performance Analysis: A Case Study on Domestic Departure Hall Tribhuvan International Airport of Nepal

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## Abstract:

This analysis is based on the energy simulation in Revit Autodesk, and Insight. This study is about the operational electricity consumption, Heating load, cooling load and Energy use intensity of the building at domestic departure hall at Tribhuvan International Airport, Tribhuvan International Airport is first international airport in Nepal, It is located in Kathmandu, capital city of Nepal. There is one runway and separate terminal building. The domestic terminal building is located in North side of the international terminal building. Domestic and international passenger go through the separate terminal building. Based on the building energy analysis the energy use intensity of domestic departure hall is  $298kWh/m^2/yr$ . From the building energy analysis report total cooling load is  $259732W$  and total heating load is  $39802W$ . while the infiltration rate reaches 0.4 Air Change per Hour from 2 Air change per year, The energy use intensity decreases from  $298kWh/m^2/yr$  to  $294kWh/m^2/yr$ . When roof insulation R19 placed over existing roof construction, The energy use intensity decreases from  $298kWh/m^2/yr$  to  $294kWh/m^2/yr$ . Maximum load of the building is occupied by the passenger movements that is occupancy load then the building infiltration, roof and windows material.

## Keywords:

Tribhuvan International Airport, Building energy analysis, Airport Terminal Building, Heating load, cooling load

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# Emerging Architectural Identity and Gentrification: A Case of Patan Core Town

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## Abstract:

The identity of architecture is occasionally imagined and portrayed as an immutable or historically continuous entity in various contemporary sectors of architectural design, heritage conservation, architectural history, and literature. Gentrification is the phenomenon through which relatively disadvantaged residents move, improve housing, and attract new businesses to a struggling urban neighborhood, frequently displacing locals in the process. The existing architectural identity has been undermined by transformations to the historical town of Kathmandu over the past few years. It has been argued that this is an uninvestigated gentrification phenomenon. The purpose of this research is to identify the emerging architectural identity and how gentrification may be driven by it in the future. The findings of this research, reality is continuously being discussed, contested, or interpreted, and the epistemological perspective is that knowledge should be investigated using whichever methods are most effective for resolving the issue. Therefore, the pragmatic paradigm is the foundation of this research. To acquire information for analysis in order to learn more about a subject and get a better grasp of it, the following tactics or procedures are employed: possible contribution that is substantial identify traits gleaned from reading for behavior in the study region, key informant interviews and a community survey were both carried out. Lastly, transcribed the interviews and survey data codes that had been taken from the literature. The fundamental idea behind gentrification is that local residents lose their homes as outsiders move in. However, my research challenges this idea. My research demonstrates that gentrification, which undermines the local architectural character, is also a result of the transient change in building use and residence. This core town is seeing gentrification as a result. According to the findings of my research, gentrification is a process. The intangible cultures that are so intimately correlated to the everyday activities of the native people are gradually disappearing, even if the native people aren't really departing in the sense that they're selling their property and shifting away. Instead, a lot of outsiders are flocking in for investment interests. Therefore, it is possible that this will lead to a greater loss of intangible cultural heritage, a feature that draws tourists to this. Thus, my research has reached the conclusion that it is crucial to think about the gentrification idea as it has been discussed by other researchers. Although native people do not leave their ownership, the identity can be lost and still pave the way for gentrification.

## Keywords:

Architectural identity, Adaptive use, Gentrification

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# Effect of Soil Structure Interaction on Seismic Pounding in Adjacent RC Buildings

*Prabesh Dhakal<sup>a</sup>, Bharat Mandal<sup>b</sup>, Sanjay Kumar Sah<sup>c</sup>*

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## Abstract:

This study presents the effects of soil structure interaction on the seismic pounding response of adjacent RC buildings. Regular 2D frame of 3, 5 and 7 storey buildings considering two buildings at a time are taken for analysis with both fixed and flexible base cases with no gap between the buildings. Non-linear modeling and analysis of building and soil is accomplished in OpenSees, a finite element based software framework. 7 different ground motions are used for time history analysis. The results are obtained in the form of pounding force and storey displacement values. The results indicate an increase in pounding force value due to consideration of SSI. The force has increased by 34% for pounding between 3 and 5 storey buildings whereas it has increased by 62% for pounding between 3 and 7 storey buildings. Due to combined effect of pounding and SSI, there is increase in displacement of 7 storey building by upto 104% on the pounding side when collided with 3 storey building whereas there is 12% reduction for 3 storey building on the pounding side for the same case. Compared to shorter building, the taller building is more affected due to SSI which becomes more vulnerable with the combined effect of both pounding and SSI. Finally, a relation to approximate the pounding force that may be considered in the design of buildings is proposed.

## Keywords:

Pounding, Soil-structure interaction, Non-linear analysis, OpenSees

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# Seismic Performance of RC Buildings with Different Positions of Lift Core Wall and Added Shear Walls

*Bikash Baral<sup>a</sup>, Rajan Suwal<sup>b</sup>*

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## Abstract:

Selection of structural systems that will be capable of resisting the earthquakes is important to prevent the structural cracks in minor shaking and prevent collapse in major shaking to create safety in life. Properly located and well-designed structures with shear walls as lateral load resisting members increase the lateral stiffness in plane of wall which would optimize the columns and would have greater living spaces in the buildings. Use of these walls in casing of elevators has been in great practice, since it affects the architectural design of the building. Easy access of lifts increases the functionality of buildings. Lift core placed in best position in the building, will greatly influence the lateral stiffness of building so that the vulnerability of buildings will be less compared to bare frames. Eccentric positioning of lift core will create eccentricity in the building, which would require the greater reinforcements. With increase in eccentricity the building may bear the torsional irregularities. So, there is need of extra shear walls to balance the irregularities. Bidirectional earthquake excitation analysis is necessary for these types of buildings. IS 1893:2016 is used in design. For various damage states drift limits are taken from FEMA 356 2000 and median values of displacements are taken as per HAZUS 4.2 SP3. This research work presents the vulnerability due to eccentric positioning of lift core in symmetrical reinforced concrete frame. The torsional irregularities are needed to be removed with optimum positioning of extra shear walls. The reduction in vulnerability of buildings due to added walls is studied. The probability of exceeding the collapse damage states at 0.4g PGA are greater for FEMA 356 2000 than HAZUS 4.2 SP3. The percentage increase in vulnerability for lift core at corner is 112.51% as compared to its centric position.

## Keywords:

Reinforced concrete, Shear wall, Lift core, Torsional irregularity, Bidirectional earthquake, Vulnerability.

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# Framing the Challenges of Urban Flooding on Accessibility

*Apsana Shrestha<sup>a</sup>, Ajay Chandra Lal<sup>b</sup>*

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## **Abstract:**

Urban flooding is a worldwide phenomenon which is witnessed more often in a growing urban city in developing countries. The insufficiency of drainage system that cannot withstand with the current precipitation due to climate change, urbanization and haphazard planning causes stormwater runoff in a city area creating inundation that lasts from few hours to even few days known as Urban Flooding. These urban floods paralyze the surface transportation of a city. Especially the daily commuters bear heavy economic and financial losses. The major objective of the paper is to assess the accessibility disruption faced by daily commuters who travel via Araniko road, Pulbazar section road and identify major cause of the flood in the study area and also explore the strategic interventions to facilitate accessibility in the region. The research is based on case study approach. A total of 243 daily commuter survey was done through stratified random sampling method. According to the research and survey, sudden flash floods inundates the highway halting transportation which occurs 10-12 days in one monsoon season. Majority of the commuters wait for the flood to settle while only few with private vehicle takes alternate route via Nala. The vast majority of commuters incurs financial loss and the commuters described commute as highly inconvenient to travel during flood/inundation. The research concludes that improvement of alternate routes as an adaptive measure and proper management of artificial drainage system as a mitigative measure should both be incorporated simultaneously to cope with the annual flooding scenario in the study area.

## **Keywords:**

Urban Flooding, Inundation, Drainage System, Urbanization, Climate Change, Daily Commuter

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# Emerging Urban Centers in Federal Setting: A Case Study of Province One in Nepal

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## Abstract:

The federal setting after the restructuring process in Nepal has caused a number of changes politically and administratively. The rearrangement of the country in seven provinces and reshaping the boundary of the local bodies have laid the foundation for new perspective of governance. This has derived many infrastructural and socio-economic changes among which emergence of the new urban centers can be regarded as one of the contributing factors in the evolution of the urban system as a whole. The research paper attempts to identify these urban centers of Province One based on the population changes and development of the market centers. The population of different municipalities were analyzed and emerging urban centers were identified as per the population hierarchy. The planning of the industrial capital and linkage of road transport in the region were studied and the same was considered for detecting the urban centers and its connectivity within the urban system. In addition to the increase in the primacy of the existing centers, few new growth centers were found to be emerging within Province One.

## Keywords:

Urban System, Urban Centers, Federalism, Province One, Market Centers

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# Analysis and Evaluation of Construction Worker Competencies of Kathmandu Valley

*Bibek Regmi<sup>a</sup>, Mahendra Raj Dhital<sup>b</sup>, Nagendra Bahadur Amatya<sup>c</sup>*

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## **Abstract:**

In addition to practical abilities, construction workers also need additional socioemotional, cognitive, and technological skills to do their jobs well as literature suggests. Therefore, a study of construction industry professionals in the Kathmandu Valley is conducted for the unskilled and skilled categories of workers respectively and 6 and 15 sets of competencies were identified. For unskilled workers, these qualities are listening, health/physical strength as essential and attitude, aptitude speaking skills and resilience as desirable competencies; for skilled workers, technical skills, working experience, confidence, and problem-solving abilities as essential and memory, writing skills, reading skills, mathematical skills and motivations as desirable competencies. Then, using these identified competencies, a support vector machine model was fitted and trained to assess the overall competency of skilled construction workers. The case study demonstrates that the support vector machine evaluation model has good accuracy and can consistently identify skilled construction workers (carpenter, bartender, and meson) with excellent efficiency with predicting score of 0.93 for Barbendor, 0.92 for carpenter and 0.96 for masonry workers.

## **Keywords:**

Support Vector Machine, Competencies, Resilience, Aptitude

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# Physics Informed Neural Network for Flow Modeling around Atherosclerotic Plaque in Human Carotid Artery

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## Abstract:

Unhealthy lifestyle habits have bloomed many life-threatening diseases in humans. Plaque, which causes blood arteries to become narrow or blocked, resulting in atherosclerosis is one of the major causes leading to vascular diseases. The idea of this study is to obtain the characteristics of the blood flow through different contents of plaque without discretization of mathematical model formed by sets of partial differential equation for conservation of mass and momentum. Generally, the study of mathematical blood flow models governed by partial differential equations is done using computational methods such as FDM, FEM, and FVM. Python-based Physics Informed Neural Network is used in this study to solve the one-dimensional blood flow model for different content of plaque in human carotid artery. Pulsatile boundary condition of pressure flow is provided as input along with constant rate of flow. It is found that the increase of plaque in the artery wall decreases the overall flow in the vessel consequently decreasing the flow rate over the vessel with peak velocity in the maximum plaque region. After plaque increases beyond 50% of initial radius (75% of initial area), the rate of flow is found to be insignificant, hence blocking the flow of oxygenated blood to reach the head part of the human body including brain which points towards the medical emergency. For the pressure inside the vessel, it is established that the pressure depends upon the mechanical characteristics of the vessel over its geometry and difference in nature of pressure for different contents of plaque is negligible. These outcomes provide additional knowledge about wave propagation in arteries and thus, endorses the convenience of using neural networks in mathematical flow models.

## Keywords:

PINN, Atherosclerosis, Plaque, Carotid artery, Cardiovascular Disease, Volumetric Flow Rate

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## Assessment on the Fixation of District Rate of Kathmandu District

*Suresh Shrestha<sup>a</sup>, Santosh Kumar Shrestha<sup>b</sup>, Nagendra Bahadur Amatya<sup>c</sup>*

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### Abstract:

The aim of this research is to assess and analyze the compliance of district rate and market rate of skilled manpower, unskilled manpower and some construction materials in Kathmandu District and search the possible correction in the prevailing process of district rate fixation if any. Many public entities were visited and the district rate of Kathmandu district since fiscal year 2071/072 was collected and initially the district rate of some construction material and manpower were compared with Input price index of construction sector. It shows the clear difference between the rate change pattern in district rate and price index. Then the real market rate of those construction material since fiscal year 2071/072 were collected from contractors, vendors and public entities and again compared with the district rate of same item for same fiscal year. Also the rate Assessment of various material with both district rate and actual market rate for various fiscal year was done and again comparison between them were made which also show the clear gap between the market rate and district rate. Then interview to the expert were conducted for the possible solution to reduce the gap between the district rate and actual market rate of construction materials and manpower. The study can be useful for the District rate fixation committee for the possible correction in the district rate fixation process.

### Keywords:

District rate, Actual Average Market Rate, Input price index of construction material, District Rate Fixation Committee

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# Nature Based Solution to Counter Urban Heat Island Effect: A Case of Kathmandu Valley

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## Abstract:

Urbanization leading to the dense population on the city core has enhanced heat effect of urban spaces. UHI enhance climatic and biophysical risks which are governed by rising anthropogenic CO<sub>2</sub> and other greenhouse gas emissions and also has potential to change the intensity, temporal pattern and spatial extent of UHI. It has been revealed that temperature in Kathmandu increased by 0°C to 2°C between 2000 and 2018. With this effect and the presence of Urban Heat Island in Kathmandu Valley, a natural solution is required. These solutions involve maintaining biodiversity and enhancing human well-being while also protecting, restoring, and sustainably managing ecosystems in ways that strengthen their resilience and capacity to solve those societal concerns. The green, blue and grey infrastructure to guide the Nature Based Solution to counter UHI in Kathmandu valley helps to understand their attributes and suitable NBS which could be integrated for Kathmandu Valley. The post-positivist paradigm was used to perform the research. For this, two case study area i.e., Kuleshwor Site and Service Area to evaluate the effect of green and grey infrastructure and Harisiddhi area for old settlement and new settlement. The temperature is recorded in hourly interval to examine the urban heat island effect. These two are completely different set of sites and are not interconnected. The study shows the role of green space and material with high albedo value in cooling the urban areas.

## Keywords:

Nature Based Solutions, Urban Heat Island, Kathmandu Valley, Albedo value

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# Stakeholders participation in managing solid waste at the point of generation;A case of Kirtipur

*Padma Aryal<sup>a</sup>, Sangeeta Singh<sup>b</sup>*

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## Abstract:

This study aims to explore how MSW can be efficiently managed at the generation point, through stakeholder participation to reduce the waste load in the landfill site by doing qualitative analysis. Ward 2 of Kirtipur, was selected as a growing urban settlement. It lies in the south of the Kathmandu. The urbanization in the modern age has had a huge impact on the environment, among the various causes solid waste is the one. Managing solid waste had become a big challenge in developed and developing cities. As the populations increased, efforts were made to transport waste farther out from the cities to landfill sites. Landfill may not be a sustainable solution for waste management. Household source reduction may be one of the sustainable solutions for waste management. Various methods of waste reduction were determined based on the standard data from literature. In this study role of stakeholders in the management of solid waste at source was evaluated. In addition, whether the current policy adequately address the problem of waste reduction at the source was evaluated. The study also examined case studies with success stories which reflects improved scenario through waste segregation. Moreover, social perspective from community, government institutions and people involved in source reduction were analyzed. Based on the qualitative analysis, behavior, level of knowledge, practices and willingness of people on source reduction was determined.

## Keywords:

Source reduction, Stakeholder's, Policy, Willingness

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# Use and Management of Public Open Spaces in Kathmandu Valley

*Rojina Shrestha<sup>a</sup>, Sudha Shrestha<sup>b</sup>*

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## Abstract:

Public open space is open area that is freely accessible to all people without any restriction for social, cultural, environmental, economic, and political uses. For the purposes of the research, public open space encompasses open spaces and parks where public access is unrestricted at least during daylight hours and people do not need to pay. This research employs a case study approach to explore the users' opinion for assessing the use and management of public open spaces focusing on three POSs of different hierarchy, scale, location, similar function and responsible management agencies located in Kathmandu Valley namely UN Park, Shankha Park and Suryamukhi Garden. To evaluate the usage of open spaces, six aspects are considered: Access and linkages, Comfort and Image, Inclusiveness, Engagement, Use and activities and Management. Also the concepts and theories of management and various models has been discussed and related to the study areas. A mixed methods approach was considered for data collection, including questionnaire survey, interviews, observation, and also collection of required information from journals, documents and past researches related to the study. According to the results, it can be inferred that these public open spaces are not well maintained, the spaces lack sitting spaces, infrastructures, regulation and timely monitoring and maintenance. The most important reason for dissatisfaction among the users is lack of maintenance and inefficient management. The study also found out the advantages and deficiencies in each of the open spaces despite being managed by the federal government, municipality or community. In order for these POSs to best serve the many facilities and services, it is crucial that they be made accessible, user-friendly, appealing, and functional with consideration for management prospect in the planning phase itself.

## Keywords:

Public open spaces, User's perception, Parks, Management

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# Implications of change in Urban Landscape on the Quality of Life in the traditional town Harisiddhi

*Shikha Shrestha<sup>a</sup>, Kirti Kusum Joshi<sup>b</sup>*

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## Abstract:

Urbanization is a global phenomenon evolving problems including urban blight, gentrification, urban poverty, urban sprawl which results into delineation of built environment of its spatial extent, change in function, transformation of a town, which forces prior local residents into poorer and isolated environment with less choices and social networks. The problems emerging reflects in the change in urban landscape of the traditional town. Traditional core settlement of Harisiddhi has gone through massive change in due to Gorkha earthquake 2015. It has affected the life of the local residents residing in the core area of the traditional town Harisiddhi. The research aims to examine how the change in urban landscape has changed and how it has impacted quality of life in the traditional neighborhood of Harisiddhi. After a brief on study area the paper introduces the research approaches and methods with different paradigmatic stances adopted for the research. Perception survey was carried out for the quantitative method whereas for the qualitative method literature, historical photographs and maps were studied to understand the change over time, following pragmatic and interpretivist paradigm along with direct observations, questionnaire surveys, key informant interview and focus group discussions. It was measured in terms of physical attributes and environment, level of independence and social aspect based on WHO attributes. Findings showed that spatial changes has led to loss in cultural and historical identity, change in traditional function, parking problems while individuals were more concerned about their thermal discomfort, health security, fire-escape and earthquake emergency, neglected open spaces, intangible characteristics of the town. The research shows that spatial changes prevailed in the town perceived by an individual varies according to individual. Alternative mechanisms for the change in physical environment of the town and restriction on inappropriate changes is very essential and individual's perception should be taken into account for the better understanding of the town which can help to retain its functional quality and acquired essence.

## Keywords:

Urbanization, Urban Landscape, Quality of Life, Individual perception

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# Architecture for Healing and Rehabilitation

*Sayesta Pokharel*<sup>a</sup>

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## **Abstract:**

There was a time when mental illnesses were dismissed as being non-existent-when the concept of health was linked primarily with the physical functioning of one's body. Today, there is significant acknowledgment of the healing and rehabilitative needs of the mentally ill. In addition, existing research on environmental psychology has shed light on the power of the environment to influence the activity as well as the psychological well-being of the person experiencing the space. That said, given the diverse and complex nature of the topic, the role of architecture in assisting healing and rehabilitation among the psychologically disturbed is yet to be explored in depth. Research on design considerations for the improvement of the mental state of individuals is in its infancy. This study investigates the architectural and spatial design considerations to be undertaken to leverage the power of architecture in the healing and rehabilitation of those experiencing different forms of anxiety disorders.

## **Keywords:**

Post Traumatic Stress Disorder (PTSD), Trauma-Informed Design, Evidence-Based Design (EBD), Gender-Based Violence (GBV), Healing Garden, Creative Stimulation.

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# KAP of Retrofitting of Typical Stone in Mud Mortar Residential Structures of Siddhalekh Rural Municipality, Dhading

*Aarjan Adhikari<sup>a</sup>, Gokarna Bahadur Motra<sup>b</sup>*

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## Abstract:

Nepal lies in active seismic region. It has experienced many destructive earthquakes in the past. Majority of building type almost half of Nepal includes low strength masonry structure such as mud bonded brick or stone structure followed by wooden pillar structure, which constitute one fourth of the total houses. To protect lives and property from earthquake it is very important to seismic retrofit of the existing non earthquake resistant structures. The study aims to examine gap for lack of expansion of retrofitting technique through the determination of knowledge attitude and practice of house owners of seismic retrofitting whose house is feasible for retrofitting and knowledge, attitude, and practice about seismic retrofitting of local authorities whose area of governance possess structures feasible for retrofitting along with the relationship between the knowledge attitude and practice. Knowledge and attitude of masons and attitude of technical personnel towards retrofitting was determined to determine perception of retrofitting in community. Moreover, the research aims to determine the motivating factors and barriers for stake holders namely house owner, local authority, engineer, and masons to focus on those primary barriers for future expansion of the retrofit project. On top of that, the research determines the major technical construction difficulties faced by masons during the retrofitting of residential buildings and provides valuable solutions to those problems through consultation with the experienced masons and engineers working in the field of retrofitting.

## Keywords:

Retrofitting, Earthquake, Stone masonry mud mortar, KAP survey

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# Analysis of Premature Cracks in Asphalt Pavement: A Case study of Kathmandu Ringroad

*Sajeet Sharma <sup>a</sup>, Rojee Pradhananga <sup>b</sup>*

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## Abstract:

Many of the roads in Nepal have cracks that have appeared at early stage of its design life of the road. Pavement failures were ultimately caused by these cracks. The majority of developed nations employ the Non Destructive Test(NDT) using Falling Weight Deflectometer (FWD) to measure the elastic pavement surface deflections in conjunction with the back calculation of the pavement layer moduli to assess the structural capacity and effectiveness of the pavement. With an emphasis on the freshly built Kathmandu Ring Road portion, the study's goal is to examine the early cracking patterns seen in the asphalt concrete pavements in Kathmandu. Dynatest FWD was used to record field distress surveys and deflection data, which were then utilized to back calculate layer moduli in the ELMOD6.0 program. Using a simple 2D Finite Element Model in the ELMOD6.0 program, a collection of data from FWD at cracked and uncracked areas of the same pavement structure was utilized to assess stress change. According to the deflection results, FWD testing showed that the surface deflection on the cracked section was slightly greater than on the uncracked Section. The Cement Stabilized Gravel Base's Modulus was significantly lower than the design value, and it was also lower in cracked sections than in uncracked sections. Although the horizontal and shear stress regimes on the pavement are considerably impacted, the vertical stress regime is unaffected by the presence of surface cracks.

## Keywords:

Premature Cracks, NDT, FWD, Back Calculation, Finite Element Analysis

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# Models of Metropolitan Region Governance: A Case of Kathmandu valley

*Prakriti K.C.<sup>a</sup>, Ajay Chandra Lal<sup>b</sup>*

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## Abstract:

It's been half a century since the Kathmandu Valley was envisioned to be developed as a single planning unit. Many efforts have been made, beginning with the 1969 physical development plan, followed by the formation of the Kathmandu Valley Town Development Committee in 1988, the establishment of the Kathmandu Valley Development Authority in 2012, etc., marking some significant efforts. The National Urban Development Strategy has also focused on reviewing, formulating, institutionalizing, and operationalizing the concept of the Kathmandu Valley as a single urban region. The governance includes the private sector, public sector and civil society. For this research, only the public sector has been considered and explored. This research uses worldwide case studies, interviews, and previously published publications on the subject to explore the modalities commonly accepted by policymakers. This research has suggested modalities broadly categorized into long-term and short-term solutions. The first category demands changes that need to be analyzed and accepted by a wide range of policymakers that demand changes on a greater scale, whereas the short-term solutions only demand some changes in the act that will incorporate representatives from all three levels of government into the existing structure of KVDA. The research concludes that for the Valley-wide integrated physical, social, economic, and political development, a bold political decision needs to be made that would make changes in the structure and the working pattern of the institution, which is way older than federalism itself.

## Keywords:

Municipalities, Authority, Council, Autonomy, Legitimacy

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# Architecture Regionalism, examination of orientation in Taragaon

*Prakash Maharjan<sup>a</sup>, Sanjaya Uprety<sup>b</sup>*

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## Abstract:

The global applicability of modern architecture has become a serious threat to the local language of architecture. The concept of critical regionalism emerged as a reaction to modern architecture's failure to include the local context of the place and region. Among several regional architectural attributes climate responsive design has been emphasized by several authors like Frampton and other researchers. In Nepal, the emergence of modern architecture after the 1950s and the design projects led by foreign architects like Carl Purscha are said to have given due consideration to the local climatic condition as a key attribute in their designs without any evaluation of such claims. Considering the local climate as a key to the Kathmandu valley's regional architectural character, this study intended to examine the climate response to achieve thermal comfort and energy consumption in the design of the Taragaon Building designed by Carl Purscha. The method used for the study included the climate analysis of 10 years data from DHM and simulation of design as it is now using the Autodesk Ecotect 2011 simulation software. The result showed that the building is oriented 15.5 degrees West of South, which it differs by 20.5 degree from best fit orientation suggested by the climatic data i.e. orienting buildings 5 degrees East of South. Even though there is slight deviation in orientation, the result shows no significant change in thermal comfort and energy consumption. It can be concluded that this building best fits the climate of Kathmandu. This study indicates that the buildings built between the 1950s and the 1990s by foreign international architects, which were believed to have regional characteristics, this analysis verifies such assumptions from a climatic perspective.

## Keywords:

Critical Regionalism, Climate, Building orientation, Carl Pruscha, Kathmandu valley

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# Geometry in Modern Architecture and Postmodern Architecture in Nepal

*Aditi Jaiswal<sup>a</sup>, Sanjay Uprety<sup>b</sup>*

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## Abstract:

Geometry, as a science of measurement and properties of space has its origins in human observation and the need to measure land. In architecture, the study of geometry led to development of new mathematical tools which was made applicable to design of buildings. Modern architecture is a growing field with a number of sub-genres that have evolved over time. Classifications vary according to style and philosophy. One common characteristic among modern architects is the use of geometry not only for aesthetics but also for structure. This article sheds light on how geometry had a significant part in developing early Nepali modern architecture in terms of forming the formative notion in which the principles of plane and solid geometry are employed to establish architectural form. The objective of this research was to examine the use of different geometry in shaping early Nepali modern architecture in terms of determining the form in a given social political context. Qualitative research method was used to investigate the use of geometry context in selected buildings design in a given socio-political since 1950s. The method mainly included the study of drawings, documents and record along with literature review. The research highlights a initial notion from the Bauhaus movement that helped to define formal archetypal structures or formative concepts through which architecture may develop. The study concludes that the post 50s buildings were designed mainly by foreign trend architects with not only strong Bauhaus influence but also the history which acts as determinant or characteristic in buildings along with drawing from local architectural context.

## Keywords:

Geometry, modern context, shaping

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# A study of Random Forest and Support Vector Machine algorithms for landslide susceptibility mapping at Bhotekoshi rural municipality

*Dipesh Pokharel <sup>a</sup>, Ram Chandra Tiwari <sup>b</sup>, Kshitij Charana Shrestha <sup>c</sup>*

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## **Abstract:**

The study aims to evaluate and compare the performances of Support Vector Machine (SVM) and Random Forest (RF) machine learning methods for landslide susceptibility mapping of Bhotekoshi rural municipality. Spatial data prepared using remote sensing and GIS tools were applied to machine learning algorithms using python code in Jupyter Notebook. Eleven landslide variables were generated which include slope, aspect, elevation, distance from road, distance to river, plan curvature, profile curvature, Total Wetness Index (TWI), Total Ruggedness Index (TRI), landcover and NDVI. The performance of the MLTs was evaluated, validated, and compared using the area under the curve (AUC-ROC) method. AUC values for RF=90%and SVM=89% was obtained. According to AUC value, random forest method was found to have the best performance for our study area. Furthermore, landslide susceptibility map of Bhotekoshi rural municipality was prepared which can be very helpful for planning and mitigation of landslide hazards.

## **Keywords:**

landslide susceptibility, machine learning algorithm, geographical information system, Random Forest, support vector machine

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# Efficient Word Embedding for Nepali

*Bishal Debb Pande*<sup>a</sup>, *Aman Shakya*<sup>b</sup>

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## Abstract:

Word embedding are a vital part for most modern Natural Language Processing (NLP) task. It is however difficult to identify if the given word embedding model works well or not. Especially with larger models, the time taken to train such models are very large. When we add to this the time required to train the eventual model for NLP task, a very large chunk of time can be spent on just training the different word embedding models to identify which word embedding models works well. Due to this, selecting between different models of word embedding can be very difficult. For this, intrinsic evaluation is used to evaluate the performance of word embedding systems instead of directly using the model for eventual NLP task. But for Nepali, it is difficult due to the lack of resources in Nepali Language. We show that using intrinsic evaluation based from similar language like Hindi with small modifications, we can gain insight about the effectiveness of word embedding. It can be justified based on the result for extrinsic evaluation where in the results are in agreement with the results from intrinsic evaluation. Using this, we find out that among the 3 models considered, the fasttext model performs the best when considering out of vocabulary words.

## Keywords:

NLP, Word embedding, word2vec, Fasttext, GLOVE

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# Silent Speech Recognition in Nepali

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*Upendra Subedi*<sup>d</sup>, *Dinesh Baniya Kshatri*<sup>e</sup>

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## Abstract:

Since the development of the very first computer, human-computer interaction has always required to have some form of physical activity as an input to the computer. Although these methods are accurate and hassle-free, they fail to be intelligible to the differently-abled. Speech interaction tackles this issue to some extent but it is still subjected to privacy issues. The proposed system in this research project confronts these problems and provides a secure and seamless interaction between a human and a computer using silent speech recognition. The surface electromyography (sEMG) signals, during the silent speech, are recorded from the facial muscles of a speaker using 8-channel gold cup electrodes and filtered to remove noise and other unwanted signals. The spectrogram of the processed signal is then extracted to train a Convolution Neural Network (CNN). The trained model is finally deployed to predict the utterances.

## Keywords:

Silent speech, Surface Electromyography, Spectrogram

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# Minimization of Non-Value Adding Activities in Irrigation Sector of Nepal

*Samjhana Maharjan <sup>a</sup>, Mahendra Raj Dhital <sup>b</sup>, Nagendra Bahadur Amatya <sup>c</sup>*

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## Abstract:

Construction waste is a problem worldwide. Non-value adding activities (NVAAs), the non-physical form of the construction waste, have an adverse effect on any project's outcome mainly in terms of Time, Cost, and Quality (all of which are directly related to Productivity). In this regard, a study was done to identify minimization techniques for such activities. This research is about minimization of NVAAs and uses a problem solving approach to determine the solutions for NVAAs (considering NVAAs as problem; minimization techniques as their solutions). The steps of the problem solving approach were followed for this study. The population for this study were construction practitioners (client, consultant and contractor) working in the Irrigation sector.

Expert Interview was done for validation of predetermined causes and generation of new minimization techniques relevant to those causes. Questionnaire Survey was done for analysis of opinion data from sample size of the target population. This study reveals 32 causes of NVAAs and proposes 62 relevant minimization techniques (one or more for each cause) both categorized into 5 groups. Based on findings of this study the top causes of NVAAs in Irrigation sector are: 1) Delay for permits from different sectors (forestry and land acquisition); 2) Frequent transfer of key professionals; 3) Quarry site problem; 4) Poor documentation control system and 5) Bureaucracy (administrative structure and regulations to control activities while the most contributive minimization techniques recommended to solve them are : 1) Skill Training & Proper Supervision; 2) Permit Acquiring prior Bidding ; 3) Field Visit Mandate by Expert Prior Design; 4) Skilled Expert Recruitment and 5) Clear Guidelines & Experienced Team respectively. Results from this study highlight the top significant causes of NVAAs and recommends most contributive or best applicable minimization techniques relevant to those causes in Irrigation Sector. The findings from this study will help construction professionals to identify relatable causes of existing NVAAs in their field and adopt the recommended minimization techniques. This study helps in minimization of NVAAs thus making a contribution towards productivity aspect of construction projects.

## Keywords:

Non-value adding activities, lean thinking, lean construction, productivity, construction waste

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# Parametric Analysis of Cantilever and Anchored Sheet Pile Walls

*Sahishnu Pokhrel<sup>a</sup>, Ram Chandra Tiwari<sup>b</sup>*

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## Abstract:

Due to the rapid increase in congestion in major cities of Nepal like Kathmandu, it becomes necessary to plan any excavation-related works properly so that there is less impact on the existing facilities or constructions. For this purpose, earth retaining structures, which may be either rigid or flexible, becomes a priority. The purpose of this study is to analyze the behavior of excavation support systems: Cantilever and Anchored Sheet Pile Walls by numerical method. In this study, the effect of embedment depth of the cantilever sheet pile wall is studied. Single anchored sheet pile wall is considered and the analysis of the effects of anchor inclination, location of the anchor with respect to the ground surface, depth up to which excavation is done before anchor installation, embedment depth of sheet pile, anchor load, free anchor length, grout length and variation of water table are studied. All the parametric analysis is done by using Plaxis 2D. The results from the study are analyzed and the effect of various parameters on the stability and serviceability of the support systems are studied.

## Keywords:

Sheet Pile Walls, Excavation, PLAXIS2D, Finite Element Analysis

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# Application of LID techniques as mitigation measures for urban flood using SWMM

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## Abstract:

Urbanization and increased imperviousness are the main causes of the inadequacy of the existing drainage system, while unplanned waste disposal and poor maintenance are further issues. The Pulbazar Area of Banepa is flooded every monsoon season, turning the Araniko highway into a stream, impacting transportation and the daily lives of the residents. The natural drainage surface is being impacted by the haphazard growth of urban areas. The Storm Water Management Model (SWMM) is one of the most popular and worldwide utilized urban flood design and management models for modeling urban flooding. In addition, it is utilized for modeling non-point source pollution, reducing combined sewer overflow, planning, evaluation, and design associated to rainfall runoff, combined and sanitary sewage, and other drainage systems. For this study, SWMM 5.2 was used. The primary goal of the research is to study the hydrological and hydraulic status of the urban storm water sewerage as well as drainage system and evaluate the application of Low Impact Development (LID) for reducing runoff volume, conduit velocity and flooded nodes in the study area. The LID practices which were modelled were Permeable Pavements and Green Roofs. The LID practices modeled were Permeable pavements and Green roofs. From the result obtained, it can be concluded that LID applications like Permeable pavements and green roofs can reduce the runoff by 28% and 72% respectively in the fast urbanizing and congested cities like Banepa.

## Keywords:

SWMM, Urban Flooding, Low Impact Development, LID, Permeable Pavement, Green roof, Storm water Management, Pulbazar, Banepa

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# Passive Lighting Design as a Tool for Energy Conservation

*Tapasya Chamling Rai*<sup>a</sup>

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## **Abstract:**

This is the research based on the study of daylighting availability and benefits of daylight inside the office buildings around the Kathmandu Valley and focuses on decreasing the use of electricity during the day hours saving energy and energy consumption. The methodology applied is several case studies and literature review where the ideas of passive daylighting is generated and eye survey in the respective case studies have been performed regarding daylight and its present condition, use of artificial light during daytime and so on. The newly constructed buildings are less able to design the office rooms as per the allowance of daylight during daytime and still using the artificial lights in major part of the buildings. It is clearly seem to be need of passive daylight office environment in office building to save energy and get more benefits due to daylighting system in office area.

## **Keywords:**

Daylight, Energy conservation, Benefits of daylight, Electrical lights, Office space

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# Runout Analysis of Landslide Using RAMMS (Rapid Mass Movement Simulation) Debris Flow Module – A Case Study of Jure Landslide

*Roshan Shrestha<sup>a</sup>, Ram Chandra Tiwari<sup>b</sup>*

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## Abstract:

In the research related to landslide damming, determining the landslide volume and the post run out parameters has always been a challenging task. The goal of this work is to comprehend the process of landslide damming using factors such as the size of the dam, the layout of the valley, the composition of the material, the friction and turbulence caused by the material, etc. The Jure Landslide is taken as the study area. The research area has already experienced landslide damming and suffered significant losses. The RAMMS (Rapid Mass Movement Simulation) Debris Flow Variant is used to simulate debris flows. The results indicate that the maximum velocity ranges from 39.77 to 55.68 m/s when the water table lies at the bottom of the debris. Additionally, with the aid of parameters identified from the debris flow simulation, the geomorphic indices HDSI (Hydro morphological Dam Stability Index) and MOI (Morphological Obstruction Index) have been determined. The Sunkoshi River would be blocked, and the ensuing dam would be unstable, according to the results of geomorphological indices.

## Keywords:

Landslide Damming, Jure, RAMMS, MOI, HDSI

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# Effect of R.C. Jacketing on Seismic Performance of Bridge Pier Considering Different Longitudinal Reinforcement Ratio

*Binaya Jamarkattel<sup>a</sup>, Rajan Suwal<sup>b</sup>*

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## Abstract:

The bridges of Nepal are getting older and old bridges were designed without considering the seismic forces, hence have low seismic capacity. The capacity of these bridges need to be enhanced and should perform well during seismic events. Jacketing technique can be used to upgrade the bridge structural performance. This research paper mostly focuses on the seismic performance enhancement after the application of RC jacketing on the bridge pier. The variable that has been varied is the longitudinal reinforcement in RC jacket. The capacity of bridge pier is evaluated using displacement controlled nonlinear static analysis (Pushover). The time history load is applied to the structure to determine the seismic demand of the bridge. The quantification of the enhancement of the bridge structure after the application of RC jacketing is evaluated by plotting fragility curve. The modeling of the bridge is done in CSI Bridge V20.2.0. The different damage state are defined using the strain values obtained from the pushover analysis. For different damage state, the capacity and demand value are used to obtain the probability of exceeding at different PGA levels. The fragility curve is developed using First Order Second Order Method (FOSM). From the study, it is found, the vulnerability of bridge after the use of jacketing for extensive damage state, the probability of failure reduced from 18.88% to 2.68% at 1.0g PGA. Similarly, the vulnerability of bridge after the use of jacketing for collapse damage state, the probability of failure decreased from 10.34% to 1.03% at 1.0 PGA.

## Keywords:

Seismic Performance, Fragility curve, Damage state, Pushover analysis, Time history analysis, Reinforced Jacketing.

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# Analysis on Placemaking Around High Rise Apartments: A Case on Westar Residency and Sun-City Apartment

*Aakriti Mishra <sup>a</sup>, Ashim Ratna Bajracharya <sup>b</sup>*

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## **Abstract:**

Nepal is a developing country where urbanization is taking place at a rapid pace. The urbanization is mostly concentrated at the major cities of the country mainly on metropolitan, sub-metropolitan and municipalities. Kathmandu, being the capital city of Nepal is the most populated urban region of the country, with an estimated population of 2.54 million, and is growing at 6.5% every year. The pressure to accommodate such a large population is resulting into unplanned land use, shrinking open spaces, and haphazard construction. In order to manage such an urban sprawl, it is high time we switch to vertical built environment to live in. However, high rise buildings are often blamed for crimes, anxiety and degeneration of urban morphology as they deform the quality by overloading the density, infrastructures and public realm where the building is standing in. On one hand, high rise are considered responsible for degeneration of urban morphology and on another hand high-rise buildings are today a prime feature of urban living, making up a large proportion of cities, skylines and architecture. The research thereby, explore the contribution of high rise apartments in placemaking of the surrounding neighborhood focusing mainly on the urban setting, socio-cultural and psychological aspects.

## **Keywords:**

High rise residences, place-making, neighborhood

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# Public Participation for Urban Infrastructure Development

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## Abstract:

Public participation is the involvement and collaboration with public to get their ideas and opinions, for decision making to bring a positive and sustainable development in the community. This research focuses on government initiatives to bring together the citizens of the community for discussions on the necessary consideration for the sewerage and drainage and road infrastructure development as per the STIUEIP project. The working mechanism of the government to complete the project in a community rapidly without fully understanding the community through the public perspective led to the project being withheld temporarily as it misses the necessities of the local citizens and the surroundings. The research explores the citizens of the community, their activities, behavior, and willingness to support the government. Mixed methods for case study is used to understand the different initiatives carried out by the Birgunj Metropolitan City for increment in participation during the planning and policy making stages. Along with literature study, paper survey was distributed among 80 residents, semi-structured interviews were conducted with 7 officials affiliated with the project. The activities and action of the government or the public explored and found during the research help us to determine the gap between the public and the local government for working collaborating with each other. The willingness for participation and contribution in infrastructural development among Adarshnagar residents is very high. However, this is contrasted by low sense of ownership among the residents which is contributed by less effective participatory approaches by the local government leading to ineffective information relay and top accumulation of decision making power.

## Keywords:

Public Participation, STIUEIP, Government Initiatives, Public, Willingness

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# Evaluating the Social Impacts of Safa Tempo in Kathmandu Valley

*Bijju Maharjan<sup>a</sup>, Sudarshan Raj Tiwari<sup>b</sup>*

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## Abstract:

Safa tempo is one of the three options for public transportation within Kathmandu Valley. Introduced in 1995 in order to outlaw and replace the city's diesel-powered three-wheelers, Safa tempos are battery powered three wheelers which make up roughly 3% of the modal share on public transportation. Imported components are assembled to manufacture the main body in Kathmandu. The city holds the distinction of being the first in South Asia that operates zero emission vehicles for public transportation. While many innovations do not pass the experimentation phase, this electric vehicle technology not only successfully went beyond its testing but was also managed to penetrate the transportation market overcoming all odds. Since Nepal have no fossil fuel reserves and heavily relies on imports, shifting to electric modes is more required now. But this innovative technology has been struggling and is at the moment experiencing deep crisis. It is neglected and forgotten that there is such technology in our city and we are in search for solution to fuel crisis elsewhere. It is important that we understand what went wrong. Social impacts are often overlooked when studies are conducted on the economic and environmental benefits. Through observation, interview and questionnaire survey, this study aims to assess the social impacts of safa tempos. The results of this report are hoped to be helpful.

## Keywords:

Safa Tempo, Public Transportation, Electric Vehicle, Social Impacts

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# Experimental Investigation of Parameters Affecting Productivity of Single Slope Basin Type Passive Solar Still

*Shah Nawaz Ansari<sup>a</sup>, Nawraj Bhattarai<sup>b</sup>, Sanjaya Neupane<sup>c</sup>*

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## **Abstract:**

Water is one of the basic needs for sustaining life on earth. A significant portion of the water present on earth is not suitable for direct usage despite being a renewable energy source. The world's drinkable water supply is steadily decreasing, with depletion occurring most prominently due to rising population, urbanisation, industrialisation and environmental pollution. One-third of the population of the world lives in countries where there is insufficient availability of fresh water. The solar desalination method can solve the problem in future if proper research and development are done. One of the devices which are based on the solar desalination method is solar still. The problem of potable water can be solved by solar still without any implementation of high-grade energy or costly energy. Solar still could be used in remote areas where there is the unavailability of electricity as a solar still is completely based on solar energy. Solar still faces the major challenge of desalinated water's low productivity. Thus, the study and research on various operational and design parameters is most needed. Hence, this research investigates the key parameters of single slope basin type solar still and their effect on its productivity. The effect of basin water depth, ambient temperature, basin temperature, etc., on the water productivity has also been investigated.

## **Keywords:**

Water Desalination, Solar Energy, Single Slope, Solar Still, Passive Still, Productivity, Evaporation, Condensation

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# Flood Hazard Mapping and Vulnerability Analysis of Hanumante Riverside Corridor Section

*Manish Karmacharya<sup>a</sup>, Sanjay Uprety<sup>b</sup>*

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## Abstract:

Urban development and Urban flooding are issues that are interlinked with each other and that can have serious effect on the settlement and the civilization of the urban population. As the pace of the urban development and Urbanization increases it increases the built-up areas and the impervious surface which eventually increases the risk of the urban flooding. This type of urban flooding causes major impacts near the riverside corridor and its catchment areas. The Riverside settlement areas are the always the vulnerable zones for the flooding in the river as well as the urban flooding in the settlement nearby it. The riverside corridor are those areas acting as the buffer zone for the settlement nearby the river and the river itself. Flooding can be Natural as well as human induced sometimes but the urbanization trends across the flooding plains on unmanaged way brings always the negative impacts on the lifestyle of the people through flooding. The main purpose of the research is to identify and mapped the flooding zone according to the setbacks assigned buffer zone or Areas with high risks, medium level risk buffer zone and low-level risk buffer zone according to the time lapse of the selected flooding zone. The research was carried out using the mixed methods of the time lapse satellite images to mapped vulnerable settlements and properly documented the increased of the buildup areas and carried out the questionnaire survey on those settlement about the vulnerability and impacts of the flooding on the lifestyle and the structures. As the research reviews the policies and others prevailing laws too for the new urban development across it.

## Keywords:

Flood, Urban Flooding, Land use Change, Madhyapur Municipality, Hazard Mapping, Vulnerability

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# Shifting Private Vehicle Owners into Public Transport User: Impact of Sajha Yatayat in Achieving it

*Roshan Thapa <sup>a</sup>, Sudarshan Raj Tiwari <sup>b</sup>*

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## **Abstract:**

This study aims to evaluate Sajha Yatayat's contribution to the mode shift from private to public transportation. For this, it is first necessary to comprehend how passengers perceive Sajha Yatayat's level of service. Based on the stated preferences of its passengers, Sajha Yatayat's performance in addressing the most significant physical and perceived qualities of high-quality public transportation is evaluated. Additionally, it is discovered which characteristics the passenger believes Sajha Yatayat addresses the best. Second, based on the preferences of those who drive private vehicles, numerous issues about public transportation and characteristics that could be changed to make it more appealing to them are assessed. The study employs a mixed methodology that fits into a sequential exploratory design. Interviews, questionnaires, and participant observation were used to collect the data.

## **Keywords:**

Public Transportation, Sustainable Transportation, Physical attributes, Perceived attributes, Public vehicle, Public Transportation

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# Managing E-waste in the Kathmandu Metropolitan City: A Case of Ward no. 22

*Shraddha Dotel<sup>a</sup>, Sangeeta Singh<sup>b</sup>*

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## Abstract:

The competitive electronic market and the growing consumer buying behavior are leading to the rapid obsolescence of electronic devices. The handling of e-waste at the end of its useful life after these devices are replaced or discarded for various reasons over time presents a challenging situation. The objective of this study is to understand the perspective of electronics consumers in managing their e-waste, taking the case of ward no.22 of Kathmandu Metropolitan City. Semi structured questionnaires were developed using the variables identified in the literature. The questions were based on various grounds of information regarding demographic information, socioeconomic information, e-waste generation and disposal practice, awareness level, and consumer intentions toward e-waste disposal. The study's findings revealed that although consumers were aware of the issues with e-waste, there was a serious lack of information on its management, including current formal recycling centers. Furthermore, it was also found that most respondents were inclined to repair and selling their e-waste such as desktops and television to scrap dealers. But the scrap dealers do not follow scientific procedures of e-waste handling, awareness efforts are essential to prevent the effects of inappropriate e-waste disposal. The research results offer guidance for creating long-term e-waste management plans in Nepal.

## Keywords:

E-waste generation, method of disposal, awareness level, e-waste management

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# Performance analysis and improvement of existing electric resistance furnace for ceramic sector in Thimi, Bhaktapur

*Nitish Shakya<sup>a</sup>, Bijendra Prajapati<sup>b</sup>, Prajwal Raj Shakya<sup>c</sup>*

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## Abstract:

Ceramic products are broad names for things made of clay. Thimi in the Bhaktapur district is one of the principal locations for industries which make ceramic products. Earlier, the ceramists of Bhaktapur used to depend in furnaces which used kerosene as an energy source to make ceramic products. Due to high price of kerosene, non-uniform distribution of temperature, eco-unfriendly and unavailability of large space to install furnace, such type of conventional furnaces are replaced by electric resistance furnaces (ERF). As the previous study has not been made to utilize such ERF to its full potential, it is chosen for study. The objective of this study is to analyze the performance and improve existing ERF of Thimi, Bhaktapur. Experimental based performance analysis is done by recording the temperature distribution and calculating the specific energy consumption, efficiency, and heat losses from the outer surface through radiation and convection. Based on the performance analysis, improvement of electric resistance furnace is done by constructing additional insulating wall of fire brick in the existing furnace. The result obtained from experiment was validated by using ANSYS 2022 R1. Based on the assessment, Everest pottery furnace was found efficient than Gathaghar pottery furnace with efficiency 37.32% and 32.11% for first and second firing respectively. Further, after modification of Everest pottery furnace, the furnace efficiency was improved by 18.89% and 15.51% for first and second firing respectively.

## Keywords:

Electric resistance furnace, Ceramics, Ansys 2022 R1, Performance analysis, Improvement, Specific energy consumption

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# Spatial Analysis for Residential Development: A case of Tulsipur SMC

*Sugam Gautam <sup>a</sup>, Ajay Chandra Lal <sup>b</sup>*

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## Abstract:

This paper tries to analyze the suitability of residential area in Tulsipur SMC. Urbanization is shift in population from small rural settlements creating positive and negative impacts. Due to haphazard growth, problem is arising, so an intervention is clearly required. Residential area suitability analysis using GIS based MCA is the process to intervene and find the solution. Literature review and KII helped to determine the restriction and development criteria for the residential development. A final map from restriction criteria was made. Each development criterion was produced as a GIS map before being normalized to a scale in raster maps, with 1,2,3,4 and 5 denoting highly, moderately, low, very low suitable and unsuitable, respectively. Hence a final raster equation was considered in GIS tool to generate a suitability map according to development criteria which was integrated to the restricted map through which a final suitability map for residential development was carried out. At the end, it was suggested that places with great potential for residential development, such as colonial homes, be approved, while those with lower potential might still be used for residential construction with certain restrictions. Similarly it was recommended that low dense community housing was more favorable than high rise apartment in the city due to cultural requirements and technological deficit.

## Keywords:

Suitability analysis, Residential development, Restriction factor, Development criteria, GIS

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# Multi-Objective Optimization of National Highways in Nepal: A case study in Gandaki Province

*Narayan Poudyal<sup>a</sup>, Jagat K. Shrestha<sup>b</sup>*

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## Abstract:

This study considers the multi-objective approach to multi-level national highway network planning in developing and mountainous country Nepal where it is difficult to find traffic and highway related data. This approach considers accessibility and robustness objectives for highway network planning. Robustness of a network is determined based on the accessibility to major cities during the monsoon season when almost all road links are disturbed to the some extent. The construction of new highways and/or upgrading of the existing highways are proposed for fulfilling the objectives. The application of the approach is demonstrated for a case study involving highway network of Gandaki province, Nepal. This methodology can be applied to mountainous areas of other developing nations.

## Keywords:

Multi-objective optimization, Accessibility, Robustness

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# Empirical and Numerical Study for Support Estimation for Stability of Underground Opening: Case Study of Two Tunnels in Lesser Himalaya Region of Nepal

*Sulabh Majganiya<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## Abstract:

Tunnel stability evaluation methods are divided into three categories: empirical methods, observational methods and analytical or numerical modeling. In this study the support estimated from empirical methods (Q-system) has been analysed with Numerical Modeling. The headrace tunnel of the two projects i.e. Solu Khola (Dudh Koshi) Hydroelectric Project and Ghar Khola Hydro Power Project both lies in the lesser Himalaya Region of Nepal has been used as a case study. The support estimated from the empirical method was sufficient for achieving the stability in the circular shaped tunnel but not inverted D and horse shoe shape tunnel. For the weak rock mass and at high stress field condition it was difficult to achieve the stability in the inverted D shape. So the horse shoe shape is preferred and modification of the support from the Q-system for the stability has been suggested on the basis of Numerical Modeling.

## Keywords:

Q-Value, Numerical Modeling, RRS, Rock Support

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# Digital Music Generation Using a Character-Level LSTM

Anil Pudasaini <sup>a</sup>, Shashidhar Ram Joshi <sup>b</sup>, Basanta Joshi <sup>c</sup>, Sanjivan Satyal <sup>d</sup>

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## Abstract:

Deep learning for sequence modeling has gained prominence during the past few years. To accomplish this, LSTM network architectures have shown to be quite helpful for forecasting the next output in a series. There are several ways to generate music and this paper presents a novel way to generate digital music. Leveraging the power of sequence modelling, a novel variant of LSTMs, character level LSTM (Long Short Term Memory) is used to generate an adequate music. The created music is then thoroughly evaluated using a Turing test and an online musical audition. The model passed the Turing test and is able to generate music with good musical qualities making it challenging for the average listener to tell the difference between human composition and those produced by AI. The thesis provides a brief synopsis of the intuition, theory, and application of LSTMs in music generation, develop and present the network that is found to best achieve this goal, identify and include potential future network improvements.

## Keywords:

MIDI, music generation, LSTM, AI music, sequence modelling

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# Techno-Financial Analysis of Floating Solar Photovoltaic System in Nepal

*Shweta Sah <sup>a</sup>, Ajay Kumar Jha <sup>b</sup>*

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## Abstract:

Floating Solar photovoltaic system is one of the fast growing PV technology in Asia. This system helps in cooling down of solar PV modules which ultimately increases the efficiency and energy production of the solar PV system. This research includes experimental technical and financial analysis of a floating solar PV system and its comparison with the land based Solar PV system. A solar panel was installed on the pond behind center of energy studies (CES) which is inside Pulchowk Campus. Another Solar panel of same capacity was installed on land on the same site. For their comparison, measurements of temperature, open circuit voltage and short circuit current were taken for 10 days. The result shows increase in the power of floating solar PV system by 11-12% in comparison to the land based solar PV system. The irradiance absorbed by floating solar PV system was nearly 1.5% more than the land based solar system. Financial analysis of a 1MW floating solar power plant was done on the basis of the obtained data.

## Keywords:

Floating solar photovoltaic system (FSPV), PV cell efficiency, Solar Irradiance, Techno-financial analysis

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# Assessing Bikeability of an Urban Road: A Case of Kupodole-Jawalakhel-Lagankhel Road Stretch

*Gaurav Paudel<sup>a</sup>, Padma Bahadur Shahi<sup>b</sup>, Astha Acharya<sup>c</sup>*

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## Abstract:

From the perspective of personal health, the environment, and the economy, using a bicycle as urban transportation within a city is a highly sustainable option. This paper establishes various built environment attributes contributing on bikeability of an urban road in context of Kathmandu valley and assess the selected road stretch. First, various built environment attributes were identified. Then each attributes influence level was calculated based on the perception survey with road users. Finally, the selected road stretch's built environment attributes were assessed on the basis of the established qualitative evaluation criteria. It was found that, current built environment condition of road is not highly favorable for cycling and also, most people preferred motorized vehicle over bicycle. Beyond the built environment, there are other social and personal factors as well such as bicycle being considered as socially inferior option than motorized transport, lack bicycle riding skills etc. that influences the use of bicycle. Enhancing the built environment condition along with programs such as awareness campaign on benefits of bicycling, supporting peoples to learn bicycling etc. can significantly promote use of cycling in an urban area.

## Keywords:

Bikeability, Urban Road, Built Environment Attributes

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# Modeling, Simulation and Thermal Analysis of Electric Resistance Furnace used in the Heat Treatment of Clay Based Ceramics

*Binod Adhikari <sup>a</sup>, Rajendra Shrestha <sup>b</sup>, Bijendra Prajapati <sup>c</sup>*

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## Abstract:

Electric resistance furnaces can replace the traditional fuel fired furnaces in the pottery industry as these furnaces utilize the electricity to heat treat the clay based ceramics in a uniform manner. In this study, an electric resistance furnace is modeled and an attempt to study the thermal behaviour of the furnace is made. The temperature distribution in the walls, the furnace environment and the material to be treated are the scope of this study. The results were then verified with the experimental data obtained from the field visit for the outer wall temperature and the furnace internal temperature. Computational study show the temperature deviation on the walls of the furnace below 15% and internal temperature below 5% than that of the experimental value. Further, an attempt to reduce the external wall temperature and heat flux is made by certain variations in the insulating material. The alteration of the insulation by constant total thickness method adopted reduces the heat flux by 29.4% while for meeting the industrial standards, minimum addition of 40mm of insulation is needed. The study is aimed to provide optimum design for reconstruction of the worn out furnaces as well as the improved future designs of the furnace.

## Keywords:

Thermal analysis, Electric resistance furnace, Heat Treatment, Clay based ceramics

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# Response Reduction Factor of Reinforced Concrete Buildings on Sloping Ground

*Arun Malla Thakuri*<sup>a</sup>, *Prem Nath Maskey*<sup>b</sup>

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## Abstract:

Due to rapid urbanization and scarcity of land, the construction of building on sloping ground is increasing in recent times. Step back building and Step back setback building are two configuration of buildings which are commonly built on sloping ground. Since Nepal lies in seismically active region, such vertically irregular buildings are vulnerable to earthquake. Seismic performance such as base shear, time period, top story displacement, interstory drift of step back building, step back setback building and regular building are evaluated using linear static analysis and response spectrum analysis. From the analysis it is found that the step back setback building has less base shear and less time period than step back building which results in less displacement. Non-linear static analysis is used to determine overstrength factor, ductility factor and response reduction factor of step back building, step back setback building and regular building. It is found that building configuration play an important role in overstrength factor, ductility factor and response reduction factor.

## Keywords:

Step back building, Step back setback building, Overstrength factor, Ductility factor, Response reduction factor

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# Climate Responsive Residential Architecture in Dhading

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## Abstract:

Climate responsive design is considered to be one of the major requirements to drive the building sector towards sustainable development. Elements like air temperature, relative humidity, wind, irradiation, and rainfall these elements affect the climate responsive design of a certain region. Nepal has high varying topography which is leading to a variety of climatic conditions within short distance. With the introduction of modern construction technologies introduced in the country, the building sector has adopted uniform design and building techniques which is neglecting local climate and rely on energy intensive mechanical means to provide comfort within the building. For the study primary quantitative and qualitative field data and secondary quantitative climate data was collected from Department of Hydrology and Meteorology and developed bioclimatic chart and Mahoney table which gives the different design strategies for Dhading. This paper reviews examples of traditional and modern residential architecture and its building features in Dhading and analyses in a qualitative manner. Climatic data from Dhading shows that most of the month in a year are hot. From bioclimatic chart it was found that the summer temperature is high in day time hence passive cooling strategies are recommended. From Mahoney table also heavy walls and roof with permanent provision of air movement is recommended. From the study it was found that traditional building have less indoor air temperature but have high indoor humidity level. However traditional building materials and design features applied in Dhading are climate responsive than contemporary buildings.

## Keywords:

Climate responsive, residential building, climate, air temperature, humidity

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# Design, fabrication and performance evaluation of portable incubator

*Bal Mukunda Kunwar<sup>a</sup>, Rajesh Kaji Kayastha<sup>b</sup>*

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## Abstract:

For rural water supply system, microbiological parameter such as Escherichia coliform needs to be monitored frequently to ensure safe water. Lack of portable incubator made difficulties in monitoring the water quality in remote areas. Difficulties in carrying and unreliable power sources are some of the existing challenges. Thus, the research focused on design, fabrication and performance evaluation of the portable incubator and performed validation of the setup. Experimental research methodology was performed for the research where data were collected from various testing setup without and with 16 nos. of test plates of incubator using 12V DC bulb as heating source. The power supply for the setup was battery powered by solar PV setup, as well as AC-DC charger connected to a grid line. A 20Wp solar with 20Ah battery setup meets the requirements of the power. Bulb Incubator consumed 0.620A current and 7.44W power. It requires 17.36Wh energy to perform one cycle of incubation and heating cycle operated for 14 times. The total operation hours for one complete incubation cycle in 24 hours was 2.33 hours. AVC -144 vaccine box of 1.4L capacity with inbuilt PU insulation of 40mm thick as an incubator casing has effectively prevented from the heat loss and is also portable.

## Keywords:

Incubator, Portable, Heat loss, microbial

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# Finite element analysis of empirically designed support: a case study of Khimti-II headrace tunnel

*Ashok Baral<sup>a</sup>, Abhay Kumar Mandal<sup>b</sup>*

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## **Abstract:**

This paper presents the numerical assessment of the stability condition and support estimation of empirically designed Khimti-II headrace tunnel. Rock mass characterization is achieved through the rock mass rating (RMR), Geological Strength Index(GSI) and Tunnel Quality Index (Q) system. The Q system is used for the rock mass quality determination as well as for the estimation and design of the required supports. A finite element software, Phase2 is used to evaluate the performance and stability of the recommended supports by analyzing deformation, stress concentration and interaction of supports with the excavated rock mass. The parameters used for the numerical analysis are obtained by field investigation, laboratory test results during feasibility study and relevant literatures. The results obtained from the numerical analysis validates the adequacy and reliability of the empirically designed supports.

## **Keywords:**

FEM, Tunnel support estimation, Rock mass classification, Phase2, Tunnel stability analysis

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# Evaluation of energy performance of residential building in a hot and humid region: A Case of Siddharthanagar, Nepal

*Skanda Rimal*<sup>a</sup>, *Sanjaya Uprety*<sup>b</sup>, *Pawan Kumar Bhattarai*<sup>c</sup>

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## Abstract:

This paper presents the results of a recent study of the energy performance of residential buildings in one of the hot and humid climatic regions of Nepal, Siddharthanagar, Rupandehi, Nepal. A building's energy performance typically correlates with its energy efficiency, as energy performance is used to determine its annual energy consumption. The energy demand increases when more discomfort is experienced in a building which results in higher consumption of cooling and heating loads. The intention of this study was to observe the thermal comfort of a residential building in the hot and humid region throughout the year and its performance after passive design strategies. The study was performed by analyzing the climatic data collected from the Department of Hydrology and Meteorology, studying the building envelope followed by simulation of a residential building located in Siddharthanagar municipality, Rupandehi, using an energy modelling software named Ecotect. The existing scenario was modified through orientation and the addition of insulation, which could reduce energy demand by 29 percent.

## Keywords:

Energy consumption, Energy efficiency, Hot and Humid climate, Passive design, Thermal comfort

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# Small World Network for Simulation of Blockchain Networks

*Prabin Kayastha<sup>a</sup>, Basanta Joshi<sup>b</sup>*

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## Abstract:

To understand the behavior of a blockchain system whether during the design or in the analysis, different simulators are used by enthusiasts and researchers to mimic the characteristics of the real blockchain technology in the Blockchain Under Test(BUT). Many blockchain simulation frameworks have been proposed and are being used for these use cases. However, most of the existing simulation frameworks seem to be focused only on certain layers of the blockchain system, usually in the consensus layer of the system. Almost all simulation systems seem to have overlooked the topology of the participating nodes on the overall behavior of the system as they use some deterministic functions to characterize the network behavior assuming that the topology is always holistic. This results in the wrong input parameters being fed to the subsequent building blocks in the simulation framework and thus yielding sub-par overall results. Recent studies suggest that the nodes of the blockchain system demonstrate certain small-world properties instead of being holistically linked. Small-World Networks show distinctive characteristics of having small average path lengths and high clustering coefficients. These characteristics help the information to be propagated within a fewer number of hops across the network.

This paper presents a state-of-the-art approach to effectively formulate the node topology design in a blockchain simulation system using Small World Networks approximation. This design yields a more realistic simulation of the network nodes and the upstream layers of BUT simulation. Simulations for various blockchains such as Bitcoin and Ethereum can be done with this simulator for various configurations.

## Keywords:

Blockchain, Simulation, Small-World Networks, Topology

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# Fire Susceptibility Mapping of Bhaktapur District, Nepal incorporating GIS-based AHP model

*Kundan Jung Thapa<sup>a</sup>, Nagendra Raj Sitoula<sup>b</sup>, Akhilesh Kumar Karna<sup>c</sup>*

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## Abstract:

The average loss of property due to fire hazard is comparatively higher than other disasters like landslide, flood, earthquake, etc. in Nepal (). The haphazard and unplanned developmental trends in urban areas of Bhaktapur district in Kathmandu Valley is making those area highly susceptible to fire disasters. A fire susceptibility mapping of this district will help to get more clear view of the nature fire susceptibility in Bhaktapur District. This research applies analytic hierarchy process (AHP) a type of multi-criteria decision making (MCDM) tool to assess the fire susceptibility factors of Bhaktapur district using expert opinion, which is then integrated with GIS software to generate fire susceptibility map. Weights of seven anthropogenic factors including, population density, distance to fuel stations, distance to roads, distance to dense settlements, distance to high-voltage transmission lines, land use and building typology is assigned using AHP, depending on the influence of each contributing factors. The fire susceptibility map is derived using weighted sum of individual maps of each contributing factors. This map shows that 76.38 percent of area fall under low to very low susceptible zone, 12.75 percent area fall under moderate zone and 10.88 percent of area fall under high to very high zone. It is seen that major fire susceptible zones lie in densely populated areas, near fuel stations and dense settlement areas. The map is also validated with past fire incidences and it is concluded that past fire incidences are in good agreement with fire susceptibility map.

## Keywords:

Fire Susceptibility, Multi-Criteria Decision Making (MCDM), Analytic Hierarchy Process (AHP), Geographic Information System (GIS).

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# Task System Generation for Hard-real Time Scheduling on Unrelated Multiprocessor Platforms

*Ashish Paudel<sup>a</sup>, Nanda B. Adhikari<sup>b</sup>*

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## Abstract:

Analysis of multiprocessor scheduling methods for real-time systems is a challenging domain of research due to the need of strong theoretical and practical guarantees of correctness for the methods to be usable. For the analytical work, a population of task systems have to be generated that accurately represents the parameters of practical systems. Although efficient and reliable algorithms are available for identical multiprocessor platforms, such is not the case for unrelated platforms. This work proposes a novel algorithm for generation of hard real-time, implicit-deadline, sporadic and recurrent task systems with the context of scheduling them upon unrelated multiprocessor platforms. The algorithm has been designed by generalizing the system parameters of identical platforms to those of unrelated platforms and by simplifying the feasibility testing process, which has made the algorithm efficient. Various system parameters relevant for the understanding of the scheduling problem and the performance of the algorithm are then proposed. Finally, the algorithm is extensively analyzed in terms of the system parameters. The analysis has shown that the proposed algorithm produces task system populations with feasibility ratio almost equal to 1 until a cutoff is reached. The population has also been shown to exhibit growing overall utilization upon increasing problem complexity. Also, the theoretical analysis has shown that the algorithm can be made to have linear time complexity in the average case for scale parameter  $\sigma_u \geq 3.0$ . These results verify that the algorithm is stable, reliable and efficient in generating task systems.

## Keywords:

task system generation, multiprocessor scheduling

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# Analysis of Solar Radiation for Pedestrian comfort in the streets of hot and humid climate, A case of Lumbini, Nepal

*Apekshya Ghimire<sup>a</sup>, Sanjaya Uprety<sup>b</sup>, Ashim Ratna Bajracharya<sup>c</sup>*

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## Abstract:

The development of road sections is a very important and critical responsibility in changing the local pedestrian behavior. The construction of roadside building structures should be carried out keeping in mind the solar shading it provides to that road section, especially in hot and humid regions. Walking outside in Lumbini's hot and humid climate is challenging, even for short distances, due to the bright sunshine during the day. Shading of the walkways influences the commuting behavior of pedestrians significantly. So, the study seeks to examine the effect of buildings and vegetation on pedestrian thermal comfort due to shading by existing buildings and vegetation. A structured questionnaire and solar analysis using Sketchup were used to examine the present conditions of the street connecting Mahilwar to Majhediya and the comfort it provides to pedestrian. In a typical east-west oriented street section, it was found that buildings over three stories performed better as shading agents compare to the buildings less than 2 stories on the southern side while plantation of local trees provides shading all over the year regardless of the direction. The buildings present in the street of Lumbini Sanskritik Municipality performed poorly in providing shade to the pedestrian walkway during the summer when it is mostly desired. Thus, this study concludes that constructing buildings over three stories provides shading to the southern walkway, and planting local trees helps in shading of the pedestrian walkways even in the north direction.

## Keywords:

Shading, Pedestrian Thermal comfort, Solar Analysis

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# Mapping earthquake induced landslides using machine learning: A case of Dolakha district in post Gorkha earthquake context

*Ajaya Pyakurel<sup>a</sup>, Dipendra Gautam<sup>b</sup>, Bhim Kumar Dahal<sup>c</sup>*

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## Abstract:

This study performs earthquake induced landslide susceptibility mapping and evaluates the underlying causative factors using Extremely Gradient Boosting algorithm (XGB) as a machine learning model. 14 landslide causative factors were taken to develop earthquake induced landslide susceptibility map. By using Gorkha earthquake induced landslide inventory map over the study area, 1275 landslide polygons used to develop training and testing data sets. Similarly, non landslide points are created randomly over the study area using QGIS. Training and testing data were in 70/30 ratio. XGB algorithm is trained using training data set and found that accuracy of training is 100%. While testing the accuracy of model to predict unknown points, testing accuracy found to be 89.97%. In the same way, area under the ROC curve (AUC) and kappa coefficient were calculated and values were obtained as 0.959 and .0799 respectively. Finally, using XGB, susceptibility map developed and result shows 90% of areas were feebly susceptible, 5%, and 6% of the areas were moderately and highly susceptible, respectively. This provides a handy information for urban planner, land use planning process, and others government authorities to make an effective mitigation and prevention action plan.

## Keywords:

earthquake induced landslide, machine learning, susceptibility, kappa coefficient

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# Post-Disaster: Social Cultural Impact in the Resettlements: In case of Giraunchaur, Sindhupalchowk

*Rabin Kambang<sup>a</sup>, Sushil B. Bajracharya<sup>b</sup>*

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## Abstract:

After Gorkha Earthquake 2015, Nepal faced rapid housing demand in urban and rural context. In consideration of ease of providing necessary services, integrated settlements have been prioritized for resettlements by Nepal Reconstruction Authority (NRA) and Department of Urban Development and Building Construction (DUDBC). In contrary to the popular belief of resettlement bringing well-being, issues of ignorance towards community identity, social-cultural and economical needs have been observed. The study focuses on two resettlements in close-proximity with similar social-cultural lifestyle in Giraunchour, Sindhupalchowk. Namuna Ekikrit Basti and Shree-Namadoling Ekikrit Basti has been built by Dhurmus-Suntali Foundation and joint effort of CG-Foundation and Nepal Reconstruction Authority (NRA) respectively. Field observation, key-informant interview, questionnaire survey has been done to understand the change in societal way of living in both areas. User-committee faces a challenge in addressing a demand of rapid building construction along with needs of individual people in the community together with the economical challenges. Furthermore, the acceptance of ideologies of donor agencies plays additional impact. Both Basti faced restriction of livestock and has made a serious impact in agricultural chain and financial portion through live-stock. Earlier common courtyard-based living has been turned towards compartment-based housing. The study focuses on modification and adaptation to address living, comparison of satisfaction in two resettlement areas.

## Keywords:

Resettlement, societal impact, adaptation, Satisfaction, Earthquake

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# Comparison of Deformation in Tunnel along Thrust Zone using Different Approaches: Case Study of BBDMP

*Ashok Bohara <sup>a</sup>, Tualsi Ram Bhattarai <sup>b</sup>, Praveen Chaudhary <sup>c</sup>*

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## Abstract:

When tunnel excavation is done, the deformation of tunnel occurs along with stress redistribution as rock mass relaxes showing movement from its position. In the event that a catastrophe such as a cave-in, rock burst, or water invasion occurs near the tunneling site in a fully mechanised, full-face excavation, the tunnel boring machine (TBM) might get twisted upon departing, becoming stuck, and in fact damaged. The misshapen mass is distorted after excavation emptying of the thrust zone, making it vital to research the misshapen shake mass within the break zone under conditions including excavation upsetting influence. There are different approaches for deformation calculation, among which analytical method and numerical model (2D model and 3D model) using Rocscience software is adopted for comparison of deformation along thrust zone (Bheri Thrust and Babai Thrust) of Bheri Babai Diversion Multipurpose Project's headrace tunnel. The result of the research demonstrates that the total displacement for higher overburden is not affected by intermediate stress whereas it has greater impact for lower overburden.

## Keywords:

Thrust zone, analytical method, 2D model, 3D Model

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# Assessment on Building Byelaws Implementation with Respect to Height and Setback, A Case of Lokanthali Madhyapur Thimi

*Tulsi Kumar Kaway<sup>a</sup>, Ashim Ratna Bajracharya<sup>b</sup>*

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## Abstract:

Building bylaws are control systems that prioritize society as a whole above an individual. In order to meet society's objectives for accessibility, safety, and health, building bylaws rules are essential tools. Such laws stop "overloading" in structures and on the land, maintaining an adequate supply of amenities and services. They are also increasingly considered as a means of achieving goals including sustainability and energy efficiency. Rapid urbanization has resulted in haphazard development that frequently violates setback, building height restriction rule and other building regulations. Significant social and environmental advantages for locals result from the setback and building height restriction. These include improved lighting, ventilation, landscaping, parking areas, the removal of encroachments, fire protection, etc. Setbacks contribute to the building's enhancement of qualities like quality space. The corridors of Lokanthali, Madhyapur Thimi have seen instances of violation of byelaws, despite the fact that laws and regulations were established for legitimate reasons. Additionally, this leads to worsening living conditions, narrowing of current road, and congestion. In order to draw implementation status to the setback and building height regulations that are now being violated by residential buildings. This paper has attempted field observation and measurement to know implementation status and engage questioner survey with the general public, municipal engineers, and consultants in the search for a solution from field. 53 dwellings were measured and field observations were made to determine the present setback and building height along with the questioner survey, which was carried out using the census technique. The statistics show that more than 85% of buildings violate setback requirements and more than 57% breach building height regulations. The results of this article will be beneficial to municipalities. The conclusion is that the majority of respondents think that awareness program and monitoring should be conducted.

## Keywords:

building height, byelaws, setback, violation

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# Parametric Study of Pre Stressed Box Girder Bridge with Different Inclination Angle of Web

*Bickey Lakha<sup>a</sup>, Rajan Suwal<sup>b</sup>*

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## Abstract:

Nowadays, civil engineers are more focused on both structural as well as aesthetic appearance of the bridge. So, there is an emerging need of pre stressed box girder bridge which meet both the structural and aesthetic needs and also tends to be more economic and effective in term of seismic performance and cost. However this type of bridge are mostly used for longer span. In this study, the parametric study of pre stressed box girder bridge with different inclination angle of bridge has been done. With variation in the inclination angle of the web at constant cross sectional area of box girder, there is change in the seismic performance of the bridge. The inclination angle is changed at the interval of 6 degree starting from 90 degree and up to 72 degree inclination with all together four models. Then for various inclination angle of web corresponding seismic performance has been determined and the maximum performance point is obtained for inclination angle of 90 degree in both transverse and longitudinal direction for both design based earthquake and maximum credible earthquake. Hence the box girder bridge with 90 degree inclination angle is recommended as the best shape in terms of seismic performance.

## Keywords:

Seismic Performance, relative yield displacement, pier top displacement, Pushover analysis, Time history analysis.

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# Word Level Nepali Sign Language Recognition Using Transformer

*Shristi Heuju<sup>a</sup>, Birodh Rijal<sup>b</sup>*

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## Abstract:

With the seemingly distinct communication gap between the hearing impaired community and all the other remaining population, introducing sign language for the communication has definitely tear down this gap. The work concentrates on creating a vision-based system that will help identify the sign language hand gestures from the video sequences and help translate that into a readable format. The work focuses on two different methods. One work uses one of the architectures of convolutional neural network that shall train a classifier to classify spatial features of Nepali Sign Language words gesture. And, RNN approach shall be used for the classification of the temporal features of the word gesture. Another method utilizes the concept of transformer in combination with feature extraction approach to recognize the hand gestures made by the individual. The word level sign gestures captured to create a dataset is fed for train and test using DenseNet-121 architecture in combination with a RNN architecture of LSTM. Same extracted frames are then fed into DenseNet-121 architecture for feature extraction and finally into transformer for the sequential features recognition. The results obtained from use of combination of CNN and RNN architectures are compared and analyzed with the second approach to determine the best accuracy provided to recognize the sign gesture.

## Keywords:

Convolutional Neural Network, Deep Learning, Sign Language Gesture, Transformer

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# Study on Voltage Based Relay on Power Distribution System with DG

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*Menaka Karki*<sup>c</sup>, *Prabhat Kumar Pankaj*<sup>d</sup>

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## Abstract:

Under voltage and over voltage protection initially placed at generating stations. Voltage based protection is applied at power distribution system with or without distributed generations (DG). This paper first design of voltage based relay and it is tested to the distribution system similar of current based relay. When fault is associated distribution system, near of the fault sections magnitude of voltage going to down and simultaneously check of magnitude of current then voltage based relay make safe healthy system by tripping the faulty sections. From the source side to fault section voltage magnitude is higher to lower, In voltage based relay there is easy to control coordination because of voltage dip near to fault. If penetration of DG or not, isolated or grid connected does not effect to selecting fault voltage magnitude. Simulation outputs shows this method is more reliable, more selective with appropriate speed without changing of relay setting values. For the minimum operating time and coordination of voltage relay and current relay using genetic algorithm technique is used.

## Keywords:

Distribution system, Distributed Generation (DG), Voltage based relay

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# Fault Detection in Printed Circuit Boards using Faster RCNN And YOLOv3

*Bipin Thapa Magar<sup>a</sup>, Ram Krishna Maharjan<sup>b</sup>*

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## Abstract:

Technology has been an essential part in everyone's daily life. With the development of new technologies, people tend to forget the thing that powers it all i.e. hardware. New and more sophisticated techniques are being developed regularly in the field of hardware design and development. With the step into automation, most large companies tend to print their circuits using automated industries. Although, it increases efficiency, quality assurance is also important. To test and verify the huge number of products, a deep learning object detection system can be developed which can verify the PCB and segregate the faulty ones from the correct ones. This paper focuses on development of object detection networks to detect the various faults in PCB, localize the faults as well as classify them. For this, Faster RCNN network and YOLOv3 have been used and their performance have been measured in terms of Mean Average Precision(mAP). For Faster RCNN, Resnet101 and Resnet50 has been used as the backbone which had mAP of 0.9309 and 0.9578 respectively whereas YOLOv3 performed even better with mAP of 0.991.

## Keywords:

Faulty PCB, Faster RCNN, YOLO, Object Detection

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# Seismic Response of Irregular High Rise Building in Kathmandu with Shear Wall

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## Abstract:

Rapid population growth is one of the common problems in city areas like Kathmandu. This rapidly growing population demands a large land area. The limitation of land and as a matter of prestige for organizations, construction of high-rise buildings is increasing. Because of aesthetics, ventilation, and land availability these buildings may be irregular in shape. An analytical study is carried out to determine the most suitable location of the shear wall in the irregular high-rise building that had Pre-existing torsion. The objective of the study is to determine the suitable position of the shear wall and the effect of curtailment and thickness of the shear wall in irregular high rise structures. Model response spectrum analysis is carried in the building using Etabs version 16. Seismic design code NBC 105:2020 is used for analysis. Maximum story displacements, story drift, base shear and model time period are taken as the parameter for analysis. According to the result, it is concluded that the proper location of shear wall can remove torsion in the building. The wall can also be curtailed by 60% of the height keeping torsion and other codal provision within the limit. From the analysis, it is found that for full height shear wall, deflection of building decreases about 1% for 50mm increase in shear wall thickness.

## Keywords:

High Rise Building, Shear wall, Torsional Irregularity, Curtailment, Wall thickness

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# GNSS TEC Computation and Comparison using Multi-GNSS Constellations

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## Abstract:

The applications of Global Navigation Satellite System has been rising tremendously, the GNSS system consisting of satellite systems of various nations, which includes Global Positioning System (GPS) by the United States of America, the Global Navigation Satellite System (GLONASS) of Russia, GALILEO of the European Union and BeiDou of China are the systems having global coverage. Regional navigation systems, such as the Indian NavIC and the Japanese QZSS, were also created in addition to GNSS. Calculating the Total Electron Content (TEC), the Ionospheric Scintillations, and Faraday's rotation of electromagnetic waves, one of the main applications of GNSS is to examine the behavior of the ionosphere as a propagation medium.

The primary goal of this study is to estimate and evaluate Total Electron Content (TEC) utilizing signals from various GNSS constellations over a receiver at Pashchimanchal Campus in Pokhara, Nepal ( $28^{\circ}15'18.3''N, 83^{\circ}58'35.1''E$ ). For this, a test setup with a multi-frequency GNSS receiver and an estimate of the TEC of the ionosphere using data from July 5, 2022 to August 3, 2022, or GNSS days 186 to 215 of the year 2022, was built. The highest TEC of the range up to (380 TECu) was discovered by examining the data along the GLONASS constellation signal path by R14 satellite. Additionally, the results demonstrated that it is possible to investigate the ionosphere medium using data from a variety of constellations.

## Keywords:

GNSS, TEC, Ionospheric Scintillation

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# Role of Small Towns for Integrated Development of Sub-Region: A Case of Siraha District

*Sujit Kumar Chaudhary*<sup>a</sup>

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## Abstract:

The uncontrolled urbanization and rural-to-urban migration have increased the possibility of expansion and provided much greater levels of social and economic benefits in large cities. It has increased the gap between small towns/market center and their hinterlands village. By supporting small towns and upgrading their amenities, these issues can be resolved. The current research examines the role of small towns for integrated growth of sub-region by studying the small towns within Siraha district. The Siraha district contains 17 small towns. Due to their backward and forward linkages, towns primarily function as market centers for the surrounding villages. In this article, questionnaire survey was conducted through random sampling method and altogether 233 people were interviewed with 119 from traders or shopkeepers and 114 from customers/farmers. The data was analyzed using MS Excel, SPSS, and QGIS software. If strengthening the small towns within the district then towns act as market center, service center and creating industrial and other off-farm employment for their surrounding areas. For this reason, small towns play crucial role for integrated development of the district.

## Keywords:

Small towns, Integrated development, backward-forward linkage, Sub-Region

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# Numerical Modeling Of Shallow Tunnel in Soft Ground: Surface Settlement Analysis

*Aashish Poudel<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## **Abstract:**

The analysis of shallow tunnel is mainly concerned with the correct evaluation of tunneling-induced ground movements. In case of shallow tunnels, these movements cause even more disturbance on the ground surface as they propagate to the surface forming the settlement basin. Among the various techniques of analysis of tunnel performance, finite element modeling is found to be much more effective. This paper presents a numerical modeling of shallow tunnel elaborated in PLAXIS 2D software. Three tunnels (Green Park, Heathrow Express and Bangkok Sewer) have been selected as case studies and simulated with analytical and experimental solutions for model validation. The idea is to employ simple constitutive model to calculate the surface settlement induced due to tunneling in soft to stiff clay. The soil mass is represented by linear elastic-perfectly plastic model using Mohr Coulomb criteria. The calculated surface settlements of tunnels have shown fairly a good result when compared to the observed field settlements, except in case of Heathrow Express Trial Tunnel which showed slight under estimation of surface settlement. Results show that the depth to diameter ratio of the tunnel (H/D) is one of the important influencing factors affecting the ground settlement.

## **Keywords:**

Shallow tunnel, surface settlement, Numerical Modeling

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# Finite Element Modeling and Study of Soil Nailed Slope - A Case Study of Silty Sandy Slope at Khadkadil, Bhaktapur

*Sabin Pudasaini<sup>a</sup>, Bhim Kumar Dahal<sup>b</sup>*

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## Abstract:

Nepal is vulnerable to hazard with frequent occurrence of landslide resulting in loss of properties and lives. There are several cases of incidents related to slope failure every year. Nepal has been using conventional methods for slope protection works like cantilever retaining wall, counterfort retaining wall, random rubble masonry (RRM) Wall, gabion walls. They can be economically justified for small slope height. But they are quite costlier for bigger slope height. Some alternative slope protection measures is a matter of study for geo-technical engineers and experts. One of the best alternative can be soil nailing due to its easiness, effectiveness, timely construction and mainly cost optimization. In this paper, soil nailing was studied in silty sand slope by varying slope angle and soil nail's inclination, spacing and length. For slope with steepness of 30°, 45° and 60°, the best factor of safety was found with soil inclination of 50°, 40° and 20° respectively. The best range for soil nail spacing was found at 1m to 2m and significantly decreases with spacing of 1m. Factor Of Safety increases with increase in length/height (L/H) ratio of soil nail.

## Keywords:

Landslide, Slope Stability, Finite Element Method, Soil Nails, Models, Factor of Safety, Spacing

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# Deterministic Analysis and Numerical Modeling of Liquefaction in Bridge Pile Abutment

*Shailendra Poudyal<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## Abstract:

This paper studies the analysis of liquefaction in bridge pile abutment. In this study deterministic liquefaction analysis is done and also this result is verified by Slope/W 2018. NCEER-1996/1998 method is used for the deterministic analysis of liquefaction and in Slope/W 2018 model is prepared and pseudo static analysis is done. In deterministic analysis factor of safety is calculated and in Slope/W 2018 general limit equilibrium method is used to calculate the pseudo static factor of safety and compare these two results. From the deterministic approach the severity of one borehole of bridge site is high and three borehole of the same bridge site is very high. The pseudo static factor of safety at the 0.3 PGA of all four boreholes of the same bridges site is less than one which indicates that all four bridge abutments are susceptible to liquefaction.

## Keywords:

Liquefaction, Abutment, Slope/W, Factor of Safety (FOS)

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# Prioritization of Factors Affecting Safety Work Behavior of Workers in Building Construction Projects: A Case Study of Kathmandu Metropolitan City

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## **Abstract:**

The construction industry, being one of the most labor intensive industries of Nepal, is considered to be a hazardous sector where accidents are very frequent and common resulting in significant losses. In a market oriented society, safety is not prioritized where the major objective is to accomplish the task with least number of resources and time. Therefore, this research study aims to prioritize the factors affecting the safety work behavior of workers in building construction sites. Two major factors influencing workers' safety behavior, namely personal and organizational factors were identified through extensive literature review and validation by industry experts. Quantitative strategies were used to prioritize the factors with the help of a structured questionnaire survey pretested with expert feedback. The identified factors were prioritized with the help of statistical methods and multiple iterations using Principal Component Analysis (PCA) and Relative Importance Index (RII) analysis. The results showed that all the factors are substantial regarding safety behavior. The appropriate grouping provided closer insights into the factors and presented the most significant factors in organizational and personal factors. It presents that the most significant organizational and personal factors are Cautionary/Warning Systems and Perception of Probable Risks by Workers respectively. The information and knowledge gained can be applied to the design and implementation of Occupational Safety and Health Systems for the construction industry in Nepal. It is expected that the findings of this research will enable the construction industry participants to help reduce construction safety issues, promote the safety culture and inspire further research in the area of construction safety in Nepal.

## **Keywords:**

Safety Behavior, Principal Component Analysis, Relative Importance Index, Occupational Safety and Health

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# Impact of Climate Change on Future Flow Response in Marshyangdi River Basin, Nepal

*Suman Sangroula<sup>a</sup>, Tirtha Raj Adhikari<sup>b</sup>, Achut Parajuli<sup>c</sup>, Khem Poudyal<sup>d</sup>*

## Abstract:

Climate change significantly impacts rivers in mountainous catchments, implying that future water shortages and uncertainty of future changes are highly vulnerable to climate-related disasters such as flooding and landslides. The snow melt process is complicated, complex, and temperature dependent. The Hydrologic Engineering Center hydrologic modeling system (HEC-HMS) was used in this study to develop hydrological modeling along with the snowmelt method and investigate future discharge under Shared Socioeconomic Pathways (SSP2-4.5 and SSP5-8.5) in the Marshyangdi River Basin. Future precipitation and temperature data were used from the recent SSPs scenario for 2025 to 2100 under ten Coupled Model Inter-comparison Project, phase 6(CMIP6). At the basin outlet, calibration and validation were performed by importing precipitation, temperature, and a Digital Elevation Model (DEM) data. The projected precipitation, temperature, and discharge trends were obtained for three time periods: near future (NF), mid future (MF), and far future (FF). The maximum annual discharge are 337 m<sup>3</sup>/s (2043), 432.9 m<sup>3</sup>/s (2070), and 571.5 m<sup>3</sup>/s (2095) respectively under both scenarios. The maximum precipitation and discharge trend seen for FF are 53.88mm/year and 6.47 m<sup>3</sup>/s/year under SSP5-8.5 scenario, respectively, while the maximum temperature trend for NF is 0.061 °C/year under SSP5-8.5. The maximum monthly discharge is 1535.5 m<sup>3</sup>/s for FF under SSP5-8.5 scenario. Overall the results show an increasing trend for NF, MF, and FF under SSP2-4.5 and SSP5-8.5 scenarios, but a decreasing trend in discharge for FF under SSP2-4.5 scenario as rainfall decrease for FF. Due to increased rainfall runoff and snowmelt runoff contribution due to temperature rise, discharge has the highest increasing trend under SSP5-8.5 scenario. Maximum future discharge has been observed in July under both scenarios for NF, MF and FF. These study's findings are expected to aware about the negative impacts of climate change in future flow and also develop different adaptation strategies to reduce the risk.

## Keywords:

CMIP6, SSP2-4.5, SSP5-8.5, HEC-HMS, Marshyangdi River Basin, Snowmelt

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# Effect of Tuned Liquid Damper on Highrise Building

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## Abstract:

Urbanization has led the current trend in construction industry to lighter and taller structure. Generally, these structures have low damping value and are flexible in nature which might increase the likelihood of the failure in serviceability point of view. So, for this we need to introduce control system in the structure. Nowadays, there are several techniques available to control the structural vibration and response of the structure, out of which the concept of Tuned liquid damper (TLD) is newer one. This study was made to study the effectiveness of TLD for high-rise building in controlling the vibration and response of the structure. In this study, analysis was carried out on a 10 and 15 Storied building, with and without TLD at the top of the building. The building was analyzed with the combination of the different mass ratio (2 %, 3 %, 4 % and 5%), with the depth ratio of 0.2. TLD was placed at the center top of the building maintaining symmetry. IS 1893:2016 (part I) response spectra were used for the analysis. Effectiveness of the TLD was expressed in terms of the percentage of reduction of amplitude of the displacement of the structures for different mass ratio. From this study, it is found that increasing the mass ratio will increase the effectiveness of the Tuned Liquid Damper and the effectiveness of TLD increases with increase in the storey of the structure and optimum mass ratio was found to be between 3% and 4%.

## Keywords:

Liquid Damper, Damper, Etabs2018, Dynamic Response, Sloshing, Mass ratio.

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# Seismic Vulnerability Assessment of Heritage Masonry Building Bal Mandir

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## Abstract:

Heritage Masonry Buildings are of great importance to society and national economy due to their Architectural, Archeological, and Historical importance. System identification of Heritage Masonry Building has very practical significance during its service life. This study explains the use of FEA software E-tabs v20 for the vulnerability assessment of masonry building. The chosen building is one of the landmarks among the palaces in Kathmandu Valley built during Rana regime. Mud mortar is used primarily except in the lintel bands, sill bands, Circular column, brick arches, jack arches which are constructed using lime-surkhi mortar. The whole building is assumed to be constructed in mud mortar. Thickness of structural wall varies from place to place and cavity walls were constructed in fire places and chimney. Finite element model, that mostly resembles the actual site condition, was prepared using E-tabs V20 software. Material properties were selected from the various literatures and loading condition are applied according to NBC 105-2020. Structure was analyzed for different performance factors like time period, base shear, story displacement, joint displacement etc. and respective obtained values were compared with the values recommended by seismic codal provision in NBC 105-2020. Linear time history analysis was performed for seven different earthquakes matched to target response spectrum as per NBC 105-2020. From the NBC 105-2020, PGA at site (Kathmandu) is 0.35g for return period of 475 years, fragility curve for four damage states slight, moderate, extensive, and complete was developed and probability of exceedance of respective damage states were obtained as 100%, 99.40%, 85.07%, and 56.89% respectively.

## Keywords:

Vulnerability Assessment, Fragility Curve, Macro Modelling, Micro Modelling, Time History Analysis, Probability of Exceedance, Linear Regression

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# Energy Retrofitting Consideration when Renovating Residential Buildings for Thermal Comfort

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## **Abstract:**

Though largely overlooked when it comes to renovation, thermal comfort is a well-known terminology in architecture. In order to attain comfort in terms of indoor quality and functionality, building maintenance is done throughout its existence. People refurbish their homes during every festive season all across the world, perpetuating a trend that has existed for years. The study area is chosen inside the Kathmandu valley which is known to have the most comfortable weather conditions but poor building envelope systems. The paper highlights the importance of climate responsive design with respect to thermal insulation in residential buildings. It has been addressed that, cold homes are a contributing factor to health issues and can also be psychologically unproductive.

In order to examine the existing level of comfort that building residents are experiencing, the research uses a case study of a residential building. Additionally, recommendations for achieving consistent thermal comfort are made. This article compares the existing state of residential buildings, analyzes it, and offers additional ways to address the problems that its residents may be experiencing. Since energy consumption in residential structures is rising quickly, efficient energy use in the residential sector is a major challenge.

## **Keywords:**

thermal comfort, building envelope, insulation, openings, orientation, renovation, strategy

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# Formulation of Electromechanical Cost Estimation Nomogram for Small Hydropower Project in Nepal

*Kapil Pudasaini<sup>a</sup>, Tri Ratna Bajracharya<sup>b</sup>, Ashesh Babu Timilsina<sup>c</sup>*

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## Abstract:

Power generation from flowing water is often known as Hydropower generation. It is one of the major capital-intensive project that requires the detailed technical as well as financial analysis before making investment decision. Cost of Electro-Mechanical (EM) equipment including turbine, generators, controls and autonomous and auxiliaries holds the major portion of the hydropower project budget. Cost of the EM equipment mainly related to the installed capacity and net head of hydropower. This research aims to develop the mathematical relation as well as the cost estimation nomogram to estimate unit cost (per kW) of EM equipment accounting the installed capacity of hydropower plant and available water head. Technical and Financial Details of eighteen hydropower projects with either Pelton or Francis type turbine units were collected and analyzed for the actual unit cost by multivariate linear regression method. Obtained mathematical relationships were then compared against the primary data of actual costs. The developed relations shows that the MAPE (Mean Absolute Percentage Error), Standard Deviation (SD) and  $R^2$  for Pelton and Francis based hydropower yields 5.81%, 6.9%, 78.94% and 8.12%, 10.2%, 83.17% respectively. From the value of MAPE obtained, it can be inferred that the modeled equation provides the excellent accurate estimation. A nomogram for cost estimation for small hydropower plant for Pelton (Head Range = 50 to 800 m) and for Francis (Head Range = 30 to 300 m) has been developed in this article.

## Keywords:

Cost Estimation Nomogram, Electromechanical, Hydropower, Small Hydropower

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# Seismic Performance of Different Types of Braced Steel Frame Buildings

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## Abstract:

The popularity of steel structure is increasing in Nepal which carries the importance of our study. This paper represents the comparative study of analyzing different bracing systems in steel structure of 5 storied steel building excluding staircase cover by static and response spectrum method. Different type of bracings like cross bracing, diagonal bracing, inverted V bracing, and K bracing have been used to observe the impacts on displacements, story drifts, time periods and base shear. Bracing have been provided at edge and mid location of the structure. Parameters such as section properties, vertical loads, design parameters, support condition were taken constant. IS 1893:2016 and NBC 105:2020 codal provisions were followed in this study. Finally it is found that cross bracing system at mid location using IS code showed better effectiveness related to seismic performance in terms of displacement, drift and time period.

## Keywords:

Steel structure, bracing system, linear analysis, bracing location, IS 1893:2016, NBC 105:2020

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# Numerical Modelling of Deflection of the Flow at the Bucket Splitter of Pelton Turbine

*Rupa Pandey<sup>a</sup>, Mahesh Chandra Luintel<sup>b</sup>*

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## Abstract:

Severe erosion of hydro-mechanical parts of hydropower projects (excluding storage type projects) seen in Himalayan-originated rivers is one of the major operational challenges for the hydropower industry. Hydropower facilities in Nepal's young and vulnerable mountainous regions must deal with severe hydro-abrasive erosion of hydraulic components, which lowers efficiency, frequently disrupts power generation, and necessitates downtime for repair or replacement. Parts like nozzles and buckets, which have strong flow acceleration and rapidly changing velocity components, make Pelton turbines susceptible to erosion. In this study, a methodology for modelling the deflection of flow at pelton turbine bucket has been proposed and then used for modelling of the flow in a micro Pelton turbine. The obtained results are compared to theoretical observations as well as to the experimental literature that has already been published. In compared to theoretical calculations, there is a 32.75 % inaccuracy in the thickness of the water sheet and a -11.5 % inaccuracy in the jet velocity.

## Keywords:

Pelton Turbine, ANSYS Fluent(CFD), Eccentricity, overpressure, water sheet thickness

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# Auto Colorization of Gray Images using GAN

*Prabin Nepali<sup>a</sup>, Rupesh Kumar Sah<sup>b</sup>, Surendra KC<sup>c</sup>*

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## Abstract:

Colorization of grayscale images was done from decades ago. However, the methodologies has upgraded from coloring images manually working in Photoshop (photo editing tool) to working with machine learning algorithms and further advanced to deep learning methods. This research introduces a simple technique of converting grayscale images into color images with the help of Generative Adversarial Network (GAN). Basically, it introduces a technique for predicting color of a gray image with the use of U-net architecture in the generator module while PatchGan in the discriminator module monitors the generated images from generator as fake or real. This method provides a comprehensive iterative method for color transfer mapping from gray to chromatic values of the image with continuous learning from generator and discriminator loss function. The LAB image format is taken into account to lessen the prediction probabilities of color channels for grayscale images. Additionally, special consideration is taken into account to train GAN using the pre-trained model ResNet-18 that enhances the evaluation of colorless images so that only chromatic information is transferred and the target image's original brightness values are retained. FID values also shows the model is comparatively good.

## Keywords:

Photoshop, U-net, PatchGAN, LAB, ResNet-18, Gray scale image, FID

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# Weather-Based Dynamic Thermal Rating Forecasting Application for Long Transmission Line of Nepalese Grid: A Case Study in Chameliya-Syaule-Attariya 132 kV Transmission Line

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*Mahammad Badrudoza*<sup>c</sup>, *Khil Nath Aryal*<sup>d</sup>

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## Abstract:

Overhead transmission line current carrying capacity is limited by its heat-bearing capacity. Different meteorological factors further limit the heat-carrying capacity. In the Traditional approach, the thermal current capacity of the overhead transmission line conductor is determined by using the worst meteorological condition of very low wind speed (about 0.5 m/s) and the highest possible ambient temperature (about 45-degree celsius). Also, the effect of air incidence angle and heat loss due to rainfall cooling is being neglected. Dynamic Thermal Rating (DTR) is the assessment of the capability of a conductor determined by measured and forecasted weather data at real-time basis. The existing transmission system assets can be operated more efficiently maintaining the thermal line security level. This study provides a scheme for probabilistic DTR forecasting by incorporating issues such as forecasting uncertainties, and topological factors along the long transmission line, etc. For long transmission lines, there will be a high voltage drop in the transmission line after implementing DTR. A regression model is designed for forecasting the weather in real-time and system voltage drop is analyzed for both of the cases of static and dynamic line rating. Minimum span thermal capacity is determined among all critical spans using forecasted weather data to estimate the real-time DTR of the transmission line. Numerical testing for this scheme is performed and analyzed on one of the longest transmission line segments connecting Chameliya Hydropower Station with Attariya Grid Station of the Integrated Nepalese Power System (INPS).

## Keywords:

Dynamic thermal rating, voltage stability, transmission line, DTR model, INPS, Static Thermal Rating

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# Generating Progressed Face Ageing Image using Generative Adversarial Network

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*Bal Krishna Nyaupane*<sup>c</sup>, *Prabin Nepali*<sup>d</sup>

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## Abstract:

The aged version of own face image is a matter of curiosity that one would look in near future. Among various technique use for modeling progressed aged face image, Generative Adversarial Network (GAN) and its extension conditional GAN with regression has shown astonishing results. This research work aims to generate the progressed facial image using the proposed model. The model takes the input image of size 256 \*256 and the target age in range 1 to 80 for the generation of aged image. The input is converted into intermediate eighteen different style of latent space by age encoder in StyleGan domain which is input to StyleGAN2 generator to produce the target aged image. The output; aged face image is passed to age predictor to estimate the age. The eighteen style control the feature of generated output images like pose, hair, face shape, eyes etc. The loss between estimated and the target age along with other losses is used to update the model to produce aged version of input face image which is of size 1024 \*1024. UTKFace datasets has been used to train the model. The model is able to generate plausible progressed aged face image in the range of 1 to 80 for single front facing image.

## Keywords:

Generative Adversarial Networks, Pixel to Style to Pixel, StyleGAN, Face Aging, Latent Space

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# Assessment of road elements in relation to road safety by multi-criteria decision making approach

*Neeraj Sharma<sup>a</sup>, Rojee Pradhananga<sup>b</sup>*

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## **Abstract:**

In Nepal, due to rapid urbanization an issue of road safety hazard is on the rise. In case of the Kathmandu ring road various elements affect the treatment of road safety. This study presents six stage methodological framework for assessment of various factors prominent for causing road safety risks based on Analytical Hierarchy Process (AHP) and field survey(condition rating) to identify the hazardous elements of Kalanki Koteshwor Road Section by weighing the safety parameters of the road section and calculating the Safety Hazardous Index (SHI). Further by making a comparative analysis, between the field data and the weights for the factors, the risk factors can be assessed in terms of their importance based on their score and correlation. Thus allowing the focusing of efforts towards specific factors to improve the road safety.

## **Keywords:**

Road Safety, condition rating, weightage of safety factors, Analytical Hierarchy Process

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# Development of Activity Based Trip Pattern Choice Model - A Case study of Biratnagar Metropolitan City

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## Abstract:

Activity Pattern Choice modeling is based on sound economic principles, where the work commuters make choices based on comparing the utility they receive from each alternative and choosing the one with the highest utility. Activity based approach determines the traveler's behavior as the derivative of activities. Activity based pattern choice models are developed by predicting the travel patterns of the activities carried out at particular destination and time. The objective of this paper is to develop activity based pattern choice model for work commuters in order to understand the activity travel pattern behavior of individuals. In this study, Home-interview Survey method has been used to collect data for the households in Biratnagar Metropolitan City (BMC). The collected data are then extracted on the excel sheet from the survey form to carry out the Multinomial Logit (MNL) Model analysis using R Programming. Activity patterns are classified into five types and selected as dependent variables while other variables like age, gender, profession, income, trip mode, travel distance, travel time, travel cost, etc., are selected as independent variables. The results of this paper shows that the variables like age, gender, income, profession and trip mode have significant effect on pattern choice of the work commuters for the Transportation Analysis Zone i.e. Biratnagar Metropolitan City. Bike users are found to follow the complex pattern of primary tour along with a secondary tour. Females are most likely to make a tour with at least one additional stop for non-work activity while returning to home form primary destination. Most of the students follow the pattern of tour with sub-tour returning to home. Public sector employee follows the pattern of tour with at least one additional stop while returning to home whereas private sector employee follows the pattern of tour with one secondary destination before primary destination.

## Keywords:

Trip Generation, Activity Based Approach, Choice Model, Work Commuters, Activity Travel Pattern, Multinomial Logit Model

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# Structural Health Assessment of the Bagmati Bridge

*Mingma Lama<sup>a</sup>, Bharat Mandal<sup>b</sup>*

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## Abstract:

Bridges are one of the main components of any transportation infrastructure network which connects roads, villages, and cities. Bridge infrastructures when subjected to evolving patterns of operational loads, relaxation, deterioration and other actions such as natural or man-made disasters declines the condition of the structure. The main objective of the study is to assess the structural health of the superstructure of the Bagmati bridge and to detect damage if present any using sensors(Accelerometer and Geophone) and CSIBridge software. The changes in the structure's physical properties such as boundary conditions, stiffness,etc. show changes in the dynamic characteristics such as frequencies, mode shapes of the structure. CSIBridge was used to establish the finite element model of the superstructure of the bridge with simply supported boundary conditions. The time domain data were collected using an accelerometer and geophones and were transformed to the frequency domain using the Fast Fourier Transformation. Then the dynamic properties of the bridge obtained from sensor data and analytical method are compared to determine the damage or deterioration in the superstructure.

## Keywords:

Physical Properties, Dynamic Characteristics, Fast Fourier Transformation(FFT), Frequency

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# Long short term memory based Web application firewall to detect Different types of Web attacks

*Bibek Adhikari<sup>a</sup>, Babu R. Dawadi<sup>b</sup>*

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## Abstract:

With the emerging new technologies, security is a challenging part that has bigger concerns with the increasing cyber threat in the modern world of computing technologies. New techniques and tactics are being used to take unauthorized access to the web and harm, steal and destroy the information. Protecting the system from many threats like DDoS, SQL injection, Cross-site scripting, etc. is very challenging. This research work makes a comparative analysis between normal HTTP traffic and attack traffic and identifies the attack-indicating parameters and features. And developed a layered architecture model for DDoS, XSS, and SQL injection attack detection using data collected from the simulation environment. In LSTM-based layered architecture first layer is the DDoS detection model with an accuracy of almost 97% and the second XSS and SQL injection layer with an accuracy of almost 89%. The higher rate HTTP traffic is checked first and then filter out and then only passed to the second layer, in this way the performance of the attack detection system can increase.

## Keywords:

LSTM, WAF, XSS, SQL Injection, Web security

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# Scalability Analysis of MANET in 5G Environment

*Pravat Aryal<sup>a</sup>, Nanda Bikram Adhikari<sup>b</sup>*

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## **Abstract:**

This research paper analyze the scalability of MANET network towards 5G environment. For this purpose, first need to compose MANET network in current environment and calculate the performance metrics. Similarly, need to compose the MANET in 5G environment and calculate those metrics and analyze the results. For the research work, this paper are considering that there are end users communicating with each other. Currently AODV and DSDV protocols are widely used. In this paper, MANET environment is created in a simulation tool and study is carried out in these two routing protocols. Firstly, analysis is carried out by increasing Node density while later analysis is carried out by increasing mobility. This is done to make 5G environment as Density and Mobility will increase drastically in 5G. As mmWave frequencies are expected to have an important role in 5G, this paper will simulate the MANET using mmWave, compare the performance metrics and analyze the scalability.

## **Keywords:**

MANET, 5G, Scalability

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# Prediction of Cost Fluctuations in Residential RC Buildings due to Seismic Non-Compliance

*Sujan Adhikari<sup>a</sup>, Dipendra Gautam<sup>b</sup>*

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## Abstract:

In Nepal, reinforced concrete buildings are being built at a very fast rate. The majority of buildings are being built without the guidance of a technical supervisor since engineers and architects are only allowed to do design and drafting work. The municipal engineer only verified that the plinth area, column rebar number, and diameter complied with municipal drawings; however, other details such as concrete mix proportion, bar development length, bar curtailment in beams and columns, foundation depth, hook length, foundation size, mortar in walls, and other detailing were left unchecked. Majorly, clients are persistent in economizing the cost which led to that non-compliance. The study has been conducted to predict the cost fluctuation in the residential RC buildings due to seismic non-compliance. For that work initially what aspects of construction were majorly seen as non-compliance were listed along with the details of the structural as well as non-structural component. A total of 60 sites were selected from Kathmandu district based on random sampling and availability of site. Checklist survey along with the measurement of structural members, non-complied aspects of building, causes of non-compliance was also enlisted. All those non-compliance issues are later on demonstrated as percentages. A typical architecture building was taken, analysed, designed using ET-ABS and drawn in Auto-Cad for the reference as compliance and non-compliance check during site visit. A standard estimate was done for the typical building using District rate 2078-79, also the cost incurred due to major non-compliance was also estimated for the same typical building and compared. The prediction of nature of cost fluctuation has been done through graph.

## Keywords:

Construction, Residential RC Buildings, Aspects of Non-compliance, Typical Estimate, Comparison

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# Techno-Economic Analysis of Impact on the Distribution Feeder with Capacitor Placement as per NEA's Regulations and Optimum Scenario

*Santosh Prasad Pant*<sup>a</sup>, *Shree Raj Shakya*<sup>b</sup>

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## Abstract:

With the aim of distribution loss reduction, Nepal Electricity Authority has brought regulation to install the capacitor with size equivalent to approx. 30% of the load demand. This paper compares the techno-economical impact of the placement of the capacitor as per NEA's regulations and the other case for the optimal placement and sizing with the cost minimization function of genetic algorithm. Melamchi feeder taken into account, the base case minimum voltage and loss was obtained as 0.704pu and 17.67% respectively. The minimum voltage with the capacitor placement as per NEA's regulation and Optimal capacitor placement (OCP) are 0.75pu and 0.802pu with loss 15.13% and 10.37% respectively. Moreover, IRR are 12.68% and 17.35% respectively. The techno-economical results indicates that the optimal placement of the capacitor is the better alternative than the placement mentioned by NEA's regulations

## Keywords:

OCP, genetic algorithm, NEA's regulation with capacitor

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# Effect of Masonry Infill on Seismic Performance, Ductility Factor and Overstrength Factor for Regular Steel Framed Structures

*Sushagya Dhonju<sup>a</sup>, Hari Darshan Shrestha<sup>b</sup>*

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## Abstract:

Steel has been the preference of construction material in industry today. It is widely used in construction of low-rise residential buildings to high-rise towers. Masonry walls are commonly used as infill panel between the frames which is not taken into account in common practice of structural analysis. However, the consideration of infill walls have shown considerable influence in the dynamic characteristics of the building. Bare frame steel buildings and steel buildings with masonry infill of three story to eight story has been considered for the study. The brick masonry infill walls has been modelled using the equivalent compressive strut width recommended by FEMA 273 with the coefficient for reduction for openings in infill recommended by Ghassan Al-Chaar. Steel frames were analyzed using Equivalent Static Method as per NBC 105: 2020. Non-linear static pushover analysis has been performed based on literatures and provisions on FEMA356. The effects of masonry infill on the seismic performance, ductility factor and overstrength factor of the steel framed buildings was analyzed. It was seen that the masonry infill increased the initial stiffness and overstrength factor of the steel framed structure but it significantly decreased the ductility of the structure.

## Keywords:

Steel Buildings, Masonry Infill, Bare Frame, Seismic Performance, Ductility Factor, Overstrength Factor

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# Numerical Study on Geogrid-Reinforced Flexible Pavement Sections

Arjun Poudel <sup>a</sup>, Ram Chandra Tiwari <sup>b</sup>

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## Abstract:

Environmental and traffic factors cause premature and severe damage to the flexible pavement, which incurs high maintenance costs. Geogrid can be introduced into the pavement layers to overcome the damage. The effectiveness of geogrid, in reducing surface displacement and subgrade strain level, as a reinforcement in a flexible pavement system has been investigated under this topic by numerical modelling using FEM-based software "PLAXIS 3D". The unreinforced pavement considered in this study is a 175 mm gravel base lying on a subgrade with a CBR of 5%. The biaxial geogrid of normal elastic stiffness 1000 kN/m was used to reinforce the pavement. Geogrid was sandwiched, at only one position at a time, at 25%, 50%, 75%, and 100% of the base thickness from the pavement surface. Static and moving traffic load on the pavement was simulated as dual point load assembly on each side of a standard axle of 80 kN. Varying the pavement thickness, geogrid stiffness, uniform acceleration and initial velocity of the standard axle, the effect on surface displacement and vertical compressive strain were reasonably analyzed. With this analysis, it is inferred that the inclusion of geogrid in the pavement reduces the surface displacement and vertical compressive strain level at the top of the subgrade of the flexible pavement system.

## Keywords:

Flexible Pavement, Geogrid, Finite Element Method, Vertical Compressive Strain, Moving Load

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# Stability Analysis of Nalsingh Gad Dam

*Kiran Simkhada <sup>a</sup>, Hari Ram Parajuli <sup>b</sup>*

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## Abstract:

Concrete gravity dam is a mega-structure that sketches the standard of living of nation's subject. Dam which spans over the fathomable waterways are inveterately jeopardized for seismic vibrations which must be designed to utterly refrain these vibrations. These civil engineering structures are subjected to various types of horizontal and vertical loads which are static or dynamic in nature. Conventional 2-D finite element method is used for the elementary analysis and for checking the stability criteria for dam structures. For the analysis the proposed Nalgad Hydro power Project is selected with some modifications. Dam-reservoir system subjected to recorded seismic events was analysed with non-linear dynamic analysis to study the consequence of an earthquake event in which models are compared by relative crest displacement with regard to foot of dam, damage profile, principal stress. The obtained results were compared for two types of dam viz, concrete dam and concrete face rock-fill dam which suggested that the additional amount of concrete can be replaced with rock fill material reducing overall cost of project.

## Keywords:

Concrete gravity dam, Concrete face rock-fill dam, Non-Linear dynamic analysis

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# Analysis of wind flow in Lumbini Sanskritik Municipality through ANSYS Fluent

*Biplav Pokhrel<sup>a</sup>, Sanjaya Uprety<sup>b</sup>, Niranjan Bastakoti<sup>c</sup>*

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## Abstract:

Urban Planning and Design plays a major role in affecting the micro as well as macro climate of an area especially in terms of wind environment. An area with proper wind circulation not only reduces the thermal discomfort for the pedestrians but also removes the suspended pollutants in the area. The orientation and planning of buildings can significantly change the wind flow behavior within a settlement by acting as wind breakers as well as funnels. The wind breakers reduce the wind velocity by acting as a barrier while by being a funnel, it increases the wind velocity exponentially as verified by principle of continuity. So, it is imperative that wind environment must be strongly considered during the urban planning and design phase of newer settlements. This study is focused on understanding and analyzing the wind environment of the settlements around the road section of 100m of the road connecting Majhediya to Mahilwaar. The research was carried out through field wind data measurement as well as CFD simulation and modelling. This research shows that the building arrangement in the site selected is negatively affecting the wind behavior within the settlement by continuously acting as a barrier to the wind flow which deteriorates the wind environment of that region. The wind flow affected by the buildings results in a negligible flow of wind through the settlements leading to suffocating feeling as personally experienced by the author during field visit. In order to improve the wind circulation, development of wind corridors is imperative in future development works in Lumbini Sanskritik Municipality.

## Keywords:

CFD, ANSYS Fluent, Stagnation Points, Pedestrian Comfort, Setbacks

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# Integrating Solar PV with Pumped hydro storage in Nepal: A case study of Sisneri-Kulekhani pump storage project

*Abijit Jirel<sup>a</sup>, Tri Ratna Bajracharya<sup>b</sup>, Martina M. Keitsch<sup>c</sup>*

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## Abstract:

Nepal's largest natural resource is potential for hydropower. The potential for hydropower could help to solve the poor economic situation in Nepal, but in spite of optimistic hydropower development plans produced by the government, progress has been slow. The main purpose of this master thesis is to investigate the feasibility of integrating renewables with pumped hydro storage in Nepal. The main criteria is that it must be economically profitable which will be beneficial for sustainable development in Nepal. The work has been conducted under the hypothesis that integrating Solar PV with pumped hydropower plants are profitable. In order to evaluate the hypothesis, a case study on Sisneri-Kulekhani pumped hydropower project was done. This project is recently halted by Nepal Electricity Authority due to its high initial investment. First necessary data were acquired and three different cases were identified. Data from one daily peaking and one seasonal storage hydropower were compared with that of Sisneri-Kulekhani hydropower. The cost of two pumped hydropower are calculated based on the same numbers used by Sweco in the original project which is collected from SN power office (Norway). Using the total cost and the current discount factor economic analysis were done. Then, levelized cost of electricity is calculated which is found to be higher in normal pumped hydropower compared with that of pumped hydropower integrated with Solar PV. Similarly, through literature and questionnaire survey various social and environmental implications of integrating solar PV were studied. Due to high investment and pumping cost the project will face deficit but after Solar PV is integrated it will be economically profitable.

## Keywords:

Pumped Hydropower, Solar PV, Economic Analysis, NPV, LCOE, Sustainability

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# Assessing the Suitability of Cycle Infrastructure in Kathmandu

*Nisha Tamang Ghising<sup>a</sup>, Sangeeta Singh<sup>b</sup>, Martina Maria Keitsch<sup>c</sup>*

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## Abstract:

Current urban mobility patterns are defined by continual urban growth, unrestrained road widening, and continued congestion. Sustainable transportation emerges in this setting to mitigate the negative impact of rising urban mobility and to promote more ecologically friendly modes of transportation. Western worlds are encouraging cycling as means of transportation as a part of the Sustainable Development Goals (SDGs). Kathmandu, the capital city of Nepal holds historical and cultural significance with amazing heritage sites. To pertain to its importance, the adoption of sustainable transportation plays an important role and Kathmandu has the capability of becoming a cycle-friendly city. The study employs an exploratory approach in which foreign undertakings related to the case area are investigated. The case area was further investigated to find the site attributes required to visualize the potential cycling infrastructure. The route examined starts from the existing cycle lane of Lalitpur city to Kathmandu durbar square including commercial and high traffic zone. The whole body of literature review, site study, and survey questionnaires helped to narrow down the potential approaches.

## Keywords:

Sustainable transportation, Cycle infrastructure, Bicycle planning, Sustainability

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# Comparative Analysis of the Driven and Grouted Soil Nail using Numerical Simulation

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## Abstract:

Soil Nailing is an in-situ method of soil retention where a long slender reinforcing member are installed in closed space on an in-situ soil either by driving or drilling and grouting method. Soil nailing technique are classified into different types according to their mode of installation. In Driven type of soil nailing, nail is directly driven into the structure along with the excavation whereas in drilled and grouting type of soil nailing, nail is installed in the predrilled hole and hole is filled with grout at low pressure. Different methods are available to design the soil nail wall among these numerical methods using finite element modelling is also a one of popular method. Here, in this study a comparative analysis between the driven and grouted nail is performed using finite element analysis in Plaxis 2D. As soil nail element are primarily subjected to the axial tensile force, Plaxis 2D allows to simulate soil nail element by taking element types as geogrid, plate or embedded beam element. In this study both driven and grouted soil nail is simulated as all three element type and Factor of Safety, deformation at the top of the wall, and induced maximum axial tension force and different depth of construction is observed. Results shows that Factor of Safety of the grouted soil nail is more as compared to the driven nail while taking nail element as an embedded beam. Top deformation of the wall is found to be more in case of driven soil nail as compare to the grouted nail in all three element types and there is no significant difference in the induced axial tension along both grouted and driven soil nail.

## Keywords:

Soil Nail, Driven, Grouted, Plate, Embedded beam, Geogrid

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# An Artificial Neural Network approach for cost estimation of consultancy services of building projects in Kathmandu Valley

*Prajwal Moktan<sup>a</sup>, Mahendra Raj Dhital<sup>b</sup>, Nagendra Bahadur Amatya<sup>c</sup>*

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## **Abstract:**

Cost estimation of an engineering projects comprises of, but not limited to, construction costs and consultancy services costs with the amount of former being more than that of later. With the advent of Machine Learning (ML) techniques, the cost estimation now has become more efficient in the availability of very limited data in compared to traditional cost estimation techniques. Many cost estimation models focus on construction phase where a little to no consideration is given to the engineering services costs. The nature of engineering service is different to that of the construction process as they are less tangible and less material based. This makes it essential to use the ML based techniques of cost estimation in the field of engineering service cost. This paper uses the Artificial Neural Networks (ANNs), a form of ML based techniques for the cost estimation of engineering service cost of building projects in Kathmandu valley. Firstly, 6 influential factors were identified through Expert opinions. Then the data of 70 building projects were collected and fed for ANN model development. Finally the results show that the fairly accurate predictions can be obtained even with small datasets. The model developed in this study showed a 12.51% Mean Absolute Percentage Error (MAPE) error.

## **Keywords:**

Cost Estimation, Consultancy Services, Artificial Neural Networks

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# Rock Engineering Assessment Along the Headrace Tunnel of Khimti-2 Hydroelectric Project

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## Abstract:

Rock engineering is the study of both rock mechanics and engineering geology. The assessment of the parameters of the rock engineering is essential for proper planning, design and construction of any underground structures. This article focuses on the study of these parameters and their effect on tunnel stability. Strength and deformability are the two main parameters of rock mass that define the mechanical behavior of rock. The strength and deformability of the rock mass is calculated using different empirical methods that are commonly in use. The engineering geological parameters such as joint characteristics, in-situ stress, and ground water condition are also studied in detail. The in plane and out of plane stresses are calculated at different chainages considering gravity as well as tectonic effect. The possibility of water leakage is studied at selected chainages and specific leakage is calculated and checked with the limiting value. Norwegian Confinement Criteria is also checked to study about the possibility of unlined/shotcrete lined tunnel. To study about the effect of rock engineering parameters on tunnel stability, parameters such as UCS, GSI, Young's modulus of elasticity, poisson's ratio are varied on Phase 2 software and corresponding value of deformation and plastic radius are compared.

## Keywords:

Rock engineering, rock engineering assessment, deformability

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# Analysis of plastic deformation around an underground opening: A case study of Tanahun Hydropower Project

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## Abstract:

Various methods have been devised over the years to determine the amount of deformation and extent of the plastic zone around the underground opening and can be categorized into empirical, semi-empirical, and analytical methods. In addition to this, 2D finite element numerical models are also utilized to determine the plastic deformation and the extent of the plastic zone surrounding the underground opening. This study focuses on the analysis of plastic deformation using the aforementioned approaches and discusses their applicability in the context of Himalayan geology. The results of the analysis of plastic deformation around the headrace tunnel of the Tanahun Hydropower Project show that it is possible to predict the extent of plastic deformation in the Himalayan rock mass by using different approaches through the correct identification of rock mass parameters.

## Keywords:

Deformation, Finite Element Analysis, Headrace tunnel, Plastic behaviour, Support Pressure

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# Comparative Analysis of Traditional Building Practice(wattle and daub) and CSEB- Alternative Building Technology

*Sunita Kutu<sup>a</sup>*

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## Abstract:

Housing is the basic right and need of any people and it must be guaranteed by the government in any nations and also there is great urgency for sustainable intervention in the construction. Affordability is the major parameters for the economic sustainability of any housing process. In context of Nepal, especially in Terai belt, many marginal groups are living in temporary shelters made by bamboo and mud which are not strong and durable enough to resist climatic impacts like wind and rain. Though this bamboo and mud technology in Terai area is a major construction technology and also the vernacular to that particular belt, the low income groups cannot afford for the improvisation of such technology. In the present days among different alternative building materials, CSEB, is one which is being used in the construction sectors and many organizations have been promoting and using such alternative materials both for low and high income groups in Nepal. CSEB has been used in constructing more than 60 residential units in Bhaura and Mateyaria community in Kalaiya, by Lumanti support for shelter. Therefore, this research aimed to find the different materials and technology which was already there in Bhaura and Mateyaria and the reasons for choosing CSEB as an alternative building materials for these communities. This research was based on post-positivist paradigm with qualitative approach of research followed by different research methods like questionnaire survey, key informant interview, observation, mobile ethnography and focus group discussion. It was concluded that social dimensions of CSEB are better than that of wattle and daub whereas economic and environmental dimensions of wattle and daub have more positive value.

## Keywords:

Sustainability assessment, Traditional building practices, CSEB alternative building technology, Sustainability parameters

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# Flood Wave Propagation

*Bharat Raj Pandey*<sup>a</sup>

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**Abstract:**

The hydraulic structures including dams pose an extreme threat to the people living in the downstream area during the event of failure in those structures and create a huge inundation in the downstream area and in some cases, the cultivated land as well as the inhabitation of the downstream communities will sweep away by the enormous flooding in the river stretches.

This article intends to discuss the various methods for solving unsteady surge wave problems using Shallow Water Equations. The open-source solver HEC-RAS has been implemented to a rectangular channel to produce a diffusive surge wave propagating downstream with respect to time and space. The travel time of the peaks has been evaluated from upstream to downstream for the implication of early warning flood forecasting.

**Keywords:**

Dam, Flood Attenuation, Unsteady Flow, Shallow Water Equation. HEC-RAS

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# Compaction and Strength Properties (after 28 days of curing) of Soil Stabilized by Stone Sust and Cement

*Ujjwal Niraula <sup>a</sup>, Bhim Kumar Dahal <sup>b</sup>, Jhalak Man Basnet <sup>c</sup>*

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## Abstract:

The weak soil of Kathmandu valley is not applicable for heavy loads from structures. In such a case, cement-soil stabilization can be an option to enhance the strength and stability of the soil and by chemical bonding properties of the cement. Another cheaper option can be the stabilization of the soil with stone dust from crushers. So, this study involves the laboratory investigation for the use of stone dust and cement to stabilize the weak soil, hauled from Kupondole, Kathmandu valley. Hauled soil was air dried, crushed, powdered, and then sieved through 425 microns. The sieved soil powder was mixed with sieved stonedust (0%, 30% and 40%) and cement (0%, 2%, 4%, 6%, 8% and 10%) to study compaction properties and strength properties. The strength properties were compared after 28 days of curing in the Unconfined Compressive Strength (UCS) test. As the result of the stabilization, the UCS values for weak soil showed improvement in strength properties after cement and stone dust mixing. Also, the stone dust increased the density and reduced the optimum moisture content in the compaction test whereas the cement showed a mixed type of behavior in the compaction test.

## Keywords:

Cement, Stone Dust, Weak soil, Compaction, Unconfined Compressive Strength

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# Local Stress Analysis of Tailing Lugs in a Vertical Pressure Vessel

*Sushil Chapai<sup>a</sup>, Sunil Adhikari<sup>b</sup>*

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## Abstract:

Vertical pressure vessel, during the erection from horizontal to vertical orientation ( $0^\circ$  to  $90^\circ$ ), requires a tailing lug with lower local stress around the lug-shell attachment in order to prevent damage to the vessel shell while lifting the vessel. Two methods of local stress analysis, WRC-537 bulletin and FEA using ASME BPVC Section-VIII Division-2 are studied and evaluated in this paper. WRC-537 being a conservative method gives a higher stress value compared to the FEA solution. Various dimensional parameters associated with lug size and shapes were studied to observe their effect on local stress around the lug-shell attachment. This paper has also purposed the paired configurations for tailing lugs as an alternative method when a single lug configuration fails to generate minimum local stress values. Paired tailing lug configurations are found to have lower localized stress compared to single lug configurations and are good for vessels with thinner shells and large diameters. With the comparative study of rectangular and circular attachment, rectangular attachment seems to have lower localized stress than circular attachment.

## Keywords:

Local Stress, WRC-537, FEA, Stress Linearization

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# Effects of Roadside Friction on Traffic Flow Parameters and Level of Service of Urban Arterials. A Case Study of Pokhara Metropolitan City

*Amod Bhattarai<sup>a</sup>, Prem Nath Bastola<sup>b</sup>*

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## Abstract:

This paper attempts to quantify the impact of roadside friction on traffic flow parameters and LOS of urban arterials in Pokhara. The roadside friction factor considered for this research are pedestriains crossing the road, pedestriains walking along the road, motorcycle parkings, vehicle parkings and stopping and slow moving vehicles. Based on data congregated from study sections, speed, flow and density models were developed considering the various side friction elements. The road sections with high impact of roadside friction are found to operate at LOS C which indicated more marked restriction to passing and overtaking and the road sections with comparatively low impact of roadside friction are found to operate at LOS B. A sensitivity analysis was performed to evaluate impact elasticity of these RSF's on the LOS and it was moderate to high. This finding emphasizes the necessity of including side friction effects in all traffic studies for efficient urban road planning.

## Keywords:

Arterials, Level of Service(LOS), Roadside Frictions(RSF's), Traffic Flow Parameters

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# Numerical Study of Dispersion and Ventilation of LP Gas in Urban Household Kitchen

Dayanand Rauniyar <sup>a</sup>, Sudip Bhattarai <sup>b</sup>

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## Abstract:

The use of LPG is increasing in South Asian Countries in different sectors like Automobiles, Industry, and households with the increase in consumption the accident due to the LPG has been also increased. An explosion of Liquefied Petroleum Gas (LPG) in a Kitchen in Sindhupalchowk district of Nepal was reported in April 2022 in which three people were killed and there was also damage to the property. This is due to the lack of proper ventilation in the kitchen room. The present study is focused on the leakage of LPG in the kitchen room and the effect of the position of the ventilation for the evacuation of the LPG gas. The effect of the bench top on the accumulation of gas was also performed. For this CFD simulation was done in the SIMSCALE software, it was observed that the gas gets accumulated at the bottom than rising in an upward direction. The ventilation provided at the lower height shows a higher mass flow rate than the ventilation provided at the higher height. The gas gets confined in a certain region if there is any disturbance like a benchtop. There was the creation of the stratification region in the lower region.

## Keywords:

LPG, Ventilation, Kitchen, SIMSCALE

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# Seismic Performance of Steel Building with Vertical Irregularities

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## Abstract:

The ground motion of an earthquake can cause damage to structures. Given the prevalence of steel construction in Nepal, it is important to investigate how these structures fare during earthquakes. This paper presents the results of analysis of five-story steel structures with vertical abnormalities, including mass, stiffness, and vertical geometric irregularities. It is necessary to research the seismic performance of those buildings if earthquake-resistant steel buildings with vertical irregularities are to be constructed. Here, a nonlinear static analysis study of five storey steel-frame buildings with vertical irregularities is taken into account. IS 1893(Part 1):2016 is used to analyze response characteristics including base shear, fundamental time period, storey stiffness, storey drifts ratio, and storey lateral displacement. Asymmetric buildings behave far more complexly and perform much poorer under seismic excitation than conventional buildings. The basic concept entails assessing the effects of asymmetric stiffness distribution, uneven mass distributions, and vertical setbacks and contrasting it with the seismic response of a conventional structure. It has been discovered that the seismic reaction is significantly impacted by irregularity. Out of all the vertical irregularities that were evaluated, vertical setbacks have been found to have the biggest effect on the reaction.

## Keywords:

Seismic Performance, Vertical Irregularities, Pushover Analysis, Steel-Framed Building

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# Site suitability analysis for new residential construction site using GIS based multi- criteria evaluation technique - A case study of Mahalaxmi Municipality, Lalitpur

*Bikalpa Guragain<sup>a</sup>, Ashim Bajracharya<sup>b</sup>*

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## Abstract:

Most cities in developing countries experience unplanned and haphazard built-up growth as a result of the intense strain of population, which opens the door to urban sprawl by encroaching on large parts of the natural environment. For this, selection of suitable places for residential construction by maintaining ecological balance has become inevitable part for proper urban planning. The goal of this work is to determine the best locations for future residential construction with the least impact on various natural features. It also calculates the amount of various types of suitability which will be transferred from various land use and land cover categories in the near future, which is a novel aspect of this work. Mahalaxmi municipality, Lalitpur, has seen a tremendous growth in built-up features after 2011. Five criteria in all have been used in the work's GIS-based multi-criteria analysis to identify the optimal locations for residential building construction. For determining the weight of criteria, Analytical Hierarchy process( AHP) has been used. Four groups have been created in the final site suitability map: most suitable, moderate suitable, less favorable and restricted region. As a result of this research, the ideal areas for residential construction projects in the near future will be identified, which will be useful for planners, stakeholders, and policy makers.

## Keywords:

Built-up growth, Urban sprawl, Multi-criteria analysis, Analytical hierarchy process

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# Human Thermo-regulation at High Humidity - A Mathematical Study

*Shiva Hari Subedi <sup>a</sup>, Gyan Bahadur Thapa <sup>b</sup>*

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## Abstract:

Human thermoregulation, an important mechanism designed to maintain a steady state of internal body temperature called homeostasis, is affected by psychological, physiological, and environmental factors. The environmental factor of humidity at different ambient temperatures plays an important role in human thermoregulation by limiting sweat evaporation on the body. The temperature regulation in the layers of the skin: epidermis, dermis, and subcutaneous tissue, established by the heat regulation within in-vivo tissue, maintains a constant core body temperature of 98.6°F or 37°C. The intention of this article is to reorganize a mathematical model for human thermoregulation to study the effect of high humidity (RH 60%-RH100%) at different ambient temperatures (15°C, and 35°C) on temperature regulation within the human body. The model has been developed for a one-dimensional unsteady-state flow of heat in human dermal parts with appropriate boundary conditions containing the humidity factors. The support of the high-level programming language MATLAB has been taken to obtain numerical computation and graphical outputs.

## Keywords:

Penne's equation, skin layers, relative humidity, evaporation, sweating, FEM

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# Seismic Vulnerability Analysis of Nuwakot Durbar

*Suman Neupane<sup>a</sup>, Prem Nath Maskey<sup>b</sup>*

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## Abstract:

Nepal lies in highly seismic active zone, between Indian and Eurasian Plates, resulting in frequent earthquake of various magnitudes. Unreinforced masonry, being one of the oldest construction technologies, its behavior is still least understood. Historic structures typically include masonry walls made of bricks, stones, and mud or lime surkhi mortar as their main structural elements. Earthquakes are one of the threats to such monuments. These unreinforced structures are more vulnerable to earthquakes due of the lateral wave of the earthquake. Macro modeling has been performed using FEM modelling software, SAP 2000. This study evaluated seismic performance and vulnerability of historical monument seven storied nuwakot durbar. Different performance factors like time period, base shear, joint displacements are analyzed for evaluation of seismic performance of building. However masonry structures are highly nonlinear in nature, due to difficulty of nonlinear analysis and limited time, Linear time history analysis is carried out to determine demand of building. Fragility curve is developed for four damage states: slight, moderate, extensive and complete to find probability of failure for various damage states for various level strong ground motions for seismic vulnerability evaluation. For PGA value of 0.3g for area near nuwakot durbar as defined by NBC 105: 2020, the probability of exceeding the Slight, Moderate, Extensive and Complete states are 99.99%,99.66%, 89.13% and 64.34%.

## Keywords:

Seismic Vulnerability, Fragility Curve, Macro Modeling, Time History Analysis, Probability of Failure

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# Possible Squeezing Effect and Design of Support System at the Headrace Tunnel of Dudhkoshi Storage Hydroelectric Project

*Bipin Gharti Magar<sup>a</sup>, Chhatra Bahadur Basnet<sup>b</sup>*

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## Abstract:

Rock mass strength, techniques used in excavation and stress and deformation characteristics of rock mass is prime challenges which should be taken in account to design underground excavation and construction. Thus, proper calculation of possible worse problematic and disastrous condition during excavation and give safer and cost-effective engineering solutions bears prime necessity before excavation of tunnel. Due to the weak composition and younger rock formation of Nepal, squeezing phenomenon is one of the common problems in excavation in Himalayan region of Nepal. Squeezing is such phenomenon where weak rock mass moves radially inward leading to decrease in size of excavated portion. So, different methods of squeezing analysis have been used for the estimation of probable squeezing phenomenon. For the simulation of deformation and support behavior, numerical approach has been carried out for the case study of Dudhkoshi Storage Hydroelectric Project (635 MW). RMR and Q-Value were found to be poor to fair for Phyllite, Schist, Quartzite, Limestone with overburden varying from 120 m to 1100 m for headrace tunnel of the same project. Accordingly, support system has been designed for the potential squeezing section.

## Keywords:

Tunnel, Squeezing, Excavation, Deformation, Rock mass, Convergence, Hydropower projects, Himalayas.

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# Seismic Vulnerability Assessment of Airport Terminal Building

*Abhinesh Khatri<sup>a</sup>, Prem Nath Maskey<sup>b</sup>*

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## Abstract:

Terminal building is the important structure of the airport that should be serviceable during and after severe earthquakes. Seismic vulnerability of the terminal building is carried out to assess the seismic capacity of the building with the structural and non structural damages. The terminal building under the consideration is the Nepalgunj airport terminal building block B which is yet to be constructed, will be made of reinforced concrete structure with three stories and one semi basement has been designed with NBC105:2020 codal guidelines. The analysis of the structure is performed using ETABS V20 finite element program. Non linear Static (Push over) analysis is done to determine the seismic capacity of the structure and it reveals the formation of plastic hinge in the structural elements which is used to investigate the potential failures. The response of the terminal building in different earthquakes with different PGA value is determined using non linear dynamic analysis. This paper describes the seismic vulnerability of structure by using fragility curve based on the HAZUS Technical Manual guidelines. Peak ground acceleration is developed for different damage states. Probability of failure for different damage state for 0.4g hazard level are quantitatively calculated.

## Keywords:

Terminal building, Vulnerability Assessment, Push-over analysis, Time history Analysis, fragility curve

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# Seismic Vulnerability Analysis of Pagoda Temple

*Girijesh Prasad Sah<sup>a</sup>, Prem Nath Maskey<sup>b</sup>*

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## Abstract:

The ancient buildings are constructed using masonry method. Construction techniques have improved over the years. However, there are still a lot of locally built, traditional brick masonry structures that were made of burnt clay bricks/sun dried bricks and mud mortar. Despite the fact that these structures have endured for centuries, they lack perfect seismic safety features to guard against potential severe earthquake threats. The goal of the research study in this area is to ensure the sustainability of the structures because of their historical and monumental importance as well as for the safety of the people. Linear time history analysis has been carried out using SAP2000 V24. Considering wall and floor as shell elements and the beam and column as frame element. The fragility curve has been generated using response of the building from analysis and capacity values obtained from HAZUS for URMM which define the probability of the building for slight to complete damage in an earthquake based on the different PGA. By generating the fragility curve one can ensure the damage state of the building during earthquake which the building can experience. At 0.35g the probability of damage for slight, moderate, extensive and complete are 99.73%, 98.29%, 89.75% and 63.06% respectively. Since the damage percentage is more than 89% there will be extensive damage in the 5 storied historic temple.

## Keywords:

Seismic Vulnerability, Fragility Curve, Macro Modeling, Time History Analysis, Probability of Failure

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# Impacts of Climate Extremes in Hydropower Generation in Nepal to Identify Optimal Capacity Mix and Generation Mix

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Nawraj Bhattarai<sup>d</sup>, Yasumasa Fujii<sup>e</sup>, Ryoichi Komiyama<sup>f</sup>*

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## Abstract:

Climate change brings major changes in hydrological regimes through which uncertainties in the electricity from hydropower generation rises. The wet climate results in loss of revenues as the hydropower are designed to operate on lower capacities and the dry climate results in increased energy cost as the hydropower generates less energy than the designed ones. Here, we couple a glacio-hydrological model to an optimal capacity expansion model through availability factor to assess the impacts of climate change in hydropower generation in a high mountain Asian country Nepal where the baseflow, rainfall runoff, snow melt and glacier melt are the constituents of river discharge. We found that less capacity requirement of the expensive storage type projects in wet scenarios and more capacity requirement of solar PV projects in dry scenarios when compared to reference. The total energy generation from hydropower decreases in dry scenarios which is compensated by the increased generation from solar PV with respect to the reference scenario. The optimal capacity mix and generation mix for 2020, 2030, 2040 and 2050 have been identified in the scenarios of climate change. The adaptation strategies in various scenarios of climate change to build climate resilient hydropower would bring payoffs in terms of total power system cost as well as the revenues.

## Keywords:

Climate change, Hydrological regime, Power system, Hydropower, Optimization

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# Assessment of Visual Comfort of an Office Building in the Kathmandu Valley

*Nunaang Tumrok Limbu<sup>a</sup>, Sanjaya Uprety<sup>b</sup>, Shreejay Tuladhar<sup>c</sup>*

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## Abstract:

Visual comfort is the primary concern for deciding the quantity of illumination required, and each individual responds to light in a variety of ways that differ significantly based on their surroundings and body temperatures. In both the home and the workplace, appropriate daylighting improves people's psychological well-being and productivity. As the trend toward largely glass façades continues throughout the valley, large fenestration regions usually cause excessive solar gains, greatly changing heating and cooling loads, and glare issues. The study aims to assess the glazing performance and visual comfort of an office building in light of the extensive use of coated/tinted glass. The study was conducted using a survey research method using a typical Prabhu Bank Limited bank office structure. A five-part questionnaire used in a random sample survey of 25 participants was created to collect data on the staff's subjective levels of visual comfort as well as their actual working environments. Additionally, measurements of the ambient temperature, humidity, and standard illumination were taken on-site. Using SPSS 25.0, a statistical analysis application, the data were precisely coded, examined, and evaluated. In the studied office setting, the illumination level at the height of the work plane was only 80–95 lux, which is lower than the suggested range of 300–500 lux. The results showed that illumination and behavioral habits both affect visual comfort. Visual comfort is significantly impacted by behavioral characteristics in people who describe their happiness with daylighting as moderately happy. Statistics show no gender or age-related disparities in the desire for daylighting. Long-term usage of artificial lighting during the day—up to 5-7 hours, and even longer than 7 hours—indicates poor daylighting conditions and reduced luminous comfort. The results demonstrate that office workers are more likely to report being bothered by glare regularly and that uncomfortable glare needs the appropriate intervention for an energy-efficient solution.

## Keywords:

Visual Comfort, Daylighting, Artificial lighting, Luminous comfort, Glare

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# Assessment of Pedestrian thermal comfort on Sidewalks

*Arpana Shakya<sup>a</sup>, Sanjaya Uprety<sup>b</sup>, Barsha Shrestha<sup>c</sup>*

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## Abstract:

With the growing problem of urban densification and the urban heat island effect, the thermal comfort of pedestrians in the outdoor spaces of urban areas has deteriorated. Since the street is the most important outdoor space that can promote physical activity, and especially with the emerging concept of walkable cities, thermal comfort in streets should be given utmost importance. Thermal comfort for pedestrians is the absence of any sense of discomfort when interacting with the outdoor thermal environment. Considering that a thermally comfortable street promotes walkability, this study aims to identify the comfort parameters in the sidewalks of the street and evaluate the thermal environment through a questionnaire survey. The study adopted a quantitative approach and chose the questionnaire survey as a research method to achieve its objective. The survey was conducted on both sidewalks of Durbarmarg, one of the dense and busy streets of Kathmandu, with a random sample of 18 people. The results of the study showed that the physical characteristics of the street, such as building shade, the presence of vegetation, and the paving material, are the most important factors for pedestrian comfort. The survey also found that the selected street section was not thermally comfortable in summer, as the majority of people felt hot, warm, or very hot sensation and preferred cooler air temperature, weaker sunlight, and stronger wind. The study concludes that subjective assessment of the thermal environment through a comfort survey is important and probably the first step before taking measures to improve thermal comfort, especially under the climatic conditions in Kathmandu.

## Keywords:

Pedestrian, Thermal Comfort, Sidewalks

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# Energy Consumption Pattern of Post Disaster Reconstructed Residential Building: A case of Dolakha Town

*Rajina Shrestha <sup>a</sup>, Sanjaya Uprety <sup>b</sup>, Barsha Shrestha <sup>c</sup>*

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## Abstract:

Buildings are the greatest energy consumer of the world making up more than one-third of all final energy consumption and 37 percent of global final energy use (IEA, 2013). In Nepal, residential sector accounts for 80.36 percent of total energy use (WECS, 2014). The energy consumption in the building sector has increased because of our increasingly modern lifestyle and blindly imitating modern architectural style. After Gorkha earthquake 2015, post disaster recovery framework offered various building typologies for the building reconstruction that focused more on seismic standards. The reconstructed buildings lack thermal comfort inside the building in both summer and winter season. The purpose of the research was to examine overall energy consumption pattern of post disaster reconstructed residential building of Dolakha town which is one of the worst affected areas. The study method used was survey research that included random sampling of fifteen post-disaster reconstructed residential building from several toles of Dolakha town. Most of the young people of Dolakha have emigrated which has limited the use of energy in the building. The research found that the energy consumption pattern is characteristics of cooking, heating, and lighting. Number of people residing in the reconstructed building are two-four and are of age group (30-59). As a result, the study comes to the conclusion that hydroelectricity is the major source for lighting and for cooking and water heating purpose LPG gas, accounts for the majority of energy use. Only a small percentage of homes use solar water heaters. For room heating purpose coal and firewood are extensively used which has several environmental and public health risks. This shows that the town is completely dependent on non-renewable energy sources like LPG gas. The households do not focus much on the utilization of renewable resources. Solar energy can be utilized for water heaters and space heating.

## Keywords:

Energy consumption pattern, post-disaster reconstruction, residential building, Dolakha town

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# Financial Analysis of Electric Vehicles with Grid Integrated Solar PV System: A Case Study of Sajha Yatayat

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## Abstract:

Transport sector is a major source of GHG emissions and local pollutants in Kathmandu Valley. This research analyzes financial viability of introducing rooftop grid integrated solar PV (GISPV) system for operating the electric vehicles (EVs) in the Kathmandu Valley's route by the Sahja Yatayat. It studied the effectiveness of implementing net metering approach in line with recent government policies and analyzed the cost and quantity of electricity needed for charging the EV, possibility of feeding excess generation to the utility grid and effects of different factors affecting the cost of electricity. While considering inflation in revenue collection, the project IRR is 3.8 percent higher in GISPV System and all other financial parameters NVP, Payback Period, Discounted Payback Period, and Benefit Cost(B/C) ratio are better in comparison to without GISPV System. When inflation is not considered in revenue, the Project NPV(NPR) would be (339,695,573.93), B/C Ratio be 0.68 other parameters like IRR, Simple Payback Period (Years), Discounted Payback Period (Years) are not favorable in GISPV System but still better in comparison without GISPV System. To achieve breakeven, inflation considered in revenue is 0.91 percent higher in without GISPV system in comparison to with GISPV system. By replacing the diesel-based bus with electric buses in the selected both route R1 and R2, the total GHG emission saving would be 1,261.46 tons of CO<sub>2</sub> equivalent and revenue from carbon trading be NPR 808,030.52 per annum. Hence this research helps in effective decision-making for solar PV system integration in EV in major cities' bus parks all over Nepal where there are enough rooftop area to run the EV in a more sustainable way in light of the economic rate of return.

## Keywords:

Electric Bus, Financial Analysis, Greenhouse Gas (GHG), Grid Integrated Solar PV (GISPV) System

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# Assessing the Sustainability of the Settlement in Pyangaun, Lalitpur focusing on Pyang

*Isha Deshar<sup>a</sup>, Sangeeta Singh<sup>b</sup>*

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## Abstract:

Local craft, an important intangible heritage of traditional settlements have enriched communities and local economies. One of the centuries-old crafting village of Kathmandu valley, Pyangaun is renowned for its skill with bamboo, which has long been a distinguishing element of the traditional Newari community. However, modernization has already created considerable severe impact, leading to significant change. The sustainability of traditional settlement Pyangaun has been evaluated in this study using a qualitative research methodology. The contribution of regional craftsmanship to livelihood has been emphasized. The potential of ecotourism through stakeholder participation in Pyangaun has also been explored. The socio-economic and ecotourism potential of Pyangaun settlement specializing pyang has been assessed using parameters which are determined from literature based on sustainable criteria and indicators of social sustainability as well as based on sustainable livelihood framework. The unique identity of the village, the traditional occupation of making pyang, is in danger of dying out and needs to be taken into consideration right away. This analysis may be useful in reviving the pyang tradition that will eventually lead to ecotourism.

## Keywords:

sustainable community, local craft, pyang, economy, ecotourism

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# An Assessment of the Energy Cost Benefit using Vernacular Construction Technology in Residential Building: A Case of Dang Deukhuri Valley

*Dilip Rana <sup>a</sup>, Sanjay Uprety <sup>b</sup>*

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## Abstract:

The aim of this research is to evaluate the vernacular material and construction technology of residential buildings to assess its comparative energy efficiency cost over modern residential building. The research is entirely based in the Dang Deukhuri Valley because it was determined that this location is ideal for achieving the research's goals. To determine the vernacular materials and technology used in residential constructions, case studies and field investigations were conducted. Energy consumption pattern were examined through software called Ecotect and energy consumption cost were analyzed and compared through excel. Vernacular building was found to bear the minimum energy consumption cost over vernacular with cgi and modern r.c.c. building. Further, 75 participants were made involved in kobo toolbox questionnaire survey for qualitative analysis. Respondents were given the option to describe the characteristics of their homes based on factors such as thermal comfort, house typology, materials and construction technology used, energy cost, etc. and then result were drawn through statistical figure such as bar graph, pie chart. Additionally, RII analysis was used to discuss the relative impact of house typology, thermal comfort, and energy cost. The RII value in this instance further revealed that the vernacular buildings were of more significance than other buildings. The research can be helpful to traders, regular inhabitants, designers, architects, engineers, constructors, and more. They can use vernacular materials and construction technology for long term energy cost benefits in building projects.

## Keywords:

Vernacular, Ecotect, House typology, Thermal comfort, Energy cost

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# Integrating Energy-Saving Strategies with Biophilic Design Concepts to Increase Thermal Comfort

*Rakshya Shrestha*<sup>a</sup>, *Sushil Bahadur Bajracharya*<sup>b</sup>

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## Abstract:

Collectively, both building construction sectors account for almost 40% of all direct indirect CO<sub>2</sub> emissions over one-third of all final energy consumption worldwide. Humans must accept responsibility for its impact on the environment create a thorough energy-saving strategy. As a result, it's crucial that we switch to renewable energy sources focus on energy optimization, efficiency, cost reduction. With the introduction of contemporary housing in the nation, that is aesthetically pleasing economically practical but typically lacks energy-saving features, particularly for thermal comfort, which drives up the cost also increases energy consumption. Individuals have lost their connection to nature due to modern living. Using biophilic design, which has the potential to maximize the advantages of environmentally friendly buildings in terms of energy efficiency practical improvements to inhabitants' comfort, health, wellbeing, is a key component of this study. Two homes at Green Hill City, Lalitpur were simulated using Ecotect & SketchUp in this study as a test case for the utilization of biophilic design energy-saving strategies. Examining daylighting, thermal comfort, energy use in the case area were the study's main objectives. The study's conclusion presents a quantitative examination of the enhanced building performance while also assessing the suggested biophilic strategies. Out of the two situations, Scenario 3 displays the fewest discomfort hours, 40% to 36%, indicating that the ratio of comfort hours to comfort hours is 59% to 64%.

## Keywords:

Biophilic design strategies, Energy efficient strategies, Altering building envelope, Simulation, Case studies

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# Simulation Based Study of the Effect on Pedestrian Flow due to Parked Vehicles: A case study on Mangal Bazar to Mahapal Road Section

*Naswa Ranjit<sup>a</sup>, Pradeep Kumar Shrestha<sup>b</sup>*

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## Abstract:

Shared carriageways are common in narrow street networks. Due to the shared nature multiple interactions between pedestrians and vehicles is inevitable. This study uses the micro-simulation software VISSIM / VISWALK to develop a model that simulates the existing scenario of the interaction of pedestrians walking along the carriageway with moving vehicles and parked vehicles. The developed model is calibrated and validated to obtain a model that represents the actual pedestrian characteristics as observed in the survey. The travel time and walking speed of pedestrians walking along the carriageway are analyzed in the existing scenario which is then compared with the values obtained in other scenarios that represent vehicles parked on the carriageway as a result of the shared carriageway. By comparing these scenarios, the impact of each obstruction like encroachment of the entire carriageway by vehicles, parked vehicles and congestion on the travel time and walking speed of pedestrians is quantified which aids to propose scenarios to be implemented to improve pedestrian mobility.

## Keywords:

Simulation, Shared Carriageway, Pedestrian Characteristics, VISSIM, VISWALK, Parked Vehicles

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# Grid Impact Analysis of Distribution System before and after Injection of Distributed Energy Resources (DERs) : A Case Study of Standard IEEE 10 Bus System

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## **Abstract:**

The Radial Distribution System (RDS) has a voltage drop that is highest at the transmitting end and gradually decreases as it approaches the feeding ends. Techniques such as injection of the capacitors, Distributed Energy Resources (DERs) such as grid connected wind and solar power plants, in the feeder can reduce power loss and improve the voltage profile of the system. Utilizing a standard IEEE 10 bus system, grid impact analysis of the penetration of the grid connected wind and solar power plants into the feeder system is used to improve the performance of the distribution system. Analysis is done on the system's performance both prior to and after the injection of DERs. In both cases, i.e., prior to and after DERs compensation and injection, bus voltages at each nodes, power loss, voltage control, and voltage profile are compared. The voltage profile is improved and power losses is decreased after the penetration of DERs in the distribution feeder. Voltage regulation of the system is also found to be improved.

## **Keywords:**

Radial Distribution System (RDS), Distributed Energy Resources (DERs), Voltage Profile, Voltage Regulation, IEEE 10 bus system

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# Flood Hazard Mapping and Vulnerability Assessment of Building Typology in West Rapti River, Nepal

Gayatri Joshi <sup>a</sup>, Suraj Lamichhane <sup>b</sup>

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## Abstract:

The frequency of flood events and associated risk in built-up area is the critical issue for developing countries, such as Nepal. This study, develop the flood hazard mapping for various return period and assess the flood vulnerability in building typology along the West Rapti River (WRR) reach. It is a rainfed river, more than 80% of annual precipitation occurs in monsoon season. The topography of basin is flat at downstream where the settlement is high, exposed to the risk of flooding. We, used Hydrological Engineering Center-River Analysis System (HEC-RAS) for 2-D flood modeling and Geographic Information System (GIS) for flood hazard mapping. Gumbel method was used to estimate flood frequency for 2, 10, 25, 50 and 100 years return period. Flood inundation map was prepared for each return period. 2329.18 ha of extent has been inundated by 2yrs flood, 4017.4 ha for 10yrs flood , 4934.14 ha for 25yrs flood, 5438.59 ha for 50yrs flood and 5849.26 ha of land was inundated by 100 yrs flood. The inundation map shows that, people and infrastructure near the banks on both sides are heavily exposed to the flooding. The marginalized people with low income were observed to live in adobe houses near river corridor which comprises of nearly 35% out of total existing households. A well-established vulnerability curve was used to assess the damage on building typology and shows that the adobe houses damage 50% at the inundation of 50 cm and are fully damaged at the depth of 1.5 m. Most of the victims of flood disasters are poor people living in flooded areas. Therefore, the results of this study are useful for floodplain planning and management to mitigate future potential disasters through engineering approaches.

## Keywords:

Flood hazard mapping, Flood vulnerability, Flood frequency analysis, West Rapti River and Hydraulic modelling

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# Optimization of Energy Consumption in Hotels – Case Study of Hotels of Nagarkot

*Sushant Bahadur Malla <sup>a</sup>, Sushil B. Bajracharya <sup>b</sup>*

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## **Abstract:**

Buildings and building construction sectors combined are responsible for over one-third of global final energy consumption and nearly 40% of total direct and indirect CO<sub>2</sub> emissions. Hotel Buildings consume a significant amount of energy and contributes a considerable weightage to the building sector energy consumption. Hence, it is high time to shift to green energy source and focus on Energy Efficiency, Energy Saving and Energy Optimization. Energy optimization aims to make our homes, workplaces, hospitals, schools, and other buildings contributors to our individual and societal health and wealth by lowering overall energy consumption and coordinating the remaining energy use to take advantage of the availability of clean, zero-carbon energy sources. This research will help us to study the energy consumption/ energy cost and develop/ identify relevant energy conservation/ optimization opportunities with the help of Climatic Data Study, Questionnaire Survey and Energy Modeling for the Hotel Project in Nagarkot. The research focuses in 3 main hotels the Nagarkot Region Hotel Mystic Mountain, Club Himalaya and Hotel Country Villa. This research concludes that with proper implementation of several energy saving options, Savings in heating and cooling load of up to 54.67% and 58.85% could be achieved in hotel rooms by means of Energy Modeling/ Simulation.

## **Keywords:**

Energy Optimization, Energy Modeling, Hotels, Insulation, Passive Design Strategies, Heating/ Cooling Load

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# Probabilistic FEM Analysis of Tunnel Lining Stability–Comparison with Traditional Deterministic Approach

*Sagar Paudel <sup>a</sup>, Subrat Subedi <sup>b</sup>, Mahesh Upadhyaya <sup>c</sup>*

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## Abstract:

In routine design, the approach to tunnel support analysis is to conduct a deterministic analysis using a single mean value for all input parameters. Such an assessment of tunnel stability does not consider variation in the ground parameters which is inherent in geomaterials. While this approach may be sound when extensive investigations reveal that the mean design parameters represent the ground well, the typical ground encountered and the level of investigations conducted in the industry seldom justify these assumptions. Probabilistic analysis allows the incorporation of the variability in the input parameters and thus is better suited for the analysis of tunnel in typical design cases. The probabilistic approach to design is only recently gaining prominence around the world and in the context of Nepal, it is yet to be adopted. In this study, data collected from Phukot Karnali Hydroelectric Project have been analyzed probabilistically with Rocscience's Phase2 software to find the reliability index and subsequently the probability of failure for a tunnel section supported by patterned rock bolts and steel ribs with shotcrete. Sensitivity analysis was conducted to find which input parameters have the highest effect on tunnel performance. The probability of failure of tunnel is evaluated at the crown and sidewall. Probabilistic analysis has shown that the steel ribs perform better at the crown than the sidewall with probabilities of failure of 2.85% and 3.90% respectively while the shotcrete performs better at sidewall than crown with probabilities of failure of 5.24% and 21.89% respectively. From the deterministic analysis, done using mean value of all input parameters, the tunnel is found to be stable with factor of safety greater than one in all region, indicating that the supported sections deemed stable in routine design may not be acceptable when considering the variability of the rock mass.

## Keywords:

Deterministic approach, point estimate method, probabilistic approach, reliability index

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# Soil Deformation behavior and SSI Study by varying Poisson's Ratio of Granular Soil

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## Abstract:

The main aim of this study is to carry out the behavior of the soil and to perform soil-structure interaction investigation by varying the Poisson's ratio of the soil. For the study, dense type sand is taken due to its wide range variation of Poisson's ratio ranging from 0.2 to 0.4. The Poisson's ratio is increased by constant step of 0.05 (i.e.  $\nu = 0.20, 0.25, 0.30, 0.35, \text{ and } 0.40$ ) for the investigation. To study the soil deformation behavior, finite element analysis is performed using geotechnical investigation tool PLAXIS 3D Connect Edition V21. Based on the static load from the superstructure and its resulting soil deformation, spring stiffnesses are calculated at base of all columns. The computed springs from varying Poisson's ratio are modelled individually in structural analysis tool ETABS V20.0.0. Modal analysis using Ritz as well as Eigen vector method and non-linear modal time history analysis are carried out and results are studied thoroughly. It is found that deformation on soil is decreased while increasing Poisson's ratio of the soil; higher Poisson's ratio makes soil more rigid and resists both lateral as well as axial deformation of the soil. In addition, it is found from the analysis, the fundamental time period and damping of structure is increased as soil-structure integrated system is considered. The response spectrum from nonlinear time history analysis shows the change in Poisson's ratio has significantly low impact on dynamic response of the structure.

## Keywords:

Soil-Structure Interaction (SSI), FNA, Poisson's ratio, Interface element

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# An XGBoost Based Ensemble Model for Customer Churn Prediction in Telecommunications Industry

*Sagar Maan Shrestha<sup>a</sup>, Aman Shakya<sup>b</sup>,*

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## Abstract:

Telecommunications Industry are one of the fastest evolving business sectors. They demand huge financial investment even at the onset of business, unlike others. And the repay of their investment is driven by the number of customers they have garnished over time. With the increasing global and national competition this has become a major challenge for all the Telecommunication companies to retain their existing customers. Therefore, the telecommunication operators have major concern over identifying customers who are at risk of churning all the time. An analysis of call detail records inside the telecom will provide an insight on how customer behaviors are affected by the available services and provide an analysis part on whether they will be potential churners. In this research paper, we propose an ensemble-based Machine Learning model with the help of Stacking Technique on the Logistic Regression and Random Forest algorithms as base classifiers and XGBoost as final classifier for churn prediction using call detail records of a fictional telecommunication company that contains 7043 records of customers. The performance metrics like accuracy and F1-Score thus, obtained by this proposed model on this publicly available dataset are 80.88% and 62.69% respectively.

## Keywords:

Machine Learning, XGBoost, Ensemble, Customer Churn, Stacking Classifier

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# A Study on The Qualification Criteria for Selection of Contractor in Nepal

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## Abstract:

During the bidding process in the construction works, there is need of selection of proper contractor who can perform the works as per contract agreement. There are the selection criteria for selection for contractors in Nepal. Due to the various reasons most of the construction works in Nepal are not performed on time and as per requirements. In the selection of contractor, there may be some missing factors due to which we are not able to select the proper contractor.

The study was focused on finding the factors that influence the qualification criteria for selection of contractor. The participants were questioned about the qualification criteria which are necessary for selection of contractor. The participants were from government officials, contractor and consultants. They were also asked if there were some factors missing in the questionnaire.

After the study it is found that in case of Nepal there are mainly three factors missing in existing Standard Bidding Document (SBD) which plays an important role in selection of contractor. The factors i.e., Quality management, failure to complete a project and health and safety management which are crucial in the selection criteria of contractor but they are not in prevailing selection criteria. These factors should be also considered which will probably help in the proper selection of contractor that can solve the problems existing in the construction industry due to improper contractor selection procedure.

## Keywords:

SBD, Qualification criteria's, Quality management, failure to complete a project, health and safety management

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# Stability Evaluation and Review of Applied Support for Headrace Tunnel of Middle Mewa Hydropower Project, Taplejung

*Bikash Thapa<sup>a</sup>, Pawan Kumar Shrestha<sup>b</sup>*

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## Abstract:

In the Nepal Himalayas, predicting rock mass quality precisely and assessing stress induced issues have been difficult tasks, where stress induced problem such as tunnel squeezing is a common phenomenon in weak rock and in weakness zones. Incompetent rock with high or moderate rock stress due to moderate to high overburden when tangential stress exceeds the strength of the rock mass may have squeezing problems in tunnels. Rock spalling or rock burst problems occur when tangential stress exceeds the strength of the rock mass in competent and brittle rock with high-stress levels due to high overburden. Prior knowledge of possible stress-induced problems in the tunnel help address problem in advance or prepare an action plan accordingly. Often, rock mass properties and state of in-situ stresses are not known fully until tunnel excavations are made. With the response of rock mass upon excavation in the form of tunnel convergence and failures, the rock mass properties and in-situ stresses are back analyzed to ascertain realistic input parameters. The headrace tunnel of the Middle Mewa Hydropower Project also has both competent and incompetent rock at varying overburden. As the tunnel is being excavated, rock mass response to excavation is known and rock supports estimated can be reviewed. This paper presents a stability assessment of the headrace tunnel using various Empirical, Semi-Analytical, Analytical and Numerical Methods. Finally, the support system is reviewed.

## Keywords:

Tunnel squeezing, Rock spalling, Rock mass properties

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# Blockchain Based E-Voting System With Zero-Knowledge Proof Using Smart Contracts

*Juned Alam <sup>a</sup>, Shashidhar R. Joshi <sup>b</sup>*

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## Abstract:

This paper proposes an e-voting system's architecture built on top of blockchain. The proposed system uses smart contracts to run all the process related with voting. This proposed architecture also utilizes paillier cryptosystem to achieve zero-knowledge proof, so as to encrypt the voters vote and perform tally on the ciphertext of the votes itself using homomorphic encryption algorithm; homomorphic encryption allows us to perform mathematical computations on the ciphertexts without the need to decrypt the ciphertexts. The focus of this paper is the use of blockchain to conduct eVoting, with zero knowledge proof as the security mechanism to provide anonymity to the voter's vote.

## Keywords:

blockchain, zero-knowledge proof (ZKP), smart contract, homomorphic addition, paillier cryptosystem

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# Analysis of Deep Excavation on Soft Soil for Basement Construction: A Case Study in Kathmandu Valley Building Construction

*Rajan Tiwari<sup>a</sup>, Ram Chandra Tiwari<sup>b</sup>*

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## Abstract:

In this research studies about the Performance of deep box cutting induced deformation with respect to soil parameters, ground loading, ground water table and depth of foundation. Ramshahpath and Thapathali site area is considered for the study purpose. It uses Mohers coulomb and Modified Cam Clay model to model in the plaxis for varying different parameters like different loading system, excavation height and soil properties. Maximum horizontal and vertical deflection of critical corner pile is when the load is at surface of excavation ground and when the loading is 2.5 m below the excavation surface is analysed; all of them lies within the acceptable range. For Ramshahpath and Thapathali site maximum horizontal and vertical deflection of critical corner pile is plotted using two constitutive soil model Mohr-Coulomb Model and Modified Cam Clay model. Graph is plotted to show the deformation of ground soil, earth retaining structure with other parameters like depth of surcharge load, different phases of excavation and compared these studies with the two constitutive soil model and these parameters correspondingly. Deformation is influenced by position of surcharge loading, and also sensitive to other factor like excavation geometry and position of loading. Deformation is more sensitive and Modified Cam Clay Model give the smaller deformation as compared with the Mohr-Coulomb Model.

## Keywords:

Ground Deformation, Protection Pile, Earth Retaining Structure, Constitutive Soil Model, Deep Excavation

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# Earthquake Affected Buildings Damage Classification Using Machine Learning

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## Abstract:

The ability to assess the impact of a seismic event on buildings are very crucial for quick recovery and emergency response planning. Several classical methods previously existed to assess such damaged buildings take significant time and resources. This study investigates the effectiveness of using machine learning algorithms in the vulnerability prediction of buildings. Three machine learning classifiers knn, decision tree, and xgboost have been utilized in this research to predict the damage grade of the building using a dataset from the Nepal earthquake that has several building's specific characteristics like (e.g., age, number of floor area, ground floor type, etc.). A portion of data from this dataset is used to evaluate the model on unseen data and rest of the dataset is used to train and select the best-performing model using stratified 5 fold validation methods. The investigation of this research illustrates that the xgboost can accurately predict the damage grade with 74.4 % accuracy in the test dataset. Furthermore, this paper suggests that the accuracy of the model can be increased even more provided that there are balanced and huge datasets.

## Keywords:

Earthquake, Building Damage, Classification, Machine Learning

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# Thermal Comfort Assessment of Classrooms in Engineering Colleges of Kathmandu Valley

*Bilove Moktan<sup>a</sup>, Sanjaya Uprety<sup>b</sup>*

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## Abstract:

On average, engineering students spend about 6.5 to 7 hours in the classroom learning every day. Spending such long hours in the learning spaces, the thermal environment of the classrooms has a direct impact on both the well-being, and academic performance of the students. There are no design standards issued by the Nepalese government which address the issue of thermal comfort while designing or constructing educational buildings. Also, there have been very few studies regarding thermal comfort in classrooms of Nepalese Educational Buildings.

This study investigated the thermal comfort perception of students inside the classrooms of two engineering colleges: Kantipur City College (KCC) and National College of Engineering (NCE) in Kathmandu Valley during June-July of 2022. A questionnaire survey of students regarding their thermal sensation and preferences along with measurement of different thermal parameters inside the classrooms of both engineering colleges was performed. A total of 124 students aged between 20-24 years, 76 (61%) males and 48 (39%) females participated in the questionnaire survey. It was found that the indoor temperature in the classrooms ranges between 27-30°C, which is beyond the comfort temperature range of 18-26°C in Kathmandu. Subjective analysis through the questionnaire survey revealed that the majority of the students from both colleges (74% in KCC, 84% in NCE) are not satisfied with the classroom's thermal environment, felt uncomfortable during the lecture hours, and preferred the classrooms to be cooler during the summer. Hence, the findings of this study indicate that it is necessary to improve the thermal comfort conditions in the classrooms.

## Keywords:

Thermal Comfort, Adaptive Nature, Passive Design, Free Running, Subjective Response

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# Parametric Study of Cavern Stability: A Case of Underground Powerhouse Cavern of Middle Mewa Hydropower Project, Nepal

*Rajiv Upreti <sup>a</sup>, Pawan Kumar Shrestha <sup>b</sup>*

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## Abstract:

The parametric study of geomechanical factors must be understood in order to analyze the stability of underground rock structures. A parametric study was performed on a underground cavern with varying rock mass quality according to Geological strength index (GSI) using RS2 to investigate the importance of these geomechanical parameters in the stability of underground cavern. The planned powerhouse cavern has a dimension of 61 m length, 15 m width, and 31 m height. The cavern lies in moderately strong schistose gneiss rockmass. The stability of a cavern has been studied by investigating the yielded elements and maximum total displacement. Best estimate values and worst-case values from laboratory data are used for sensitivity analysis. Rockmass parameters are calculated using Generalized Hoek-Brown criterion in RS2 model. Residual parameters in plastic analysis are calculated from strength parameters using GSI-dependent equations. Results showed that the most sensitive property is young's modulus and the parameters of the Hoek-Brown criterion have little significance in the elastic analysis. But in plastic analysis, the parameters of the Hoek-Brown criterion affect the deformability, which becomes more remarkable with increasing plastic area. Similarly, Young's modulus, Uniaxial compressive strength, and Geological strength index also have major significance in parametric study. Best fit model with actual ground deformation is also found by doing back analysis.

## Keywords:

Parametric Study, Cavern Stability, Numerical modelling

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# Evaluation of thermal comfort and ventilation in General patient room of Godawari Midcity Hospital

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## Abstract:

Hospital is an important public buildings in which ventilation, room temperature and humidity inside a room plays an important role during the recovery phase of a patient. General patient room are usually in high demand in context of Nepal in comparison to other deluxe rooms. Various standard about room temperature and humidity for hospitals were studied to determine thermal comfort and discomfort hours. During the selected hospitals survey in Kathmandu and Lalitpur on ventilation and thermal comfort standards for general patient room, it was vivid that it is not up to the required standards. The study investigated on the total discomfort hours under natural ventilation and total heating and cooling loads required for a general patient room under mixed mode of ventilation in the Godawari Midcity Hospital in Lalitpur. Comparing various standards with each other shows that higher heating load is required to meet the thermal comfort level of IS 659 standard. Further, in the general patient room, there was ventilation losses of about 25% and increased to 80% according to ASHRAE 170 ventilation standard and IS 659 standard respectively. In addition, for south orientation a total of 90kWhr/m<sup>2</sup> of heating and cooling is needed which is the least among all the scenarios analyzed with north orientation of the building being the worst. As for WWR, 20% openings gave the best possible result as the higher WWR increased the heating and ventilation load. It is clear that the use of natural ventilation is not enough to maintain the thermal comfort in the room in both summer and winter seasons. Therefore use of mechanical ventilation is required and passive strategies can reduce the load in a certain extent.

## Keywords:

Hospital, Ventilation, Thermal Comfort, Passive Design

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# Detection of Pneumonia Disease based on Digital Chest X-ray Image using Vgg16 Transfer Learning

*Chandan Shah <sup>a</sup>, Sanjeeb Prasad Panday <sup>b</sup>, Tej Prasad Dhamala <sup>c</sup>*

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## **Abstract:**

Pneumonia is a life threatening lungs disease that is caused by viral or bacterial infection. Life may be at risk especially in case of newly born baby if not acted upon right time. Thus early diagnosis is vital. The aim of this research paper is to detect bacterial and Viral pneumonia using the digital chest x-ray images and analyze result under different data set after tuning different hyper-parameters . In this research paper, we have three classes identified by chest x-ray images: Bacterial Pneumonia chest x-ray, Normal chest x-ray, Viral Pneumonia chest x-ray. The classification accuracy achieved is 92 percent.It can be useful in quick diagnosing of pneumonia by the radiologist . Image classification has become one of the main tasks in the areas of computer vision technologies. Here, we have used a transfer learning-based approach that yields lower reconstruction error and higher classification accuracy.

## **Keywords:**

Bacterial Pneumonia, Chest X-ray, Deep CNN, VGG16, Viral Pneumonia, Image processing

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# Neural Network Model for the Prediction of Ultimate Tensile Strength of Multi-Principal Elements Alloys

*Prabash Khatiwada<sup>a</sup>, Khem Gyanwali<sup>b</sup>, Anil Kunwar<sup>c</sup>, Upadesh Subedi<sup>d</sup>*

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## Abstract:

Multi-Principal Elements Alloys (MPEAs) have outstanding mechanical properties compared to traditional alloys and are very useful in the present days manufacturing. As no rules for identifying mechanical properties of MPEAs exist and experimentally preparing the alloys for identifying their mechanical properties will be expensive hence data-driven approach will be fruitful for it. In this study 177 data observations were collected from peer reviewed research papers and then Artificial Neural Network (ANN) regression model was built for Ultimate Tensile Strength (UTS). The collected data consists of 129 CAST and 48 WROUGHT manufactured types of alloys having different microstructure. Important features determining the UTS value were identified, calculated and then best features were used as inputs along with elemental compositions in the input layers of the ANN model. From the collected data training, validating and testing data were separated in the ratio of 80:10:10 and different models were developed. Among the different models trained, the most efficient model was selected to build Graphic User Interface (GUI) application. The coefficient of determination R<sup>2</sup> achieved for test data set was 0.81. The GUI application shall be useful in determining UTS values of different MPEAs and could be easily used by any individual.

## Keywords:

Multi-Principal Elements Alloys, Complex Concentrated Alloys, High Entropy Alloys, Artificial Neural Network Model, Pearson's Correlation Coefficient, Principal Component Analysis

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# Citizen Perception on use of ICT in Citizen Engagement: A case of Tokha Municipality in Kathmandu Valley

*Anil Nepal<sup>a</sup>, Sanjay Uprety<sup>b</sup>*

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## **Abstract:**

This is a study to link the idea of citizen participation in the municipal process with the concept of e-participation. OECD's (2001) framework on e-Participation is widely known and is constituted by i) Information, ii) Consultation and iii) Active participation. Extensive literature review showed that citizen participation increases effective governance system. Data collection is done in three steps in this research. The first data collection was done through the collection of policy related documents and analyzing the provisions related to citizen participation. Second level of data collection was through the observation of municipal websites to identify the e-participation status. Finally, citizen's perception of use of e-participation tool was identified using the identified variables from literature review. From the results major issues and challenges was identified in terms of citizen participation. Also, the contemporary tools which is used for citizen participation was identified as well as the e-participation tools which is being used by the global world. The output of this study is to design a mainstreaming model using prevalent ICT tools for e-participation to enhance citizen participation.

## **Keywords:**

association football, audio signal, soccer game highlights, summarization

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# Groundwater Potential Mapping Using GIS Based Machine Learning Technique in Eastern Terai Region of Nepal

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## Abstract:

In many regions of the world, groundwater is the most significant natural resource that demands the implementation of new technologies for control and monitoring. In the case of Nepal, sufficient groundwater databases and research work is extremely lacking in the field of groundwater studies. This study presents a comparative analysis of three GIS based machine learning techniques, i.e., Random Forest, Random Subspace, and Bagging for the groundwater potential mapping of two districts of eastern terai region of Nepal i.e Siraha and Saptari district. Thirteen influencing factors such as Elevation, Slope, Land Use Land Cover, Rainfall, Geology, Drainage density, Soil, Aspect, Curvature, Lineament Density, Topographic Ruggedness Index (TRI) and Topographic wetness index (TWI) and 37 groundwater wells from the study area, were utilized to set up a geospatial dataset. Using this database, three machine learning models i.e., Random Forest, Random Subspace, and Bagging were trained to produce the groundwater potential map of the study area. OneR algorithm in weka software is used to investigate the relative importance of the influencing factors. It showed rainfall, elevation and drainage density are the most influencing factors in groundwater potentiality of the study area. Based on ROC AUC and other statistical tools, it is found that the Random Forest model had the best performance, followed by Bagging and Random Subspace models. The result of this study can play a significant value addition in the field of groundwater studies in Nepal and can be used as a reference by policymakers, professionals, researchers and other interested personnel.

## Keywords:

Eastern Terai Region of Nepal, GIS, Groundwater Potential Mapping, Machine Learning

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# Preparation and Characterization of Activated Carbon from Amla (*Phyllanthus emblica*) Seed Stone by Chemical Activation with Phosphoric Acid for energy storage devices

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*Chhabi Lal Gnawali*<sup>c</sup>, *Bhadra Prasad Pokharel*<sup>d</sup>

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## Abstract:

In order to mitigate climate change and ensure stable energy supply, energy storage is essential. Activated carbon has a large surface area which makes it ideal electrode for energy storage devices such as supercapacitors. In this work we have used Amla seeds as precursors to produce AC because of their novelty and managing agricultural waste. AC was produced at temperatures of 400<sup>0</sup>C, 500<sup>0</sup>C, and 600<sup>0</sup>C using Phosphoric acid as activating agent. Their characterization showed AC prepared at 500<sup>0</sup>C and 600<sup>0</sup>C had the highest surface area and amorphous contents. They also showed the comparatively high specific capacity of 0.113 Fcm<sup>-2</sup> and 0.0729 Fcm<sup>-2</sup> respectively for S<sub>500</sub> and S<sub>600</sub> which means the AC prepared at these temperatures are suitable for energy storage devices.

## Keywords:

Activated Carbon, Electrode, Energy Storage

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# Analysis of Labor Productivity for Rebar Placement Operation of Building Construction in Kathmandu Valley

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## Abstract:

This research primarily focus on developing a predictive model of the labor productivity for rebar placement operation in building construction project using Artificial Neural Network (ANN). Construction industry being a labor intensive industry requires a significant amount of labors for completion of project. One of such task which is not yet highly mechanized in Nepal is rebar placement works in building construction. Labor productivity is not only dependent on number of labors but also various constraints that may appear in the workplace. Factors were well identified from various literatures and were included in questionnaire survey done among industry professionals followed by the computation of Relative Importance Index (RII). High ranked factors were selected for further development of models. Datasets required for the model development were defined based on selected factors and were collected from active construction sites in Kathmandu valley in which rebar placement operation at slab including beam were performed. ANN model was developed based upon the defined variables and data collected from the field to predict the labor productivity for the rebar placement operation in building construction in Kathmandu valley. Mean square Error (MSE) was calculated from actual productivity and estimated productivity and was found to be 0.0219 which lies in acceptable region for the use of model. Likewise, model was further assessed for the importance study using permutation importance study for determining the most important and least important variables.

## Keywords:

Labor, Productivity, Artificial Neural Network (ANN), Building Construction, Rebar placement, Relative Importance Index (RII)

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# Effect of Mixing Ratio on Co Digestion of Septage with Sewage Sludge

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## Abstract:

Proper management of septage has been a challenge in Kathmandu valley. Co digestion of septage with sewage sludge in an anaerobic digester in an existing WWTP is an effective solution to this problem. This study was done to determine the optimum mixing ratio for addition of septage to the digester. For this, batch test was performed to determine the biochemical methane potential for the substrates i.e. sewage sludge and septage as well as for their mixtures. Co digestion of septage showed synergistic effect for 15 and 25% addition of septage. The observed methane potential was 7.36 and 5.9% higher than the theoretical methane potential of 15 and 25% addition of septage respectively. The maximum synergistic effect was found for mixture with 25% septage added to it.

## Keywords:

Anaerobic digestion, Co digestion, Septage

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# Environmental Monitoring and Modeling (EMM) of Kathmandu Valley with Remote Sensing to Understand the Drivers of Climate Change

*Suyog Rai*<sup>a</sup>, *Nawraj Bhattarai*<sup>b</sup>, *Ram Kumar Sharma*<sup>c</sup>

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## Abstract:

This study observes the actors of climate change by observing various environmental aspects such as Normalized Difference Vegetation Index (NDVI), Land Surface Temperature (LST), Land Use and Land Cover (LULC), Atmospheric Pollution levels like Aerosol Optical Depth (AOD), Methane (CH<sub>4</sub>), Nitrogen Dioxide (NO<sub>2</sub>), and Carbon Monoxide (CO), moreover the precipitation patterns using Remote Sensing (RS) data in Kathmandu Valley of Nepal. To generate the results, various RS sources were viewed and were estimated in Goggle Earth Engine (GEE) code editor. The findings are according to the available data of selected sources and demonstrate that there's been a shift in the characteristics of studied environmental aspects throughout these years. There's been an increase in the NDVI value which suggests an increase in vegetation index, however according to LULC results over these 3 decades the forest cover declined from about 45.48% to 37.96%. The LST in winter season have also shown an increase of 20°C from an average of 15°C. As the urban areas have also nearly doubled within these 3 decades, the results of the current problems with global warming are the consequences of this transition. The results of estimating the amount of pollutants in the atmosphere and precipitation levels likewise indicates increasing tendency. Between 2001 and 2021, the Aerosol Optical Depth (AOD) value grew by about 30%. The atmospheric content of CH<sub>4</sub> has also increased to almost 2% in just three years. While the general trend for precipitation in mm/pentad is increasing, with an average increase of 28% in 2021 over 1991. Consequently, the study supports that the change in LULC like the expansion of residential areas and the addition of contaminants to the atmosphere in the Kathmandu Valley are contributing to global warming.

## Keywords:

Climate Change, Remote sensing, Land Surface Temperature, Land Cover, Atmospheric Pollution, Precipitation

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# Impact of Natural Ventilation and window wall ratio for Energy Efficient Building: A Case of Residential Building at Janakpur

*Nishma Shrestha<sup>a</sup>, Shree Raj Shakya<sup>b</sup>*

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## Abstract:

While maintaining ventilation rates that are consistent with acceptable interior air quality, natural ventilation has the potential to save construction costs and operating costs for some commercial buildings. Compared to mechanical ventilation systems, which are created specifically for the supply of fresh air, natural ventilation can achieve far higher ventilation rates. This study explores the possibility of maximizing the use of natural ventilation there by reducing the need for mechanical ventilation in the buildings, and compare the overall energy efficiency and comfort delivery by controlled natural ventilation as compared to the existing mechanical ventilation used in the case studied building. It studied the building retrofitting intervention measures that can save energy in the building having higher summer cooling loads and lower winter heating demands, a typical characteristics of southern plain terai region of Nepal. This research mainly focuses on how the window wall ratio impact on building cooling load and heating load reducing the electrical cost of the building.

## Keywords:

Natural Ventilation, Window Wall Ratio, Energy Efficiency, Heating Load Cooling Load

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# Effects of alkaline activated egg shell powder in soil stabilization

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## Abstract:

The effectiveness in soil stabilization by adding alkali activated egg shell powder (ESP) to cohesive soil has been studied taking into consideration Atterberg's limits, compaction characteristics and unconfined compressive strength (UCS) behavior. Laboratory test have been conducted at various proportions of activator egg shell powder (5%, 10%, 15%, 20%, 25% & 30% of total solid mass). The combination of sodium hydroxide and sodium silicate serve as the alkaline activator solution. The activator to alkali ratio were 0.25, 0.45 and 0.65. The mass ratio of  $\text{Na}_2\text{SiO}_3$ : NaOH was fixed at 2 and a constant 10 Molar concentration of NaOH was adopted. The effects at different curing periods of 1, 7 and 28 days were analyzed. The increase in maximum dry density and unconfined compressive strength imply the improvement of soil geotechnical properties. This marked the feasibility of using alkaline activated egg shell powder in stabilization of soil.

## Keywords:

Soil Stabilization, Unconfined Compressive Strength (UCS), Egg Shell Powder (ESP), Atterberg's Limit, Compaction.

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# Assessing Impact of Climate Change and Land Use Cover on Soil Erosion using RUSLE and SWAT model in Kaligandaki Watershed

*Srijana Shrestha<sup>a</sup>, Sadikshya Rana Dangri<sup>b</sup>, Khem Narayan Poudyal<sup>c</sup>*

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## Abstract:

Soil erosion is becoming a greater global issue because of the impact of climate change and human action. In Kaligandaki watershed, soil erosion is a problem because it reduces the fertility of agricultural land in hilly terrain. Due to its vulnerability to climate change and reliance on agriculture, it is essential to estimate soil erosion in hilly regions of Nepal. The spatial variation of soil erosion exposed due to Land Use Land Cover (LULC) and climate change was identified using Revised Universal Soil Loss Equation (RUSLE) and Soil and Water Assessment Tool (SWAT) in the ArcGIS interface. The findings of this study demonstrate that the average soil erosion losses anticipated by the two models. The annual average soil rate was found 14.4 t/ha/yr and 8.89 t/ha/yr by the SWAT model and RUSLE model respectively. The most eroded area was identified in barren lands and agricultural areas having steep slopes. It was found that both models are suitable for soil erosion estimation. The strong correlation between rainfall, soil loss and surface runoff was found. The watershed was classified into seven priority categories for conservation intervention based on threats of soil loss. The result of the study strongly points to the necessity of sufficient quality and quantity of observed data. The finding is useful for policy-making and watershed management planning processes by land use planners and decision-makers for prioritization of different regions.

## Keywords:

Soil Erosion, RUSLE, SWAT, Remote Sensing, Kaligandaki

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# Slope Stability Assessment of Plane Failure Along the Road at Sundaridanda, Begnas

*Amisha Deo*<sup>a</sup>, *Krishna Kanta Panthi*<sup>b</sup>, *Naba Raj Neupane*<sup>c</sup>

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**Abstract:**

This paper deals with the assessment of rock slope failure along the road at Sundaridanda, Begnas Tal which lies in western region of Nepal. A comprehensive stability assessment was done for rock slope stability. Kinematic analysis using stereographic projection are used to analyze slope failure types along road cuts at project area and for more detailed analysis numerical methods using slide software are used for obtained the factor of safety. Barton and Bendis criteria analysis was carried to assess the frictional properties of the discontinuities. From analysis of these methods obtained potential to plane failure at a different location in this project area and also provide the support as required for the rock slope stability.

**Keywords:**

Slope stability, shear strength, plane failure

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# Biomimicry Inspired Concept of Multi-Layer Skin and Jaali Extracted from Vernacular Buildings for Energy Efficient Building Envelope

*Nashibha Tamrakar <sup>a</sup>, Sanjaya Uprety <sup>b</sup>, Sudarshan Raj Tiwari <sup>c</sup>*

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## **Abstract:**

Biomimicry is a new perspective on the nature that contributes in making the built environment resemble living organisms in many ways. Building envelope is a subdivision of biomimetic that surrounds the entire building's exterior serves as the structure's line of defense against outside forces that could affect every part of the surroundings. Around the world issues with climate change, environmental problems and energy resources crises have posed numerous challenges. Therefore, a new trend of energy efficiency is established to demand sustainable solutions which could get along with the natural ecosystem and solve manmade problems. The study is concerned with engaging biomimicry in building envelope, which offers a high potential to reduce energy demand, through accessing current scenario of building in Terai region of Nepal in terms of heat control. The main aim of this paper is to investigate how energy efficiency can be obtained by using vernacular element in building envelope which mimics nature. This study used both qualitative and quantitative methods which included observation of the vernacular, old and modern buildings of Biratnagar in the field followed by the questionnaire survey to determine the preferred parameters of biomimicry/biophilia. The identified parameters were, then used as inputs for energy modeling. The proposed bio-mimicked envelope reduced 13.25% total load. The study concludes that there is good chance for architects and designers to find sustainable solutions in the vernacular architecture which already consists of biomimicry ideas.

## **Keywords:**

Biomimicry, energy efficiency, building envelope, nature-inspired, vernacular

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# Solar Radiation Control Techniques in Public Building: A Case Study of Ward Office Buildings in Kathmandu

*Bishal Adhikari<sup>a</sup>, Ajay Kumar Jha<sup>b</sup>*

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## Abstract:

This article is about the investigation of heat impact on ward office buildings with the changes in window wall ratio and the application of insulation materials in building envelope. The study was performed based on the case study of an existing ward office building in Tarakeshwor Municipality, Kathmandu performing energy analysis modeling in Ecotect. The window wall ratio and insulating materials of the building are discussed and the optimum design and materials for solar radiation control are recommended. Experiments and simulations were carried out on the two most popular ward buildings. The building design is important for saving energy by applying passive design principles for cold climates and using the right materials and appropriate design tools. This will make the home healthier and more comfortable. The research aims at analyzing the influence of window wall ratio and insulation for public buildings in Kathmandu. Kathmandu is chosen as an area of study. The climate of this area is studied after which bioclimatic analysis is carried out. The analysis gave comfort limits which were used to analyze the performance of different scenarios of the selected building. Five scenarios including a base case scenario are developed. Using the simulation tool, i.e., Autodesk Ecotect, the reduction in cooling load, reduction in heating load, passive gains, and loss are evaluated and compared. The results show that the application of polystyrene sheet insulation reduced the heating and cooling loads by 2564.63 Kwh in ward office building 9 and 3201.46 Kwh in ward office 11 when compared with the base case. According to the cost analysis, the polystyrene sheet insulation method resulted in an energy-efficient design.

## Keywords:

Solar Radiation, Window Wall Ratio, Insulation, Heating Load, Cooling Load, Energy Consumption, Gypsum board, Polystyrene Sheet

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# Multi-criteria Decision Making for Rural Road Project Selection

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## Abstract:

This research aims to develop a Multi Criteria Decision Making (MCDM) criteria for selection of rural road projects. In identifying the suitable criteria, Analytic Hierarchy Process (AHP) formulation was used. For the identification of criteria and sub criteria for selection of rural road projects, pilot survey was done with experts working in rural road sectors. Five criteria and seventeen sub criteria identified after pilot survey were sent as questionnaire in the form of pairwise comparison to experts for main survey. Responses were analyzed using Super Decisions software to determine the weights of criteria as well as sub criteria. It was found that Employment Generation has the highest weightage of 13.4% among the seventeen sub criteria. Similarly, Access to Agricultural and Livestock pocket Areas and Tourism Destination (12.6%), Population Served per Km (9.9%), Connection to Strategic Road Network (8.3%) and Access to Growth Centers (6.8%) lie in the top five ranked categories of sub criteria. Finally, a case study was done for ranking of selected three road projects using Simple Additive Weightage method.

## Keywords:

MCDM, AHP, Rural Road Selection, Simple Additive Weightage

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## Issues and Challenges in Urban Planning and Practices regarding Urban Public Health and Well-Being

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### **Abstract:**

Urban planning and public health both come to existence in the 19th century and were collaborated to access and adjust poor health and well-being conditions that were connected to the urban environment simultaneously with human health in the emerging urban areas. This report introduces the proposed thesis research topic of issues and challenges of urban planning, talks about the global, regional and local background, insights into public health care systems, clarify the aims and objective of the research topic, defines the scope and limitations, advocates the projects need and importance, illustrates the research methodology and procedure and describe the topic validity along with the conclusion of the proposal at the end of this thesis proposal report. Urban Planning and Public Health have always been major issues of discussion for urban developers, public health professional, medical professional, and dwellers from the industrial age to the present. Urban Planning and Public Health are sources of knowledge of practice for developing healthy cities for being healthy people. Hence examining the relationship between urban planning and public health in terms of prevention and control of infectious disease is the major concern of this research. This is an effort of my research effort to examine various aspects of urban planning with epidemiology aspects of public health. This work particularly focuses on the review of international and national documents such as policies, strategies, laws/acts, etc.

### **Keywords:**

Urban, Planning and Practices, Public Health, Well-Being

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# Study on Impacts of Photovoltaic Integration in Radial Distribution System

*Hari Bhusal<sup>a</sup>, Radhika Kumari Sah<sup>b</sup>,  
Saubhagya Acharya<sup>c</sup>, Shailendra Kumar Jha<sup>d</sup>*

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## Abstract:

This paper presents the impact of integrating photovoltaic (PV) generation system on the distribution system in a radial distribution network. IEEE 33 radial bus system and modified 24 bus Dharan feeder of Dharan substation are selected as candidate system. Particle Swarm Optimization (PSO) is proposed for optimal location for PV penetration at different penetration level with minimum power loss as objective function. The results in terms of voltage profile improvement and power loss minimization are studied with PV integration. Also, a comparative analysis for the system with integration of Distributed Generation (DG), PV with capacitor bank for reactive power injection as well is conducted. Voltage profile improvement and significant decrease in power loss was observed in both the cases. Also, PV with capacitor bank used had shown effective results at lower penetration level than that with just PV.

## Keywords:

Backward-forward sweep, Distributed generation, Distribution system, Particle swarm optimization, Photovoltaic penetration

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# The Urban Park for Sustainable Development through Community participation

*Sunita Manandhar<sup>a</sup>, Sudarshan Raj Tiwari<sup>b</sup>*

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## **Abstract:**

People living in the core cities have no or limited access to green spaces as a result of rapid urbanization. This leads to an unhealthy life filled with mental and physical stress. Small urban parks in densely populated areas are required to alleviate this type of stress. Small urban parks require small spaces and can meet the needs of the people who live nearby. This study attempted to discover the existing situation of urban parks in the core area, as well as the community's involvement in the use and management of urban parks. It also identifies vacant or unutilized spaces that could be converted into urban parks. Due to time constraints, the study is limited to three wards of the core city and attempted to list the potential spaces that could be converted into urban parks. Three existing parks were visited to learn about the current situation, the facilities provided, and how the community is involved in the parks. And how can the community get involved in the new parks? What facilities are needed in urban parks to ensure maximum utilization, and how can parks be made gender friendly?

## **Keywords:**

Urban Park, Small Park, Pocket Park, Community Participation, Sustainable Development

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# A study on the influence of discontinuities orientations on seismic response of shallow rock tunnel, using Phase2

*Mahesh Upadhyaya <sup>a</sup>, Subrat Subedi <sup>b</sup>, Sagar Paudel <sup>c</sup>*

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## Abstract:

A pseudo-static analysis of a shallow rock tunnel has been carried out in a Phase2 to study the effect of an earthquake with different dipping orientations of rock joints. For the analysis, rock mechanical properties of intact rock have been collected from the Phukot Karnali Hydroelectric Project (PKHEP) and parametric analysis has been performed, referencing various literature. The seismic coefficient for the analysis has been taken from the site's seismic hazard analysis report. Thirty numerical models have been prepared and analyzed under varying discontinuity orientations and seismic force directions. The significance of the seismic effect varied on the orientation of discontinuities. For the combinations analyzed, joint sets with orientation dipping 60° / 120° joint set orientations are found to be most unfavorable.

## Keywords:

Pseudo-static analysis, shallow rock tunnels

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# Investigation of Base Stability for an Underground Kathmandu Metro Station

*Pareekshit Poudel<sup>a</sup>, Indra Prasad Acharya<sup>b</sup>, Santosh Kumar Yadav<sup>c</sup>*

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## **Abstract:**

Excavation work essential for the development of underground space is heading in the directions of greater depths, larger scale, and difficult soils. The aim here is to analyze a deep excavation planned for the underground Kathmandu Metro Railway Station in the soil of Kathmandu valley in order to understand the basal heaving mechanism. The research relies on the use of classical analytical and recent numerical limit analysis solution from different literatures to verify the finite element analysis performed for the determination of Factor of safety.

## **Keywords:**

Deep Excavation, Numerical Analysis, FE Analysis, Total Stress Analysis, LEPP Mohr-Coulomb Model, Manual  $c-\phi$  reduction, Intersection Method, Failure Mechanism study, Underground Kathmandu Metro Station, Braced Excavation

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# Performance of Vernacular Building in Hot and Humid Climate of Janakpur

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## Abstract:

Nepali art and architecture have become an important part of the country's cultural heritage. Architecture is a term used to describe the art of organizing a living space in Nepali, which is known as Bastukala. Even from a scientific standpoint, Nepal's ancient architecture, such as the art of painting and sculpting, is considered exceptional. The Objective is to find out the performance of the studied vernacular building in Janakpur and measure and depict its performance in terms of the materials used and field data that was collected. The places with hot and humid climate have temperature which ranges from 35°C to 40°C in summer. This study focuses on the aspect for understanding and measuring the performance of vernacular buildings in hot and humid climate of Janakpur. The study analyses the various aspects and evaluates and tables the performance of the vernacular building in Janakpur in exact real condition and the way it is being built. The Climatic data measurements were taken on field and those were taken as the software inputs which is crucial for determining the building performance of the area. The on-site measurements and case study of a building was done in JanakpurDham and the performance with regard to the climate and the data collected on field was used in this research. The discomfort period was found to be maximum in month of May and June to September was also uncomfortable to live in. The Fabric gains suggested that the months in April to June had the most heat gains through envelope resulting in higher discomfort inside. The conduction gains was found to be the main reason of discomfort contributing to 29% of the total building gains and Inter-zonal losses was found to be 58% which was found to be the main reason for winter discomfort in the studied building in Janakpur. Thus, the study helped to find out the building performance of vernacular buildings in Hot and Humid climate of Janakpur and helped us study about the various aspects of building performance in the place. The study also found out that one of the main reasons of winter discomfort was due to the lack of air tightness and an open-space type of planning in vernacular architecture in the studied building in Janakpur.

## Keywords:

Vernacular Buildings, Janakpur, Hot and Humid Climate, Building Performance, Ecotect

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# Content Based Image Retrieval Based on Image Feature Fusion and Principal Component Analysis

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## Abstract:

This paper proposes an analysis of image feature fusion(IFF) based method with different combinations of Inception-V3, Resnet50 and EfficientnetB0 for efficient image retrieval. Principal component analysis(PCA) technique has been introduced to produce fused image feature maps with the help of dimensionality reduction concept. Experimentations have been conducted using euclidean, cityblock and correlation distance functions on popular natural image dataset Corel-1k. The results have been evaluated using mean average precision(MAP) scores. The experimental results on Corel-1k dataset show that the best mean average precision scores for top 20 and top 50 retrieved images are 96.85% and 95.92% respectively. The experimental results also show that the proposed method outperforms some methods using shallow descriptors for feature extraction purpose and the methods using fusion of low level features extracted from classical approaches.

Feature extraction and similarity measures always have been crucial subjects to evaluate the performance of content based image retrieval(CBIR). Many deep learning algorithms have been experimented for efficient learning of high level features. Image feature fusion(IFF) by Fusing the deep features extracted by multiple convolutional neural networks (CNNs) for efficient image retrieval is considered as challenging task. This paper proposed an analysis of different combination of some of such powerful state-of-the-art deep neural networks on the basis of their performance as a powerful classifier. Inception-v3, Resnet50 and Efficientnet are the three CNNs we have used for this work. Again, three different distance functions have been implemented as similarity measures. The features from average pooling layers of two CNNs are fused with the help of principle component analysis(PCA) technique which converts high dimensional features into low dimensional features. The analysis have been done for different combination of networks for different values of PCA feature dimensions utilizing different distance functions for a popular natural image dataset corel-1k. The results are evaluated using average precision(APs) scores for different classes of the dataset and overall mean average precision(MAP) score for the entire dataset for top 20 retrieved images and top 50 retrieved images. The experimental results show that proposed method outperforms the methods using shallow descriptors for feature extraction purpose and the methods using fusion of low level features extracted from classical approaches. The best MAP score for our proposed method is found to be 0.9685.

## Keywords:

CBIR, CNN, DNN, IFF, QI, PCA, NR, AP, MAP

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# Climate Change, Impacts and Adaptation in Chisankhugadhi Rural Municipality, Okhaldhunga - An Application of Perception-based Approach and Climate Data Analysis

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## Abstract:

Due to Nepal's extensive geographical, climatic, biological, and cultural diversity, perception and place-based studies provide useful information on climate change in the country. As no previous studies in the Chisankhugadhi rural municipality, Okhaldhunga had been done, this study used a household survey, focus groups, and key informant interviews to record local people's perceptions of climate change, its impact, and adapted adaptation practices, along with climate data analysis. Using the web-based version of ClimPACT, trends in the observed data for the nearby meteorological station Okhaldhunga (1206) were determined for the period 1980-2020 to support people's perception. In the study area, the majority of respondents perceive that summer day and night temperatures, dry days, hot days, summer days, rainfall intensity, landslides, and droughts are increasing, while monsoon and winter rain, winter night and day temperatures, flood frequency and magnitude, and total precipitation amount are decreasing. Chi-squared ( $\chi^2$ ) test was used to examine the relationship between people's perception of climatic variables and climate change. The majority of people's perceptions are supported by trends in climate extremes, with the exception of total annual precipitation which shows increasing trends.

Impacts of these changes on agriculture, water resources, and biodiversity have been noted. Fundamentally, they have perceived a decline in agricultural production and productivity, improved fertilizer use, fruit and vegetable storage stability, drying up of water sources, deterioration of water quality, an increase in crop failure, populations of insects and pests, a change in the number and species of plants and animals, fish, and shifting vegetation. As an adaptation strategy, people have changed agricultural zones, crop varieties, and cropping patterns; switched to off-farm employment; planted tap roots and quickly growing plants like bamboo in steep barren slopes; avoided building new homes on steep slopes or in already flooded areas; and raised home foundations.

## Keywords:

Adaptation, Chisankhugadhi, Climate Change, Impacts Perception, Prioritization, Trends

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# Numerical Study on the Performance of Shallow Foundation on Liquefiable Soil during an Earthquake

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## Abstract:

Shearing of loose saturated sand results in rise of pore water pressure. When excess pore water pressure equals effective overburden stress then the soil essentially behaves like fluids and deforms without mobilizing much shear strength. The phenomenon is known as Liquefaction which is a typical occurrence after large earthquakes and has caused significant infrastructure damage. In this research, a critical state compatible constitutive model calibrated for Ottawa sand was used to simulate the dynamic response of sand using FEM analysis. OpenSees was used to investigate the liquefaction susceptibility and settlement behavior of structures founded on such sand. Furthermore, numerical parametric study was conducted to examine the effect of various structural parameters (foundation width, structure height and bearing pressure) and ground parameters (thickness of top and bottom non-liquefiable layers) on settlement of shallow foundation due to liquefaction. Rate of settlement was found to be governed by the acceleration time history of ground motion with maximum settlement occurring during peak acceleration period. Shear-induced displacement played key role in settlement of structures which implies that empirical methods for free field cases cannot be relied upon. The ground parameters were found to have more significance on liquefaction induced settlement than structural parameters.

## Keywords:

Liquefaction, Open Sees, Ottawa sand, parametric study

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# Study on the possible Sustainable solutions to make a stable road network in rural roads in monsoon seasons

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## Abstract:

Road transportation is one of the most significant forms of infrastructure a country can have, if not the most important. It goes without saying that the socioeconomic growth of a country is accelerated by the expansion of a good road transportation network. The current state of Nepal's road network, however, is not far from sad circumstances. The majority of Nepal's roadways are in poor condition, with the exception of a small number of important thoroughfares in large towns. This issue requires immediate attention, yet the most likely solution is not feasible everywhere because of the Nepali government's spending capability and economic capacity restrictions. The main issues and difficulties with rural roads were discovered by this study, along with the causes of the roads' inefficiency. Through a self-sustaining process of participative approach that makes use of local resources, this study explored the role of nature-based solutions and developed a framework for potential sustainable solutions of rural roads.

## Keywords:

Sustainable rural road, Nature based solutions, Participatory approach

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# Stability Analysis and Mitigation Optimization: A Case Study of Landslide in Godawari, Lalitpur, Nepal

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## Abstract:

Landslide and slope failure phenomenon is recurrent phenomenon in Nepal. The study area comprises a stretch of Landslide in Godawari, Lalitpur, Nepal as a case study to carry out a stability analysis of the nearly vertical cut slopes. The main objective of the research work is to perform parametric variations to find out optimum value of soil nail parameters affecting soil nail wall system and find the optimized design of soil nail wall. Numerical simulations using Finite Element Method has been performed on both; unstable and soil nailed slopes, and thereby, find the optimized design of the soil nail wall. Soil is modeled as Mohr-Coulomb (MC) material and soil nail with grout and its facing is simulated as elastic plate material. The factor of safety for reinforced slope is obtained from c-phi reduction method in 2D Numerical Model at standard condition. From the parametric variations of soil nail such as length, diameter, spacing and inclination, the most sensitive soil nail parameter for this site is obtained. As there is spring of water at considerable depth from the toe of existing slope, depth of water table is varied with the most sensitive parameter to attain the minimum recommended factor of safety of soil nail wall as per (FHWA,2015) after finding the most sensitive parameter. The parameters of soil nail can be optimized to achieve the minimum recommended factor of safety values at static condition for different water table conditions. The optimized parameters can be directly applied for the similar nature of slope and soil.

## Keywords:

Soil Nailing, Plate Material, Finite Element Method (FEM), Cut slope, 2D Numerical Model, parametric study

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# Optimization of Sediment Management Measures for Andhikhola Storage Project Using RESCON-2 Model

*Bal Mukunda Joshi<sup>a</sup>, Umesh Singh<sup>b</sup>, Pawan Kumar Bhattarai<sup>c</sup>*

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## Abstract:

Reservoir has multiple advantages and it's sustainability is important to meet the future water demand. Sedimentation in reservoir has challenged reservoir sustainability. Sediment inflow and the type of sediment management measure plays important role in the life of reservoir. RESCON 2 model is widely used tool for optimizing sediment management strategies in any Reservoir. Sediment measurement in a river is challenging task and it require both cost, time and qualified manpower. Very often sediment measurement data are not available at the planning stage of the project. So, sediment inflow is estimated using different empirical or semi-empirical formulas. This article focusses on the evaluation of sediment yield using BQART model and Optimization of sediment management strategy for Andhikhola Storage Project (AKSP). The model output shows No action will be economic method, as there is no any cost of implementation of this method but the aggregate Net Present Value of Benefit is higher with this method among other alternatives.

## Keywords:

Reservoir Sedimentation, Sediment Yield, Sustainability

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# Placement and Stress Analysis of Underground Powerhouse Cavern

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## Abstract:

Planning an underground cavern is mainly influenced by geological investigation of the project area. Stress distribution around the excavation contour plays the vital role for stability of underground cavern. The cavern's overburden is 304 to 330 meters. By dividing the maximum intersection angle between the two main joint directions, the cavern's orientation is achieved. Three joint sets, one foliation plane of 45–55 degree dipping SW, another joint set of 75–85 degree dipping NE, and another joint set of 55–65 degree dipping NE, make up the majority. The cavern's length axis lies between the foilation plane and the joint set dipping 75–85 degrees. Hydrofacturing test and diametrical cone deformation analysis are used to measure stress. 10.2 MPa of major horizontal stress and 2.2 MPa of minor horizontal stress are measured dipping in the N21.4W and N68.6E, respectively. The major principal stress makes a 49.4 degree clockwise angle with the cavern's length axis. Then, using empirical techniques and numerical modeling, the redistribution of stress around the excavation's contour is estimated. Since it is not dependent on the size of an underground opening, numerical modeling is more successful than an empirical approach. The deformation monitoring data that MPBX recorded at the project site is used to validate the model. Plastic zone of the crown and wall are 8m and 18m respectively and support provided at the cavern is optimized.

## Keywords:

Orientation, stress, slate, powerhouse cavern, spalling

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# Performance Analysis of Radial Distribution System using Optimal Capacitor Bank Placement

*Saubhagya Acharya<sup>a</sup>, Hari Bhusal<sup>b</sup>,  
Radhika Kumari Sah<sup>c</sup>, Pramish Shrestha<sup>d</sup>*

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## Abstract:

Abstract—This paper presents two stages of methods to identify the location and size of the capacitor bank. The load flow is carried out to find the losses of the system using the sweep algorithm in the initial stage. In the next stage, the particle swarm optimization algorithm is used to determine the location and sizes of the capacitors to be installed. Loss sensitivity factors are calculated using a single base case load flow study on the IEEE 15 bus system for the validation purpose which provides important information about the sequence of potential nodes for the capacitor placement. The fixed, switched capacitors are considered to obtain the optimal solution. The proposed procedure is applied to standard test systems as a 15-bus radial distribution system and on a real distribution scenario, a section of 11 kV Banepa Feeder which identifies sensitive buses and computes the optimal size and location of the capacitors that are to be installed. The optimal capacitor placement in a Banepa feeder was done in ETAP. The drop in voltage and power loss before and after installing the capacitor were compared for the system in the analysis. The output showed improvement in voltage profile and power losses after installing capacitors in the system.

## Keywords:

Distribution feeder, Loss minimization, Loss Sensitivity Factors, Particle Swarm Optimization, Voltage profile

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# Development of Bridge Management System for Existing Bridge in Nepal Using Analytical Hierarchy Process

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## Abstract:

Bridge Management System (BMS) is a rational and systematic management approach that includes all the activities for the proper management of bridges as vital transportation infrastructure. The bridges in Nepal were constructed 60 years back. The failure rate of bridges has tremendously increased in the last five years. The formulation of practical based Bridge Rating Expert System (BREX) for the condition assessment of bridges along with their application for the proper management of bridge network was main outcome of the study. The Maintenance, Repair and Rehabilitation strategy was adopted through proper prioritization of bridge via Condition rating. The expert opinion survey for the BREX was done via Analytical Hierarchy process (AHP), Whereas criteria for the studies were finalized through literature review. The pairwise comparison of the criteria and sub criteria was done for Multi-Criteria Decision-Making (MCDM) process. The weightage of Criteria and Sub criteria for the Maintenance, Repair and Rehabilitation prioritization ranking of bridges was then finalized through Expert responses in AHP. It was found that Piers has the highest weightage of 28.4% among nine sub-criteria. Similarly, the decreasing order of top five ranked Sub-criteria weightage was Deck Structure (24.1%), Bearings (18.5%), Abutments, wing wall and retaining walls (14.1%) and Bridge protection and river training works (8.9%) respectively. The 12 bridges within the kaski district were studied for maintenance prioritization of Bridges.

## Keywords:

Bridge Rating Expert System (BREX), Bridge Management System (BMS), Multi-Criteria Decision Making (MCDM), Maintenance Prioritization, Analytical Hierarchy Process (AHP)

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# Impact in Distribution Feeder Transformer Due to Injection of Non-linear Load

*Sujit Tiwari*<sup>a</sup>, *Mahammad Badrudoza*<sup>b</sup>

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## Abstract:

In electrical power system transformer is consider as one of the mostly used major component. The thermal condition of transformer is considered as a critical case while operating in abnormal conditions such as harmonic loading. In this thesis, transformer thermal behavior analysis is carried out due to influence of nonlinear load and impact on its life is simulated and analyzed. As, additional heat is generated due to core loss in transformer caused by harmonic load which will increase in hot spot temperature and decrease in transformer loading capacity. For this purposed, IEEE standard C57.91 modelling is used to identify the hot spot temperature of transformer by using MATLAB simulation at different nonlinear loading conditions. The measured hot spot temperature of 22.5 MVA, 66/11 kV, ONAF cooling temperature at different loading conditions are compared with the model. It is concluded that the temperature of transformer rises with the percentage increase in non-linear loading of the transformer. There is significant loss of life of transformer is noticed when non-linear loading insertion is greater than 15 percent of total transformer rating. So, awareness of the effect on increasing non-linear load must be considered while inserting large number of non-linear loads in feeder and designing the next generation of transformer.

## Keywords:

Transformer, Non-linear Load, Harmonics, Hot spot temperature, Loss of life

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# Energy Consumption Pattern in Earthbag House in Nuwakot, Nepal

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## Abstract:

With rising environmental challenges like climate change and global warming, there is a huge interest in finding alternative building materials and technology that suits our structural needs as well as consumes less energy. Earthbag technology is widely regarded as the most promising of all sustainable construction methods. Earthbag technology is a sustainable and cost-effective construction approach with enhanced strength using ordinary soil. It does not require any industrial processing thus, reducing the global energy consumption and resource supplies. Earthbag technology has been accepted by the Nepalese government as one of the model houses for reconstruction, and it was also featured in the DUDBC catalogue volume II in 2017. This paper aims to investigate the energy consumption pattern in earthbag housing in case of Nepal. The consumption pattern differs with the building area, occupation of the families and their lifestyle. The main research approach applied for this paper is survey research. For the study, a questionnaire survey was carried out in Nuwakot district of Nepal where number of earthbag houses have been built. Electricity bills, family income, family size, electricity-using appliances, energy expenditures, and energy use for heating/cooling, cooking, and lighting have all been gathered. It is found that the major energy sources used in earthbag houses are electricity, firewood and LPG.

## Keywords:

Biomass, Earthbag Technology, Energy Consumption

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# Improvement on CBR Strength of Soil Modified with Brick Dust using Geogrid Reinforcement

*Ramchandra Lamichhane<sup>a</sup>, Indra Prasad Acharya<sup>b</sup>*

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## Abstract:

This study deals with improving the CBR strength of soil using Geogrid as a reinforcing material. A sample was taken from the problematic location. Various laboratory tests were conducted to Engineering properties of soil and CBR test by providing the geogrid at varying depths in a single layer under the soaked and unsoaked conditions. The geogrid was placed in different heights of soil sample that are 0.1H, .2H, .3H, .4H,.5H and .6H from top of soil sample. The test result shows that the CBR value of the soil sample is considerably improved by using geogrid reinforcement. The result shows that geogrid placed at .2H height from the top of soil shows a higher unsoaked CBR value of 4.54% for 2.5 mm penetration and 5.90% for 5 mm penetration which is 228% and 289% higher than the unsoaked CBR value of unreinforced soil for the respective penetration. Similarly, geogrid added at .2H height from the top shows a higher soaked CBR value of 2.27% for 2.5 mm penetration and 2.52% for 5 mm penetration which is 156.5% and 130.4% higher than the CBR value of unreinforced soil for the respective penetration, %, it is still insufficient to meet the requirements of the Flexible Pavement Design Guideline (2nd Revision, 2021), so the soil is modified with brick dust in addition to geogrid reinforcement. Unsoaked CBR value of soil mixed with 20% BD are 5.01% and 8.00 % which are 261% and 430% more than unsoaked CBR of natural soil without BD at 2.5mm and 5mm penetration respectively. CBR value of soil sample after adding 20% of brick dust and providing geogrid at 0.2H from the top of soil sample, increases to 8.3% and 10.51 % at 2.5mm and 5mm penetration respectively which are 837% and 860% more than untreated soil at their respective penetration.

## Keywords:

Geogrid, CBR, Soaked CBR, Unsoaked CBR, Subgrade, reinforcement, Brick Dust

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# Risk Stratification in Healthcare Data using Clustering Algorithms

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## Abstract:

Risk stratification in healthcare is about grouping the patients based on their historical information and risk of spending higher amount in near future. There are different methods for risk stratification in healthcare. Simply using only diagnosis for grouping is a simple approach but that requires extensive domain knowledge. Machine learning algorithms are also used for risk stratification. Regression, classification and clustering can be used for risk stratification. In this research, clustering is used for risk stratification. 2 data periods are used: 1 year and 3 years, and implemented 3 different clustering algorithms: k-means, DBSCAN and mean-shift. For data transformation, scaling and PCA are used. Evaluated results after each data transformation in each of clustering algorithms and compared the results. For internal evaluation silhouette score, C-H index and D-B index are used. Among them, silhouette score is used for comparing the results with one another. The best result is in k-means clustering with data normalization in 1 year dataset. The best silhouette score is 0.689 with k=8.

## Keywords:

Clustering, DBSCAN, K-Means, Mean-Shift, Risk Stratification

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# Flow Analysis in Asymmetric and Symmetric Bifurcation with Varied Layout: A Case Study of Daram Khola HEP

*Prashant Neupane<sup>a</sup>, Mahesh Chandra Luintel<sup>b</sup>*

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## Abstract:

A bifurcation is used whenever it is needed to divide the fluid flow into more than one turbines for power generation. Its design is conventionally done by using analytical techniques, design codes and guidelines. Nowadays with the advancement of computing devices, computational methods can be used for the design process for more accurate results. In this study, a case of Daram Khola HEP has been considered where the layout of bifurcation is mainly constrained by the geological arrangement of penstock and powerhouse orientation. Asymmetric bifurcation layouts with conventional design approach are developed, modeled and analyzed in ANSYS platform to determine head loss and flow distribution pattern in the branch pipes. These layouts are revised by incorporating symmetric bifurcation layout with angle of bifurcation  $60^\circ$  and adding a bend pipe just upstream of the bifurcation. Multiple layouts are proposed with change in upstream bend angle by  $1^\circ$  in each revision, ranging the bend angle from  $24^\circ$  to  $32^\circ$ . Flow simulation, analysis and head loss calculation is done for each layout and the results are compared. The difference in mass flow rate at the two outlets has decreased from 892.83 kg/s in the asymmetrical layout to 140.82 kg/s in the symmetric layout with bend angle  $31^\circ$ . The head loss in outlet 1 and outlet 2 of the asymmetrical layout are 154.52 mm and 571.51 mm respectively, while for the symmetric layout, the head loss is minimum for outlet 1 at a bend angle of  $32^\circ$  i.e. 223.30 mm and for outlet 2 at  $24^\circ$  i.e. 171.08 mm. Since the mass flow rate difference in the two outlets is minimum for bend angle  $31^\circ$  and head loss in the two outlets are also close to the lowest head loss for each outlets in the considered range, it is concluded to be the optimum layout.

## Keywords:

Bifurcation, Head loss, CFD, Turbulence

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# Impact Analysis of Penetration of Induction Heater on Distribution System: A Case Study of Nitampur Feeder

*Sapana Bohara <sup>a</sup>, Ajay Kumar Jha <sup>b</sup>, Bijendra Prajapati <sup>c</sup>*

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## Abstract:

Massive penetration of induction heaters in feeder results in degradation of power quality of distribution system such as power loss and voltage drop. So integration of induction heater must be encouraged only after strengthening the power distribution infrastructure in order to ensure secured, safe and reliable power quality and security of power distribution network. This paper investigates the impacts of integrating induction heater in 11kV Nitampur feeder under 132/11 KV Parwanipur Substation through using CYME Distribution. CYME uses backward/forward-sweep method to converge unbalanced load flow solution. Feeder was observed to be overloaded in base case load flow which prevents penetration of induction heaters. Mitigation to the existing feeder was given to make system feasible for induction heater penetration by Running Dog conductor parallel to existing conductor from Substation to Chhatapipra Chowk (2.7 Km) and upgrading all public transformers to next higher sizes as they were overloaded at base case. Load flow was done for different level of penetration and result showed increased penetration level of induction heater results in increased power losses. The optimum penetration level of induction heaters was found to be 10% (143 number of consumers). For ensuring 20% and 50% penetration of induction heaters transformers should be upgraded to higher sizes. For 100% induction heaters penetrations the required transformer capacities seems unrealizable in the existing distribution system and demands new load centers of realizable capacities to be formed. If consumers shift from LPG gas to induction heaters then per consumer of one category can make saving of NRs. 365.82 per month and consumer from another category can make saving of NRs. 229.58 per month. For induction heating penetration a minimum of 15A MCB connection is suggested.

## Keywords:

Forward Backward Sweep, CYME

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# Stormwater Analysis and Drainage Management in Pokhara Metropolitan City, Nepal

*Santosh Paudel<sup>a</sup>, Narayan Prasad Dawadi<sup>b</sup>*

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## Abstract:

The size of the city's previously undeveloped lands is shrinking as urbanization grows. The natural and agricultural ground has been transformed with a paved surface. So one of the primary issue in urban areas has been stormwater drainage. Pokhara City has seen storm water overflow in the streets and roads during high heavy rainfall even in a short period of time due to its location in the zone of higher rainfall and quick rise in concrete constructions and paved roadways. Therefore, the purpose of this study is to estimate, using SWMM, the hydraulic capacity of the current drainage, which was built roughly two decades ago. The drainage's cross-sectional flaw is rectified in order to properly discharge runoff at the potential outfall position. Additionally, the study uses the platform offered by SWMM 5.2 software to investigate the impact of using Rain Gardens in impervious areas. According to the study's findings, the major portion of the city's drainage conduits are insufficient to convey runoff, thus they were redesigned in SWMM using a trial procedure. The modeling and analysis of the rain gardens in the various study area sub catchments reveals a significant decrease in peak as well as total runoff.

## Keywords:

Storm Water, Runoff, Rain Garden, Precipitation, Drainage Network, SWMM

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# Study on Effective Technical Audit of Grid Connected Solar PV Project in Nepal

*Niroj Bahadur Bhujel<sup>a</sup>, Tri Ratna Bajracharya<sup>b</sup>*

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## Abstract:

Evidence suggests poor performance of many solar projects especially in low and middle income countries. The technical audit contributes for the increase in the performance, reliability and quality of the project. Therefore, the present investigation aims to identify key indicators required for ensuring effective technical audit and analyze the existing technical audit practice through those indicators. The research found very rare and poor existing technical audit practice, usually audit is based on visual inspection and documentation verification. The further research through questionnaires shows prevailing technical conditions of grid connected solar PV system that can be considered during auditing. The use of AHP for ranking major problems of grid connected solar PV technology concluded module shading and soiling as a most influential challenge. The results obtained from the study can have significant contribution in the technical audit field of grid connected solar PV projects.

## Keywords:

Grid connected solar PV system, AHP (Analytical Hierarchical Process), NVC (National Vigilance Center)

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# Towards Accelerated Design of Multi-Principal Element Alloys with Optimized Hardness and Elongation Features by an Ensemble of Neural Network

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Yuri Amorim Coutinho<sup>d</sup>, Anil Kunwar<sup>e</sup>*

## Abstract:

Multi-principal element alloys (MPEAs) have enhanced mechanical properties compared to traditional alloy systems. The prime hindrance in determining the mechanical properties of MPEAs is that the method used for the evaluation in the present day is to physically make the alloy and perform experimental observations. Modern data-driven approaches will be appropriate while predicting the mechanical properties of the alloy without physically producing the alloy. Information of hardness is important as an alloy with high hardness usually has lower ductility which limits its design scope. Machine learning techniques are suitable for predicting the mechanical properties of MPEAs. This work involves automatic featurization technique of the MPEAs datasets for extracting element composition and property features. A machine learning model is prepared using an Artificial Neural Network algorithm to predict hardness and elongation of MPEA. The feature selection was made by Pearson Correlation Coefficient (PCC) heatmap analysis, Variance Inflation Factor analysis, and Principal Component Analysis (PCA). 8 features for hardness and 7 for elongation is selected by PCC. Principal components that can capture 90% of data variance are selected by PCA. Four different feature sets were formed based on feature selection techniques for each hardness and elongation model. A committee of four Neural Network models was formed on the four different feature sets. The hyper-parameters are tuned for the optimum configurations to increase the prediction accuracy of the model. The trained model with minimum RMSE is selected as the best model to avoid overfitting during training. An ensemble of Neural Networks was formed by taking a weighted fraction of the model committee. The hardness ensemble model results in  $R^2 = 0.877$  and for elongation  $R^2 = 0.67$ . Then Finally, the prediction model is used for the design of materials. The effect of doping a pair of two refractory elements on *ZrHfNb* and *VNbTa* based alloy is studied simultaneously. Molybdenum has shown a positive impact on optimum hardness and elongation in comparison to other dopants.

## Keywords:

MPEA, Hardness, Elongation, Automatic Featurization, Feature Selection, Hyper-Parameter Tuning, Artificial Neural Network Analysis, Ensemble model, Simultaneous effect of two dopants, Material design

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# Numerical Analysis of Pile Wall for Excavation Support in Soft Ground

*Madan Puri<sup>a</sup>, Bhim Kumar Dahal<sup>b</sup>*

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## Abstract:

Cantilever pile walls are one of the earth support structure which can be beneficial to reduce excessive deformation during ground excavation. In many cases construction of basement and underground structures nearby existing old buildings are proposed. In such a case the influence zone of the old building exerts earth pressure into the new excavation area and to retain such a lateral earth pressure cantilever pile wall is provided. The most populated city and capital city of Nepal, Kathmandu, where mostly the buildings are built over soft ground composed of grey to dark silty clay and clayey silt. The city is on the verge of developing high-rise building so for the proper excavation without hampering the old building near the construction site well designed cantilever pile wall are studied using three-dimensional finite element (3D FE). Pile wall is used in this study as excavation support system. The choice of cantilever pile wall is as it is common and relatively easy to be used in cohesive soil. Parametric study was performed considering soil property, excavation depth, pile embedded depth and adjacent building foundation stress.

## Keywords:

Excavation, Cantilever pile wall, FEM, Adjacent building

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# Parametric Study on Post-Tensioned Concrete Box Girder Bridge in Earthquake

*Laxman Khati<sup>a</sup>, Rajan Suwal<sup>b</sup>*

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## Abstract:

In this research comparative study of rectangular and trapezoidal sections of post tensioned box girder for same width, depth and loading conditions is done. For this research, a three dimensional finite element (FE) model of two-lane Box Girder Bridge made up of prestressed concrete has been developed using commercially available software CSiBridge v23.3.1. Three dimensional 4-noded shell elements have been employed for discretization of domain and to analyze the complex behavior box girders. The linear analysis has been carried out for moving load with maximum eccentricity at mid span. Also the study intends to present the parametric study for deflections, longitudinal bending moment, shear force, consumption of concrete and stiffness for these cross-sections. And draw fragility curve to identify the probability of exceedence for the defined damage state conditions.

## Keywords:

Concrete box girder, Push over analysis, Time history analysis, Fragility analysis

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# Impact Assessment of Cross-Border Natural Gas Infrastructure on the Power Sector of South-West Asia

*Sutishna Pokharel<sup>a</sup>, Khem Gyanwali<sup>b</sup>, Debendra Bahadur Raut<sup>c</sup>*

## Abstract:

Due to the expanding economies of South Asia region, there is a demand of energy resources in various parts of the region. Though, various energy sources are present scattered in the Asian region there is a lack of energy trade with transmission grids as well as pipelines to overcome the deficit state in one part of Asia whereas to supply excess of available energy from the other part of the region. To ensure the energy security of the Asian region by promotion of multilateral trade there is a necessity of study of the cost-efficient availability of various energy resources available in different countries (Bhutan, Bangladesh, India, Pakistan, Afghanistan, Turkmenistan, Iran, Nepal) of Asian region. For ensuring cost efficient optimal generation mix the multi-regional model with 12 nodes, 11 fuel transport lines, 21 transmission lines is modeled in hourly temporal resolution in CPLEX optimization studio whose objective function is to minimize the overall cost during the study period. The output is obtained under five scenarios i.e. Business-as-usual, Emission Reduction (25%, 50%, 75%), coal restriction and the techno-economic feasibility of natural gas pipelines in the overall energy sector is analyzed from the model. The economic benefits of cross border natural gas transport lines is analyzed and the share of natural gas in the power sector as well as the energy sector has been analyzed from the obtained results of optimal generation mix. The results shows flow of 213Mtoe of natural gas in BAU scenario whereas 494Mtoe natural gas in CR scenario in the TAPI pipeline whereas 593Mtoe natural gas in the CR scenario in IPI pipeline and insignificant flow in BAU scenario. Whenever restriction is applied for emission reduction considerable share of transported natural gas is seen in the fuel consumed with a value 34.64Mtoe in ER25 and increasing upto 843.95Mtoe in CR scenario when compared to the BAU scenario which shows that on restricting emission and coal plants natural gas is seen to be economical to be consumed. Also, total net present value is obtained to be 2351, 2258, 2368, 2536 and 2694 billion USD for BAU, ER25, ER50, ER75 and CR scenarios respectively indicating the rise in cost with the increasing restrictions applied. This shows a trade off between the environment and total cost.

## Keywords:

Expansion model, Energy security, Energy model, Temporal resolution, Multi-regional model

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# Aspect Based Sentiment Analysis Of Nepali Text using BiLSTM

*Piyush Pant*<sup>a</sup>

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**Abstract:**

Aspect Based Sentiment Analysis is a text analysis technique which classifies the sentiment of a specific aspect in a text. There are not significant numbers of dataset for restaurant review in low resource language like Nepali. In this paper we present our work to create a dataset and model for target aspect based sentiment analysis in restaurant review domain. The dataset comprises of comments extracted from social media sites, websites and manually prepared data. Aspect and sentiments are extracted using POS Tagging. Sentiment classification model classifies the sentiments into positive or negative. Target classification model classifies text into 5 target categories Food(F), Price(P), Service(S), Hygiene(H) and Experience(E).

**Keywords:**

ABSA, BiLSTM, LSTM, POS

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# Estimation of Contract Duration for Construction on Urban Road Projects within Pokhara Metropolitan City

*Nabin Gautam<sup>a</sup>, Ramesh Banstola<sup>b</sup>*

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## Abstract:

Implementation status of projects is poor in Nepal, and fails to obtain expected results, hence schedule and price overruns are common. Construction project operates in a dynamic environment, with a great deal of complexity, uncertainty, competition for resources, flexibility and rapidly changing construction technologies. Urban road construction projects include internal, task and external environment which provides resources and limitations. So, appropriate method is required for the proper estimation of contract duration. This study aims in establishing an empirical relation for estimation of contract duration. A total of 28 urban road projects of similar nature with estimated amount ten million within Pokhara Metropolitan City (PMC) at immediate past three fiscal year from 077/78 were taken into consideration. The data was then projected to Brownmillo's time – cost model. Based on the primary data collected through desk study from the sampled urban road projects within PMC, regression analysis was carried out to develop an empirical relation between time and cost of the project as:

$$T = 48.202C^{0.3759}$$

This relation is applicable for the urban road projects within Pokhara Metropolitan City with estimated amount greater than ten million for the public entity, contractors and consultants involved in construction as well as in procurement works.

## Keywords:

Brownmillo's Time–Cost Model, Extension of Time, Project Environment, Regression Analysis

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# Detection of the Diabetic Retinopathy by Classical - Quantum Transfer Learning

*Pumal Dahal<sup>a</sup>, Basanta Joshi<sup>b</sup>*

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## Abstract:

Diabetic Retinopathy (DR), one of the major eye disease which eventually cause blindness if not detected in early phase. The primary cause of DR is due to increase in blood sugar, which blocks the tiny blood vessels eventually causing the hemorrhages in the retina. This paper proposes the hybrid model to detect the DR by addressing the problem in automatic detection of DR. The main concept behind this is embedding of classical CNN and Quantum computing (QC) in which classical CNN extracts the feature and QC is responsible for classification task. Three different pre-trained models ResNet-34, Inception V3 and VGG-19 are used for feature extraction and best performing model is chosen for feature extraction. The dataset used in the experiment is benchmark MESSIDOR-I with two classes, one containing the infected and another the normal one. The performance of hybrid model is compared with the output of classical CNN where, hybrid model with accuracy 86.75% outperformed the classical CNN with accuracy of 82.97%.

## Keywords:

Diabetic Retinopathy, Quantum computing, CNN, ResNet-34, Entanglement

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# Flood Prediction using Time Series Decomposition and Temporal Convolution Network

*Suhel Shrestha <sup>a</sup>, Dibakar Raj Pant <sup>b</sup>*

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## Abstract:

The need for an accurate flood prediction is apparent when considering the severity of human life casualty and infrastructural loss due to unpreparedness during flood and thus the benefits it provides with valuable information for risk mitigation. Flooding is mainly caused by heavy rainfall and precipitation, whose immediate effect is seen in rising river water levels, that can be used as the required time series data for this prediction. Although there have been many methods introduced, there are complexities regarding each leading to certain limitations. Traditional methods of statistical or probabilistic forecasting suffers from assumptions of stationary and linearity and pose additional challenges. In this study, combination of Time Series Decomposition and Temporal Convolution Network is used to make the prediction using water-level observations from three different stations. The time series is deconstructed into its constituent components which is fed into temporal convolution network model individually. The result from model is then reconstructed to get the required prediction on original time series. The model performed with average RMSE, MAPE and  $R^2$  of 0.107, 2.25% and 0.88 respectively.

## Keywords:

Flood, Time Series, Temporal Convolution Network

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# Study on Effectiveness of Barrier Grouting at Transitional Area of Pressurized Tunnel: A Case Study in Upper Tamakoshi Hydro Electric Project-456MW

*Prathiva Bhattarai<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## **Abstract:**

Regarding pressurized tunnel, if there are any crack/void/rock fissures inside rock mass then it may cause high seepage, permeability, erosion, weaken rock mass which eventually might lead to the failure of structure, delay of project, increase in cost and other risks. In pressurized tunnel, if rock mass is very weak, concrete lining can be done instead of unlined tunnel (shot-creting). But in-case of penetration of water into weak rock mass from the transition section (lined-unlined) of tunnel, concreted portion of tunnel might be weak in future. In order to fill the void and make barrier in between lined and unlined tunnel, grouting could become effective which is termed as barrier grouting. But barrier grouting might be useless if method of grouting is not suitable. Considering aforementioned facts, this research including case study regarding barrier grouting at transition section of pressured tunnel in "UTKHEP-456MW" is done. Based on Lugeon test, grouting data, site observation, data analysis is done to find the result of currently practiced method of barrier grouting. Drawbacks of accepted method are listed out. Based on result, modification of method of barrier grouting is given as a suitable method of barrier grouting for pressurized tunnel construction project. This research recommends to avoid Lugeon test prior to doing barrier grouting. Since water is incompressible, if grouting is done immediately after Lugeon test, grout injection might be less than actual void percentage due to injection of high volume of water during Lugeon test. Due to which, void might not be filled with grout. Based on this research, identification and verification of filling such void with grout can be done as reconfirmation test regarding completion of barrier grouting for respective work front.

## **Keywords:**

Barrier Grouting, Identification and Verification of Filling Void with Grout, Lugeon Test, Stopping Criteria

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# Coupled Lateral and Torsional Vibration of a Rigid Disk Attached to a Flexible Shaft

*Sushant Poudel<sup>a</sup>, Mahesh Chandra Luintel<sup>b</sup>*

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## Abstract:

Various rotational mechanical equipment consists of disk attached to a shaft. These undergo torsion and bending in operation. The coupled effect of lateral and torsional vibration is a common reason for failure of system which creates a necessity for it to be studied so that it may help curb the potential failures. Coupled torsional-transverse vibration for a rigid disk attached to the middle of a flexible shaft system is studied. The equations of motion are established by applying the Hamilton equation to the energy expressions and by applying the kinematic constraints. Expressing the displacement as perturbation series separates the governing equation into different orders. This showed interaction of torsional and transverse term at second and higher order. To better understand the interaction, rigid disk attached to a simply supported uniform shaft is considered and its equation of motion is solved using eigenfunction expansion. This response showed that resonance occurs if the critical speed is half of the torsional natural frequency. A numerical example is also considered to determine the characteristics of torsional vibration as a result of this interaction.

## Keywords:

Coupled Vibration, Perturbation, Eigenfunction Expansion

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# Generation and Split of the Compound Words in Nepali Text

*Prabin Acharya<sup>a</sup>, Subarna Shakya<sup>b</sup>*

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## Abstract:

In Nepali language, compound word formation is mostly associated with inflection, derivation, and post position attachment. Inflection occurs due to suffixation, whereas derivation is driven by both prefixation and suffixation. The compound word generated by the rule may produce lots of out-of-vocabulary words due to limited lexical resources and numerous exceptions. Hence, the machine learning approach can help to generate valid compounds and split them into valid morphemes that can be further used as a resource for spelling suggestions, information retrieval, and machine translation. In this research, a method to generate valid compounds from the corresponding compound splits(head word and prefix/suffix/post positions) is suggested. A Bi-LSTM based deep learning approach was used to generate and split the valid compound words. Publicly available Nepali Brihat Sabdakosh data from Nepal Academy and scrapped news data were used for the experimentation. The obtained results were found to be outstanding compared to the rule-based approach applied to a similar job.

## Keywords:

inflection, derivation, post position, out-of-vocabulary, information retrieval, Bi-LSTM

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# Development of a Low-cost GNSS Data Logger and Deployment in Dynamic mode for GNSS Data Logging and Analysis

*Ajay Kumar Thapa<sup>a</sup>, Dinesh Manandhar<sup>b</sup>, Krishna Prasad Bhandari<sup>c</sup>*

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## Abstract:

The global network of satellite constellations known as GNSS is used to determine location and time worldwide using a constellation of many artificial satellites, ensuring that at least four satellites are visible at once from any spot on Earth. A GNSS receiver uses the signals it has received from the visible satellites to calculate the transit time and the distance to each satellite. Low-cost GNSS receivers are those receivers with low costs and compact designs that are frequently utilized for determining position, velocity and time(PVT). The NEO-M8T receiver module is a single frequency, multi-GNSS receiver when paired with a GNSS patch antenna, it can offer a significant level of positional accuracy. A Low-cost GNSS Data Logger using inexpensive hardware and freely available software which is portable, and operable in static and dynamic mode was developed capable of obtaining PVT data as well as raw GNSS data. The PVT information was obtained for both city commute as well as the highway, and visualization was performed between time and speed. In both of the cases, the variation of speed with time, traffic and road conditions could be seen from the comparison. On further analysis, it was found that for the city commute, the decline in speed was seen mainly at the road intersections depicting increase in traffic volume and a necessity to decelerate the vehicle. Whereas in highway, the decline in speed was seen along the road sections where the road conditions are bad or in off-road sections. The raw GNSS data was also automatically logged and with post-processing techniques the positioning could be further enhanced. Overall, this study further recommends studies related to speed monitoring, driving behavior and traffic congestion with the application of low-cost GNSS receivers.

## Keywords:

low-cost GNSS receiver, ublox NEO-M8T, Internet of Things (IoT), low-cost GNSS Data Logger, Traffic analysis

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# Quantum Computer Based Feature Extraction Deep Learning Model for Medical Image Classification

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## Abstract:

Medical images are difficult to collect and are expensive full of insecurities. Pandemic such as COVID-19 break out suddenly and may be transferable from one person to another, so we need to identify the victim and isolate them. Presence of less datasets of such cases are difficult for the classical convolution model for prediction of disease. We need a high performance and accurate image classification model that assists doctor in diagnosis. The CNN layer of deep learning is also computationally complex as it needs a lot of weights to train for better performance, this increases the computational complexity of the model. Therefore, it is very necessary to develop a model which is fast, accurate and computationally efficient model. Here, we present a hybrid quantum classical convolution neural network for image classification. This research consists of three hybrid quantum classical models for three different input size images 28\*28, 32\*32 and 64\*64 pixels. We run the model in simulators and different real quantum devices. We found that the hybrid model with less trainable parameters with low resolution and small training images was able to outperform the classical convolution neural network. The best hybrid quantum-classical model in this work was with an accuracy of 0.9348 and 12318 trainable parameters. The best classical model was with an accuracy of 0.9076. The computationally efficient model was with an accuracy of 0.9239 with 2355 learnable parameters.

## Keywords:

COVID-19, medical image classification, hybrid quantum classical neural networks, quantum convolutional neural networks, quantum computing, image processing.

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# Adaptive Reuse and Energy Performance: Case Study of *Newa Chhen*

*Sajina Shrestha*<sup>a</sup>, *Sanjaya Uprety*<sup>b</sup>

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## Abstract:

Adaptive reuse in traditional buildings is gradually growing all over the world. To conserve the heritage, architectural values, socio-cultural, and economic aspects, repurposing old buildings is widely adopted in Nepal. Research and studies are found in the repurposing of traditional buildings, but merely in the context of energy performance. This research investigated the energy performance of a typical historical building subjected to adaptive reuse. A pilot case study was carried out on *Newa Chhen*, a traditional building, to understand the energy performance of the building. This building was used as a residence and was converted into a bed and breakfast after renovation. Energy modeling using Autodesk Ecotect, 2011 was performed to study the change in energy demand. Necessary data and information were collected from interviews, field visits, available diagrams, and literature. The analysis showed that the heating and cooling loads increased by 36% and 11% after adaptive reuse, respectively. Alternatives for optimization of the demands were also studied by intervening in the fenestration only due to limitations of preserving the exterior façade in its original form. The single-glazed window was first replaced by a double-glazed and then by a double-glazed LowE with the wooden window frame. The results showed that the heating load and cooling load is reduced by 25% and 10%, respectively, in the former option, whereas the heating load and cooling load is reduced by 31% and 15% for the latter. The research concludes that altering the window material can have a considerable effect on energy performance of traditional building.

## Keywords:

Traditional Buildings, Adaptive Reuse, Building Materials, Energy Performance

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# Impact of Inertia-Less Generation in the System Stability: A Case Study with Nuwakot PV

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## **Abstract:**

In this paper, the simulation has been performed for the interconnected system encapsulating the Kathmandu valley, considering the scenario of injection of inertia-less generation at Nuwakot. The load flow analysis before and after the placement of PV infers that the generation being placed away from the load center increases the overall network loss with minor change in the voltage at the nearby substations. The transient analysis indicate that for the higher value of generation, the impact on the frequency and voltage is severe however is within the limits for the case of Nuwakot PV. Finally, the small signal stability analysis confirms that the existing system is stable even due to the small disturbances. However, the system with synchronous generator is more stable than that with inertia-less generation.

## **Keywords:**

PV, inertia-less generation, transient response, small signal stability

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# Artificial Neural Networks for Cost Estimation of Road Projects in Nepal

*Bibhor Acharya<sup>a</sup>, Samrakshya Karki<sup>b</sup>*

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## Abstract:

The success of any Construction Project relies on the accuracy of the cost estimated at the early stage of the Project. Estimating such cost in Road Projects with high accuracy is challenging, as only limited information is available at the early stage. However, past data collected from the completed Road projects can be used to estimate the Construction cost of Road Projects using Artificial Neural Networks. In this study, feed forward artificial neural networks with different numbers of Hidden layers were modeled. Dataset from 70 Road projects of Nepal were collected and models were trained and validated using 10 Folds cross validation. ANN model with structure of (14-6-6-9-1) produced the best result with MAPE of 13.90%. The application of Neural Network in the cost estimation of Road Projects can yield much more quick and accurate results.

## Keywords:

Cost Estimation, Road Construction Project, Artificial Neural Network, Multi-layer Perceptron, Prediction Modeling

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# Variational Auto-encoder Based Multiple Image Captioning Using a Caption Attention Map

*Dinesh Rijal*<sup>a</sup>

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## Abstract:

Image captioning is a current research in the field of computer vision machine learning. It has many practical applications for example remote sensing image analysis, image to natural language generation, understand the image by visually impaired people, etc. This is applicable to services that search for desired content in a large amount of video data and a situation where explanation service for visually impaired people. Most of the previous research has been focused on generating one caption per image. However to increase the usability in the application, it is necessary to generate several different captions that contain various representations for an image. This paper uses the variational autoencoder to generate the captions of the image. It contains two models, one for encoding which is used for extracting the visual feature of the image and decoder for generating the caption based on the image input. This project uses ResNet-152 as a encoder which generates the feature map from the input image and Long short-term memory (LSTM) as a decoder. The Bilingual Evaluation Understudy Score (BLEU) is used to validate the generated caption and the BLEU score 0.81 is obtained.

## Keywords:

Image Captioning, Variational Autoencoder, BiLingual Evaluation Understudy, Long short-term memory, RestNet-151

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# Generation of Digital Elevation Models from Sentinel-1 Datasets and Suitability Assessment: A case study of Melamchi Watershed

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*Pawan Kumar Bhattarai*<sup>a</sup>, *Ananta Man Singh Pradhan*<sup>c</sup>

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## Abstract:

Digital Elevation Model (DEM) represent the continuous variation of earth topography and is main input for wide range of geospatial applications. Mass wasting processes which are frequent in mountainous regions change the landforms of the area. Continuously updated DEMs are thus required for reliable estimates of volume of sediments associated with such events. In this research, we generated DEMs from Sentinel-1 SAR datasets and assessed their suitability for estimation of sediment volumes associated with mass wasting event that occurred in upper parts of Melamchi watershed on 15 June, 2021. The pre and post event DEMs generated using image pairs from ascending and descending flight directions and two orbit tracks showed high difference in elevation range for the same spatial extent and are thus unsuitable for DEMs of Difference technique for volume estimation without further post-processing since DEM generation from Sentinel-1 datasets are influenced by many factors.

## Keywords:

DEM, InSAR, mass wasting, Melamchi, Nepal, perpendicular baseline, SAR, sediment volume, Sentinel-1, SNAP, temporal baseline

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# Techno-Economic Assessment of Green Urea Production in Nepal Utilizing Municipal Solid Waste and Hydroelectricity

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## Abstract:

Urea is primary and extensively used solid fertilizer having high nitrogen content. Worldwide production of urea mainly depends on the fossils fuel. Further, with rapid growth in economy, populations and living standards, municipal solid wastes has been the major problem especially in the developing country like Nepal. Thus, in the context where the country is struggling for adequate supply of urea fertilizer and proper utilization of waste, techno-economic assessment is carried out for concurrently resolving these imbroglio through production of green urea by utilizing the organic and combustible waste of the Kathmandu Valley. Result show that there is potential of 574 TPD (189 thousand tonne per annual) of green urea production from 960.66 TPD of municipal solid waste which accounts for around one fourth of the annual demand in the country. Through the study of change in percentage composition of major components of combustible and organic waste, comparatively less influence is found on urea yield which signifies that urea production remains almost consistent despite certain variation in MSWs composition. The total electricity consumption, CAPEX, OPEX, payback period, internal rate of return and LCOU is found to be 115 MW, 368 million USD, 68.64 million USD, 5.82 years, 25% and 603.71 \$/T respectively. Also, upon risk analysis on LCOU and NPV, 99.77% certainty is obtained for LCOU to be less than the expected selling price 879 \$/T of urea and 99.87% certainty for net present worth of the investment to be positive or greater than zero. Further, upon sensitivity analysis on influence of electricity and municipal solid waste price on LCOU, electricity price is found highly influencing on the LCOU as compared to municipal solid waste price. At 12% interest rate and electricity price 10 \$/MWh, the LCOU is found to be 363.29 \$/T while at 12% interest rate and 100 \$/MWh electricity price, LCOU is found to be 796 \$/T. Thus, municipal solid waste posses a great potential as a perennial feed stock for green urea production to mitigate waste management problems, urea crisis, import dependency, food and fertilizer security in Nepal.

## Keywords:

Municipal Solid Waste, Electrolysis, Green urea, economic analysis, Levelized Cost of Urea

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# Optimal Allocation of DG along with Network Reconfiguration considering Protection Constraints

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## Abstract:

Power losses and voltage deviations in the distribution network are a frequent issue for electrical distributors. Network reconfiguration is a typical method of reducing power losses and improve the voltage profile of a distribution system. At the same time, integration of DGs in the form of renewable energy are increasing which can change the direction of power flow that may lead to blinding of protection and miscoordination of protective devices. It is uneconomical and technically demanding to redesign or replace the original protective devices on distribution network. So, study on network reconfiguration (NR) incorporating distributed generations (DGs), it is usual to have concern on power loss, voltage deviation, DG sizing, and placement and operating conditions of protective devices as these are crucial and necessary during the design stage of distribution system. The objective of this paper is to find the optimal size and location of distributed generation along with network reconfiguration to simultaneously minimize active power losses, improve voltage profile while ensuring existing protection devices remain coordinated under normal and overload condition of the network. Constraints on network reconfiguration, DGs size and protection coordination are explicitly formulated in the proposed method. Genetic Algorithm is used as optimization technique to meet the objective of this study. The validity of the proposed method is analyzed on IEEE 33-bus radial distribution network.

## Keywords:

Protection Constraints, Genetic algorithm, Relay

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# Hybrid Classical Quantum Deep Learning Model For The Classification of Interstitial Lung Diseases

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## Abstract:

Interstitial lung disease (ILD) is associated with certain abnormal imaging patterns seen in computed tomography (CT) images. The correct classification of these patterns plays an important role in making accurate clinical decisions about the extent and nature of the disease. In this research, we train hybrid classical-quantum neural network that combines classical and quantum neural network for the classification of abnormal CT attenuation patterns of interstitial lung diseases using transfer learning (TL). We use VGG16 to extract the features from the image and those extracted features were reduced using affine transformation and embed on the Variational Quantum Circuit (VQC) which is composed from different quantum gates and have characteristics of superposition and entanglement of qubits for classification. We implement the parameter shift rule for the gradient of quantum layer and optimization is done by classical computer. With the implement of parameter shift rule, gradient of quantum circuit is found with the use of same quantum circuit. Experiment were run on quantum simulator and result were compared with the classical pre-trained vgg16 architecture. We found that hybrid classical-quantum neural network enhance the performance of pre-trained VGG16 architecture from our experiment.

## Keywords:

Quantum Computing, Transfer Learning, Interstitial Lung Disease, Hybrid Classical-Quantum Model, Parameter-Shift Rule

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# Factors Influencing the Project Performance of Housing Construction in Kathmandu Valley

*Binita Bhattarai<sup>a</sup>, Mahendra Raj Dhital<sup>b</sup>*

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## Abstract:

The project lifecycle of housing construction is one of the most dynamic and complex process because of the various factors that influence the project and numerous practices adopted by various decision-making teams in different stages of the project. In order to plan, manage and execute a commercially viable and successful project, proper development activities, its key issue and successful practices are imperative which must be properly planned and executed by the developer and their project management team. The goal of this research is to identify the key issues and factors that influence the project performance of the housing construction in different phases of the project life cycle. This paper also identifies the degree of influence of those identified factors in relation to each other. The influencing factors were identified and classified through literature review and the qualitative interview with the industry experts. The quantitative data were collected through questionnaire survey where a total of Twenty four respondents were selected from various housing development companies. AHP method was used to analyze and determine the weightage of the factors which helped in determining prioritization of the factors through multi-criteria decision-making process. The study identified availability and proximity of infrastructure and amenities, project manager's authority and competency, technical capability of the developer, adequate and on time project fund and resource allocation, housing unit and community amenities as the key factors that influence the success of housing projects.

## Keywords:

Housing Construction, project life cycle, success factors, AHP, Multi- criteria decision-making process

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# Planning and Construction Aspects of Hemja-Patichaur Road Tunnel

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## Abstract:

This paper evaluates and discusses the engineering geological conditions and tunnel construction method to be used on the proposed Hemja-Patichaur Road Tunnel (13.5 km). The proposed tunnel lies in the Lesser Himalayan region and the tunnel connects Kaski and Parbat districts of Gandaki Province. Development of this tunnel will substantially reduce both the travel distance and travel time and increase travel safety. Hence, the introduction of tunnel will lead to smooth transportation network. As the TBM excavates only circular geometry and the road tunnels are inverted-D shaped, the conventional drill and blast method was recommended. Also, the cost of the tunnel excavated by TBM is much higher than that of the drill and blast method. The cross-section of the tunnel is chosen on the basis of AADT and the length of the tunnel. Important aspects of tunnel installations like ventilation, lighting and safety equipment are discussed. Drillability condition was assessed to evaluate the deformability of the rocks. Quartzite, metasandstone and phyllite are the dominant rocks found along the tunnel alignment. The mapped RMR and Q values suggest the rock mass along the tunnel alignment will vary from good to poor class. Rock support was estimated using Q system of rock mass classification. Alignment of tunnel was fixed based on topographic condition and use of joint rosette. Quantities of the tunnel works were estimated based on tunnel size and rock mass class along the tunnel alignment. Preliminary cost estimates and construction time of the project were evaluated. Recommendations are given for further site investigations and detailed design and construction.

## Keywords:

Drill and blast, TBM, Q, RMR

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# Design, Fabrication and Performance Analysis of Hydraulic Ram Pump

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Khadka Prasad Timilsina<sup>d</sup> Prakash Giri<sup>e</sup>*

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## Abstract:

The study describes the techniques for fabrication and performance analysis of a Hydraulic Ram Pump (HRP) which is powered by water falling from a small height to lift a fraction to a higher elevation. The pump was fabricated using an inlet diameter of 25 mm whereas the outlet diameter of parts used is 18.75 mm. The size of the waste valve and spring valve was 18.75 mm and the inlet pipe length was 3 m. The mass of the impulse/waste valve used in the pump was 94 grams. Preliminary testing was done to confirm the pump's operation feasibility and different experimental data values were obtained after further testing. Testing was done by varying input and output heads to obtain different data for pump parameters. Performance curves were plotted in the graph for obtained data values to analyse the characteristics of pump parameters. The designed efficiency of the pump was initially assumed to be 50 percent and the experimental value of efficiency was calculated for each observed data. Both practical efficiencies with loss and theoretical efficiency excluding loss were calculated. The maximum value of experimental efficiency was 25 percent and the value of theoretical efficiency averaged to 46.205 percent. Obtained values of theoretical efficiency fell under the confidence interval of the t-test with a 5 percent significance level when statistical analysis of the project was done which proved the project to be efficient technically.

## Keywords:

Hydraulic Ram Pump, Waste Valve, Water Hammer, Unplasticized Polyvinyl Chloride, t-Test

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# Gender Inclusiveness in the Planning of Urban Spaces

*Astha Acharya*<sup>a</sup>, *Ajay Chandra Lal*<sup>b</sup>, *Basana Sapkota*<sup>c</sup>, *Gaurav Paudel*<sup>d</sup>

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## Abstract:

Due to the difference in the biological and social need of men and women in urban society, they have different ways of using public spaces. Such concerns are rarely addressed in the planning process. Therefore, cities planned and built in gender-neutral ways limit women and girls from exploiting the city's infrastructure and services equitably. This paper aims to identify the extent to which gender inclusivity is considered during the planning stage of urban spaces in Kathmandu and what impact it has on the designed space's gender inclusiveness. It was found that there was limited involvement of the female in the planning and designing process of the parks. The infrastructure of the park was found gender neutral and the percentage of females using the park was significantly lower than males. This was due to the lack of incorporation of a female perspective in the design. Hence, functions such as child cares in parks and less male-dominated spaces need to be integrated into the design through female participation starting from the planning phase to render the urban spaces gender-inclusive.

## Keywords:

Gender, Inclusion, Urban Spaces, Gender Inclusiveness

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# Human Emotion Recognition from Gait Analysis using Graph Convolution Network

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*Shashidhar Ram Joshi*<sup>c</sup>, *Janardan Bhatta*<sup>d</sup>

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## Abstract:

Human walks refers to a constantly motion that represents not only flexibility, but it can too be used to identify the walker by either human spectators or computers. The mapping between differing emotions and walks patterns supports a new beginning for automated emotion recognition. The classification of perceived human emotion from gaits has been based on a Spatial Temporal Graph Convolutional Network (ST-GCN) architecture. From the RGB video of person's walking, the formulation implicitly used the gait features to classify the emotion of the human into one of the four emotions: Angry, Neutral, Happy and Sad. The annotated 1835 ELMD (Edinburgh Locomotion Mocap Database) dataset has been used both for 2D and 3D Model. The dataset has been increased up to 3841 after augmentation. The neural network model has been trained on annotated real-world gait videos and acquired an efficiency of 88.67% for 3D model and 96.77% for 2D model.

## Keywords:

Emotion Recognition, Gait, Gait Analysis, Gait Cycle, GCN, Human Gait, ST-GCN

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# Parametric Study on Slope Reinforced With Pile

*Ramesh Kumar Devkota <sup>a</sup>, Bhim Kumar Dahal <sup>b</sup>*

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## **Abstract:**

A slope of proposed residential building site at Bode, Bhaktapur is taken as a case study to perform slope stability analysis of natural slope by performing numerical analysis on the critical slope among three slope and pile reinforced soil slope after assigning residential building load. Numerical models were developed in PLAXIS 2D V20 for parametric study of vertical pile i.e., depth of installation of pile, diameter and spacing based on factor of safety. A comparative study was performed by changing the configuration of vertical pile to the slope without pile after assigning the building load. The result of the study is that pile has better performance on slope.

## **Keywords:**

Slope stability, Finite Element Method, Pile, Factor of Safety, Parametric Variation

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# Automated Log Parsing through Named Entity Recognition

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## Abstract:

Modern software-intensive systems generate millions of logs each day for troubleshooting purposes. These devices log their activities and events in some form resulting in exponential growth in the number of logs generated. These logs are in thousands of formats, some of which are structured while others are not. Extracting information from the structured logs is simple and can be done accurately using classical programming approaches. However, the remaining semi-structured logs are difficult to work with. Structured logs refer to the logs following specific format such as json, xml, cef and so on. Semi-structured logs here refers to the logs that follow some specific log template generated from the logging statement written by the system developer which might not necessarily have keys demarcated in the log itself. An example of a system whose logs are semi-structured is the Unix system. Unix logs come with common header formats with thousands of variants in the log body format. While using classical programmatic approach, whenever a new log format appears, extra effort has to be put to extract the information from the log which is a never-ending process. This research work aims to solve this through a deep learning-based named entity recognition algorithm. Name Entity Recognition, a modern Natural Language Processing (NLP) approach, is used to create a model trained with large amount of known data points that helps to identify and extract meaningful information from new logs of a variety of formats. The scope of this research work is to automate log parsing for such semi-structured logs generated from Unix processes. This project has studied creation of a Bidirectional Long Short-Term Memory (BLSTM) model to extract important values from these logs and assign them certain field names. The model was able to achieve a F-measure of 89% on the test set.

## Keywords:

Log parser, Long short-term memory, Named entity recognition, Regex-based parsers

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# A Proxy Basin Approach for Hydrological Modelling in Ungauged Snow-fed Basin of Nepal

*Nischal Karki<sup>a</sup>, Narendra Man Shakya<sup>b</sup>, Ananta M S Pradhan<sup>c</sup>*

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## Abstract:

Runoff prediction in ungauged basins is a vital task in hydrologic sciences. This study implements a GR4J rainfall-runoff model to simulate runoff in two nested basins of western Nepal. The calibrated model parameters are then interchanged in a proxy-basin framework in order to assess spatially transferability of model parameters for runoff simulation in ungauged basin. The calibrated model showed good performance for both the downstream Chamelia basin and upstream Naugragad basin with a NSE of 0.86 and 0.83 during calibration and 0.84 and 0.64 during validation respectively. Spatial transfer of calibrated model parameters from upstream to downstream basin and vice-versa closely match the hydrograph obtained from calibrated model. The results show spatial transfer of model parameters as a feasible option for streamflow prediction in ungauged basins of Nepal.

## Keywords:

Ungauged, Chamelia, Proxy-basin, GR4J, Calibration

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# Behaviour of Highly Weathered Slope under Various Support Conditions

*Ashish Thapa<sup>a</sup>, Santosh Kumar Yadav<sup>b</sup>*

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## Abstract:

This paper describes a method that allows direct use of the Mohr-Coulomb and Generalized Hoek-Brown criterion in Finite Element (FE), Shear Strength Reduction (SSR) analysis of weathered rock slopes. To investigate the failure process in the debris/rock slides, the slopes were modeled as a continuum using 2D finite element plain strain approach. Shear strength reduction analysis is performed to determine the most critical strength reduction factor. When compared to field observations, it was discovered that the computed deformations and stress distributions along the failure surface were in good agreement. The analysis's findings suggested that rock/debris slide slopes are quite unstable. However, once a failure has place or a possible failure is discovered, information and knowledge of the key causes of the failure are needed to create a successful remediation plan. It is essential to quickly and effectively assess the stability of the affected slopes or look into the reasons behind slope failures. A slope stability analysis, also known as a landslide hazard analysis, is carried out to access the soil mechanics and make plans for upcoming stabilization initiatives. This study aims at fulfilling these shortcomings and propose a framework to choose the support design parameters for the most efficient design.

## Keywords:

Finite element modeling, Shear strength reduction analysis, Continuum Plain strain approach, Slope failures

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# Drought Risk Assessment in Sunkoshi River Basin: An Application of Hydrological Model

*Prabhat Banjara<sup>a</sup>, Vishnu Prasad Pandey<sup>b</sup>, Pallav Kumar Shrestha<sup>c</sup>*

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## Abstract:

Drought is an event that lasts for months or years and causes economic damages, compromises ecosystem and threat food security. In order to reduce drought impacts drought risk assessment, need to be done. Commonly used methods for drought risk assessment are, observation-based method, in situ data-based method, remote sensing data-based method, model-based method. This study uses model-based method to assess the agricultural drought risk using Soil Moisture Index (SMI) in Sunkoshi, Hampuachaur. The model was optimized at 0.25° resolution by taking KGE as objective function and was analyzed at 0.015625° resolution. The model was calibrated from 1981-2000 and validated from 2001-2016. Spatial and temporal variation of drought risk was determined at the Sunkoshi, Hampuachaur basin. SMI was calculated on the basis of base period (1951-2000) for the evaluation period (2001-2016). From the area under drought August of 2006 experiences maximum area under drought i.e., 50.76 %; followed by January of 2013 (27.39%); December of 2012 (27.20%); November of 2012 (25.08%); September of 2005 (23.16%); August of 2016 (21.86%); March of 2009 (19.14%); September of 2002 (14.68%); February of 2009 (13.37%); October of 2014 (11.30%). Year 2009 and 2010 experiences maximum duration of exceptional drought i.e., for 7 months each; 2006 and 2013 for 6 months each; 2001 and 2016 for 4 months each; 2008 and 2012 for 3 months each; 2004, 2005, 2015 for 2 months each; 2002 and 2014 for 1 month each. In the evaluation period abnormally dry condition is in 2988.58 km<sup>2</sup> area, moderate drought is in 4327.09 km<sup>2</sup> area, severe drought is in 153.42 km<sup>2</sup> area, extreme drought is in 365.76 km<sup>2</sup> area, exceptional drought is in 204.16 km<sup>2</sup> area in Sunkoshi. Our results indicated that the mHM model can be applied in the Sunkoshi, Hampuachaur basin to evaluate the drought risk in that basin.

## Keywords:

Drought, Mesoscale Hydrologic Model (mHM), Koshi River Basin (KRB), Soil Moisture Index (SMI)

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# Routine Pile Load Test: A Case Study of Bagdwar Khola Bridge

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## Abstract:

The use of bored cast in situ piles for supporting bridge foundations is becoming popular among the designers in Nepal. Whereas, proper judgement and experience is very important in declaring the ultimate capacity of bored piles as the calculations are based on the empirical formulas which were generated elsewhere. Hence, appropriate load tests must be carried out to verify and substantiate the designed capacity of Pile. Large scale static pile load test on bored piles of bridges are rarely conducted in Nepal as it is costly, time consuming and requires high capacity loading arrangements and reaction mechanisms. Hence, Routine pile load tests are carried out to verify the load bearing capacity of working piles at service loads. Routine pile load tests for bored piles were carried out for one test pile in each foundation of Bagdwar Khola Bridge and settlements were noted using dial gauges. The Ultimate pile capacity was extrapolated using Chin, Davission and latest technique suggested by Giovanni Dalerici and Rossella Bovolenta. The proposed technique was also applied to estimate ultimate loads of two of the piles on which Initial Pile Load Test were performed and the result found are in good agreement with the method proposed by Hirany and Kulhawy. The Load-Settlement Curve from the Routine Pile Load Test is extrapolated upto the ultimate capacity and the shaft, base and total load curves are also generated. The method proposed can be used to estimate the ultimate capacity of bored piles provided the pile displacement is at least 0.5% the pile diameter and there are at least five loading steps.

## Keywords:

Bored Pile, Routine Pile Load Test, Extrapolation, Load-Settlement Curves

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# Effectiveness of Grouting at Hydropower Tunnel: A case Study of Headrace Tunnel at Super Dordi Hydropower Project

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## **Abstract:**

The tunneling activities have increased considerably with the development of many hydropower projects in Nepal. Majority of tunnel in the design phase decision in selecting tunnel alignment and predicting the rock mass quality and rock support requirement has direct influence on the overall cost and time requirement. The geology along a tunnel alignment plays a dominant role in many of the major decisions that must be made in planning, designing, and constructing a tunnel. Mainly with the headrace tunnel water inflow and leakage problem induces the instability along with sometimes the losses of the valuable water which makes the huge economical losses and create the safety issues. This paper mainly focused on the leakage assessment and control measure which helps to identify the possible water leakage from unlined or shotcrete lined tunnels and method of control on it. Different methods of leakage control and effectiveness is also discussed. Effectiveness of post injection grouting in the headrace tunnel of Superdordi Hydropower project taken and concludes the role of grouting as control measure of leakage in tunnel.

## **Keywords:**

Leakage, inflow, estimation, effectiveness, and grouting

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# Factors Affecting Turnover Intention of Construction Professionals in Nepali Construction Industry

*Manish Mahat<sup>a</sup>, Mahendra Raj Dhital<sup>b</sup>*

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## Abstract:

Retention of skilled technical manpower is essential for gaining competitive edge against the competitors, increasing organizational efficiency and profit, boosting employees' morale, strengthening company culture and gaining various other benefits. Due to its special nature, the rate of employees' turnover is higher in construction industries than other industries. Employee turnover refers to the voluntarily leaving the organization by the contracted employees under a given period of time. Turnover intention refers to the thinking or intending to leave the organization. The turnover intention closely relates with the actual turnover since employees leave the organization after thinking about leaving. This paper aims to determine the factors that determines the turnover intention of construction professionals in Nepali construction industries. In order to achieve the objective, quantitative research method is applied. Questionnaire Survey based analysis is conducted consisting turnover intention scale and 7 major factors consisting 33 measurement items is done among the class A and class B construction companies registered in FCAN and response from 61 respondents is used for analysis. The data analysis conducted using SPSS and MS excel results showed all the 7 identified factors are significantly correlated with the turnover intention. The most imperative factor is identified as Work Environment with the highest value of Relative Importance index followed by Work Benefits, Organizational Politics, Job Satisfaction, Organizational Commitment, Colleague Relation and Person-Organization Fit respectively. The result obtained from this research will be useful to identify the important factors affecting turnover of construction professionals which in turn helps to reduce turnover and develop retention strategies in Nepali construction industry.

## Keywords:

Employees' Turnover, Construction Professionals, Construction Industry, Quantitative Research, Correlation

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# Cost Overrun in Building Construction due to Material Wastage: A case study of Kathmandu Valley

*Taraman Bhandari <sup>a</sup>, Mahendra Raj Dhital <sup>b</sup>, Nagendra Bahadur Amatya <sup>c</sup>*

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## Abstract:

While wastage of materials has become a serious problem requiring urgent attention in the Nepalese Construction Industry, cost overrun is a problem, which affects 90 percent of the completed projects in the world; the argument on how to reduce/eliminate cost overrun has been ongoing for the past 70 years; as the on-site wastage of materials leads to increases in the final project cost. Studies from different parts of the world have shown that construction-material waste represents a relatively large percentage of production costs. Consequently, as a result of low levels of awareness, the Nepalese construction industry pays little attention to the effects of generated material waste on cost overruns. Thus, this research aimed to investigate the relationship between material waste and cost overruns in the Nepalese construction industry. A comprehensive review of the related literature revealed that all material waste causes are related to cost overrun causes at both pre-contract and post-contract stages of a project; but not vice versa. The mixed method (quantitative and qualitative) approach that is rooted in the positivist paradigm was adopted for this study. Kathmandu, the federal capital city of Nepal was the selected geographical scope of this research, out of which thirty (30) construction projects were purposeful. The research instrument was an interview guide used in conjunction with a tick box. Other sources of data included field investigation (measurement of onsite material waste) and the collection of archival records from bills of quantities, project records, and specifications. Analyses of the findings lead to the conclusion that a relationship exists between material waste and cost overrun; at the construction stages of a project. The implication is that an increase in material wastage on-site leads to a corresponding increase in the amount of cost overrun, regardless of the percentage allowance for material waste in the process of bill preparation. The study also concluded that the average percentage contribution of material waste to project-cost overruns is four (4) percent. Material-waste sources, causes, and control measures were found to have significant effects (very high, high, medium, low, and very low), in causing or minimizing cost overruns at both pre-contract and post-contract stages of projects. The research has developed a conceptual model for the management of material waste and cost overruns in the construction industry based on the results and informed by the theoretical framework. The research has also developed a mathematical model for quantifying the amount of material waste to be generated by a project; as well as a mathematical equation for the effective management of material waste and cost overrun for projects. The study has achieved its aim of establishing an understanding of the issues leading to the relationship between material waste and cost overruns, as well as their management in the Nepalese construction industry. The study recommends that the management of material waste and cost overrun should be revised, based on the findings of this research, and included as part of the procurement process.

## Keywords:

Cost overrun, Material wastage, mathematical model, Nepalese procurement process

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# Analysis of $\text{Ag}_3\text{PO}_4$ immobilized Electrospun PAN composite Nano-fibers for its morphological Properties

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## Abstract:

By using a quick and inexpensive electro-spinning approach, PAN nano-fibers were first surface-modified with amidoxime groups  $-\text{C}(\text{CN}_2=\text{NOH})$  by utilization of Hydrazine via coordinate bonding to anchor the  $\text{Ag}^+$  ions onto the fibers. The coordinated positive silver ions were then permitted to react with negative phosphate ions to create the  $\text{Ag}_3\text{PO}_4/\text{PAN}$  composite nano-fibers. The composites that were produced in this way were evaluated using XRD, FTIR, and UV-vis. Photocatalytic behaviour and antibacterial testing was done on the composite and analyzed. According to experimental findings, composite nano-fibers made by reacting functionalized PAN nano-fibers with 0.02 M concentration solutions of  $\text{AgNO}_3$  and  $\text{Na}_2\text{HPO}_4$  are found to be more effective in the photo-degradation of dyes when exposed to visible light and for antibacterial activity 0.05 M concentration solutions was found to be effective.

## Keywords:

Amidoxime groups, Hydrazine, Composite nano-fibers, Photocatalyst,  $\text{Ag}_3\text{PO}_4$ , Electrospinning.

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# Cross-Border Transmission Line Cost Burden Sharing among BBIN Countries using Cooperative Game Theory

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## Abstract:

There is a rapid growth in electricity demand in Eastern South Asian countries (Bangladesh, Bhutan, India, and Nepal) however, the resources and demand are scattered unevenly in the region. The countries of this subregion have already agreed to Paris Agreement's goal to keep the average global temperature well below 2°C above the preindustrial levels. The share of resources in the power generation mix and different load patterns and demands in the member countries have created an increased opportunity for electricity trade. The region is divided into four nodes and five power lines. Five interconnections between India-Nepal, India-Bhutan, India-Bangladesh, Nepal-Bangladesh, and Bhutan-Bangladesh are constructed. Even though the electricity trade is present in this region there is an absence of scientific methods for cross-border power transmission line cost sharing among these countries. This study deals with quantifying the benefits of the electricity trade along with suggesting cost-benefit techniques. Cost-benefit allocation of the interconnections is analyzed according to the marginal contribution of each country to the grand coalition. Accordingly, Game Theory concepts (Shapely Value) are used in our analysis. Moreover, we employ the concept of cooperative game theory to attempt to distribute fairly the cost of power transmission lines within the interconnections. The investigation is performed using a dynamic optimal power generation mix model. We observed that the grand coalition (i.e., the scenario where every country agrees on cooperation) is optimal. We also found that allocated cross-border power transmission line cost is maximum for India. As it is the largest country and has a high demand for electricity, it has to import more from other countries which need the construction of more power transmission lines.

## Keywords:

Electricity trade, energy model, temporal resolution, multi-regional model, game theory concepts, shapely value

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# Nepali Sign Language Gesture Recognition using Deep Learning

*Sanyukta Ligal<sup>a</sup>, Daya Sagar Baral<sup>b</sup>*

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## Abstract:

Sign languages play a vital role in order to develop a proper communication between the hearing impaired people and normal people. Hand gestures are most widely used sign languages which includes hand movements. In this paper we proposed a Nepali Sign Language Gesture Recognition System where both hands or single hand are used for performing gestures. Two approaches are used in which feature extraction is done by using CNN model. The classification part is done by using RNN in first approach and Vision Transformer in second approach. Results obtained from approach 2 is found to give better accuracy than approach 1. These two approaches were able to recognize word level Nepali Sign Language gestures in which percentage of 87 test accuracy has been obtained from approach 1 where RNN has been used as a classifier and percentage of 88 test accuracy has been obtained from approach 2 where Vision Transformer has been used as a classifier. VGG-16 has outperformed than two other models for features extraction part. Thus, the features extracted from VGG-16 has found to be better has compared to other two CNN models. Likewise, the results obtained shows that Vision Transformer can outperform RNN not only in machine translation task but they can also do better in task of computer vision.

## Keywords:

Convolution Neural Network, Vision Transformer, Gesture, Nepali Sign Language

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# Conversion of Petrol Driven Vehicles into Electric: Detail case assessment of Nepal

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## Abstract:

The broad goal of this research is to explore the economic, environmental, and socio-cultural aspects of sustainable development due to the conversion of petrol-driven vehicle into electric. Study has been started by exploring the vehicle conversion history and further study flows with the identification of conversion cases in present scenario of Nepal. The paper focuses on the cost-benefit analysis of vehicle conversion in terms of initial investment, conversion cost operational cost and maintenance cost. The paper also seeks to quantify the reduction of carbon footprint which results from conversion and also tries to figure out the socio-cultural perception towards conversion. Five different cases of vehicle conversion in Nepal are taken and a broad study has been done. During the study, many research gaps and challenges were found regarding conversion. However, the use of electric vehicles is just an emerging mode in Nepal and thus, the conversion cases are so few in number. The study employs a mixed methodology that fits into a sequential exploratory design. Interviews, questionnaires, and participant observation were used to collect the data.

## Keywords:

Petrol driven vehicle, Vehicle Conversion, electric vehicle, plugin hybrid vehicle, Sustainable development

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# Photocatalytic Degradation of Dye in Aqueous Solution using Metal Oxide/Activated Carbon Nanocomposite

*Anshu Kumari*<sup>a</sup>, *Manoj Gyanwali*<sup>b</sup>, *Sahira Joshi*<sup>c</sup>

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## Abstract:

This study focuses on photocatalytic degradation of persistent organic pollutants from aqueous solution. For the effective photocatalytic degradation, Zinc oxide/activated carbon (ZNO/AC) and Copper oxide/ activated carbon (CuO/AC) nanocomposites have been synthesized by one step facile hydrothermal process. Activated carbon was also prepared from jujube seed stones by using ZnCl<sub>2</sub> as an activating agent at carbonization temperature 500<sup>0</sup>C for 3 hours. The prepared activated carbon (AC) was characterized by iodine number, methylene blue number and used for nanocomposite fabrication. The degradation effect of nanocomposites on methylene blue (MB) and methyl orange (MO) were studied under UV-light irradiation. The ZnO/AC showed efficient degradation of MB and MO dye than that of the CuO/AC nanocomposite and pristine Zinc oxide nanoparticles.

## Keywords:

ZnO/AC nanocomposite, Photocatalytic degradation, CuO/AC nanocomposite, MB

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# Architectural Design Aspect of Value Engineering In Heritage Building: A Case Study of “Panchadeval Bridhashram”

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## Abstract:

Many scholars have suggested that application of value engineering during design phase can decrease the cost of construction through 5% to 10%. Though it has lots of importance, value engineering is hardly found in developing country like Nepal. Therefore, the overall objective of the study is to follow value engineering approach during the initial phase of retrofitting and reconstruction phase of Panchadeval Bridhashram project and optimize the estimated cost of the project. In achieving the stated research objective, both qualitative and quantitative research method has been adopted i.e., mixed method case study. Theoretical proposition for value engineering was proposed, and quantitatively above proposition was verified. The research data were collected through the literature review, site visits, interrogations, consultants related to the project. Data analyses were done both qualitatively and quantitatively. From the qualitative analysis it was found that, the extra added redundant structures and space could be well managed and planned by restoring the heritage, architectural, religious, spiritual, and contemporary use value. Therefore, value engineering not only optimizes cost, but also improves overall quality and function of the building.

## Keywords:

Value Engineering, Panchadeval Bridhashram, Retrofitting, Redundant, Reconstruction, Value, Cost Optimization

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# Axisymmetric Analysis of Cylindrical Shells Considering Geometry and Lattice Variation

*Nabin Tandan <sup>a</sup>, Hikmat Raj Joshi <sup>b</sup>*

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## **Abstract:**

An analytical approach has been developed for the axisymmetric analysis of lattice cylindrical shells as a homogenization technique. This approach is applicable to the axisymmetric strained state of the shells considering variation in geometry and lattice configurations. For the numeric verification, the analytical solution obtained from MATLAB is compared with results obtained from FEM software ANSYS. The deformations in the resulting structure is calculated from the stress resultants in its structural members.

## **Keywords:**

Lattice, Axisymmetric strained state, Homogenisation

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# English Sign Gesture Recognition using CNN

*Sushant Bhattarai*<sup>a</sup>, *Yateesh Bhurtel*<sup>b</sup>, *Bipin KC*<sup>c</sup>, *Sudarshan Subedi*<sup>d</sup>

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## Abstract:

The understanding of sign language is one of the most exciting fields of gesture recognition study. In this study, camera vision-based methods are employed for image analysis. The goal of the project is to develop sign language system that can identify typical English phonetics as well as a variety of gestures that can be converted to text and subsequently to spoken sentences. A different type of computing technology called convolutional neural networks (CNN) seeks to replicate how the brain operates. An audio built-in system is also used to improve communication between the general public and the community of hearing impaired people. Text-to-speech (TTS) synthesis, a method for automatically converting text into speech, is used and it is utilized in this study to read aloud letters and words that the system has recognized.

## Keywords:

Gesture Recognition Systems, Convolutional Neural Network, Text to speech conversion, Histogram

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# Load Frequency Control of Integrated Nepal Power System

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## Abstract:

The frequency stability of a power system is concerned with the overall inertia of the system, effective droop coefficient, and governor/turbine time constants. The frequency sensitive loads like motor, transformers operates inefficiently for frequency unstable system which results poor output power. Variable frequency causes mechanical resonance which creates large amplitude stress in turbine blades. The speed of the motor depends on the system frequency. A stable system frequency should be maintained within specified limits for proper operation of power system equipment. The frequency related parameters change with the change in load and the type of generation integrated into the power system network. This research paper analyzes the Load Frequency Control of Integrated Nepal power system (INPS) which is responsible to maintain the frequency and power output in the interconnected power system. It keeps net power exchanges within control regions at predetermined levels, and keeps the distribution of power among units at the optimum economic levels. This paper studies three different scenarios which includes base case scenario, 50% reduction in droop and 50% reduction in inertia along with load change scenarios. This paper considers two area system; Area-1 as INPS and Area-2 as Indian Power System. The simulation result shows steady state deviation errors in each cases, the transients in frequency, and the changes in mechanical power response of the area that has undergone various modifications.

## Keywords:

Load Frequency Control, Two Area System, Tie-line Power, Inertia Constant, Damping Control

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## Adsorptive Removable of Methylene Blue using low-cost adsorbent prepared from *Azolla pinnata*

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*Hem Raj Pant*<sup>e</sup>

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### Abstract:

This study was performed in order to investigate the low cost adsorbent derived from the *azolla pinnata* (AP) biomass for removing the methylene blue dye from the aqueous solution. The influence of the various adsorption parameters such as initial dye concentration, doses and contact time were studied. The results showed that the adsorption percentage of the methylene blue was reduced with the increment of the initial dye concentration. The dye adsorbed percentage was found to be higher than 90% in lower concentration (50 mg/l to 300 mg/l). Langmuir isotherm best fits the experimental data model which suggest the monolayer adsorption of the dye by biomass. The maximum Langmuir adsorption of the dye was found to be 344.827 mg/g. In addition to this, the rate of the adsorption was best fitted with the Pseudo-second order kinetic model. Our Studies shows that the biomass of the *azolla pinnata* can be used as the alternative adsorbent for the methylene blue dye removal

### Keywords:

Azolla Pinnata, Biomass, Methylene blue Dye, Removal Efficiency

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# Climatic variability change analysis in Tamor River Basin Projected by CMIP6 Model

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## Abstract:

A sound understanding of projected climate is crucial for the effective structural design and planning of adaptation and mitigation measures in combating the adverse effects of climate change. This study projects precipitation, Tmax, and Tmin in the Tamor River Basin (TRB) up to 2100 using CMIP6 GCMs model output under two shared socioeconomic pathways, SSP245 (4.5 Watt/m<sup>2</sup>) and SSP585 (8.5 Watt/m<sup>2</sup>). All selected meteorological stations in the basin showed a widespread and robust rising trend of temperature, decrease in precipitation in NF, and increase in FF using the Multi-model Ensemble (MME) of selected GCMs, with very few exceptions. The multi-model ensemble indicated considerable variation in annual precipitation, initially decreasing up to 2.5 % in NF and increasing to 5.73 % at the end of the 21st century. The average annual Tmax across the TRB is projected to increase by 0.37 °C, .96 °C, and 1.25°C in NF, MF, and FF under the SSP245 scenario. Similarly, under SSP585, Tmax will increase by 0.4°C, 1.26°C, and 2.29°C to the base period. Tmin under SSP245 increases it by 0.2°C, 0.8 °C to 1.2°C in NF, MF, and FF. Similarly, under SSP585, Tmin will increase by 0.4°C, 1.6°C, and 3.0 °C. From MME analysis, there is no clear changing trend of precipitation, Tmax and Tmin, according to season, but for most of the station, precipitation increases in winter and monsoon season and decreases in pre-monsoon and autumn. As with precipitation, Tmax and Tmin increase in the winter season and decrease in the autumn season. This bias-corrected Projection of Precipitation, Tmax and Tmin may apply to future research on the basin's climate change and hydrological analysis.

## Keywords:

Climate Change, CMIP6, GCM, SSP, Tamor River Basin (TRB)

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# Assessment of Service Quality of Public Bus based on Comfort Features

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## Abstract:

Since the major portion of public transportation in the Kathmandu is covered by the bus services, it has become increasingly important to conduct regular assessment of user satisfaction with these services. Although many researchers have attempted to assess the service quality of public transportation, few have attempted to benchmark service quality of qualitative features such as comforts in public buses, which are often difficult to describe quantitatively. The main propose of this this paper is to determine the benchmark level of service quality of public buses based on user's perception. The technical terms used in study was "bus comfort features" based on various bus design sub-components and features that reflect various aspect of bus users comfort. For this, an average weighted scoring technique was combined with the method of successive interval scaling to create a five graded LOS scale that can benchmarks service quality of public bus based on user's satisfaction for the qualitative features. The majors finding of this study was a LOS scale from LOS A to LOS E that represent users perception from very good to very poor service quality of public buses that are currently operating in Kathmandu valley. For this study different five bus types i.e. Old City bus, Sajha yatayat bus, Digo yatayat bus, Deluxe bus and Electric bus were selected from different routes of Kathmandu valley. Thus using above method it was observed that LOS of Electric bus and Sajha yatayat bus based on users perception was LOS B (Good) with the average total weighted score of 6.00 and 5.14 respectively. Similarly Digo yatayat bus and Deluxe bus was perceived as LOSC (Average) with score 4.95 and 3.85 respectively whereas City yatayat bus was perceived as LOS D (Poor) with average total weighted score of 3.64 respectively. Similarly, the degree of criticality of different features was determined based on user perception, which identified the key features for improvement and was also found to differ for different bus types.

## Keywords:

LOS scale, Bus comforts features, Qualitative service quality assessment, Law of Successive Interval Scaling

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# Fantasy Premier League Performance Prediction

Pratik Pokharel <sup>a</sup>, Arun Timalsina <sup>b</sup>, Sanjeeb Panday <sup>c</sup>, Bikram Acharya <sup>d</sup>

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## Abstract:

Fantasy Premier League (FPL) participants often use personal bias, favoritism and recency logic, when picking the squad or making the transfers. Their decision is often based on which club they support and on the so called "star image" of a player. But if these factors are put aside and decisions are made focusing on possible return of investment(ROI), it could be a wiser option. This paper presents a rational approach to the player selection, team drafting and transfer- by predicting return of investments- using xgboost regression. In addition, the effects of fixture congestion on FPL points is also assessed by using the mid-week cup fixture data. On evaluation using FPL global ranking- using the initial drafted team throughout the season without transfers performed better. The transfer algorithm had shortcomings due to its dependency on accuracy of regression model. The mean rmse score for all players was 2.048. The effect of cup fixture congestion was found to be insignificant as far as FPL points is concerned.

## Keywords:

FPL, xgboost regression, rmse, ROI

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# Analyzing the Future Flooding and Risk Assessment under CMIP6 Climate Projection Using HEC-HMS And HEC-RAS 2D Modelling of Babai River Basin

*Anup Dahal<sup>a</sup>, Pawan Kumar Bhattarai<sup>b</sup>, Surendra Maharjan<sup>c</sup>*

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## Abstract:

Floods are the mostly occurring natural hazards around the globe. Many lives and property are in a serious threat every year due to this hazard. Nepal has also always been a part of it due to fast flowing larger rivers. Terai mainly becomes the main victim yearly and bring about loss of lives and property. Due to these Hazards, flood prediction has always been useful in eradicating the Risks it brings about. In order to simulate the rainfall-runoff process in river basins, various well-known and widely-applicable hydrologic models have been developed, including HEC HMS (version 4.9) by the US army corps of Hydrologic Engineering center. and HEC-RAS version 6.0.2 which is able to perform two dimensional unsteady simulations. In this study Babai River is modeled and run using HEC HMS rainfall runoff model for hydrologic analysis and HEC-RAS 2D unsteady simulation for hydraulic analysis of results and for preparation of hazard and risk maps for different flood flows and future climatic flood flows. HEC-HMS is used for the hydrologic analysis, and HEC-RAS is used for the hydraulic modeling. By creating flood inundation maps, forcing the model with predicted precipitation can benefit the flood warning system. CMIP6 climate projection is used for generating future precipitation data of extreme climatic condition. This study also compared the future and existing flooding scenarios with to understand the increased severity of flooding in future years. This study compares the historical flooding extent to the estimated flooding in the future as a result of changing global climate. The predicted flood risk was assessed, and vulnerability and hazards assessments were used to help determine the level of risk in the research area. Finally, the projected design discharges were used to map the risk zones. The area of the future floodplain that will be flooded was thus predicted by this study. In order to assess the extent to which urban and agricultural regions might be affected by rising flood levels, it also evaluated the potential for future flooding.

## Keywords:

Climate Change, Coupled Model Inter Comparison Project Phase 6 (CMIP6), HEC-HMS, HEC-RAS

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# Seasonal Analysis of Precipitable Water Vapor Variation using GNSS Observation

Roshan Paudel <sup>a</sup>

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## Abstract:

The amount of water that condenses from a column of humid air in a unit cross-sectional area is known as precipitable water vapor (PWV). As it is created by evapotranspiration from the surface into the sky and condenses into clouds that may return to the surface in the form of precipitation, water vapor plays a significant role in climate change and hydrological processes. Weather predictions and climatology have long focused on the variability in the amount of water vapor in the atmosphere. The variance of GNSS-derived PWV under various weather circumstances is examined using the observations from two GNSS stations in Pokhara and Nagarkot. A total of 82 days of GNSS data in the different seasons were processed utilizing the online Precise Point Positioning offered by Canadian Spatial Reference System (CSRS-PPP). The 15-second RINEX data was obtained from Pokhara and Nagarkot GNSS stations. The processing mode was static under International Terrestrial Reference Frame (ITRF), where the epoch was as the GPS data and a Universal Transverse Mercator zone was calculated from the longitude. The dry and wet component after processing was obtained in the troposphere file. This file contains the Zenith hydrostatic delay (ZHD) and Zenith Wet delay (ZWD). The sum of ZHD and ZWD is Zenith Total Delay. The Precipitable Water Vapor was determined by applying the formula developed by Saastamoinen. The mean temperature ( $T_m$ ) was calculated using the weighted mean temperature model created by Bevis et al. in 1972. Meteorological information was gathered using the Automatic Weather Station, which is close to the GNSS station. Precipitable water vapor is quite sensitive to rainfall, according to an investigation of its variation. It was discovered that in around 85 percent of the data collected during a rainy month, rainfall starts 3 to 5 hours after the PWV achieves its maximum value. Additionally, 15percent of the recorded data produced a false alarm, meaning that even though the PWV value was high, there was little or no precipitation. The limitation of this study is that we cannot predict which type of rainfalls will occur because the thresholds we have established only tell us if rainfall events will occur or not. Additionally, the estimation of Precipitable water vapor would be substantially improved by the meteorological station close by the GNSS station.

## Keywords:

Precipitable Water Vapor, Zenith Total Delay, Zenith Hydrostatic Delay, Zenith Wet Delay, CORS, Rinex

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# Morphological and Mechanical Characterization of Electrospun Ag Nanospecies Decorated Polyacrylonitrile (PAN) Membrane for Water Purification

*Kshitij Thapa*<sup>a</sup>, *Hem Raj Pant*<sup>b</sup>, *Surya Prasad Adhikari*<sup>c</sup>

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## Abstract:

Membrane development includes a wide array of technological fields, which includes interaction phenomena, materials engineering, chemical engineering, and process and product design. The majority of the global issues relating to water, air, energy, healthcare, and subsequently global warming can be resolved with the help of advancements in membrane technology. Currently, electrospun polymeric fiber membranes are dominant products because of their broad spectrum of materials and process-dependent architecture with desirable physico-chemical properties for diverse applications. In this work, dual membranes, one having amphiphilic/antibacterial and photocatalytic properties and another having antibacterial and hydrophobic properties, are being fabricated using electrospinning. Hexadecyltrimethylammonium bromide (CTAB) loaded electrospun PAN nanofibers treated with aqueous  $AgNO_3$  become amphiphilic/photocatalytic and antibacterial. For the first membrane, freshly prepared electrospun nanofibers of PAN fabricated from its DMF solution were treated with  $AgNO_3$  solution. Similarly, for the second membrane, CTAB dispersed in PAN solution was subjected to electrospinning and the as-fabricated membrane was treated with  $AgNO_3$  in the dark to obtain an AgBr loaded PAN fiber. The AgBr-loaded PAN shows amphiphilic, photocatalytic, and antibacterial characteristics. Therefore, designing the dual membrane, upper with AgBr/PAN and lower with Ag/PAN, can be applied to obtain pure water if water is contaminated with dyes, bacteria, and oil.

## Keywords:

Silver nanoparticles, Silver bromide, Polyacrylonitrile, Dimethylformamide, Electrospinning

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# Impact of Recycling Filter Backwash Water on Turbidity Removal in Water Treatment Process

*Kamal Hari Dulal<sup>a</sup>, Iswar Man Amatya<sup>b</sup>*

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## Abstract:

This study's main goal was to determine how recycling filter backwash water (FBW) affected the water's quality during the water treatment process. The investigation was specifically done at the drinking water treatment facility in Bode, Bhaktapur, Nepal, where the FBW produced by the rapid sand filter was recycled into the sedimentation unit's inlet. The efficiency of removing turbidity from a sedimentation tank, rapid sand filter, and the entire treatment plant were compared to FBW recycling. The result shows that the turbidity removal efficiency of overall water treatment plant will not be affected during recycling of FBW. The optimum turbidity removal efficiency of sedimentation with coagulation is obtained at PACl dose of 20 mg/l in both cases (recycling and without recycling). So that no additional PACl is required during recycling of FBW. The economic analysis shows that 690 m<sup>3</sup> water per day and 12,878 rupees/ day can be saved in case of BWTP.

## Keywords:

recycling filter backwash, sedimentation, filtration

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# Comparison of Engineers' Job Satisfactions Working in Local Level Government at Karnali Province with Federal Engineers

*Lokendra Budha <sup>a</sup>, Mahendra Raj Dhital <sup>b</sup>, Nagendra Bahadur Amatya <sup>c</sup>*

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## **Abstract:**

Civil engineering is the most well-known profession in the country and civil engineering have direct impact on the development of the country. Many local government projects in Nepal are currently facing problems of time/cost overrun, poor quality & unsustainable work, which somehow related with the engineer's job satisfaction. This study shows the job satisfaction of local level engineers from Karnali province and compares with other engineers working at federal level. Data were collected from 52 civil engineers working locally, mostly through structure questionnaire responses from local level as well as federal offices. The variables were than analyzed using descriptive statistical analysis procedures utilizing SPSS and MS Excel. The study's finding shows that the majority of civil engineers in local level government were less satisfied. The level of job satisfaction varies little by designation and gender. Engineers working at local level in Karnali Province were less satisfied than engineers at federal offices according to research comparing the two sectors.

## **Keywords:**

Local level, Civil engineers, Job satisfaction, Designation level

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# Capacity Assessment of Stone Masonry Building of Jumla District

*Dewakar Acharya<sup>a</sup>, Haridarshan Shrestha<sup>b</sup>*

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## Abstract:

Located in the colloidal boundary of Indian and Eurasian plates, Nepal lies in the earthquake prone Zone of Nepal. Studies carried out after Gorkha earthquakes 2015 shows that building constructed with stone masonry in mud mortar are highly vulnerable to the earthquakes. Beside shifting of the stress towards western area of Nepal has added the possibility of earthquake of greater magnitude in the western region of Nepal. Jumla district, located in the western regions of Nepal has significant stocks of buildings with stone masonry in the mud mortar. Two storey building with mud roof and two storey with attic floor having CGI sheet cover are most common type of building existing in the Jumla district. Non linear static analysis of two storey building with attic floor has been carried out in FEM based software Abaqus to obtain the push over curve. Response spectrum curve of Jumla district as specified in NBC 105:2020 and the capacity curve has been used to obtain the performance points (displacement demand). Damaged observed at the performance point (displacement demands) has shown that structure undergoes various damages which includes separation of out of plane gable walls and in plane walls at the attic floor level, shear slides cracks at the footing level and shear failures of in plane walls. Inter storey drift value calculated at the corresponding displacement demand i.e 1.8 % exceeds the limiting values of collapse prevention limit values i.e 1% as per FEMA 356 which shows that structure are likely to get collapse which conclude that building in Jumla district are highly vulnerable to the earthquakes ..

## Keywords:

Abaqus, push over analysis, Performance point

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# Preparation and Characterization of Activated Carbon from Harro (*Terminalia Chebula*) Seed Stone by Chemical Activation with Phosphoric Acid for energy storage devices

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*Chhabi Lal Gnawali*<sup>c</sup>, *Bhadra Prasad Pokharel*<sup>d</sup>

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## Abstract:

In order to meet the growing energy demand, effective energy storage devices are essential. Activated Carbon is used as an electrode in energy storage devices. Harro is a novel and bio-based precursor for the preparation of AC. The effect of temperature on the pore structure and surface chemistry of activated carbon prepared from Harro seed stones by using phosphoric acid as the activating agent were studied. Activated carbon was prepared at various temperatures such as 400,500,600 and 700 degree celsius. The properties of the resulting activated carbon were: Yield (31.73%- 45.53%) at various temperature. By using FT-IR, surface area, total pore volume, Methylene Blue number, XRD and Iodine number, study examined at the physiochemical characteristics of synthesized activated carbon. The highest value of methylene blue number of prepared AC was 334.72 mg/g at 700 degree celsius and the maximum surface area of prepared AC was 977.19 m<sup>2</sup>/g at 400 degree celsius for 4 hrs. The specific capacitance of the AC prepared at 700 degree celsius is highest with value  $9.26 \times 10^{-3} Fcm^{-1}$  and mesoporous structure. Therefore, the AC prepared at 700 degree Celsius is applicable for energy storage devices.

## Keywords:

Activated carbon, phosphoric acid, electrode, Energy storage devices

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# Preparation of Waste Betel Nut based Activated Carbon (AC) to Test its Storage Performance

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## Abstract:

Energy storage is the main focus of today's world and in the scientific community. Due to the limited of the fossil fuels and the energy storage issues in the electrostatic field, a very high power density fast charging supercapacitor has emerged as the best potentials in energy storage development. Activated carbon (AC) due to its many fascinating properties like high porosity, low cost and easy processing, chemical and thermal stability, AC has become one of the major candidate electrode materials for the capacitor. Different agro-waste based AC carbons are on investigations for the applications in the fabrication of supercapacitor and solid state hydrogen stores. In this study, waste betel nut based AC was prepared by chemical activation with  $H_3PO_4$  as an activating by mixing finely crushed waste betel nut powder and  $H_3PO_4$  in ratio 1:1 (by weight) followed by carbonization at 500°C for 3 hours in nitrogen gas environment. Characterization of the resultant AC were performed by iodine number ( $I_N$ ), methylene blue ( $MB_N$ ), surface area, X-ray diffraction (XRD), Fourier infrared spectroscopy (FTIR), Scanning electron microscopy (SEM), Raman Spectroscopy. The methylene blue, iodine number and surface area of the resultant AC were found to be 365  $mgg^{-1}$ , 882  $mgg^{-1}$  and 927  $m^2g^{-1}$ . The SEM image signifies that there is presence of mesopores on the surface of the resultant AC which means it has high adsorptive efficiency favourable for many applications like energy storage, dye removal and decontamination.

## Keywords:

Betel nut, activated carbon, energy storage, chemical activation, supercapacitor

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# Synthesis and Characterization of Carbon and Nitrogen Intermingled Three Dimensional Porous Cobalt Oxide Polyhedrons/Nanowires for Energy Storage

*Bishal GC<sup>a</sup>, Ram Bahaur Ale<sup>b</sup>, Tanka Mukhiya<sup>c</sup>*

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## Abstract:

There is great demand in the development of efficient and economic energy storage devices to address the environmental and exhausting issues of fossil fuel. Supercapacitor, a promising energy storage technology for future generation, demands enormous improvement in its electrode such high specific surface area, high porosity, conductivity and proper architecture. Among various materials, cobalt Oxide ( $Co_3O_4$ ) has high capacitance, performance but less stability and conductivity. Recently, metal-organic frameworks (MOFs) have been used to enhance the surface area and controllable porosity. However, there is still a challenge to design and synthesize assembly of nanostructure with proper architecture. Here, metal-organic framework-based carbon and nitrogen intermingled highly porous three dimensional (3D) cobalt oxide polyhedrons have been assembled with their nanowires on nickel foam by a combination of hydrothermal, solution, carbonization and calcinations method. Here, MOFs ensured high surface area, high porosity and also contribute carbon and nitrogen required for enhancing conductivity of cobalt oxide. In this study, electrode material in a new architecture has been synthesized through the route of MOFs by simple laboratory methods such as hydrothermal, solution method, carbonization and calcinations. The materials have been characterized by x-ray diffraction (XRD), scanning electron microscopy (SEM), field emission scanning electron microscopy (FESEM), elemental mapping, Energy Dispersive X-ray Spectroscopy (EDS). The energy storage capacity has been studied.

## Keywords:

Cobalt oxide; Metal-organic framework; Polyhedron; Nanowire; Supercapacitor

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