Travel time prediction with graph neural network: A case study in Bangkok Thailand

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การพยากรณ์สภาพการจราจรเป็นงานที่มีความสำคัญอย่างยิ่งต่อการบริหารการจราจรและการทำธุรกิจอื่น โดยปกติแล้วการเรียนรู้ของเครื่องจะพยากรณ์โดยมองลักษณะการจราจรในรูปแบบของอนุกรมเวลา เนื่องจากข้อมูลดังกล่าวมีรูปแบบตามเวลาที่ชัดเจน ในปัจจุบันความสัมพันธ์เชิงภูมิศาสตร์ระหว่างโครงข่ายถนน ถูกนำมาใช้ในการพัฒนาการพยากรณ์สภาพการจราจรด้วยเช่นกัน วิทยานิพนธ์ฉบับนี้นำเสนอวิธีการพยากรณ์สภาพการจราจร เช่น ความเร็วในช่วงถนนและเวลาที่ใช้ในการเดินทาง โดยใช้โครงข่ายประสาทเทียมชนิดกราฟและเมทริกซ์แสดงความสัมพันธ์เชิงสเปกตรัม ซึ่งแตกต่างจากความสัมพันธ์เชิงภูมิศาสตร์ของโครงข่ายถนนที่เชื่อมติดกัน เมทริกซ์แสดงความสัมพันธ์เชิงสเปกตรัมสามารถอธิบายความสัมพันธ์ระหว่างถนนเส้นต่าง ๆ และช่วยในการอธิบายความสัมพันธ์ในเชิงจราจรได้ โครงข่ายประสาทเทียมชนิดกราฟและเมทริกซ์แสดงความสัมพันธ์เชิงสเปกตรัมถูกทดลอง และเปรียบเทียบกับโครงข่ายประสาทเทียมชนิดเพอเซปตรอนหลายชั้น ซึ่งเป็นแบบจำลองที่ไม่คำนึงถึงสภาพทางภูมิศาสตร์ กับโครงข่ายประสาทเทียมชนิดกราฟและเมทริกซ์แสดงความสัมพันธ์เชิงภูมิศาสตร์ ผลพยากรณ์ความเร็วถูกวิเคราะห์ในมิติต่าง ๆ คือ ลักษณะของถนน ความยาวของถนน วันที่พยากรณ์และช่วงเวลาที่พยากรณ์ เพื่ออธิบายข้อดีและข้อเสียของแบบจำลองชนิดต่าง ๆ ข้อมูลที่ใช้ในวิทยานิพนธ์ฉบับนี้เป็นข้อมูลพิกัดรถสาธารณะบริเวณกรุงเทพมหานคร ผลการทดลองพบว่าโครงข่ายประสาทเทียมชนิดกราฟและเมทริกซ์แสดงความสัมพันธ์แบบผสมให้ผลการพยากรณ์ความเร็วในแต่ละช่วงถนนดีที่สุดสำหรับโครงข่ายประสาทเทียมชนิดกราฟรูปแบบต่าง ๆ

อย่างไรก็ตามโครงข่ายประสาทเทียมชนิดเพอเซปตรอนหลายชั้น ให้ผลการทดลองที่ดีที่สุดในทุกตัววัดสำหรับการพยากรณ์ความเร็วในช่วงถนน โครงข่ายประสาทเทียมแบบเพอเซปตรอนหลายชั้นทำงานได้ดีในทุกวันและทุกช่วงเวลา ในขณะที่โครงข่ายประสาทเทียมชนิดกราฟจะทำงานได้ดีในช่วงสายและเย็นของวัน โดยที่ทำงานได้ผลดีในวันธรรมดามากกว่าสุดสัปดาห์ จำนวนช่องทางบนถนนไม่มีผลต่อการพยากรณ์ความเร็วในการเดินทาง ในขณะที่ความยาวของถนนมีผลต่อการพยากรณ์ความเร็วในการเดินทางน้อย การพยากรณ์เวลาในการเดินทางใช้ผลจากการพยากรณ์ความเร็วในการเดินทางมาคำนวณ โดยผลคำนวณจะมีความสัมพันธ์กับความยาวของช่วงถนนด้วยเช่นกัน ดังนั้นหากถนนยิ่งยาว โอกาสในการพยากรณ์เวลาในการเดินทางพลาดก็จะสูงตามไปด้วย ผลการทดลองพบว่าแบบจำลองที่มีความคลาดเคลื่อนของเวลาในการเดินทางต่ำสุดคือแบบจำลองโครงข่ายประสาทเทียมชนิดกราฟและเมทริกซ์แสดงความสัมพันธ์เชิงภูมิศาสตร์

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Sathita Buapang : Travel time prediction with graph neural network: A case study in Bangkok Thailand. Advisor: Asst. Prof. VEERA MUANGSIN, Ph.D.

Traffic prediction is an essential and challenging task for traffic management and commercial purposes. Machine learning methods for traffic prediction usually treat traffic conditions as time-series due to obvious temporal patterns. Recently, spatial relationships among roads in a road network have also been used to improve traffic prediction. This study proposes a novel method to predict traffic conditions such as speed using a graph convolutional neural network with a spectral adjacency matrix (GCN-Spectral). Unlike a spatial adjacency matrix representing physical connections between road segments, a spectral matrix represents the correlation between road segments regarding traffic conditions. The GCN-Spectral model is evaluated by comparing with a multi-layer perceptron model (MLP), as a non-spatial model, and a graph convolutional neural network with a spatial adjacency matrix (GCN-Spatial). The prediction results were analyzed with the robustness characteristics of the road segment in various dimensions. For example, the road length, time of the day, and day of the week. The error of results analysis aimed to explain model limitations and strong points. The data used in this study are GPS probe data collected from taxis in Bangkok. Empirical results show that the GCN-Spectral with a combination matrix model mostly outperforms GCN-Spatial models in the Bangkok dataset.

However, MLP performs the best in most cases in speed prediction tasks. The MLP works well every day of the week and time of day. In contrast, the GCN works well in late morning, evening, and on a weekday. The number of lanes in a road segment does not correlate with prediction error. And the road segment length has a weak correlation with the prediction error on GCN-Spectral with LSTM layers and GCN-Spectral with combination matrix. The travel time spent in the road segment is calculated using speed prediction, and relative to road segment length. The more extended the road segment is, the higher the error on travel time. The result found that the lowest error is from GCN-Spatial model.

Field of Study:	Computer Science	Student's Signature .....
Academic Year:	2021	Advisor's Signature .....

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Sathita Buapang

TABLE OF CONTENTS

Page

Chapter 1: Introduction

1.1 Motivation

Traffic prediction or traffic forecasting is an active research area related to Intelligent Transportation Systems. It can be defined as estimating some traffic parameters into the short-term future, from a few minutes to a few hours. Such parameters include traffic volume, density, traffic congestion, speed, and travel time. Traffic prediction has a wide range of applications, including urban planning, traffic management, and real-time driving plan, such as the Google Maps application. The importance of traffic prediction is improving the traffic management process for government purposes, planning the traveling path for private purposes, or even planning the delivery route on a commercial platform (Sawtell-Rickson, 2018). An example of using traffic forecasting in commercial platforms is the Grab Food plan for delivering food to the customer and shows the expected arrival time on the application. The more accurate arrival time prediction is, the happier customers are.

Over the years, prediction methods have evolved from mathematical models to machine learning models and finally to deep learning models.The mathematical traffic models have been studied since the 1950s. In this approach, the researchers tried to find equations that fit the real-world traffic quantity, such as traffic flow density and traffic flow speed (Newell, 1955). However, it is difficult to represent real-world systems in mathematical relationships accurately.

In the late 2000s to early 2020s, the machine learning algorithm was a popular method to predict traffic congestion and travel time. The models implemented in traffic forecasting are AutoRegressive Integrated Moving Average(ARIMA), Support Vector Regression (SVR), and K-nearest neighbor (KNN) (Li & Shahabi, 2018),(Akhtar & Moridpour, 2021). K-mean clustering and the Gaussian Mixture Model (GMM) approach were applied to the congestion problem (Chiabaut & Faitout, 2021) .

In the late 2010s, the internet of things (IoT) and Big Data were popularized. As a result, various sensors installed on vehicles and transportation infrastructure could provide unprecedented large traffic datasets. For example, GPS (Global Positioning System) probe data, which showed the coordinate position (latitude, longitude), vehicle ID, and other information such as speed, direction, or taxi occupancy status.

One of the well-known datasets for spatial prediction based on the GPS point dataset is the NYC taxi dataset (Kaggle, 2018) which contains more than 2.08 million points of taxi trips. This dataset was widely used for data visualization, data analysis, and basic machine learning models such as clustering problems. Manoharan's study use this dataset to predict the time of trip spent with the Extreme Gradient Boosting (XGBoost) model and multi-layer perceptron (MLP) which later found that the XGBoost model gives better results than the MLP model (Manoharan et al., 2021).

As large and complex datasets became available, deep learning methods emerged as a novel machine learning paradigm that exploits such data. For instance, Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN), such as Long Short-

Term Memory (LSTM), are basic deep learning algorithms widely used in spatial-temporal analysis and traffic prediction research. (Jakteerangkool & Muangsin, 2020)

However, these models usually take the problem as time-series forecasting and do not include the spatial factor, i.e., the road network or correlation between road segments. Recently, a deep learning model called Graph Neural Network (GNN) was specially designed for data described as graphs by representing relationships between nodes in a graph. GNN has been used in traffic prediction research due to its ability to recognize spatial characteristics and interdependency among nodes (Yuan & Li, 2021).

And in late 2010s the combination between GNN and CNN was developed (Kipf & Welling, 2016), the combination called graph convolutional neural network (GCN). The pros of GCN are treating data as graph representation and can extract nearby node features which is CNN behavior. The GCN also a new approach to use in traffic prediction problem.(Zhao et al., 2020)

1.2 Objective, contribution, and expected result

This research aims to improve the previous work on travel time prediction with the graph neural network method and predict the travel times on multiple road segments.

The graph neural network used in this study will be a graph convolutional network with a temporal layer. Two kinds of adjacency matrices are compared. The first one, called a spectral graph convolutional network, represents the correlation between the speed of road segments. The second one, called a spatial graph convolutional network, represents the adjacency of road segments.

Thus, the expected contribution of this study includes:

1. A novel travel time prediction model based on a graph convolutional neural network that considers the relative spatial effect.

2. Evaluation results of the proposed model with a GPS probe dataset covering a part of the road network in Bangkok.

3. Comparison results between the proposed methods and other deep-learning methods such as multi-layer perceptron (MLP).

1.3 Scope of the study

The study focuses on the travel-time prediction problem and proposes a novel method of solving this problem using a speed prediction model with a spectral graph convolutional neural network method. The proposed model aims to solve the problem of being unable to predict road network travel time in a previous study (Jakteerangkool & Muangsin, 2020).

Due to the availability of the data, the area of study is in central Bangkok, with Rama IV Road at the center and other selected primary roads, including Sukhumvit Road, Phetchaburi Road, and a few others connecting them.1.4 Publication

A part of this thesis was presented at the 2022 7th International Conference on Business and Industrial Research (ICBIR 2022) on 19-20 May 2022. The paper is entitled "Traffic Prediction With a Spectral Graph Neural Network".

Chapter 2: Background and Related Works

2.1 Background

2.1.1 OpenStreetMap

OpenStreetMap (OSM) is a crowd-sourced digital map database of the world. OSM data is free and can be used for any purpose, including commercial use. In OSM, each road with the same name can be composed of multiple road segments or '*ways*'. Each way is an ordered list of nodes with other features, including ID (called '*wayid*') and key-value tags like type, name, lanes, and way conditions such as one-way segment (*Map features*, 2021). Each node is a point location with ID, latitude, and longitude features.

2.1.2 GPS probe data

GPS probe data is generated by collecting the GPS positions of individual vehicles over time to represent tracks of movements of the vehicles. In addition to the basic features, namely timestamp and geographic coordinates, probe data also contains other features, including vehicle ID, speed, bearing (direction), and GPS accuracy. The raw GPS coordinates can be projected onto the closest road segments using a map-matching algorithm.

For our dataset, the frequency of data collection is every 4 seconds. A sample of GPS probe records is shown in *Figure 1*. The *driver_id* column represents individual vehicles. The *rawlat* and *rawlng* columns are geographic coordinates. Each raw GPS location is projected onto a OSM road segment identified by *wayids* at the location specified by *projectedlat* and *projectedlng*. *Figure 2* shows the trajectory of one vehicle.

This dataset can be transformed into secondary information such as free-flow speed, congestion index, and travel time later.

driver_id	time	speed	bearing	accuracy	projectedlat	projectedlng	rawlat	rawlng	segmentstartnode	segmentendnode	wayids
:70c77a75653c1c87bae...	1559405800	5.27	137	32.000	13.731097	100.568825	13.731135	100.568851	272195158	4489959601	452046129
c78945593eb97d59694...	1559374043	5.61	278	14.000	13.744321	100.541213	13.744119	100.541178	5936258117	5936258109	659313262
85d143bcbf35426ed63d...	1559374031	4.89	17	12.864	13.748309	100.563223	13.748302	100.563265	6472163703	6362812630	452425406

Figure 1 An example of the dataset.

Figure 2 Trajectory data from one driver. The point colors represent the timesteps.

2.1.3 Neural Network

2.1.3.1 Multilayer Perceptron

A multi-layer perceptron (MLP) is a basic feedforward artificial neural network. An MLP consists of an input layer, an output layer, and one or more hidden layers. An MLP is fully connected, meaning that each node in one layer connects to every node in the next layer with a weight. The hidden layers are where the inputs to the nodes are multiplied with the weights before passing through the activation function such as tanh, sigmoid, or rectifier linear unit (ReLU) and sending the results to the output layer. The MLP model will adjust the weights for every epoch of training using backpropagation until the output of the training set is closest to the answer.

An example of MLP operation process shows in *Figure 3*.

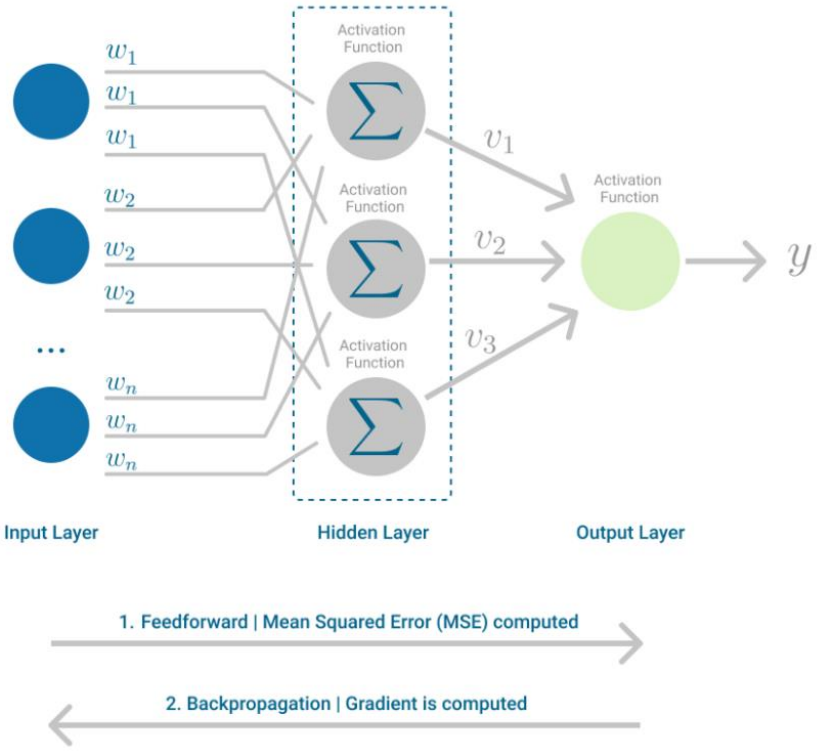


Figure 3 The architecture of MLP model

2.1.3.2 Convolutional Neural Network (CNN)

A convolutional neural network (CNN) is one of the first deep neural network models commonly applied to computer vision and other problems with 2-dimension data. The feature extraction from CNN was done using a filter to slide along the array. Before using the method of pooling to aggregate information from each cell. Then combining all cell pooling values, flatten them, and pass through the activation function to complete the study task (Stewart, 2019). The overview of CNN process is in *Figure 4*.

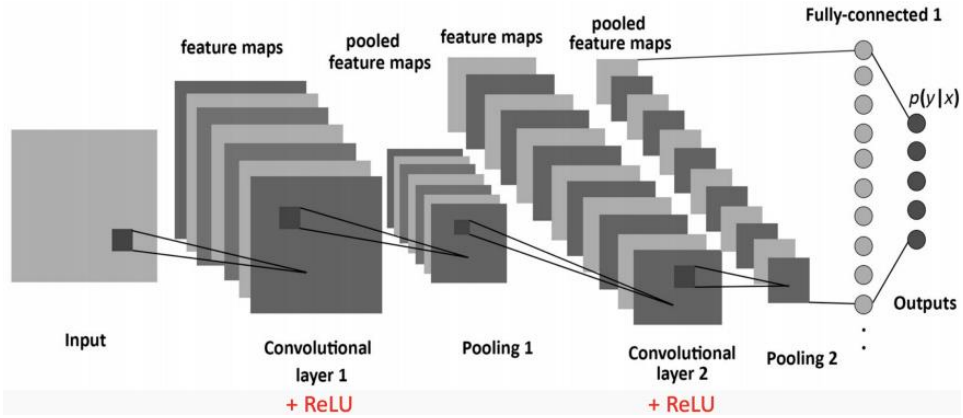


Figure 4 Architecture of CNN model with two convolutional layers (Stewart, 2019)

The filter is a small matrix with factors to multiply with original picture cell values. Their operation is shown in *Figure 5*.

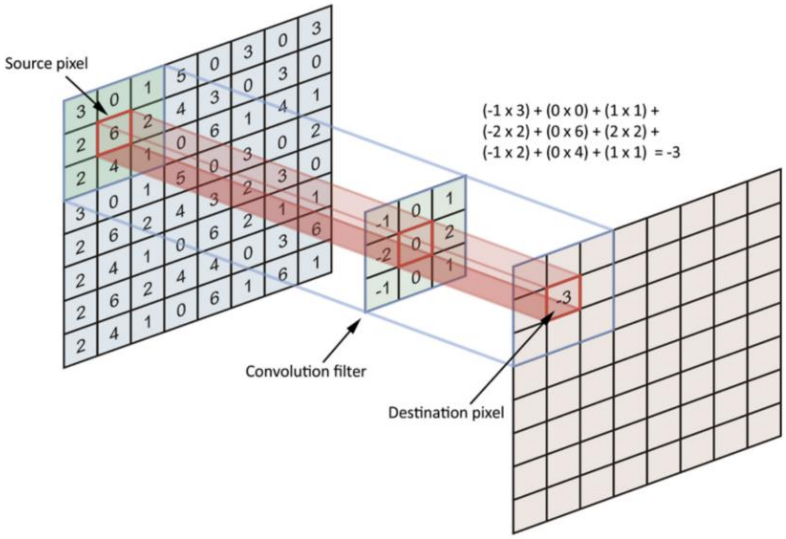


Figure 5 Convolution operations (Stewart, 2019)

2.1.3.3 Recurrent Neural Network (RNN)

RNN is a kind of neural network mostly applied on time series problems which will predict the cell by the concept of the timestep. The timestep is the focus time point in the interested period such as every 5 minutes in 1 hour there are 12 timesteps the first timestep start at 00:05:00, 00:10:00 and so on until it meets the maximum boundary at 01:00:00.

For RNN, the hidden state from the previous timestep's cell (t-1) will take the memory pass through the cell before adding new input from the current cell (t), and both inputs will pass through the tanh function before turning to the hidden state and pass to next timestep cell (t+1) again as shown in *Figure 6*. (Phi, 2018)

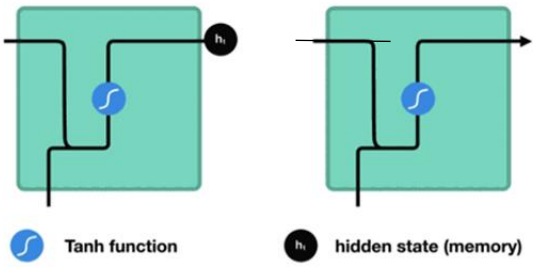


Figure 6 RNN nodes with input and output movement between 2 timesteps; the left is timestep t-1 and the right is t (Phi, 2018).

2.1.3.4 Long Short-Term Memory (LSTM)

LSTM is a kind of RNN with improved memory transferring by adding sigmoid gates and tanh gate. The gates are added to extract more information by choosing what information should be forgotten or memorized before passing to the next cell. In LSTM, there are three kinds of gates, forget gate, input gate, and output gate. Output in LSTM cell contains two values, the cell state and hidden state. The operation and equation represent each process of a LSTM unit show in *Figure 7* and *Figure 8* respectively.

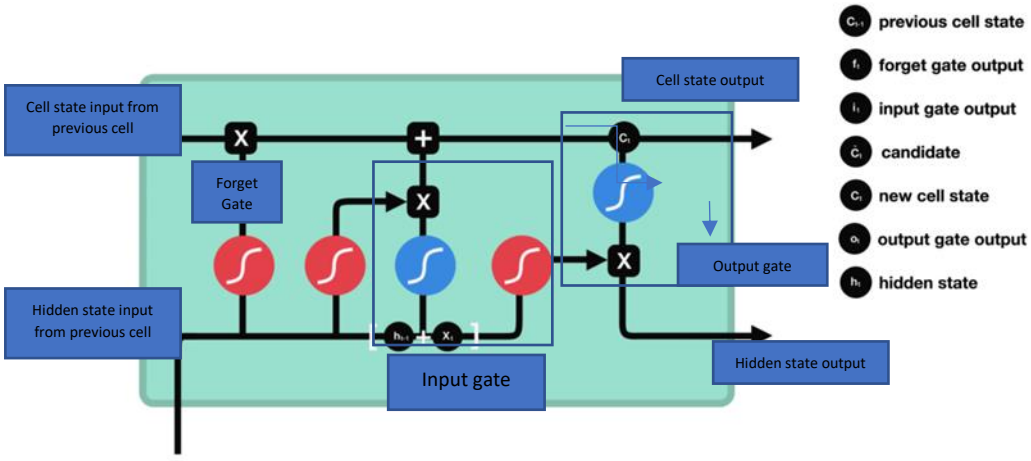


Figure 7 Inside LSTM cell diagram where red activation functions mean sigmoid function and blue activation functions mean tanh. (Phi, 2018)

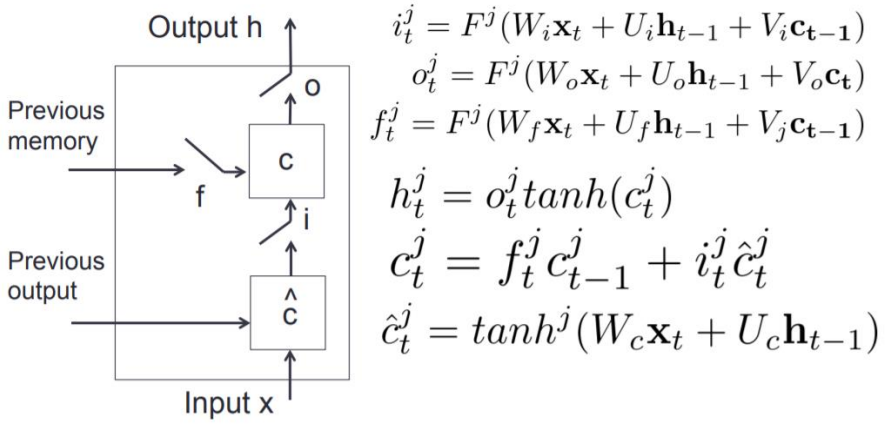


Figure 8 LSTM diagram and equations for operation where i is input gate, o is output gate, f is forgotten gate, h is hidden state output, cˆis a candidate for cell state output c. (Chuangsuwanich, 2018)

2.1.3.5 Gated Recurrent Unit (GRU)

GRU is a kind of RNN similar to LSTM, but it simplified the gates and reduced the number of gates from 3 to 2. GRU also reduces output product which will pass to the next cell from 2 outputs to only one output called hidden state, and use this to carry the memory to the next cell.

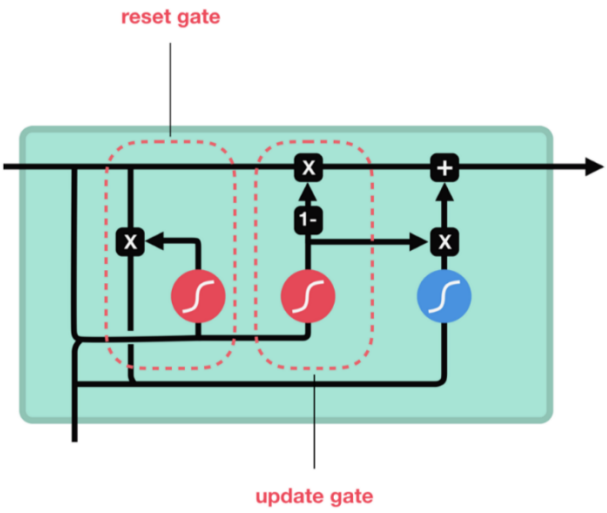
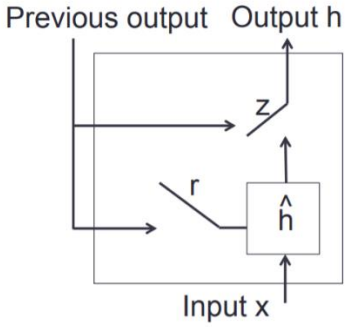


Figure 9 Inside GRU cell diagram (Phi, 2018)

The GRU cell consists of two gates: the reset gate and the update gate as show in *Figure 9*. The reset gate decides which memory from the previous cell should be forgotten. The update gate is where information from input at the current cell state and hidden state from the previous cell pass through. The update gate combines the forgetting gate and input gate in LSTM. The equations use in each process of GRU unit are showed in *Figure 10*.



$$h_t^j = (1 - z_t^j)h_{t-1}^j + z_t^j \hat{h}_t^j$$
$$\hat{h}_t^j = tanh^j(W\mathbf{x}_t + U(\mathbf{r}_t \odot \mathbf{h}_{t-1}))$$
$$z_t^j = sigmoid^j(W_z\mathbf{x}_t + U_z\mathbf{h}_{t-1})$$
$$r_t^j = sigmoid^j(W_r\mathbf{x}_t + U_r\mathbf{h}_{t-1})$$

Figure 10 GRU diagram and equations for operation where r is reset gate, z is update gate, hˆis where input at the current state passes, and h is an output of the GRU cell. (Chuangsuwanich, 2018)

The difference between GRU and LSTM is that LSTM takes a longer process time than GRU in a large dataset but shows the same performance on the Natural Language Processing (NLP) task. Also, GRU is suitable for a small dataset with fewer parameters to learn. (Chuangsuwanich, 2018)

2.1.4 Graph Neural network

A graph neural network is used in machine learning when data is represented as a graph, such as chemical structure or social network, to detect community and other patterns (Menzli, 2021). Graph neural network was developed to process graph data, which could not be directly treated as typical deep learning problems that involve images and text.

In the late 2010s and early 2020s, a graph neural network was a newly popular method used for graph-based data to feed on the neural network as shown an example in *Figure 11*. The application of graph ML has on many industries, the famous industry uses this kind of network to analyze and predict their special kind of data is such as chemistry where they treat each chemical molecular as a node and linkage between a pair of molecular as an edge. On the other hand, the traffic simulation study can adapt this

concept but change road segments and nodes in road networks as nodes and edges or edges and nodes instead. Some studies solve traffic problems with this neural network type too.

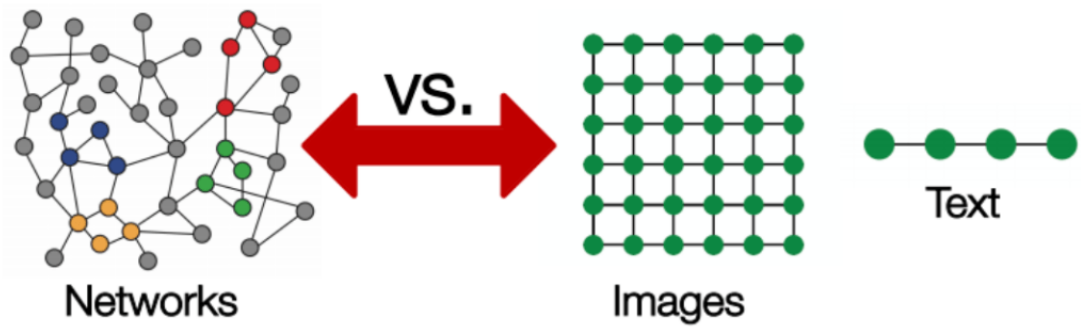


Figure 11 Comparison between network data and images and text structure data (Leskovec)

2.1.4.1 Graph Convolutional Neural Network

A graph convolutional network (GCN) combines a graph neural network (GNN) and a convolutional neural network (CNN). The concept idea of GCN is "Node's neighborhood defines a computation graph" (Leskovec) . The concept of connected nodes diagram and GCN concept are showed in *Figure 12* and *Figure 13*.

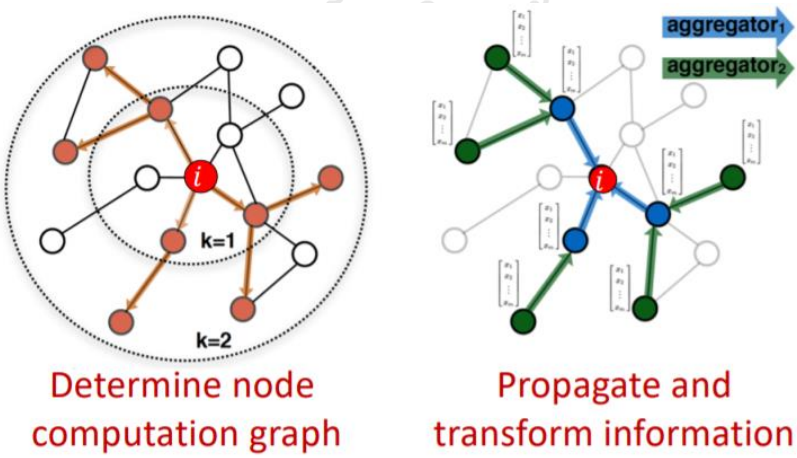


Figure 12 GCN concept diagram (Leskovec)

Graph convolutional network was introduced in (Kipf & Welling, 2016). The researchers worked on a node classification problem, and they found a problem that some nodes might have many relations to others but did not give useful information for the task. Therefore, they proposed a graph neural network combined with a convolutional layer to extract information around each focus node. Similar to the traditional CNN, called GCN, the filter around the node and their linkage to extract the information of the adjacency node. Moreover, they use the Laplacian regularization matrix for handling with a high degree but less useful information to the model prediction.

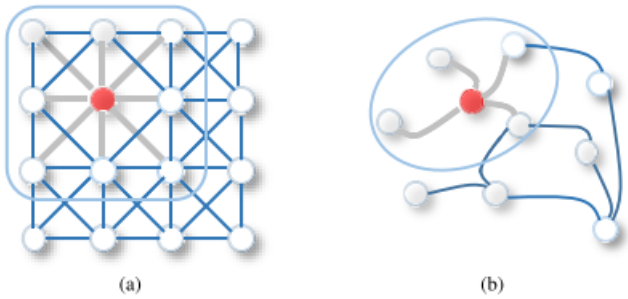


Figure 13 a) a traditional CNN concept (b) Graph convolutional concept (Wu et al., 2021)

They construct the experiment into two semi-supervised learning classification tasks. Their aim was to measure the performance of the 2-layer GCN model on various kinds of graph datasets. For instance, a bipartite graph extracted from the knowledge graph and document citation network. And compared with another model on the graph classification task e.g., ManiReg, SemiEmb, LP. The result shows that the GCN model performs better than other baseline models. However, Kipf and Welling suggested that the GCN model is unsuitable for directed graph data.

Some sources might separate GCN into two classes, spatial and spectral type, by using the definition of the adjacency matrix. (Hui, 2021)

2.1.4.2 Spectral Graph Convolutional Neural Network

For spectral graph convolutional neural network (spectral GCN), the adjacency matrix was defined from the surrounding nodes of the focus node correlation, which may change over time in temporal concept. The propagation for a hidden layer with a self-loop in a spectral neural network was defined by

$H^{(k)} = \sigma\left(\tilde{A}H^{(k-1)}W^{(k)}\right)$ where $\tilde{A}$ is a normalized variant of the adjacency matrix.

And $\tilde{A} = (D + I)^{-\frac{1}{2}}(I + A)(D + I)^{-\frac{1}{2}}$ where D is a degree matrix.

Source: Equation 7.39 (Hamilton, 2020).

For A (adjacency matrix) in spectral GCN, there is still some discussion about how the matrix should be calculated since the nodes in a spectral graph are not physically connected like the spatial one (Hui, 2021). So, some studies use the Laplacian graph normalization equation to normalize matrix A and use this is as a factor in propagation with undirected graph data. After normalized the matrix A, the output matrix will represent the self-loop, the relation within the same road segment or at a diagonal line of the matrix and also represent the relation between other road segment on other rows and columns of the matrix.

$$normalized\ graph\ Laplacian\ L = I_N - D^{-\frac{1}{2}}AD^{-\frac{1}{2}}$$

Source: Equation 3 (Kipf & Welling, 2016)

An example of a spectral graph neural network is given in Time Series Forecasting with Graph Convolutional Neural Network: Store Item Demand Forecasting Combining Graph and Recurrent Structures (Cerliani, 2020). Marco Cerliani proposed a model which forecasts store and item demand using GCN with the LSTM model. The data consist of ten stores, each selling ten items, and items are related. Each store and item is a node whose demand correlation is an edge. However, there are two kinds of nodes, i.e., store and item. So, they were managed by using a new label of store and node so that each input will have 10x10 nodes multiplied by timesteps instead of two types of nodes.

Furthermore, instead of getting an adjacency matrix by using location or physical connections like in traffic problems, Cerliani used the concept of correlation on each store and item to be the adjacency matrix. However, most graph neural networks assume that nodes have similarities, such as sharing the same label on a classification problem. At the same time, there are no substantial similarities and thus result in poor prediction (Kipf & Welling, 2016). So, Cerliani uses the Laplacian method mentioned in Kipf & Welling to normalize the correlation matrix before passing through GCN layers. The before and after correlation matrix that passed the Laplacian equation are show in *Figure 14*.

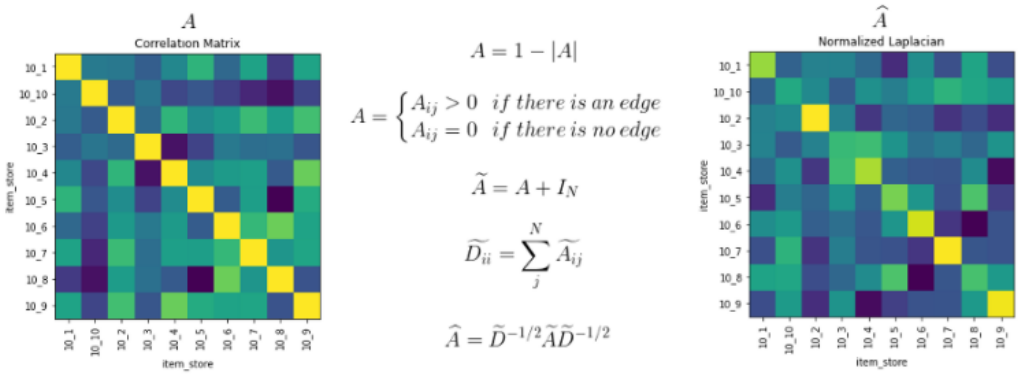


Figure 14 Heatmaps of correlation matrix before and after do the Laplacian equation

The feature engineering matrix is extracted using statistical features such as mean, standard deviation from each product, and store stack together before passing through two GCN layers and two LSTM layers to predict the result of demand in the testing period. The result is the model that can predict demand for each item by a store in the same model. RMSE was used for measuring the performance of store-level prediction. The project code is based on the Spektral library (Grattarola & Alippi, 2021), Graph ML python library developed with TensorFlow and Keras.

2.1.4.3 Spatial Graph Convolutional Neural Network

Unlike a spectral graph, the spatial graph has its exact adjacency matrix defined by a spatial component such as a road network or chemical molecule. The hidden layers of spatial GCN with self-loop of adjacency matrix were calculated by:

$$H^{(l)} = \sigma\left(\widetilde{D}^{-\frac{1}{2}}\hat{A}\widetilde{D}^{-\frac{1}{2}}H^{(l-1)}\theta^{(l-1)}\right) \text{ where } \tilde{A} = A + I_N \text{ and } \hat{A} = \widetilde{D}^{-\frac{1}{2}}\tilde{A}\widetilde{D}^{-\frac{1}{2}}$$

Source: Equation 2 from (Zhao et al., 2020)

An example of a spatial graph convolution neural network used in traffic prediction problems is T-GCN: A Temporal Graph Convolutional Network for Traffic Prediction (Zhao et al., 2020)

2.1.5 Travel time definition

In this study, the travel time means time spent traveling from a start node to the end node of the road segment. The travel time will be predicted using speed prediction from the proposed model multiplied by road segment length.

The Graph Convolutional Neural Networks (GCN) was selected as the experimental model in this study because GCN was concerned with the relations of each node and time and could represent traffic prediction more clearly than the traditional time-series deep learning method, i.e., Recurrent Neural Network (RNN), etc.

2.2 Related Works

2.2.1 Short-Term Travel Time Prediction from GPS Trace Data using Recurrent Neural Networks

This previous work used GPS probe data to predict travel time on Rama IV Road. The data was processed with LSTM, Gated Recurrent Unit (GRU), Recurrent Neural Network (RNN), LSTM-RNN, and LSTM-Deep Learning Neural Network (DNN) (Jakteerangkool & Muangsin, 2020) and other model show with different configuration in *Figure 15*. The result shows that the LSTM-DNN model gives the highest accuracy based on RMSE as in *Figure 16.* The model architecture and experiment results are shown in the figures below.

Model	**Configuration**	
	Layer	***Parameter***
GRU	[288, 288, 144]	Learning rate = 0.001
RNN	[288, 144,144]	Optimizer = Adam
LSTM	[288, 288, 288, 144]	Epochs = 50 and 200
LSTM-RNN	[288] + [288]	Batch Size = 36
LSTM-GRU	[288, 288, 288] + [288,288]	
LSTM-DNN	**[288, 288, 144] + [36][a]**	

a. the activation function is tanh

Figure 15 Model Configuration in Jakteerangkool and Muangsin study

Model	Evaluation Metrics	
	RSME (seconds)	*Execute Time (seconds)*
GRU	212.33472	74.08
RNN	217.29364	**21.85**
LSTM	222.1707	119.50
LSTM-RNN	221.14834	75.89
LSTM-GRU	221.8348	72.99
LSTM-DNN	**211.60288**	79.27

Figure 16 RMSE and execute time result in Jakteerangkool and Muangsin study study

However, this work studied only the Lumphini intersection to the Klong Toey intersection which in the maps in *Figure 17*. The travel time in this study was the direct result of the model since they selected the scope of study in one road segment and selected the same drivers who traveled from the start to the end of the segment.

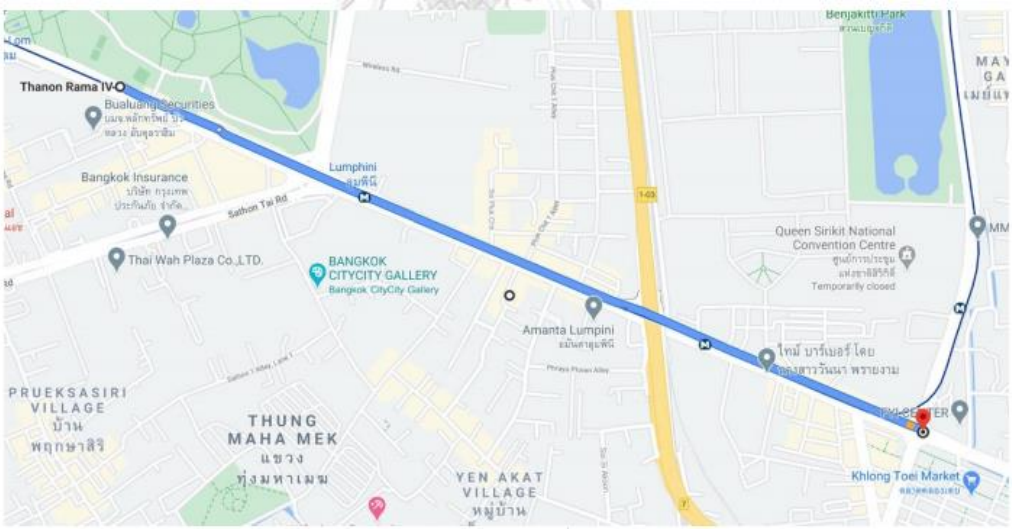


Figure 17 Road segment selected to use in Jakteerangkool & Muangsin study

2.2.2 Network Scale Travel Time Prediction using Deep Learning

Different road segments can have different travel time prediction models. However, building a model for every road segment is overwork. Hou and Edara (Hou & Edara,

2018) proposed a CNN and LSTM-based model compared with other models such as random forests (RF) or gradient boosting machines (GBM) for forecasting network-scale travel time. The study focused on the main road in the City of Saint Louis, Missouri, USA, where each road segment's travel time and time step will be treated as a row for input for the CNN and LSTM model. The scope of this study and results show in *Figure 18* and *Figure 19*, respectively.

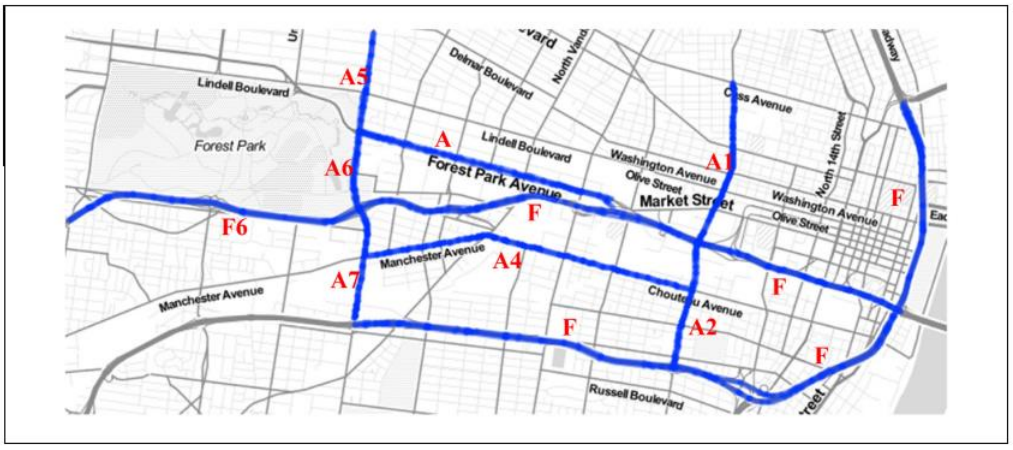


Figure 18 Area of Hou & Edara study.

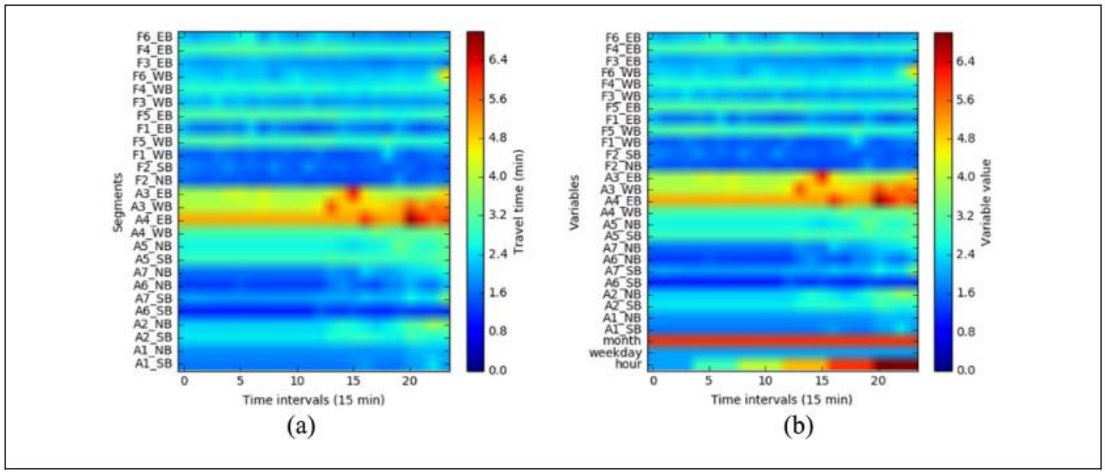


Figure 19 An example of Hou & Edara CNN input

The study used means absolute percentage error (MAPE) for measuring each model's performance. The results can be concluded that both deep learning methods perform similarly to the other models, RF and GBM, except RF and GBM methods, have to train each road segment separately. So, it can be concluded that deep learning

algorithms can help solve network scale problems and cost less complexity in building the model's process.

2.2.3 Scalable Deep Traffic Flow Neural Networks for Urban Traffic Congestion Prediction

The relationship between spatial features and other incidents should be included in modeling. Therefore, (Fouladgar et al., 2017) uses features such as holidays, events and weather converted into an incident matrix. They also have a congestion index that passes through the CNN layer before combining with the normalized incident matrix in the LSTM model. The output will be the congestion index independent of each road segment. The area of study is the freeway in northern California, USA.

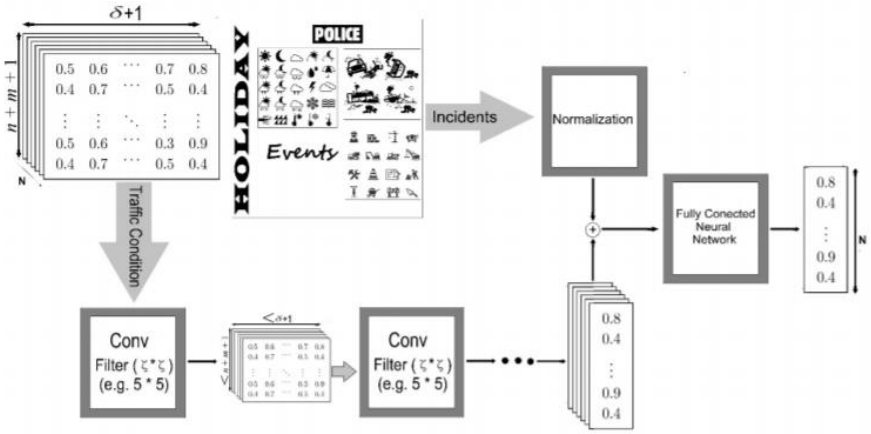


Figure 20 Deep Traffic Flow Convolutional Network in the paper

So, this study model was established from spatial feature engineering and CNN and LSTM-based models as shown in *Figure 20*. The study's contribution will be the proposed model that does not require much historical data since the training and testing data cover 48 days for the training set and 12 days in the testing set. Furthermore, the model is decentralized. Each road segment (station) can predict their congestion index and instruction to predict the new station where there is no historical data before by applying with other location traffic patterns passed through the LSTM model. The researcher evaluates the model using daily root mean squared error (RMSE) on each station for both CNN and LSTM models.

2.2.4 GPS-based citywide traffic congestion forecasting using CNN-RNN and C3D hybrid model

Spatial features may be included in neural network calculation in many ways. (Guo et al., 2021) proposed the method that used input location data (latitude and longitude) as both the matrix dimension and time as the third dimension of the matrix as in *Figure 21*.

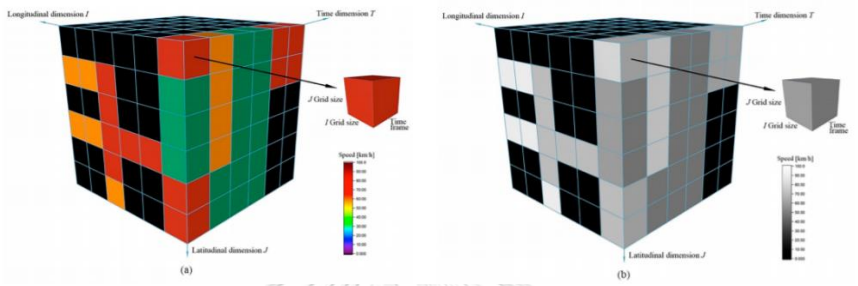


Figure 21 Transportation speed cube where latitude, longitude, and time are the cube's axis for feeding into the CNN model.

The previous 3D matrix is the input for the CNN neural network model merged with a more well-known method like the CNN-RNN model and called the CRC3D model to predict traffic speed and explain traffic congestion situations as shown in *Figure 22*.

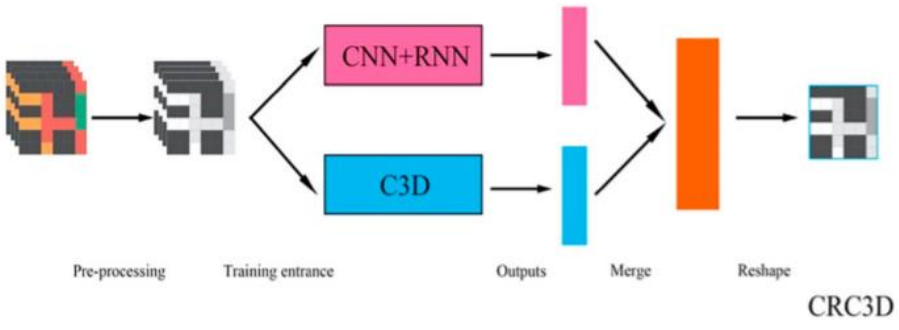


Figure 22 CRC3D model diagram

The study area is in the Futian district in Shenzhen City, China. This study evaluated the model using RMSE, accuracy, and recall compared with trajectory points of GPS data.

2.2.5 DEEPTRAVEL: a Neural Network Based Travel Time Estimation Model with Auxiliary Supervision

While some studies extract spatial relationship using a deep learning network, (Zhang et al., 2018) proposed a solution for feature engineering by extracting features from grid and neighbor grids. The grids are drawn on a map where the road passed. If the grids are fine enough, it can calculate the road segment's travel time by calculating the time spent on each grid by feeding GPS trajectory data on each trip into them. The five features in these grids are Spatio-temporal embedding, driving state features, and short-term and long-term traffic features, including neighbor grids' behavior. After calculating the feature grid, the features will be passed through LSTM and BiLSTM models to predict travel time, as shown in the diagram in *Figure 23*.

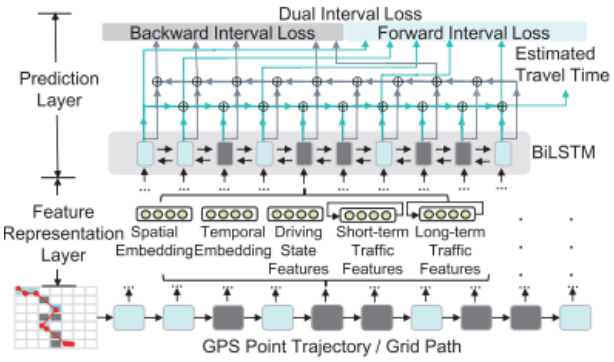


Figure 23 DEEPTravel framework diagram

The study performed experiments in Shanghai, China, and evaluated using MAE and MAPE values. BiLSTM gave a better performance than the LSTM model. However, the study also found that if the road segment is longer than 4 km, the prediction result of travel time is less accurate.

2.2.6 T-GCN: A Temporal Graph Convolutional Network for Traffic Prediction

Temporal and spatial dependency are two main factors that play an important role in traffic forecasting. (Zhao et al., 2020) analyzed the relationship between speed and traffic volume on each road segment by direction called upstream, middle stream, and downstream and found that the speed and traffic in each streamline have a high correlation. The researcher proposed a temporal graph convolutional neural network (T-GCN), a model that connected a graph convolutional neural network (GCN) with

GRU for predicting traffic speed. The TGCN layers are responsible for extracting spatial dependency features from a road segment and its adjacency roads. In this study, a road segment is treated as a node, and each segment's linkage is treated as an edge in the adjacency matrix. The effect of adjacency road segment in previous time step (T-1) passed to current time step (T) can be called massage passing, as depicted in *Figure 24*.

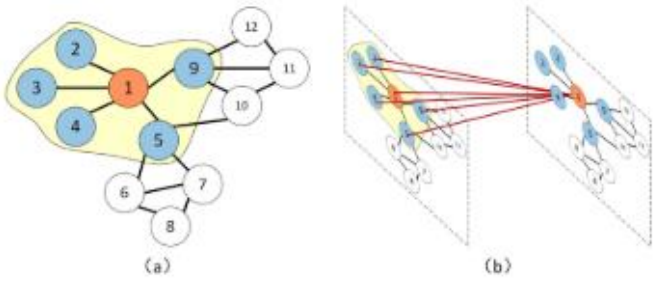


Figure 24 A concept of message passing between nodes of graph and time where node 1 is the focus road segment, and node 2, 3, 4, 5, and 9 are adjacency segments

The evaluation of the T-GCN model was measured using five metrics RMSE, MAE, accuracy, and coefficient of determination (R^2). To explain variance score (var), comparing process with different methods was done. The methods are History Average model (HA), AutoRegressive Integrated Moving Average model (ARIMA), Support Vector Regression model (SVR), GCN, and GRU. The result shows that T-GCN performed best. The data used in this study is scope on two areas. One is taxi trajectory and speed data set in Shenzhen, Luohu District, China, and the other is from loop detectors on a highway in Los Angeles, USA. The result of this study comparing two datasets is shown in *Figure 25*.

T	Metric	SZ-taxi						Los-loop					
		HA	ARIMA	SVR	GCN	GRU	T-GCN	HA	ARIMA	SVR	GCN	GRU	T-GCN
15min	$RMSE$	4.2951	7.2406	4.1455	5.6596	3.9994	**3.9265**	7.4427	10.0439	6.0084	7.7922	5.2182	**5.1264**
	MAE	2.7815	4.9824	2.6233	4.2367	**2.5955**	2.7117	4.0145	7.6832	3.7285	5.3525	**3.0602**	3.1802
	$Accuracy$	0.7008	0.4463	0.7112	0.6107	0.7249	**0.7299**	0.8733	0.8275	0.8977	0.8673	0.9109	**0.9127**
	R^2	0.8307	*	0.8423	0.6654	0.8329	**0.8541**	0.7121	*	0.8123	0.6843	0.8576	**0.8634**
	var	0.8307	0.0035	0.8424	0.6655	0.8329	**0.8541**	0.7121	*	0.8146	0.6844	0.8577	**0.8634**
30min	$RMSE$	4.2951	6.7899	4.1628	5.6918	4.0942	**3.9663**	7.4427	9.3450	6.9588	8.3353	6.2802	**6.0598**
	MAE	2.7815	4.6765	**2.6875**	4.2647	2.6906	2.7410	4.0145	7.6891	3.7248	5.6118	**3.6505**	3.7466
	$Accuracy$	0.7008	0.3845	0.7100	0.6085	0.7184	**0.7272**	0.8733	0.8275	0.8815	0.8581	0.8931	**0.8968**
	R^2	0.8307	*	0.8410	0.6616	0.8249	**0.8456**	0.7121	*	0.7492	0.6402	0.7957	**0.8098**
	var	0.8307	0.0081	0.8413	0.6617	0.8250	**0.8457**	0.7121	*	0.7523	0.6404	0.7958	**0.8100**
45min	$RMSE$	4.2951	6.7852	4.1885	5.7142	4.1534	**3.9859**	7.4427	10.0508	7.7504	8.8036	7.0343	**6.7065**
	MAE	2.7815	4.6734	**2.7359**	4.2844	2.7743	2.7612	4.0145	7.6924	4.1288	5.9534	**4.0915**	4.1158
	$Accuracy$	0.7008	0.3847	0.7082	0.6069	0.7143	**0.7258**	0.8733	0.8273	0.8680	0.8500	0.8801	**0.8857**
	R^2	0.8307	*	0.8391	0.6589	0.8198	**0.8441**	0.7121	*	0.6899	0.5999	0.7446	**0.7679**
	var	0.8307	0.0087	0.8397	0.6590	0.8199	**0.8441**	0.7121	*	0.6947	0.6001	0.7451	**0.7684**
60min	$RMSE$	4.2951	6.7708	4.2156	5.7361	4.0747	**4.0048**	7.4427	10.0538	8.4388	9.2657	7.6621	**7.2677**
	MAE	2.7815	4.6655	2.7751	4.3034	**2.7712**	2.7889	4.0145	7.6952	**4.5036**	6.2892	4.5186	4.6021
	$Accuracy$	0.7008	0.3851	0.7063	0.6054	0.7197	**0.7243**	0.8733	0.8273	0.8562	0.8421	0.8694	**0.8762**
	R^2	0.8307	*	0.8370	0.6564	0.8266	**0.8422**	0.7121	*	0.6336	0.5583	0.6980	**0.7283**
	var	0.8307	0.0111	0.8379	0.6564	0.8267	**0.8423**	0.7121	*	0.5593	0.5593	0.6984	**0.7290**

Figure 25 Prediction Result for each time interval and model on Zhao et al. study.

T-GCN is a significantly outstanding performance model compared to the others mentioned above.

2.2.7 Traffic prediction with advanced Graph Neural Networks

Google Maps is a well-known traffic planning and simulation application with users worldwide. DeepMind, a company that works with Google Maps, participated in a time of arrivals (ETAs) prediction model, building a shared modeling approach. The model was built with historical and real-time traffic data and used RNNs. Recently, they changed the model to a graph neural network combining with reinforcement learning as a modeling method due to big segments in the prediction process (Austin Derrow-Pinion, 2021).

The model starts with input from "Supersegments" of road, a divided segment from the real-world road network. The Supersegments consist of many adjacent segments grouped. The ETAs will be calculated using the supersegment before ranking them and suggesting the best supersegment to the user. The diagram of the overall process is shown in *Figure 26*.

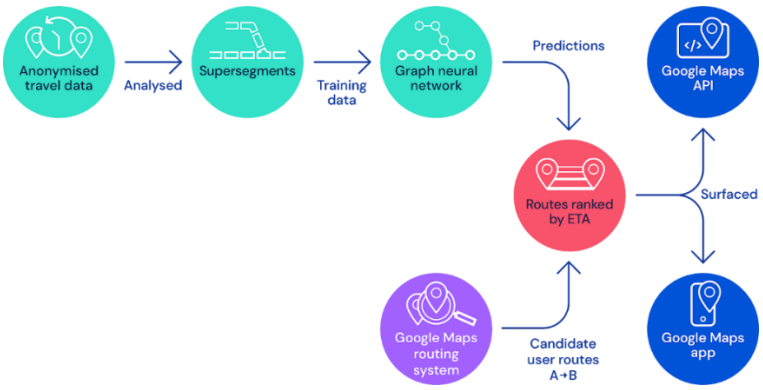


Figure 26 Google Maps ETAs prediction pipeline (Oliver Lange, 2020)

2.2.8 Diffusion Convolutional Recurrent Neural Network: Data-Driven Traffic Forecasting

This study (Li et al., 2017) proposed a novel method for traffic volume prediction with a graph convolutional neural network with a diffusion matrix. The dataset is the vehicle volume in Kuala Lumpur, Malaysia, in September 2019.

The graph representation was used in diffusion, where nodes are the location of vehicle sensors in the focus study area and edges are the connection between them by a random walk approach. The diffusion matrix is generated from the relation shown in *Figure 27* and is a non-direction graph.

Figure 27 Diffusion Network from vehicles sensors

They compared the forecasting result with the other five models, historical average, Auto-Regressive Integrated Moving Average model with Kalman filter, Support Vector Regression, Feedforward Neural network, and Recurrent Neural Network with fully connected LSTM hidden units. The purposed method, Diffusion Convolutional Recurrent Neural Network or DCRNN perform with outstanding results on their dataset.

2.2.9 Summary of related works

Study name	Scope of study	Methodology	Output/ remarks
Non-spatial related model study			
Short-Term Travel Time Prediction from GPS Trace Data using Recurrent Neural Networks	Compare the efficiency of each deep learning model for travel time prediction task in a single road segment	1. GRU 2. RNN 3. LSTM-RNN 4. LSTM-GRU 5. LSTM-DNN	LSTM-DNN performs the best next in 5-min and 10-min prediction
Network Scale Travel Time Prediction using Deep Learning	Compare the efficiency of each deep learning model for travel time prediction task on a network scale.	1. Random Forest (RF) 2. Gradient boosting machines (GBM) 3. CNN-LSTM	CNN-LSTM solves the training problem in many models for road segments, one model per one segment, in RF and GBM methods.

Study name	Scope of study	Methodology	Output/ remarks
Spatially related model study			
Scalable Deep Traffic Flow Neural Networks for Urban Traffic Congestion Prediction	Proposed a model for traffic congestion prediction by putting spatial features for each road segment into the model and predicting a new road segment with no historical dataset.	CNN-LSTM	Able to predict traffic flow in new road segments with other road segment data by using traffic patterns from point detector data.
GPS-based citywide traffic congestion forecasting using CNN-RNN and C3D hybrid model	The study proposed a 3-dimension CNN with other layers model for forecasting speed in the Shenzhen GPS Probe dataset. And using location (latitude, longitude) and time as inputs, in cube form, in the model.	CRC3D model (CNN+RNN merge with C3D model)	Able to apply spatial dimension into the model directly.
DEEPTRAVEL: a Neural Network Based Travel Time Estimation Model with Auxiliary Supervision	The study proposed a spatial related model using gridding in location data fed into each grid data into the model.	Grid data + LSTM Grid data+ BiLSTM	Able to forecast travel time estimation with gridding and neural network model. BiLSTM is better performed in the dataset. The road segment longer than 4 km gave less accurate results.

Study name	Scope of study	Methodology	Output/ remarks
T-GCN: A Temporal Graph Convolutional Network for Traffic Prediction	Predict speed from Shenzhen GPS Probe dataset and Los Angeles (LOS) loop detecter dataset using T-GCN model comparing with other models as in list.	1. Graph convolutional neural network with temporal layer (T-GCN) 2. GRU 3. LSTM 4. Historical Average (HA) 5. AutoRegressive Integrated Moving Average model (ARIMA) Support Vector Regression model (SVR)	T-GCN with spatial adjacency matrix performed the best among others.
Traffic prediction with advanced Graph Neural Networks	Predict estimate time of arrival (ETA) with graph neural network with super segments data in Google Maps.	Prepare super segment; a frequency used group of road segments from google data. The model's input is traffic volumes for each grid in road segments and predicts output as arrival time using a graph neural network.	Able to predict ETAs in large-scale production in Google Maps application.
Diffusion Convolutional Recurrent Neural Network: Data-Driven Traffic Forecasting	Predict traffic volume using vehicles sensors detector in Malaysia.	GCN+ RNN with diffusion matrix (DCRNN) Historical Average ARIMA + Kalman filter	DCRNN performs best among the three models.

2.3 Summary of background and related work

After reviewing related work and considering feasibility from background knowledge, the graph convolution neural network or GCN will be used as the primary approach in this thesis. That is because GCN can help explain and extract the relationship between road networks. The previous study (Jakteerangkool & Muangsin, 2020) only predicted

a single road segment instead of a road network which can be more useful at the application level.

An example application for travel time prediction is traffic information displays that show expected travel time from the current junction to nearby junctions, as shown in *Figure 28*.

Figure 28 Estimate time of arrival from Sathorn-Narathiwas junction to others (picture from Google StreetView)

The other model chosen to compare with GCN is the multi-layer perceptron model (MLP), a neural network model with no spatial included model. Since there is no related work comparing the result of the spatial included model with this neural network type, it is a great opportunity to study their performance compared with GCN, which seems to be a higher performance model concept in traffic prediction tasks.

Chapter 3: Methodology

The experiment in this study can be divided into two main experiments, the speed prediction task and the travel time prediction task.

The speed prediction was performed using various methods, including MLP, GCN-Spatial, and GCN-Spectral. Each model predicts a different result based on its logic and calculation. Therefore, feature engineering on each model is different, but all input data are based on the same dataset with the same primary preparation data.

3.1 Raw Data

The GPS probe data used in this thesis were provided by Grab Taxi, a taxi calling platform. The data are collected from the mobile application used by the taxi drivers and sent back to the data center every second. The raw GPS locations were projected onto OSM road segments, resulting in wayids and projected coordinates. The attributes on each record include the driver id, timestamp, speed, raw latitude, raw longitude, projected latitude, projected longitude, and wayid.

The dataset is stored in parquet format, containing around 50 million records per day. This study uses data for 30 days, from 1st to 30th June 2019. An example of data is shown in *Figure 29*.

	driverid	pingtimestamp	speed	bearing	accuracy	mapversion	projectedlat
4ba4bee5eee94b1b64b0ba6d0ad58e838f72e5173cb1f3...		1561461354	3.18	272	10.000	2019-22	13.716060
4ba4bee5eee94b1b64b0ba6d0ad58e838f72e5173cb1f3...		1561461358	3.18	277	10.000	2019-22	13.716060
4427a2e3534e0d064bbcf5b6b5721b9c0b48014ad3f905...		1561461346	5.07	171	3.900	2019-22	13.700582
4427a2e3534e0d064bbcf5b6b5721b9c0b48014ad3f905...		1561461350	5.95	175	3.900	2019-22	13.700382
4427a2e3534e0d064bbcf5b6b5721b9c0b48014ad3f905...		1561461354	6.25	173	3.900	2019-22	13.700163

projectedlng	rawlat	rawlng	segmentstartnode	segmentendnode	wayids	mapid
100.561610	13.716067	100.561613	3576517459	272491960	482384850	BKK_4W
100.561610	13.716067	100.561613	3576517459	272491960	482384850	BKK_4W
100.589188	13.700589	100.589250	567147390	5220991962	44695699	BKK_4W
100.589210	13.700389	100.589272	567147390	5220991962	44695699	BKK_4W
100.589235	13.700170	100.589297	567147390	5220991962	44695699	BKK_4W

Figure 29 Example of raw data received

The received data covers the central Bangkok area as shown in *Figure 30*.

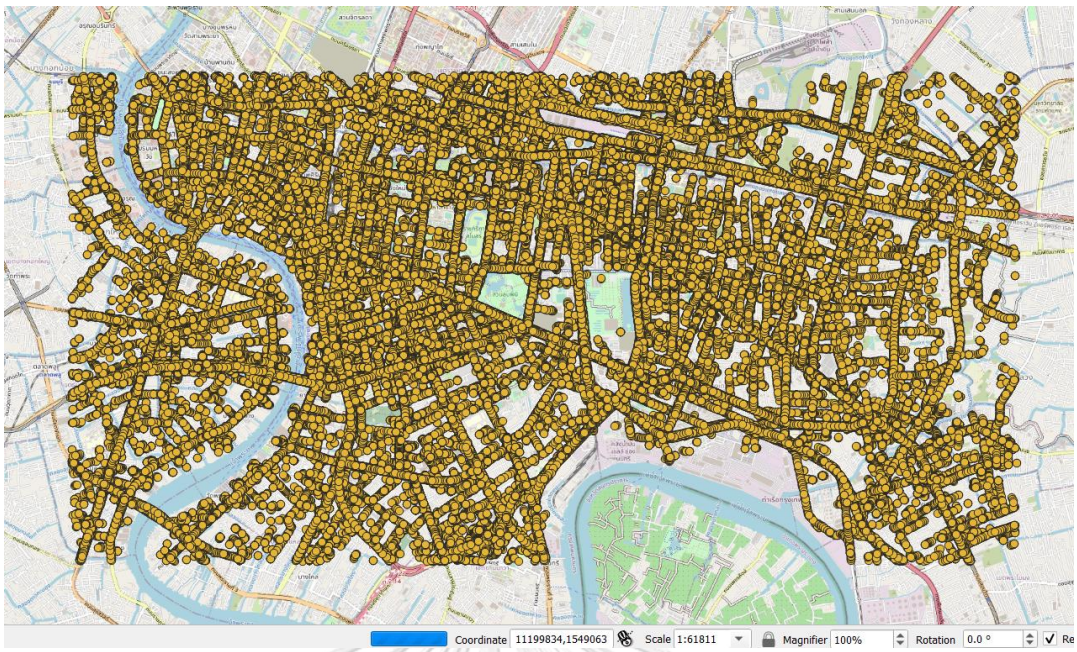


Figure 30 Raw data scope

3.2 Data Selection

As the data cover most road segments in the selected area, some road segments are small and may not have data for some time. Only the data points on the main road segments during the rush hours were selected to avoid the lack of data. The selected roads are on the following list:

- Rama I Road
- Rama IV Road
- Asoke montri road
- Phayathai Road
- Silom Road
- Surawong Road
- Phetchaburi Road
- Charoenkrung Road
- Henri Dunant Road
- Chidlom Road
- Sukhumvit Rod
- Sukhumvit 71 Road

The fragmented road segments that connect each pair of main junctions are combined into a road segment. Two-way roads have two road segments in different directions. The resulting road network comprises 69 combined road segments, as shown in *Figure 31*. The selected time is from 6:00:00 to 20:00:00 each day in June 2019, with a 5-minute window. Thus, there are 180 timesteps each day.

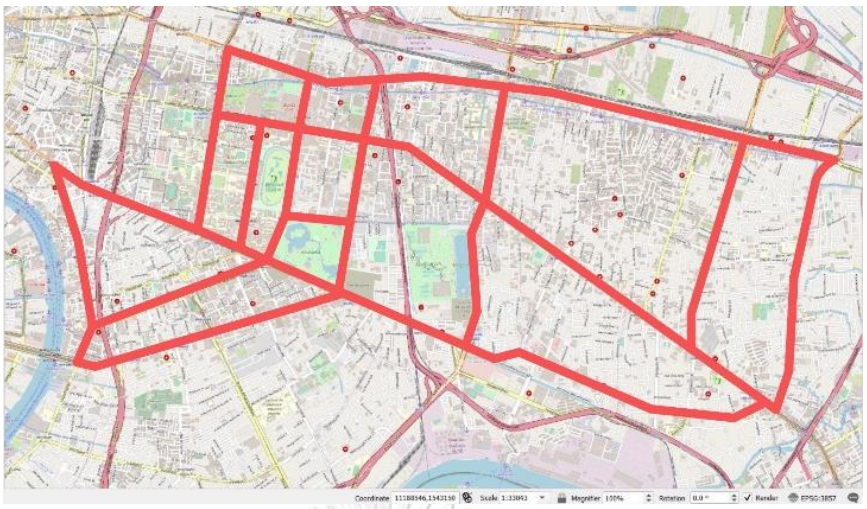


Figure 31 Selected Road segment in data scope

3.3 Data Primary Preparation

This study aims to predict the travel time on each road segment. First, the median speed of unique vehicles in the same road segment during a timestep is calculated. Then, the median speed is used to predict the speed of the road segment in the next timestep. For travel time prediction, the forecasting results were calculated separately with the speed value.

The travel time data collect from ground truth data of travel time in the same road segment. The gap between first and last point in the road segment will be used to define travel time for a vechicle id. Before using median of travel time data from many driver id to be a travel time in a road segment to avoid personal behavior of a driver. The incorrect data, such as negative speed values, were excluded.

3.3.1 Experiment I: Speed Prediction with a forecasting model

The overall process for the experiment I is shown in *Figure 32*. The process contains three main steps: primary data processing, data preparation on each model, and the feature engineering process. The details in each step will be explained later in this section.

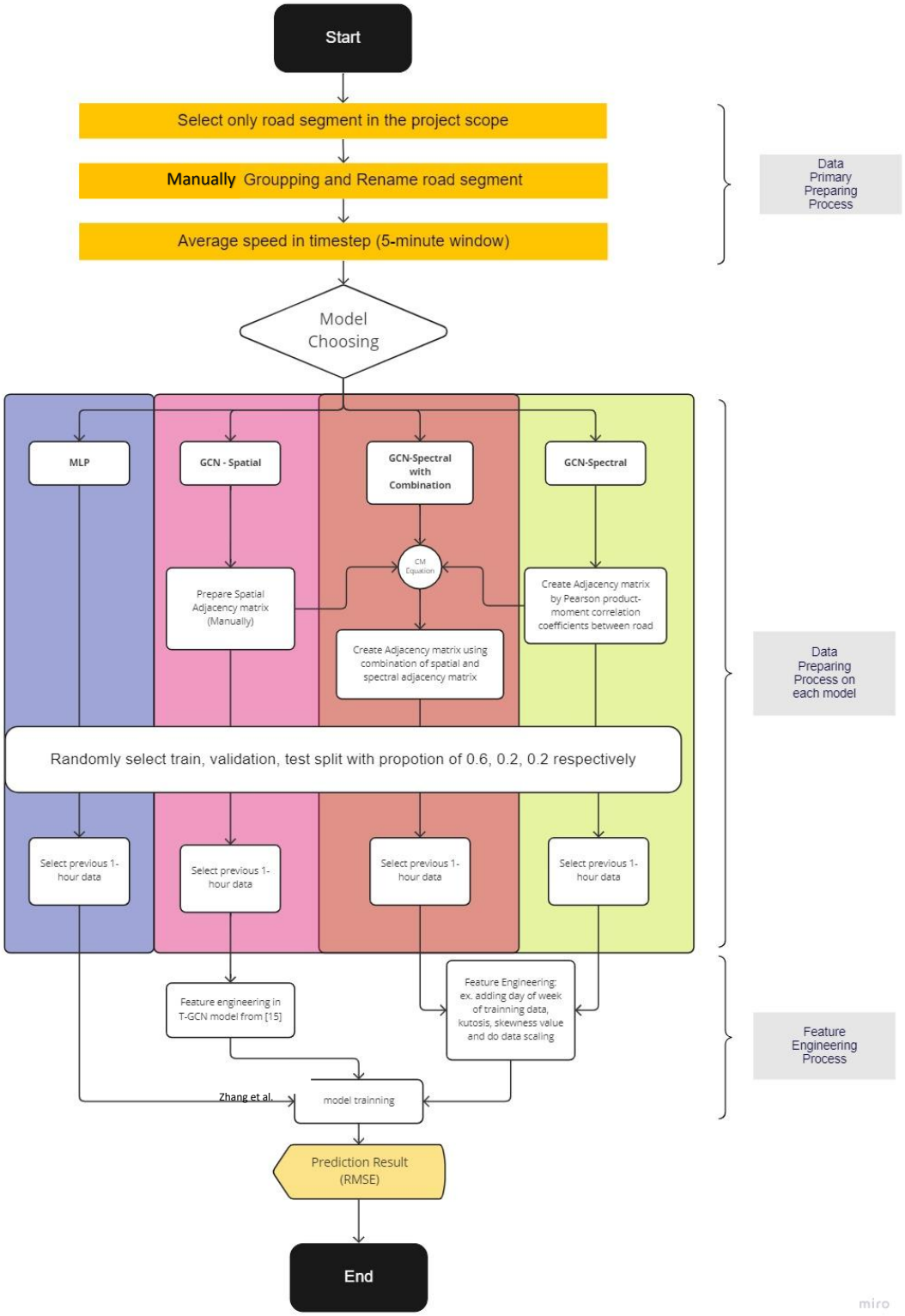


Figure 32 Experiment I diagram

3.3.1.1 Input data for the speed forecasting model

The data were grouped by rearranging wayid and timestep then average speed values from every point that meet the wayid and timing criteria. The average speed per timestep is input for the speed prediction model. The timestep in this study is 5 minutes interval. For some wayids and epochs with no data, the speed of previous timestep data will be used to fill the null values.

The model also used these data as input and target values. The input data are 12 timesteps (previous 60 minutes) before the prediction timestep. An example of processed data is shown in *Figure 33*. The unit of speed value is meters per second (m/s).

5_minutes_window	2019-06-01 06:55:00	2019-06-01 07:00:00	2019-06-01 07:05:00	2019-06-01 07:10:00	2019-06-01 07:15:00	2019-06-01 07:20:00	2019-06-01 07:25:00	2019-06-01 07:30:00	2019-06-01 07:35:00	2019-06-01 07:40:00
AA_1	7.760633	7.096287	7.634983	6.196284	5.944102	7.016945	7.476362	6.636332	7.749359	6.290909
AA_2	6.479206	3.178696	4.108333	6.030355	6.660557	6.071720	5.536762	4.934259	4.605272	5.346276
AB_1	11.184545	7.448065	9.457436	8.418824	8.105120	7.235072	8.361902	10.388647	9.404952	12.007879
AB_2	3.685484	4.932069	4.772700	3.936486	7.292247	9.141479	5.671835	8.313187	5.598125	9.254493
AC_1	12.190000	4.218800	6.419149	4.024762	13.091000	4.307805	4.694783	7.209091	6.538980	7.400909

Figure 33 The input data for the speed prediction model

The processed data can be easily explored and visualized by the day of the week. From *Figure 34*, it is obvious that the data have some patterns. For example, on Sunday, the speed is relatively higher than the speed on other days in the week. Thus, the day of the week for feature engineering will be one of the features in the GCN-spectral model. In contrast, other models (MLP and GCN-Spatial) will use additional features and be explained more in the model creation section.

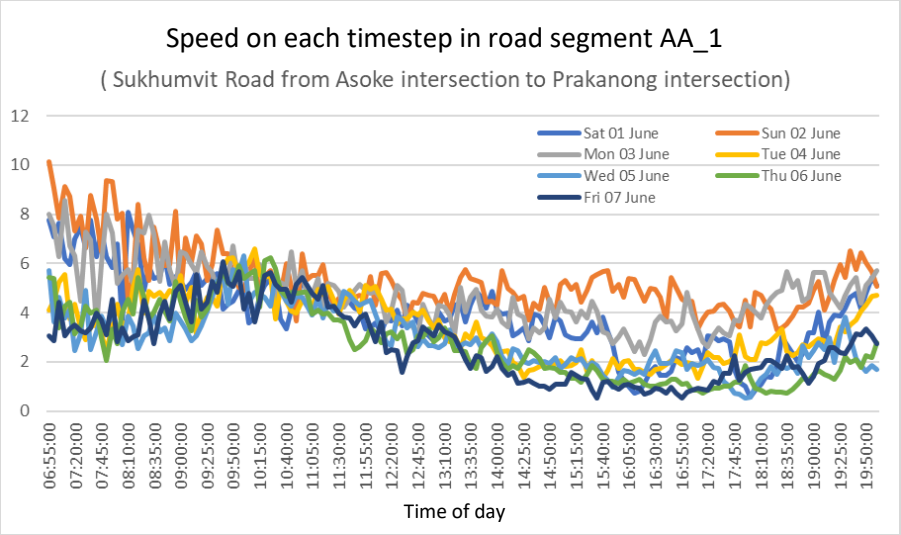


Figure 34 Example of data from road segment Sukhumvit Road from Asoke intersection to Prakanong intersection by day of week

3.3.1.2 Forecasting model creation and data engineering for each model

1) Multi-Layer Perceptron (MLP)

Multi-layer perceptron (MLP) was selected in this study as an example model in which no spatial relationship is included in the model. The model input and output use only speed values, no scaling data, and other feature engineering.

The model was created using the simplest structure; only one hidden layer with ten hidden nodes will be used in the speed prediction experiment and use Rectified Linear Units (ReLU) as an activation function.

The objective of using ReLU instead of other activation functions is that ReLU is suitable for predicting the positive output data. In this case, the speed values are predicted, and speed cannot be a negative value; it can be 0 when the car stop. Thus, ReLU is the best suitable activation function for the traffic forecasting method.

The ReLU activation function is shown in *Figure 35*, and the MLP architecture is shown in *Figure 36*.

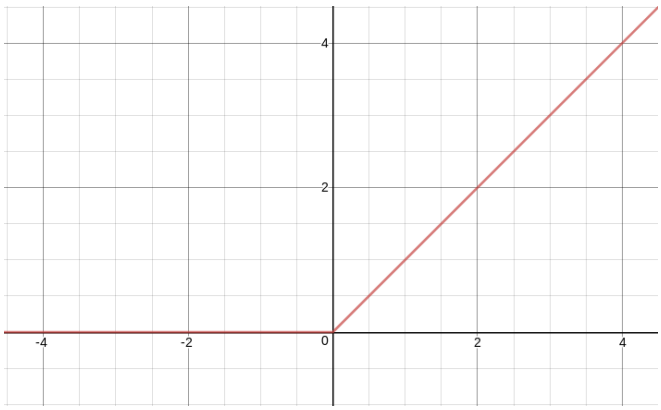


Figure 35 ReLU activation function (Agarap, 2018)

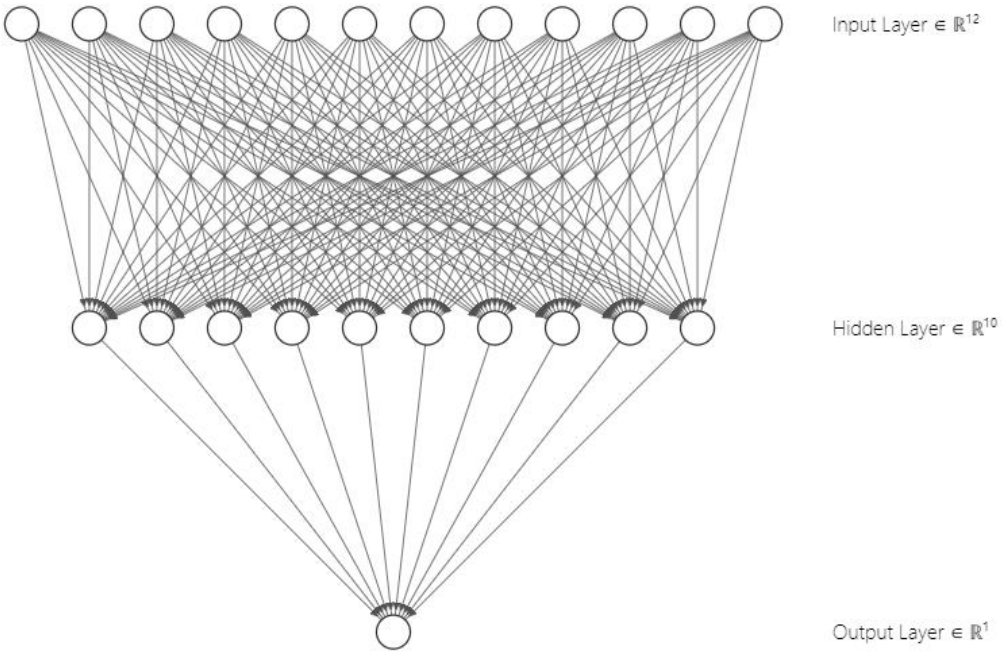


Figure 36 MLP model structure

	07:00:00	07:05:00	07:10:00	07:15:00	07:20:00	07:25:00	07:30:00	07:35:00	07:40:00	07:45:00	07:50:00	07:55:00		08:00:00
Timestep	1	2	3	4	5	6	7	8	9	10	11	12		target
AA_1	7.10	7.63	6.20	5.94	7.02	7.48	6.64	7.75	6.29	7.32	6.28	5.84		6.81

Figure 37 An example of input data and target

The model used blind date training data, i.e., no spatial features will be included in the model. Only the previous 12 timesteps and one output will be used for training. An example of training data is in *Figure 37*. The MLP model was created by concept one fit all to compare with the GCN models which can predict every road segment in a single model. So the MLP model trained all data from every road segment simultaneously. The data were selected for training, validation, and testing using a random index with the proposition of 60:20:20. These criteria will also be used in other models in this study.

2) Graph Convolutional Neural Network with Spatial Adjacency Matrix (GCN-Spatial)

The concept of GCN-Spatial is the physical adjacency of road segments. The speed of the connected road segments in the previous timestep impacts the speed of the focused road segment in the predicted timestep. This concept is widely used in traffic prediction studies (Li et al., 2017) and (Zhao et al., 2020). Spatial road relationships are mentioned in the GCN prediction method and are widely applied with grid-based prediction approaches such as in (Zhang et al., 2018) and (Guo et al., 2021).

The spatial adjacency relationship in this study was defined by sharing the same junction between road segments.

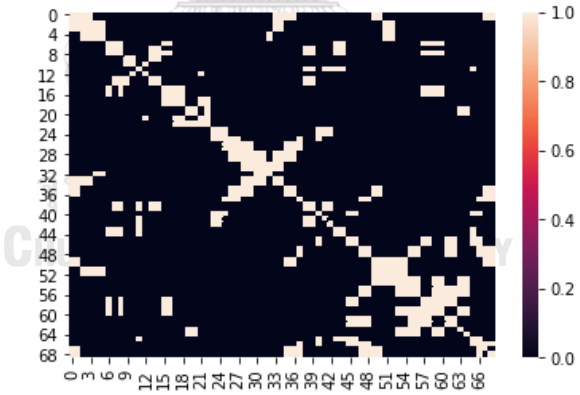


Figure 38 Spatial Adjacency Matrix for the Rama IV dataset. The row and column number is a number of road segment transform from texts into the numerical values.

As shown in Figure 38, the spatial adjacency matrix has 69 x 69 cells for the number of road segments in the network by the number of road segments in the network. The spatial relationship is static by time. If the roads are connected, the value in the adjacency matrix is one; else, it will be zero.

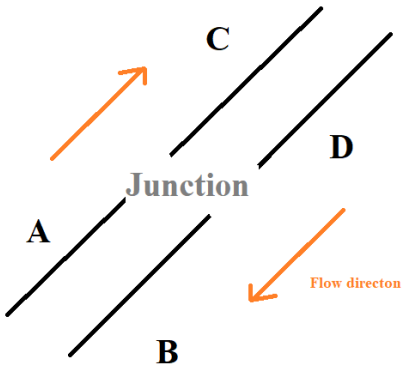


Figure 39 Ilustration of spatial adjacency matrix concept

The spatial adjacency matrix was designed with the assumption of every road segments shared the same junction will have connectivity without concerning about direction. In Figure 39, road segment A B C and D are connected even the direction of road segment A and D might not connected physically. The spatial adjacency matrix in this example can be wrote as 4x4 matrix:

$$\begin{bmatrix} . & A & B & C & D \\ A & 1 & 1 & 1 & 1 \\ B & 1 & 1 & 1 & 1 \\ C & 1 & 1 & 1 & 1 \\ D & 1 & 1 & 1 & 1 \end{bmatrix}$$

The limitation of spatial relationships is that the matrix is static, while in the real-world situation, time has a significant effect on driving behavior, as shown in *Figure 38* before. Changing the time of the day or the day of the week can affect the traffic speed on a road segment.

For the calculation method, the model architecture is based on the (Zhao et al., 2020) model with the spatial relationship of the Rama IV dataset instead of the Shenzhen and Los Angeles dataset in the Zhao et al. experiment. The model architecture is depicted in *Figure 40*.

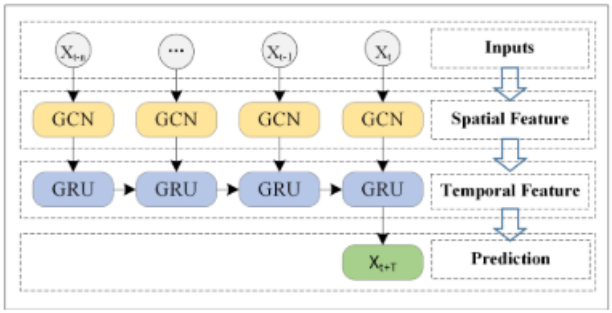


Figure 40 Zhao et al. T-GCN model architecture

Zhao et al.'s study uses GCN-Spatial combination with GRU, a well-known neural network for predicting time series data as a temporal feature extract layer. The model received inputs of t time step, where t is the timeframe of interest. In this study, the t value is subtituded with 12 where 12 is a number of focusing 12 timestep previously to predict the next time step. The inputs will pass through the GCN and GRU layers respectively and will store as a constant value before passing through the next training input in the GRU layer. The GRU layer will choose to forget or remember the previous timestep constant value before passing the new constant into the next training cell.

3) Graph Convolutional Neural Network with Spectral Adjacency Matrix (GCN-Spectral)

The GCN-Spectral adjacency matrix can be calculated by using the concept of correlation between each road segment that can occur even if the components are not connected. Because of in the real world, the effect of traffic light controller and driving behavior will affect the speed in some road segments that are not connected. The spectral adjacency matrix and GCN model was chosen. An example of this situation is when a driver choose the parallel road to go to the same destination instead to avoid traffic jam. These behaviors cannot show in the spatial adjacency matrix, which is static by time. The parallel road choice is shown in *Figure 41*.

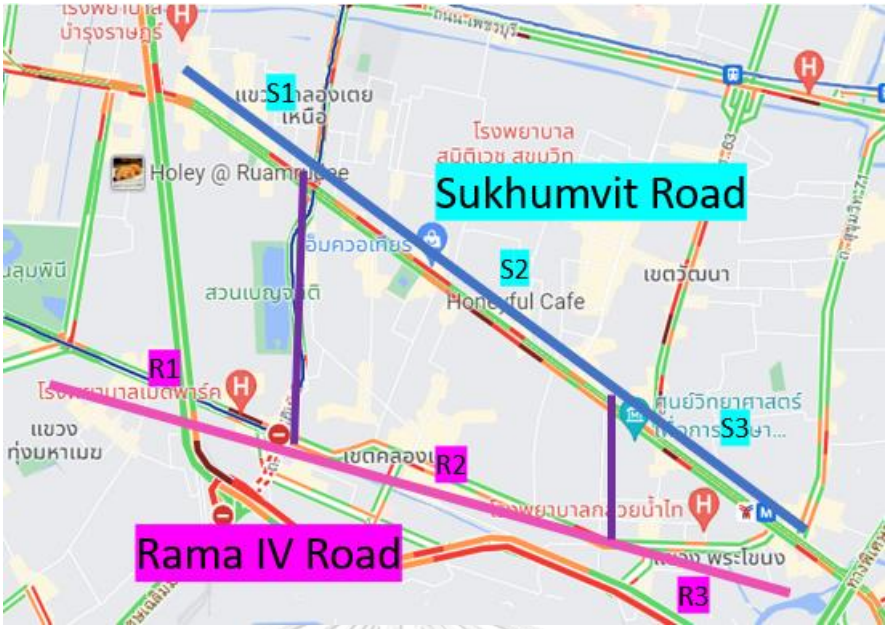


Figure 41 The parallel road choice explanation.

Focusing on the road segments R1 and S2, imagine that the driver starts driving in the R1 road segment, and the destination is at the Prakanong intersection (the intersection between R3 and S3). To reach the destination, the driver can choose a direct path (R1, R2, and R3). However, if there is a traffic jam in R2, the driver can choose S2 instead and pass S3 to reach the destination. With the spatial adjacency matrix concept, R1 and S2 are not connected and will have no relation to each other. However, in the spectral view, both of them can also be affected by others, representing the parallel road choosing behavior concept.

The GCN-Spectral adjacency matrix was calculated using Pearson product-moment correlation coefficients (R) between road segments, as in the equation below.

$$R_{ij} = \frac{c_{ij}}{\sqrt{c_{ii} * c_{jj}}}$$

Where c is a covariance matrix of speed in a selected sequence, i.e., twelve timesteps of 5-minute intervals, or an hour, before the prediction target. The spectral adjacency matrixes are unique and can be adjustable by timestep, as shown in *Figure 42* the colors in the cells of adjacency matrix refer to the weak-strong connection between each pair of row and column.

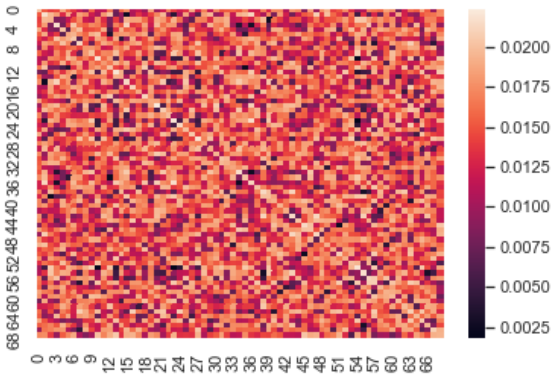


Figure 42 An Example of Spectral Adjacency Matrix on 2019-06-20 17:15:00. The row and column number is a number of road segment transform from texts into the numerical values.

However, considering correlation values, the spectral adjacency matrix shows a very weak correlation on each point compared with the spatial one. Thus, while the relationship of the spatial adjacency matrix is between 0 and 1, the correlation in the spectral adjacency matrix is only 0.002 to 0.02, about 200 times weaker than the spatial.

The model architecture applied to spectral adjacency matrix is from Cerliani's work (Cerliani, 2020) with a little configuration to apply in the Rama IV dataset such as config the dimension of the input. The modified model architecture is shown in *Figure 43*. The orginal work from Cerliani used the GCN modoel connected with LSTM as and temporal layer. In this study, for the speed prediction experiment, GRU layers were also applied with this model architecture instead of LSTM to compare the result between two RNN neural networks.

Because of the concern of weak relationship in the spectral adjacency matrix. And the disadvantage of cannot include the relationship between non-connected road segments in the matrix of a spatial type. A combination matrix is a combination approach between two kinds of adjacencies which will be explained in the next topic.

Layer (type)	Output Shape	Param #
input_6 (InputLayer)	[(None, 69, 7)]	0
input_5 (InputLayer)	[(None, 69, 69)]	0
graph_conv_2 (GraphConv)	(None, 69, 16)	128
input_4 (InputLayer)	[(None, 12, 69)]	0
graph_conv_3 (GraphConv)	(None, 69, 4)	68
lstm_2 (LSTM)	(None, 12, 128)	101376
flatten_1 (Flatten)	(None, 276)	0
lstm_3 (LSTM)	(None, 64)	49408
concatenate_1 (Concatenate)	(None, 340)	0
batch_normalization_1 (BatchNor	(None, 340)	1360
dropout_2 (Dropout)	(None, 340)	0
dense_4 (Dense)	(None, 256)	87296
dense_5 (Dense)	(None, 128)	32896
dense_6 (Dense)	(None, 16)	2064
dropout_3 (Dropout)	(None, 16)	0
dense_7 (Dense)	(None, 1)	17

Figure 43 Architecture of GCN-Spectral model

From *Figure 43*, the architecture of GCN-Spectral model will be used in the combination matrix and spatial matrix to further comparison in error analysis in this study.

The model will starting with received input from 3 sources the (3 input layers) which are the feature engineering input that calculated from 12 previous timestep to transform into statistic number such as kutosis, mean, standard deviation, skewness etc. The feature engineering matrix has 69x7 dimension. Second input is adjacency matrix with dimension of 69x69, the 2 inputs will passed through a GCN layer before combining with the third input, the previously 12 timestep speed value of each road segment, 12x69 dimension. Both inputs passed the second GCN layes, the output will pass through LSTM layers with a flattening layers to reduce dimension into one dimension array. And passing through the last step batch normalization and dense with ReLu activation function to get the output of a single value of speed.

4) GCN-Spectral with Combination Matrix

The inspiration for creating a combination matrix is to avoid the weak relationship in the spectral adjacency matrix and to combine spatial relationship features into the model. To avoiding weak correlation of spectral adjacency matrix the multiplier should apply to the equation aim to emphasize the value of spectral relationship. In this case the (Spatial+1) is the multiplier.

The equation applied for creating a combination matrix (CM) is:

$$CM = (Spatial + 1) * Spectral$$

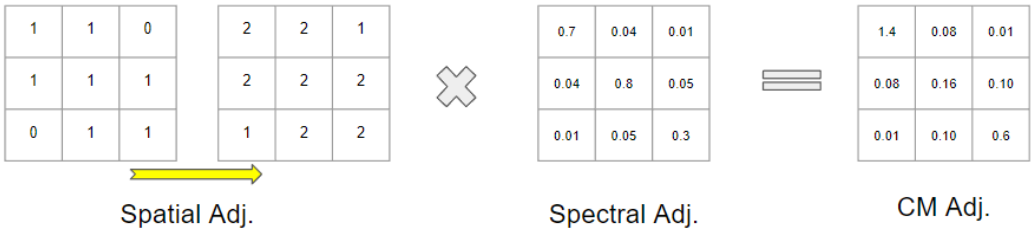


Figure 44 Combination Matrix (CM) conceptual calculation

This equation and illustration as showed in *Figure 44* means to emphasize the spatial feature by one (to avoid zero value) and multiply with spectral correlation values, so the unconnected road segment will be multiplied by 1 while the connected road segment will be multiplied by 2 to emphasize this relationship. The combination matrix is unique by time, like the spectral adjacency matrix.

3.3.2 Experiment II: Travel time calculation

3.3.2.1 Ground Truth data for travel time prediction experiment

The ground truth data is defined by the time spent in the road segment calculated using the median of time spent in the road segment from every car in a time step. The calculation process can be shown in *Figure 45*, and the result of the preparation process is in *Figure 46*.

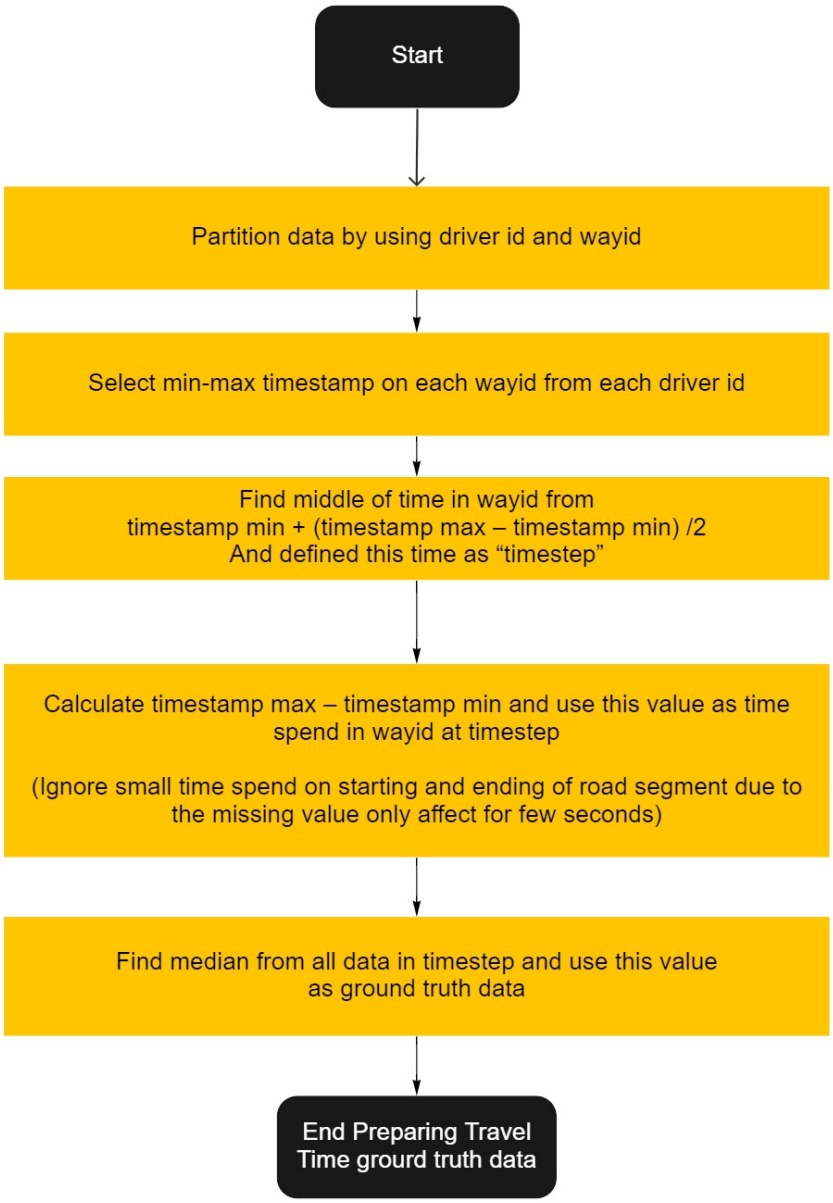


Figure 45 Travel time ground truth data preparing process

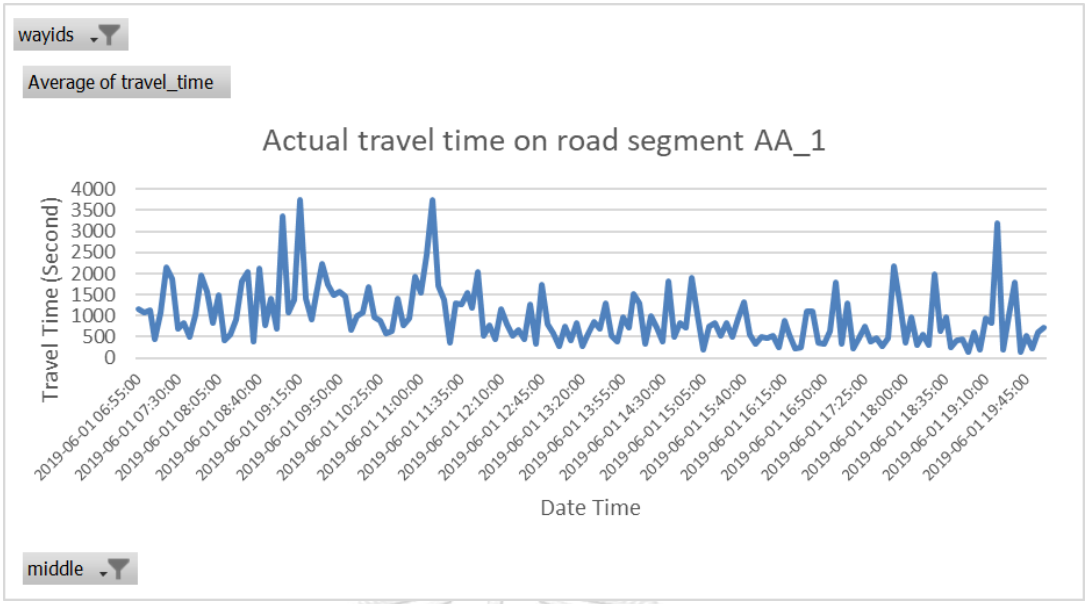


Figure 46 Example of actual travel time data in AA_1 (Sukhumvit Road from Asoke intersection to Prakanong intersection road segment).

The actual data which are calculated from probe data will be used to validate the prediction result from the speed prediction model.

As can be seen in the spike of the graph, some timestep can have the actual travel time higher than one hour, this means the actual of travel time data is vary and has a high error itself. The errors might be caused from the GPS error or IoT device error or map matching error.

3.3.2.2 Converting speed prediction result into the travel time value

From the models in experiment I, the prediction result will be used to calculate the travel time value using a simple formula.

$$Travel\ time = \frac{velocity}{Road\ Segment\ Length}$$

3.4 Model evaluation

Since the traffic prediction models proposed in this study are for speed prediction tasks that can apply to other traffic forecasting problems, such as travel time prediction. The speed prediction models themselves will use root mean square (RMSE) to measure the efficiency of the speed

prediction task. The formula of RMSE shows in the equation below, where n is the total prediction value on every road segment. Thus,

$$RMSE = \sqrt{\sum_{i=1}^{n} \frac{(prediction - actual)^2}{n}}$$

Furthermore, for the travel time prediction task, the RMSE will also apply to measure the prediction result; however, the error of the result also depends on road segment length. The longer the road segment length is, the higher the error amount will be. Thus, further analysis will be applied to the speed prediction task to find which factor will impact their accuracy.

3.5 Result analysis

Three main dimensions will analyze the result of speed prediction.

1) Relationship between error and road segment length
2) Relationship between error and number of lanes in a road segment
3) Relationship between error and time
    3.1) Time of day
    3.2) Day of week

The resulting use in the analysis will come from MLP, GCN-Spectral, and GCN-Spectral with a combination matrix only since the GCN-Spatial (Zhao et al., 2020) cannot extract the predicted data from each road segment and timestep directly. The result of the models will be compared with the RMSE value to define its efficiency only.

Chapter 4: Results

As mentioned in Chapter 3: methodology, the experiment in this study can be divided into two main parts, the speed prediction task and the travel time prediction task. In this chapter, the tools used in this study, the result from the speed prediction model, the impact of speed prediction analysis, and the travel time prediction result will be explained, respectively.

4.1 Tools

4.1.1 Programming tools

- Python 3.8 with libraries on the following list:
    1. pyspark
    2. Numpy
    3. Pandas and Geopandas
    4. TensorFlow, Keras, and PyTorch
    5. Spektral and torch-geometric for graph deep learning framework
    6. Scipy
- QGIS3 Software for visualization and spatial correction, e.g., cut, merge analysis shapefile of road segments
- Tableau Public 2020 for graph visualization purpose
- Excel for analysis and some graph visualization

4.1.2 Equipment

- Computer processor: AMD Ryzen 7 3750H with Radeon Vega Mobile Gfx 2.30 GHz
- RAM: 16 GB
- GPU: NVIDIA GeForce GTX 1660 Ti with Max-Q Design

4.2 Experiment I: Speed Prediction Task

Firstly, the experiment is done on the Rama IV dataset only. The control environment for each model is on the following list:

1) Training Epochs: 10 epochs
2) Size of training data: 60% of total data (shuffle)
3) Size of validation data: 20% of total data (shuffle)
4) Size of testing data: 20% shuffle
5) No GPU or special parallel computing techniques apply to each model
6) Time windows interval: 5-minute interval
7) Prediction output: next timestep (next 5 minutes)

The result of the experiment I can be shown in *Table 1*. MLP model performs best on every key performance. The RMSE of the MLP model shows a surprising result with a 1.29 m/s significantly better number than other GCN-model, which conflicts with the assumption of this experiment that MLP will have the worst performance due to non-spatial features included, and it is the least complicated model in the experiment.

4.2.1 Rama IV dataset

Measurement	Model Name					
	MLP	***GCN-Spatial (Zhao et al.)***	***GCN-Spatial***	***GCN-Spectral (LSTM)***	***GCN-Spectral (GRU)***	***GCN-Spectral (LSTM) with CM***
RMSE (m/s)	1.29	1.63	1.58	1.60	1.59	1.57
Maximum memory (MB)	471	2825	1212	1324	1154	1362
Trainning Time	0:01:38	0:03:48	0:08:23	0:25:55	0:35:54	0:09:29

Table 1 Speed prediction result in Rama IV dataset

Meanwhile, the MLP performs the best result, and the other GCN models perform slightly differently on RMSE value. The GCN-Spectral with combination matrix performs the best among GCN models with a 1.57 m/s RMSE result.

Among the type of adjacency matrices, the combination matrix performs the best while the spatial matrix gives the poorest result. It can be implied that the spatial relationship on road segment level affects the traffic flows more than the spectral of speed relationship in the Bangkok area. The adjacency matrix also affected training time, and the spatially related adjacency matrix consumed about 2.5 times faster than the only spectral adjacency matrix.

By comaparing temporal layers type in GCN-Spectral (LSTM) and GCN-Spectral (GRU) with the same conditions of feature engineering and adjacency matrix aim to understand the performance of temporal type to model accuray.The different type of temporal layers does not significantly improve the RMSE result. but they affects training time, GRU taking a little longer training period.

Due to the outstanding performance of MLP, the Shenzhen dataset from (Zhao et al., 2020) was done through the same process as an experiment I to compare the MLP result with other models. The objective of validation model with another dataset is to confirm the performance of MLP model that better than spatial related model that firstly expected to be better performed than MLP.

However, there are some differences between the data characteristics of the two datasets, which can be shown in *Table 2*.

Differences	**Rama IV dataset**	**Shenzhen dataset**
Time interval	5-minute	15-minute
Period of data	6.55 am- 8.00 pm, June 2019	24 hours a day, January 2015
Relation of road network criteria	Main road segment, grouped by a junction to a junction	No information on road selection criteria

Table 2 Differences between Rama IV dataset and Shenzhen dataset

4.2.2 Shenzhen dataset

Measurement	**Model Name**					
	MLP	***GCN-Spatial (Zhao et al.)***	***GCN-Spatial***	***GCN-Spectral (LSTM)***	***GCN-Spectral (GRU)***	***GCN-Spectral (LSTM) with CM***
RMSE (m/s)	5.56	5.69	5.92	5.94	5.93	6.09
Maximum memory (MiB)	483	2789	2513	2372	1679	1854
Training Time	0:01:39	0:17:08	0:15:20	0:17:07	0:15:00	0:17:19

Table 3 Speed prediction results in the Shenzhen dataset

The Shenzhen dataset was 4,328 kb stored in comma-separated value (CSV) format without heading. Since there is no heading in the dataset, it is impossible to track the data back to find the real spatial relationship (except the spatial adjacency matrix provided with the dataset). In addition, the criteria for data selection and preparation are not provided. The data contains 156 road segments with 24-hours data from 1 January 2015 to 31 January 2015 with a 15-minute interval.

The result of the Shenzhen dataset shows in table III. The model environment setting is the same as the Rama IV dataset with ten training epochs without GPU-assisted training sessions. The GCN-Spatial model from Zhao et al. can be trained with higher epochs, and the RMSE can perform better to the 2.34 m/s as reported in their paper. However,

in this experiment, only ten epochs were trained to compare with the Rama IV dataset. Results as shown in *Table 3.*

The empirical level difference between GCN-Spatial from Zhao et al. and GCN-Spatial in this study (GCN with the same feature engineering set as GCN-Spectral but using spatial adjacency matrix) shows that the Shenzhen data perform worse in this study because of feature engineering cause.

4.3 Error from speed prediction analysis

4.3.1 Box plot analysis

Box plot analysis compares the prediction result quality of error on each road segment with the others. The result from the Rama IV dataset showed that the model type directly impacted each road segment's error.

The average frequency of data used to train the model is shown in *Figure 47* and the average data count by hour of day is shown in *Table 4.* The overall timestep is 4742 steps and the null in overall time from each road segment is in *Figure 48.*

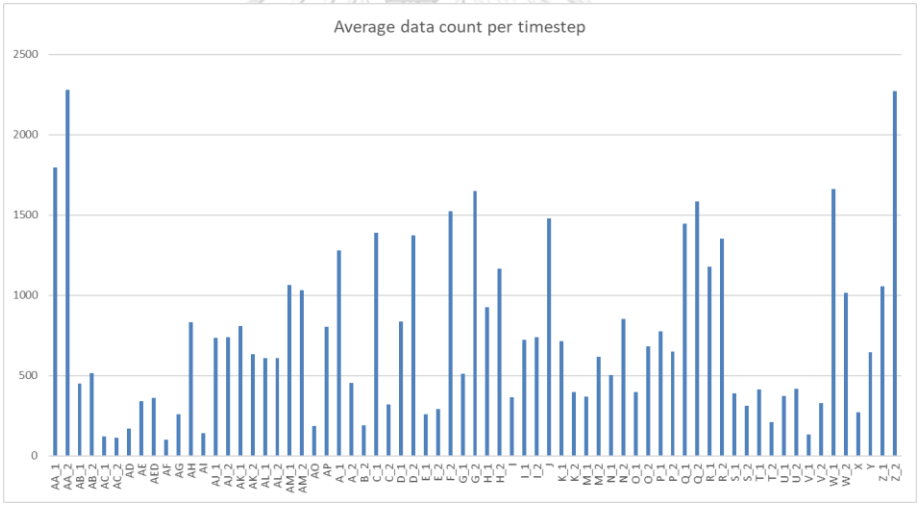


Figure 47 Average data count per timestep

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM
A_1	260	483	808	1,161	1,419	1,453	1,458	1,595	1,644	1,764	1,661	1,561	1,469
A_2	97	177	275	401	492	511	513	523	533	600	576	584	629
AA_1	509	759	1,067	1,362	1,662	1,913	2,028	2,215	2,204	2,226	2,380	2,616	2,512
AA_2	880	1,272	1,550	2,051	2,652	2,937	2,865	2,812	2,659	2,607	2,539	2,604	2,422
AB_1	188	181	278	332	404	443	447	480	546	541	625	685	714
AB_2	164	247	359	499	615	653	642	586	593	557	576	616	604
AC_1	52	67	100	121	139	142	136	122	123	116	131	152	169

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM
AC_2	59	88	108	140	152	142	125	114	108	101	95	109	115
AD	52	104	107	120	152	159	167	187	203	229	252	278	209
AE	87	190	220	309	354	386	380	340	350	391	504	557	362
AED	116	215	241	279	350	415	386	394	349	416	514	544	493
AF	19	37	58	105	131	111	102	103	92	106	124	137	152
AG	103	156	202	271	295	293	284	279	274	292	296	337	294
AH	164	309	410	570	757	889	937	980	1,027	1,091	1,191	1,229	1,291
AI	56	79	106	138	155	166	154	145	137	154	166	186	182
AJ_1	313	585	611	696	811	900	812	754	731	852	978	896	693
AJ_2	249	405	501	674	824	875	800	722	693	823	995	1,066	1,032
AK_1	168	368	482	573	854	998	944	922	830	911	1,078	1,328	1,077
AK_2	142	330	434	536	727	835	789	722	631	714	873	899	670
AL_1	216	439	525	587	683	691	629	562	512	599	795	961	756
AL_2	188	327	424	460	569	615	606	535	542	720	906	1,123	908
AM_1	364	624	760	756	983	1,073	995	985	1,121	1,231	1,578	1,816	1,603
AM_2	447	987	999	949	1,117	1,107	1,048	934	841	1,097	1,380	1,485	1,093
AO	86	78	122	136	155	141	137	127	153	249	331	355	331
AP	396	494	516	714	890	864	758	696	709	874	1,150	1,241	1,177
B_2	44	80	123	155	176	173	184	184	176	278	279	280	330
C_1	396	732	978	1,209	1,322	1,513	1,567	1,509	1,479	1,574	1,817	2,120	1,914
C_2	102	180	262	299	358	388	369	316	314	325	387	451	399
D_1	332	488	702	784	852	838	889	924	944	872	1,043	1,159	1,090
D_2	638	937	1,152	1,312	1,503	1,580	1,499	1,469	1,419	1,435	1,706	1,808	1,503
E_1	130	182	217	223	234	218	223	231	250	318	376	421	330
E_2	180	247	314	394	383	295	273	274	232	240	353	365	282
F_2	765	1,030	1,341	1,463	1,703	1,688	1,468	1,484	1,482	1,599	1,818	2,080	1,967
G_1	185	311	459	567	591	563	522	514	503	529	577	670	660
G_2	473	713	1,031	1,313	1,916	2,078	1,834	1,812	1,750	1,831	2,131	2,330	2,313
H_1	297	578	742	882	1,044	1,138	1,156	1,030	975	962	985	1,116	1,184
H_2	295	530	765	879	1,115	1,219	1,362	1,424	1,314	1,430	1,618	1,632	1,644
I	116	259	353	341	367	377	459	389	395	340	451	519	410
I_1	195	390	393	420	540	710	851	847	898	1,093	1,106	1,038	950
I_2	185	285	330	450	552	781	895	900	993	1,130	1,224	987	946
J	263	515	807	1,078	1,330	1,527	1,709	1,847	1,781	1,932	2,200	2,164	2,139
K_1	205	364	474	516	673	792	846	872	939	934	875	896	933
K_2	119	214	225	288	371	457	481	476	467	484	511	521	544
M_1	128	179	173	202	293	333	361	390	415	638	644	578	480
M_2	89	136	184	341	481	635	720	831	873	982	973	921	886
N_1	164	317	352	407	516	552	562	558	534	628	620	683	653
N_2	125	254	458	712	924	998	984	1,215	1,168	1,205	1,122	1,078	934
O_1	134	273	319	343	417	438	501	466	395	442	476	518	467
O_2	160	388	475	608	707	839	840	825	824	794	781	865	795
P_1	233	397	487	552	682	789	856	894	920	1,002	1,130	1,138	1,042

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM
P_2	225	358	517	583	686	718	746	713	754	774	754	811	822
Q_1	657	1,159	1,263	1,476	1,715	1,726	1,630	1,657	1,567	1,424	1,564	1,622	1,463
Q_2	495	807	1,175	1,301	1,625	1,700	1,729	1,782	1,853	1,825	2,066	2,176	2,157
R_1	462	870	1,082	1,207	1,418	1,518	1,425	1,406	1,318	1,333	1,216	1,164	1,023
R_2	341	702	1,024	1,238	1,473	1,667	1,613	1,635	1,507	1,418	1,501	1,825	1,747
S_1	225	356	276	281	396	378	359	417	400	469	474	582	450
S_2	106	293	340	303	302	337	314	322	324	314	365	423	339
T_1	193	295	285	285	352	379	362	384	476	592	604	638	553
T_2	78	136	163	211	226	230	227	210	218	250	259	282	249
U_1	102	242	238	223	288	337	365	415	395	477	585	671	526
U_2	142	221	305	367	428	447	440	424	495	554	543	590	480
V_1	50	92	104	127	139	136	130	125	111	171	171	205	153
V_2	102	234	241	229	288	298	323	325	307	417	531	580	426
W_1	585	1,422	1,587	1,589	1,831	1,991	1,946	1,815	1,520	1,631	2,094	2,147	1,616
W_2	389	588	774	784	1,005	1,069	938	885	837	1,203	1,620	1,820	1,379
X	43	73	112	209	282	308	316	316	312	399	395	377	401
Y	137	273	427	576	769	804	811	820	800	806	766	770	704
Z_1	340	404	608	832	1,108	1,234	1,205	1,150	1,175	1,271	1,348	1,522	1,588
Z_2	791	1,391	1,694	1,881	2,328	2,786	2,744	2,724	2,727	2,801	2,724	2,653	2,459

Table 4 Average of data count in each hour by road segment

In the *Table 4*, the amount of data in the morning period i.e. 7 AM-8AM is low compare with other time of the day. This could lead into the lack of data and cause the inaccurate in actual data to compare with the prediction result. For further investigation, the Null data count chart was visualized in *Figure 48*. However, in the data preparation process, the null timestep will used the prior timestep average data to fill in the gap.

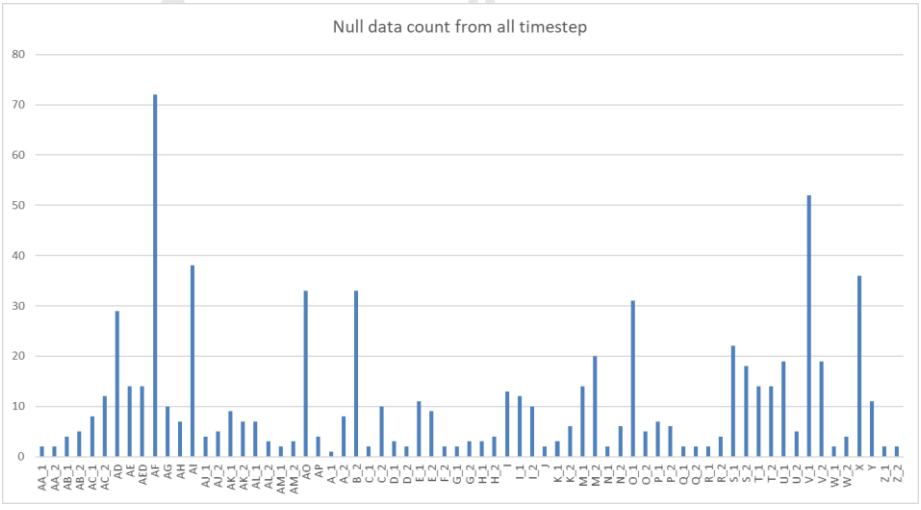


Figure 48 Null data count from all timestep

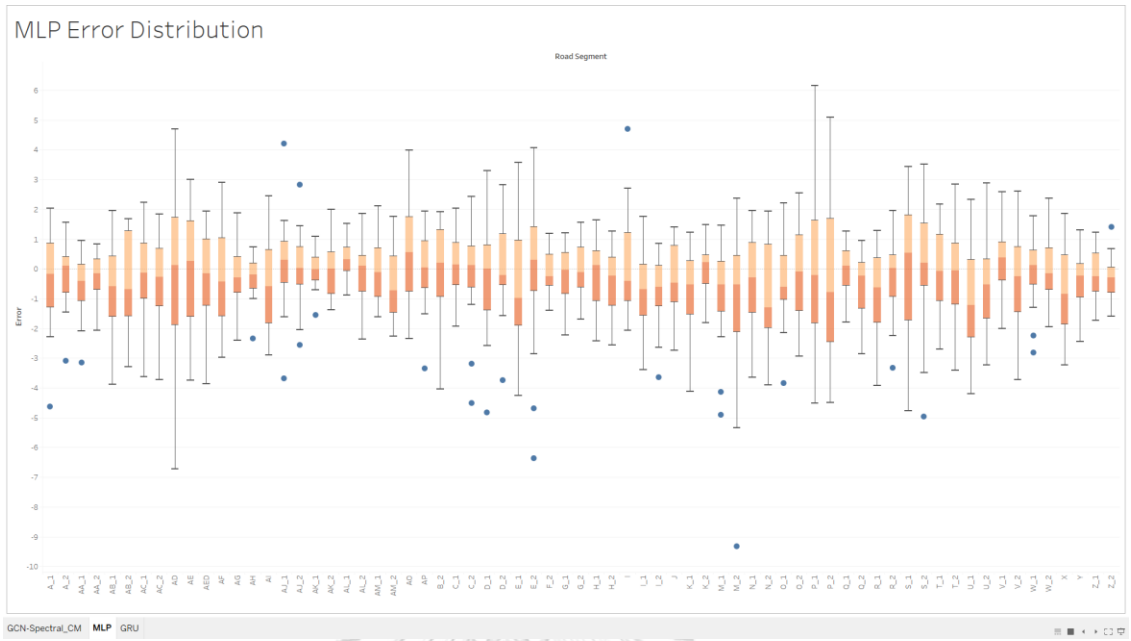


Figure 49 Box plot for error from MLP model

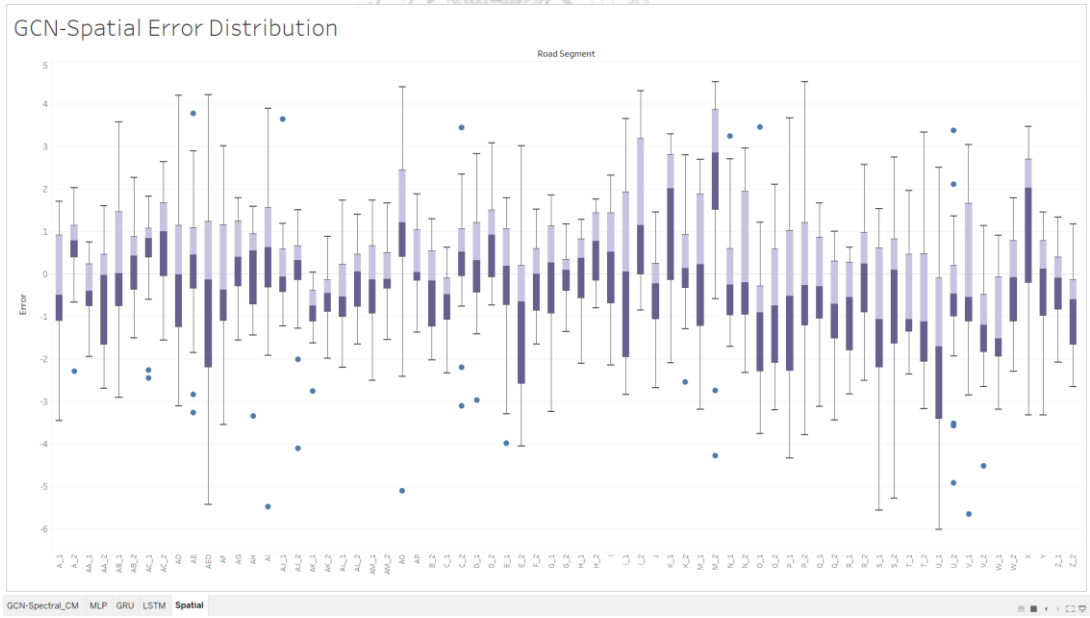


Figure 50 *Box plot for error from GCN-Spatial model*

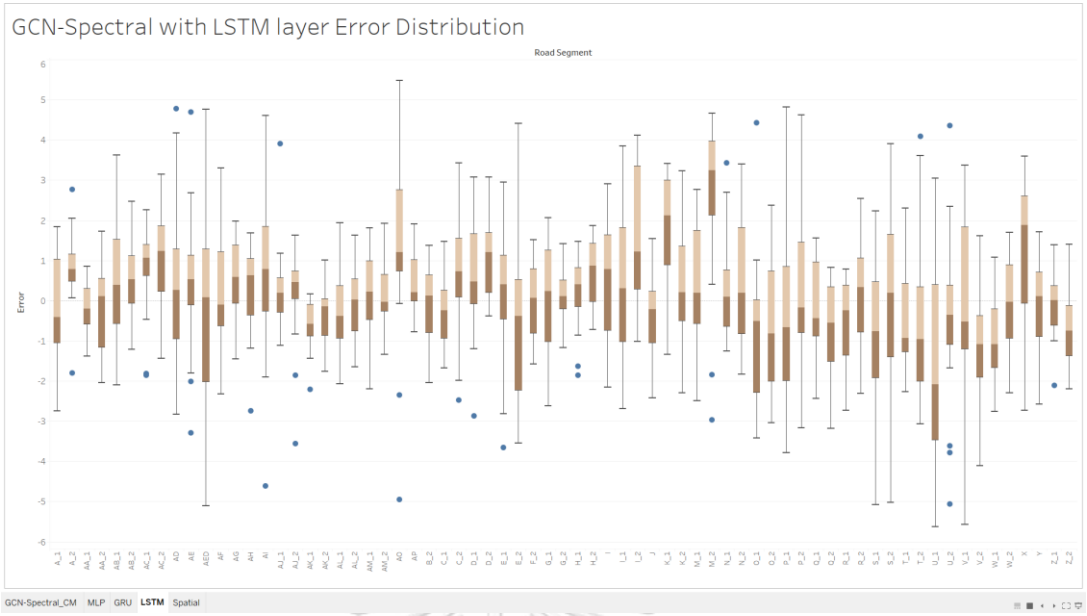


Figure 51 *Box plot for error from GCN-Spectral with LSTM Layer model*

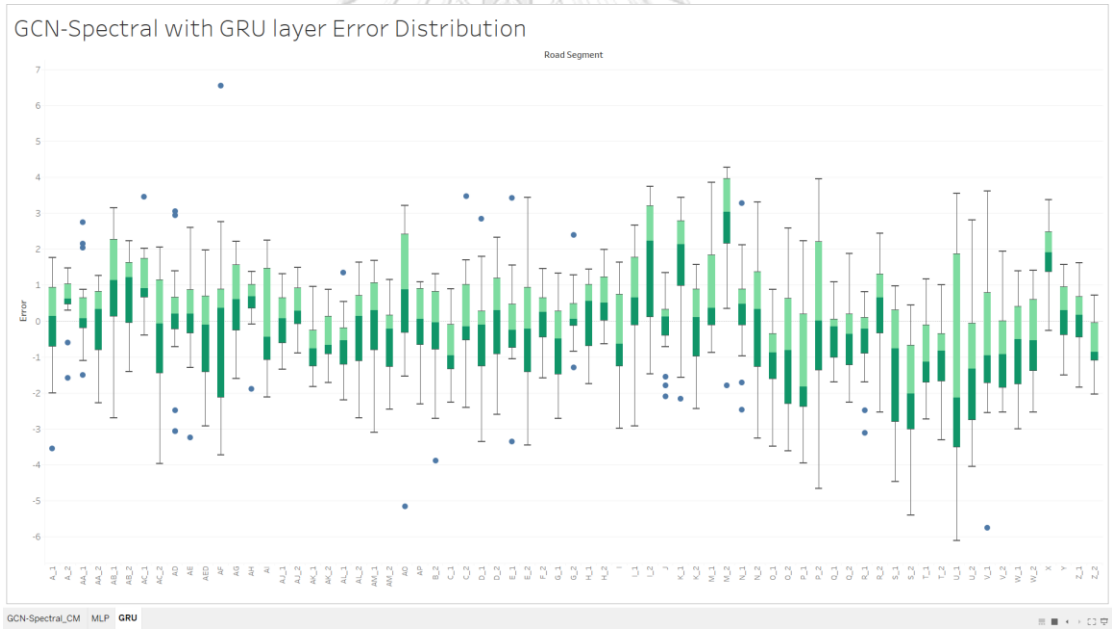


Figure 52 *Boxplot for error from GCN-Spectral with GRU Layer model*

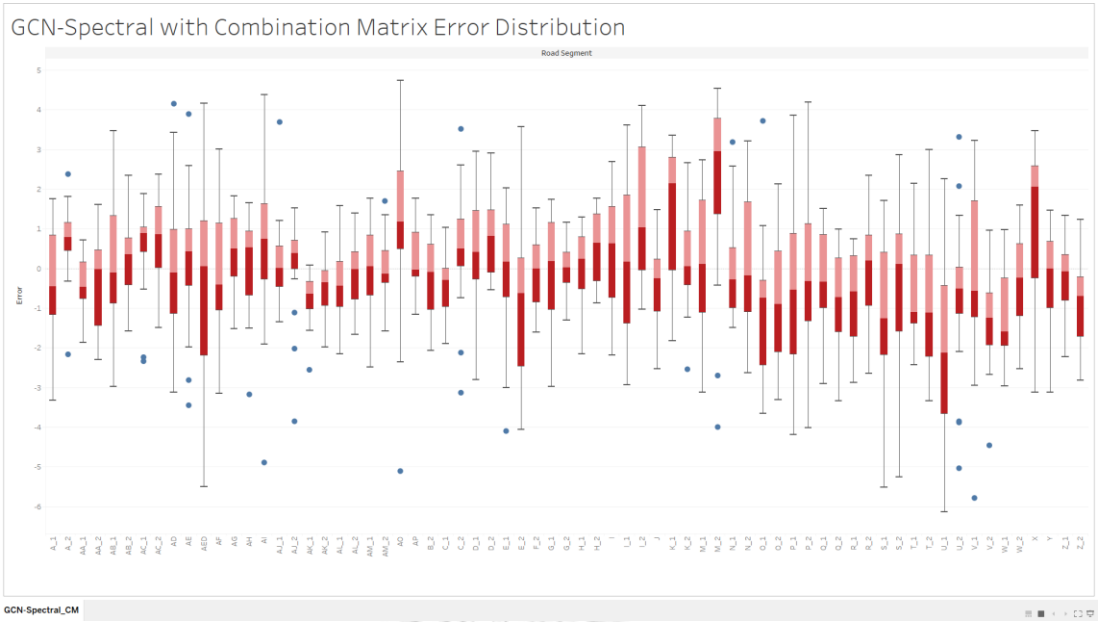


Figure 53 Boxplot for error from GCN-Spectral with Combination Matrix model

From *Figure 49* to *Figure 53*, it can be summarized that the MLP prediction error result is around 0 m/s for the overall model. Only some road segments gave a wide range of error results, such as segment AD (Rama IV road starts at Chamchuri square intersection to Henri Dunant Road). The GCN model has the trend on some road segments such as segment M_2, Henri Dunant road always has a high prediction error on each type of GCN model. Moreover, the model gave a wide range of errors at the AED road segment. Since this road segment is located under the Thai-Belgium bridge, it may impact to GPS signal. The AED segment is a part of Rama IV road located around Chamchuri square intersection to Chulalongkorn Hospital intersection heading to the West. Thus, the wrong projection and low data quality might cause this result.

After investigation of the high error values on both segments, the cause of the error result is because these two road segments are connected, as shown in *Figure 54*. Thus, the GCN model can explain the relationship of error with spatial features.

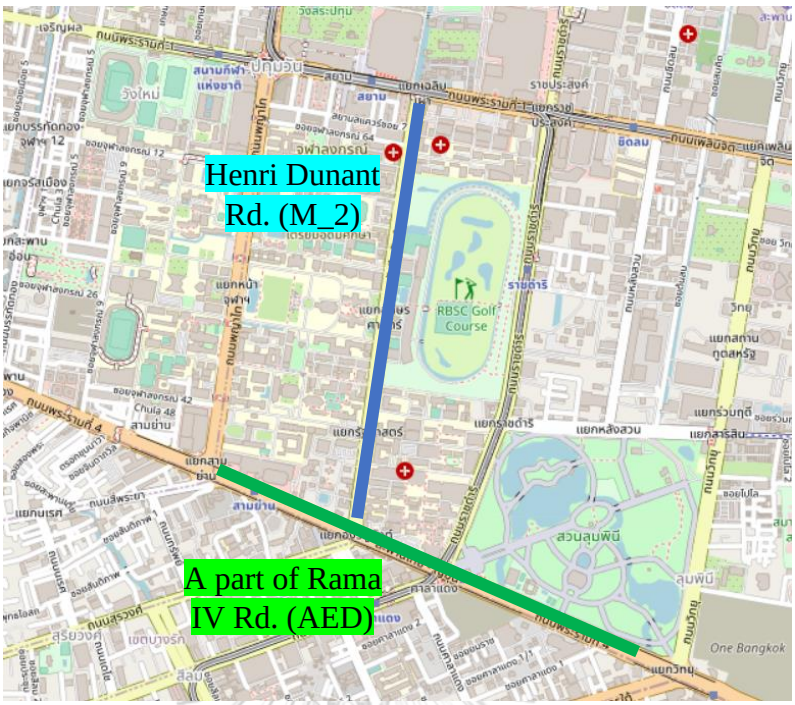


Figure 54 Henri Dunant Road (M_2) and a part of Rama IV road segment physically connected relationship

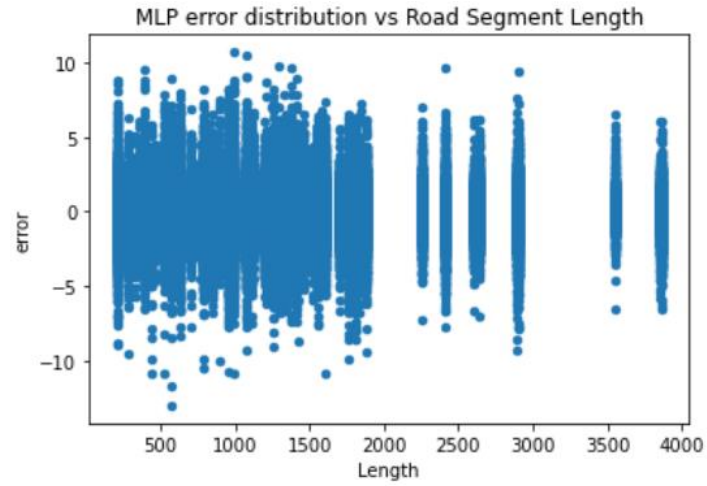
4.3.2 Relationship between error and road segment length

The previous section analyzes errors by using a boxplot. In this section, the error measurement in the boxplot (10^{th} percentile, 25^{th} percentile, mean, 75^{th} percentile, and 90^{th} percentile) will be used to analyze the cause of error compared with road segment length.

The correlation of data is defined using R-value from the formula:

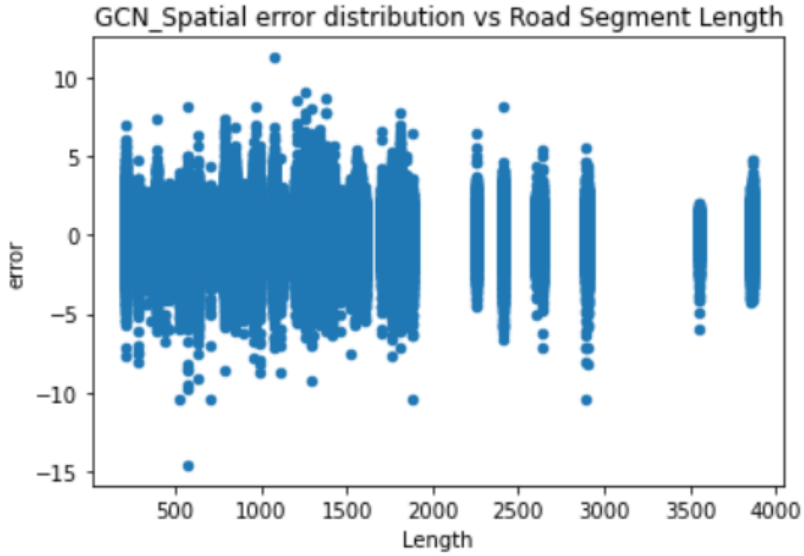
$$Correl(X,Y) = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

The closer the correlation coefficient is to -1 or 1, the highly impact correlated between two variables. The correlation and result of error distribution compare with road segment length show in *Figure 55* to *Figure 59*.



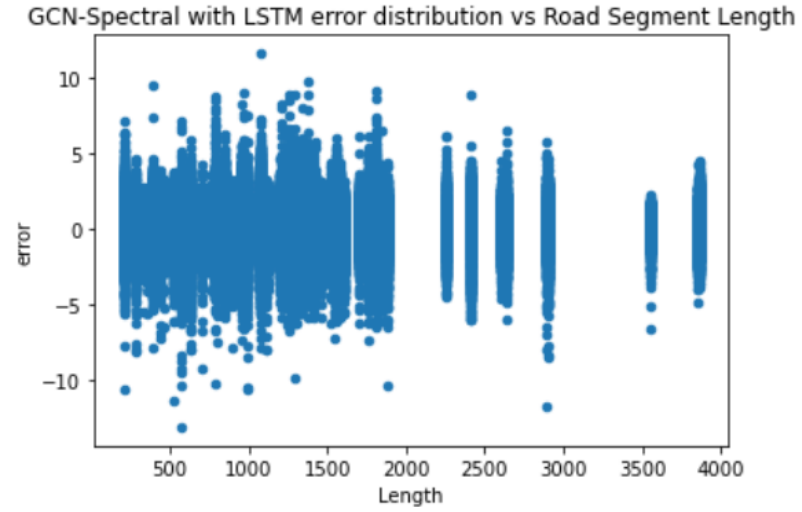

```
correlation = -0.002
```

Figure 55 MLP Model boxplot parameter error (x-axis) scatter plot with road segment length (y-axis)



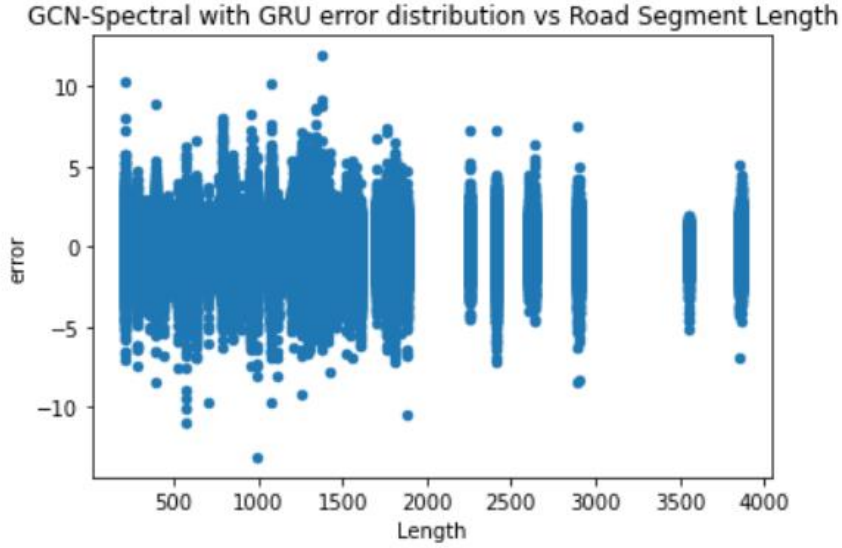

```
correlation = 0.001
```

Figure 56 GCN-Spatial Model boxplot parameter error (x-axis) scatter plot with road segment length (y-axis)




```
correlation = 0.006
```

Figure 57 GCN-Spectral with LSTM layer model error (x-axis) scatter plot with road segment length (y-axis)




```
correlation = -0.002
```

Figure 58 GCN-Spectral with GRU layer model error (x-axis) scatter plot with road segment length (y-axis)

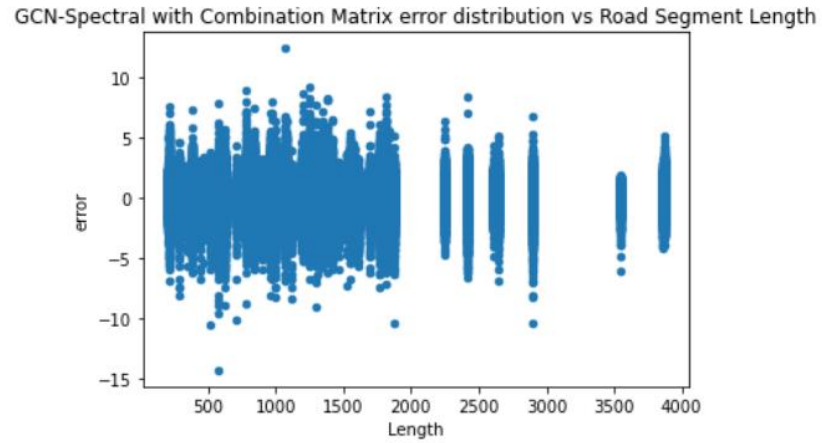


Figure 59 GCN-Spectral with LSTM layer and Combination Adjacency matrix model error (x-axis) scatter plot with road segment length (y-axis)

Corr Coef.	Mean	10th percentile	25th percentile	75th percentile	90th percentile
MLP	-0.03	-0.01	0.00	0.01	0.00
GCN-Spatial	0.07	-0.04	0.00	0.03	0.04
GCN-Spectral (LSTM)	**0.20**	-0.03	0.02	0.04	0.04
GCN-Spectral (GRU)	-0.03	-0.01	-0.04	0.01	0.01
GCN-Spectral with CM	**0.21**	-0.02	0.03	0.06	0.05

Table 5 Correlation coefficient between each model error parameter and road segment length

As shown in *Table 5*, the correlation coefficient between each boxplot measurement error and model type is very weak (correlation coefficient < 0.2). Only two models, GCN-Spectral with LSTM layer and GCN-Spectral with combination matrix, seem to have a fragile associative relationship between mean error and road segment length.

Thus, this can be concluded that the model error is very weak related to road segment length.

4.3.3 Relationship between error and number of lanes in a road segment

This section describes the analysis of the relationship between the number of lanes in a road segment and model error.

In this study, the main road segment in Bangkok was selected. Some of the road segments may have inconsistencies along the group road segment. The highest number of lanes among the segment with the same traffic direction will be recorded. The number of lanes data was collected manually using Google Maps and the Google Street View application.

The distribution of lanes number is shown in *Figure 60*. Most of the road segments are 2 to 4 lanes.

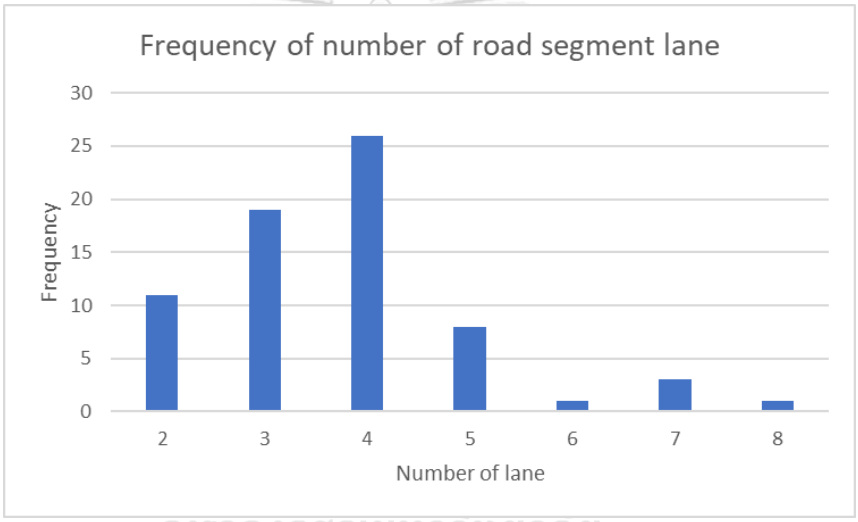
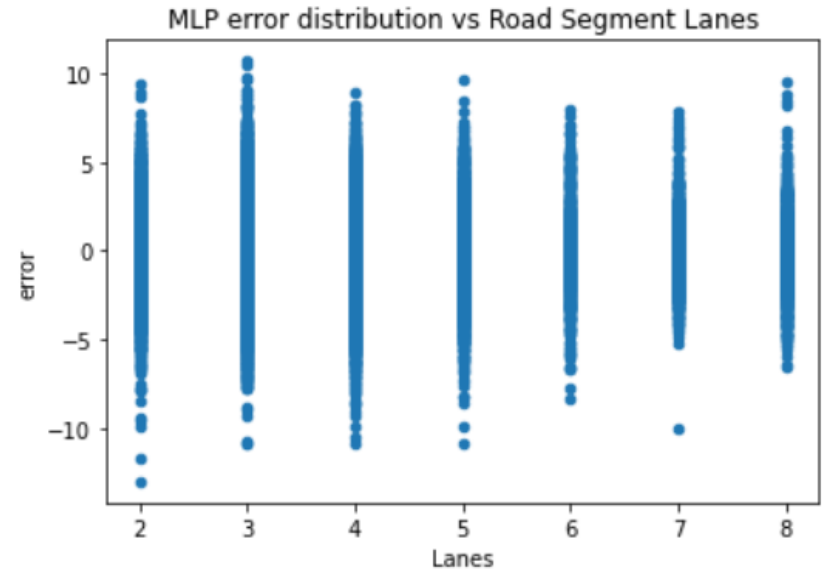
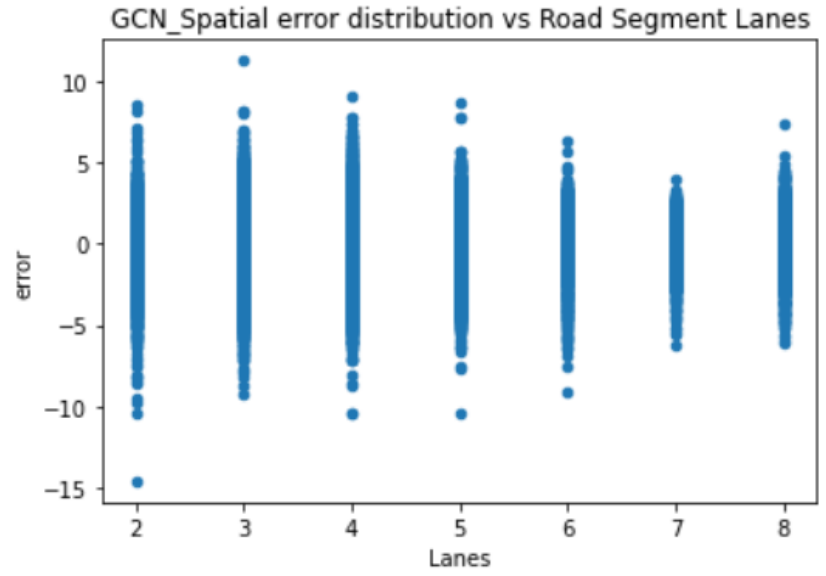


Figure 60 Number of lanes distribution



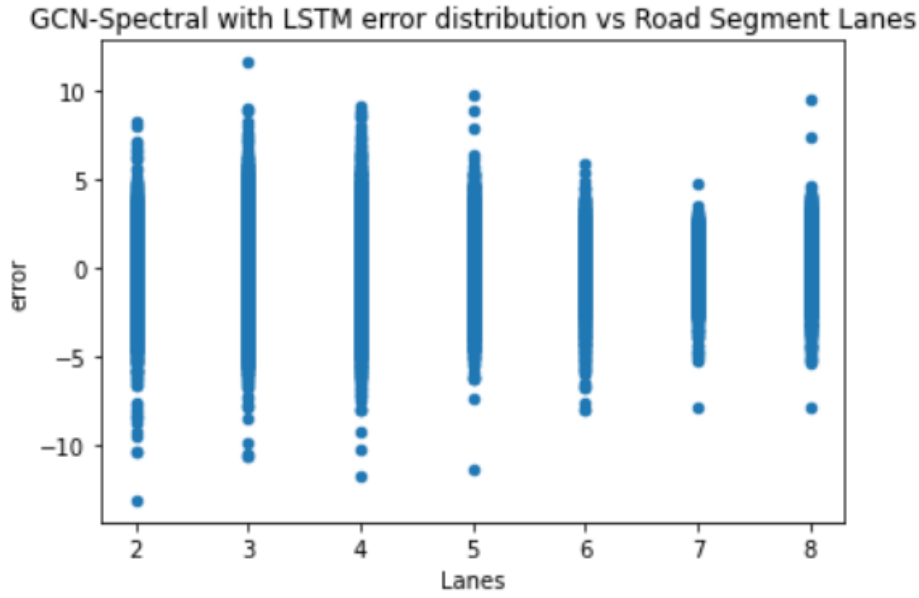
correlation = 0.003

Figure 61 Error distribution comparing with road segment lanes from the MLP model



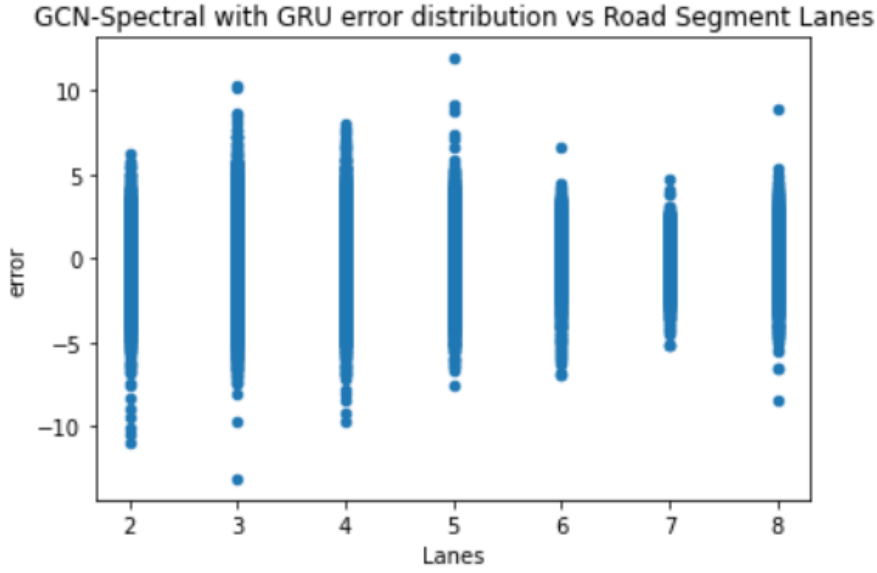
correlation = -0.002

Figure 62 Error distribution comparing with road segment lanes from GCN-Spatial model




```
correlation = 0.001
```

Figure 63 Error distribution comparing with road segment lanes from GCN-Spectral with LSTM layers model




```
correlation = -0.0
```

Figure 64 Error distribution comparing with road segment lanes from GCN-Spectral with GRU layers model

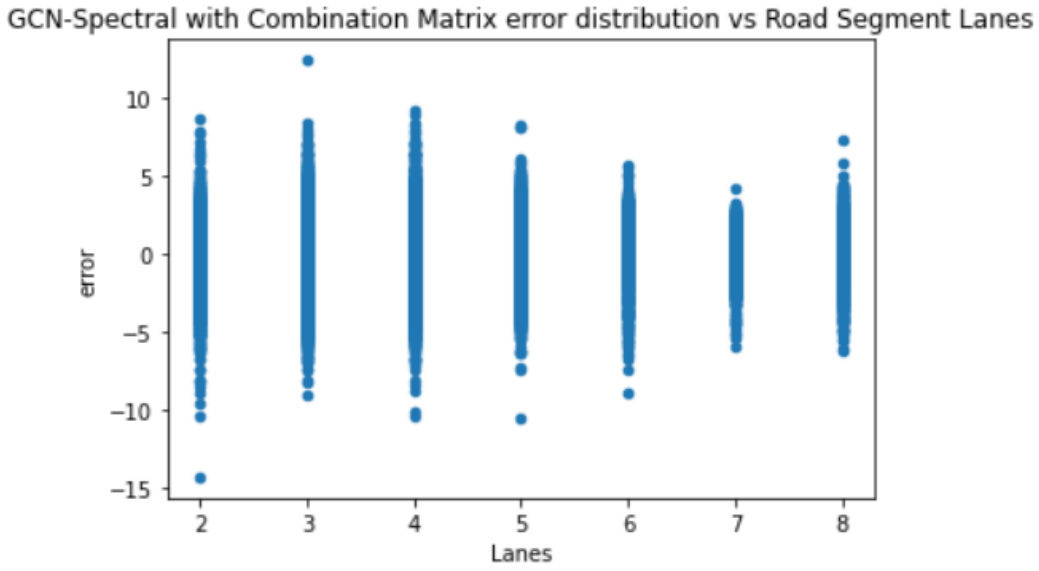


Figure 65 Error distribution comparing with road segment lanes from GCN-Spectral with combination matrix model

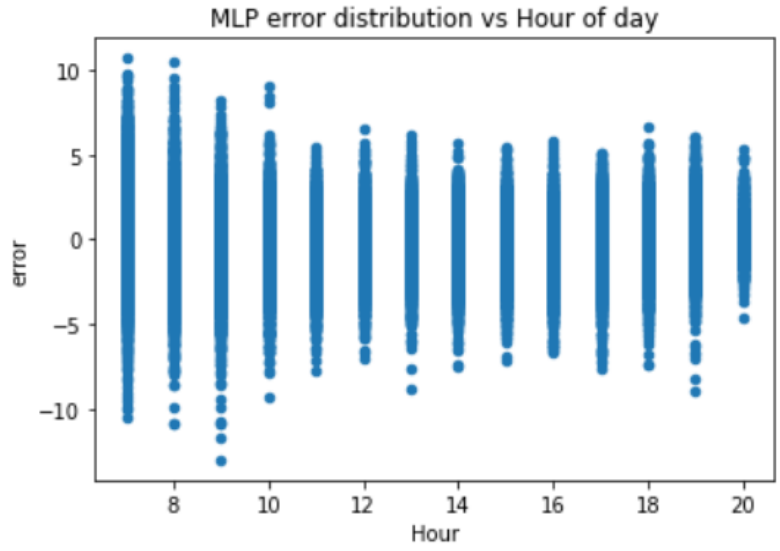
As shown in *Figure 61* to *Figure 65*, there is no correlation between model error results and the number of lanes in road segments. The correlation coefficient compared with each boxplot parameter can be shown in *Table 6.*

Corr Coef.	Overall Error	Mean	10th percentile	25th percentile	75th percentile	90th percentile
MLP	0.00	0.06	0.05	0.04	-0.04	-0.05
GCN-Spatial	0.00	-0.06	0.00	0.00	-0.02	-0.03
GCN-Spectral (LSTM)	0.00	0.00	0.04	0.02	-0.01	-0.04
GCN-Spectral (GRU)	0.00	0.01	0.01	0.04	-0.01	-0.03
GCN-Spectral with CM	0.00	-0.07	0.01	0.00	-0.02	-0.03

Table 6 Correlation coefficient between each model error parameter and road segment lanes

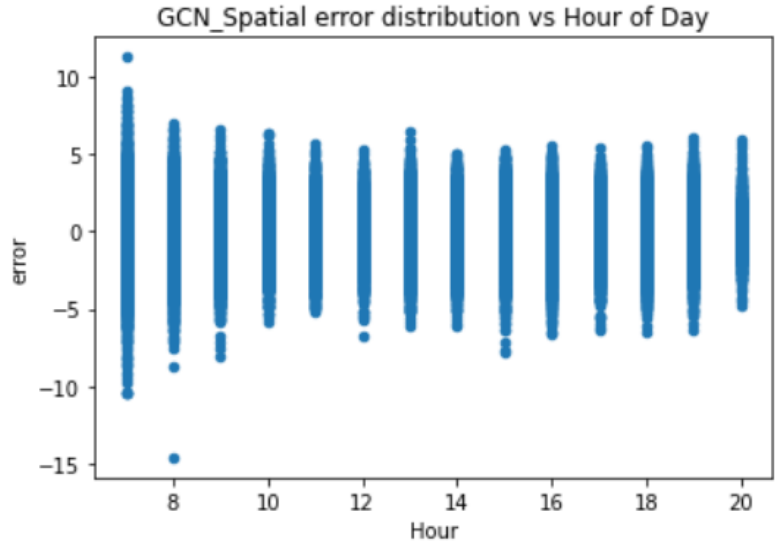
4.3.4 Relationship between error and time

4.3.4.1 Time of day



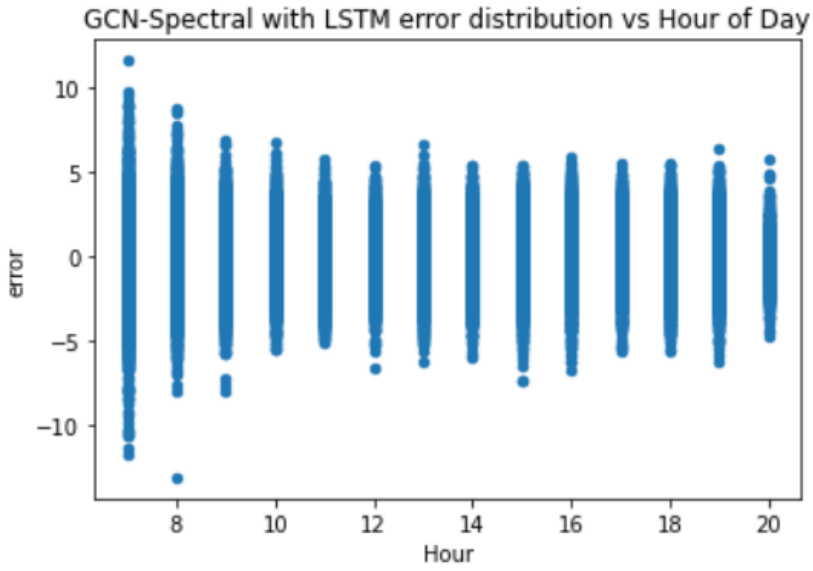
correlation = -0.038

Figure 66 MLP model error distribution plot with hours of the day



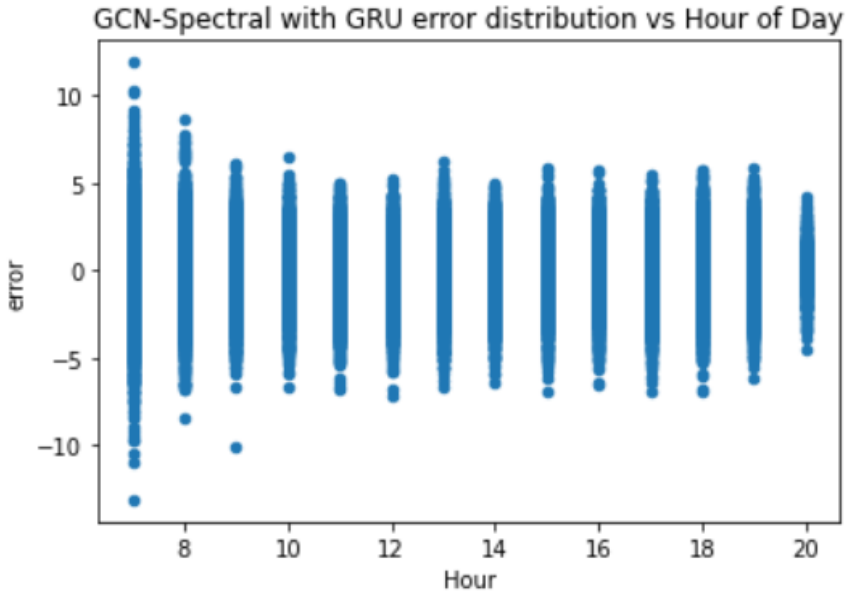
correlation = 0.047

Figure 67 GCN-Spatial model's error distribution plot with hours of the day



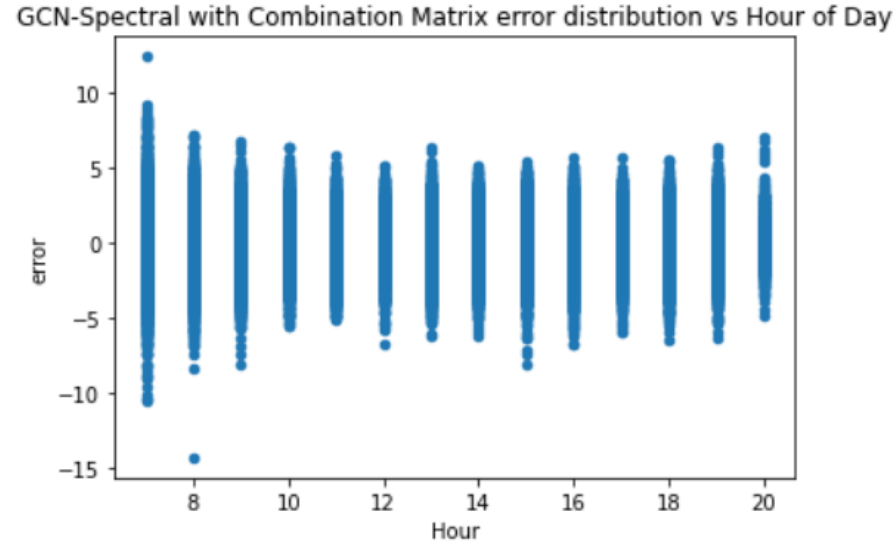

```
correlation = 0.058
```

Figure 68 GCN-Spectral with LSTM layers model's error distribution plot with hours of the day




```
correlation = 0.057
```

Figure 69 GCN-Spectral with GRU layers model's error distribution plot with hours of the day




```
correlation = 0.035
```

Figure 70 GCN-Spectral with Combination Matrix model's error distribution plot with hours of the day

Figure 66 to *Figure 70* show a very weak correlation, correlation coefficient ≥ 0.05, between the error of model prediction and hour of the day from GCN-Spatial, GCN-Spectral with LSTM, and GCN-Spectral. However, some patterns can be seen by comparing error distribution with the time of day.

For the MLP model, the day does not affect the error distribution, i.e., errors are distributed in the same range between times. Furthermore, the outlier of the output appears every hour of the day, as seen in the small points different from the other main group plot on the edge of the error line.

Nevertheless, in all GCN models, the range of error distributed from 7 am to 10 am is wider than at other times. Between 10 am and 12 pm, the error distribution ranges are narrower. Also, in the evening time, between 6 pm and 8 pm, the prediction error range is getting narrower. Therefore, it can be concluded that the prediction results are more accurate at both 10 am to 12 pm and 6 pm to 8 pm. Thus, the GCN model is better at prediction in the late morning and evening periods.

4.3.4.2 Day of week

This section will analyze the relationship between the day of the week and speed error. Unfortunately, the correlation between these two values cannot be measured directly as a correlation coefficient like previous dimension analysis. Thus, only a range of error distribution will be used in this section to explain the quality of prediction results.

Day of the week is a feature put into the GCN prediction model. Thus, the prediction result should be reflected in some trends of the day of the week feature.

The result of prediction error distribution compares with day of week show in Figure 71 to *Figure 75*.

From the error distribution analysis, the MLP model error distribution with the same range on every day of the week except Tuesday. While in every kind of GCN model, weekday and weekend error distribution were significantly different. The narrowest error distribution of the GCN model is on Tuesday and Thursday.

Therefore, the Tuesday data have the most recognition pattern, while the MLP model performs best every day of the week. All GCN models performed best on a weekday, especially Tuesday and Thursday.

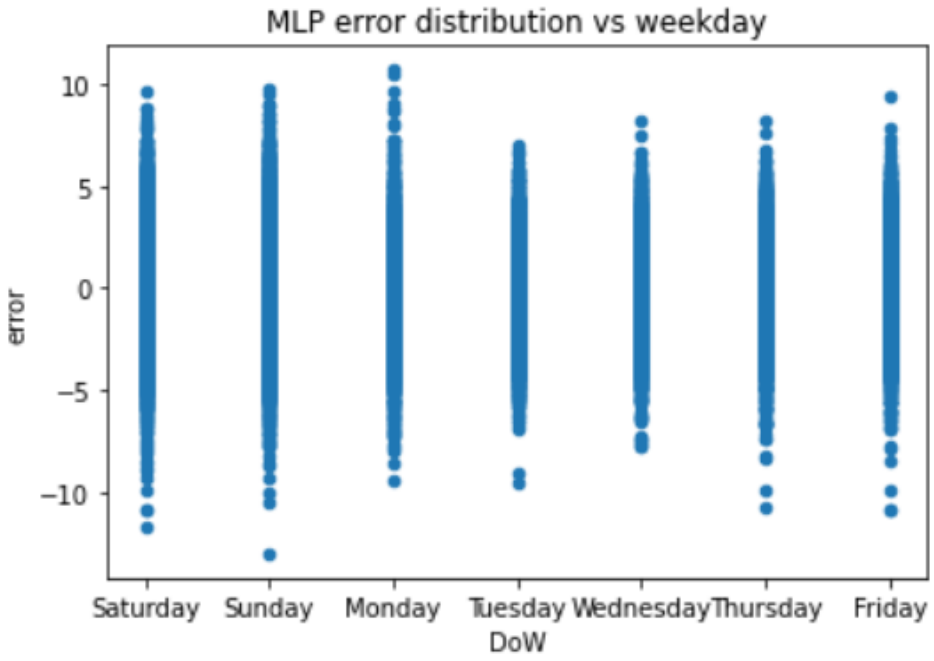


Figure 71 MLP model error distribution with day of week parameter

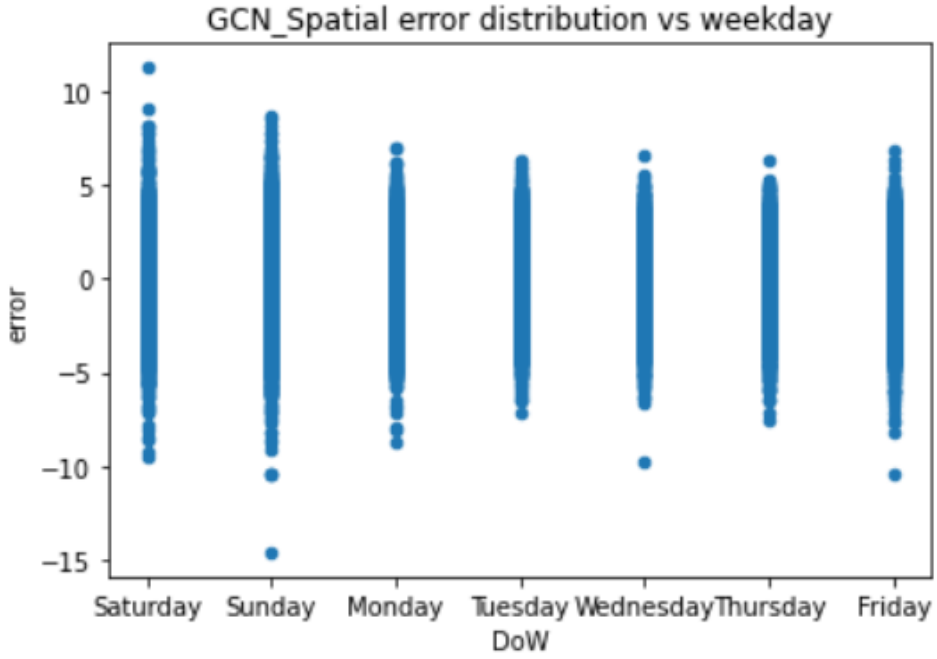


Figure 72 GCN-Spatial model error distribution with day of week parameter

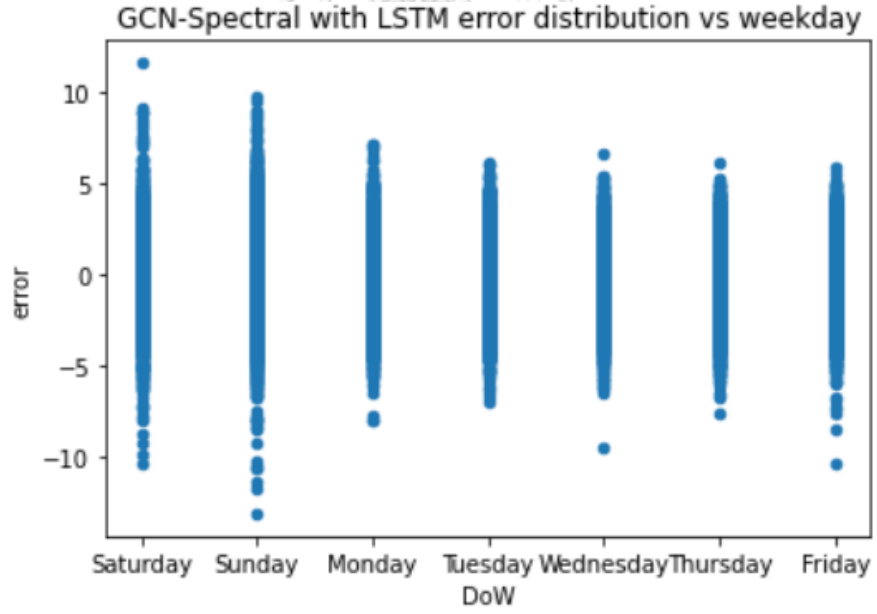


Figure 73 GCN-Spectral with LSTM model's error distribution with the day of week parameter

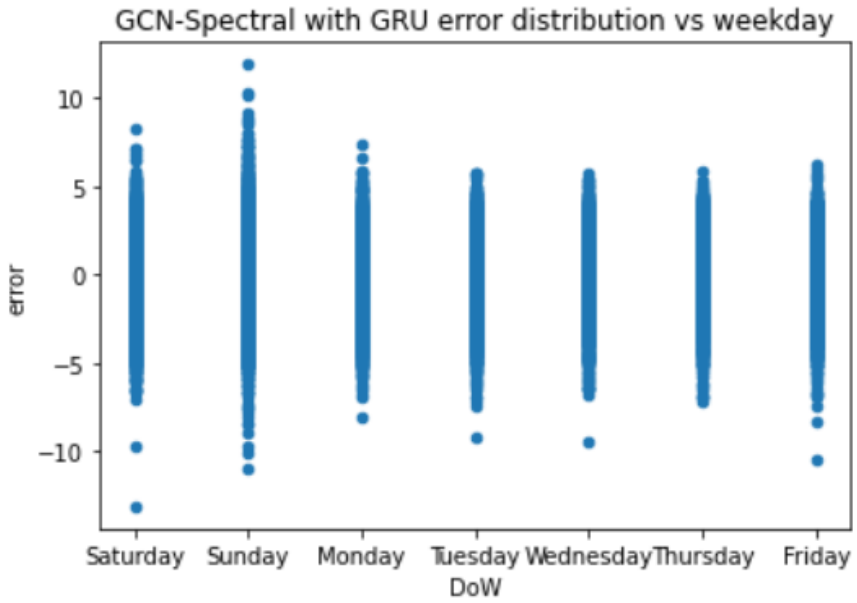


Figure 74 GCN-Spectral with GRU model's error distribution with the day of week parameter

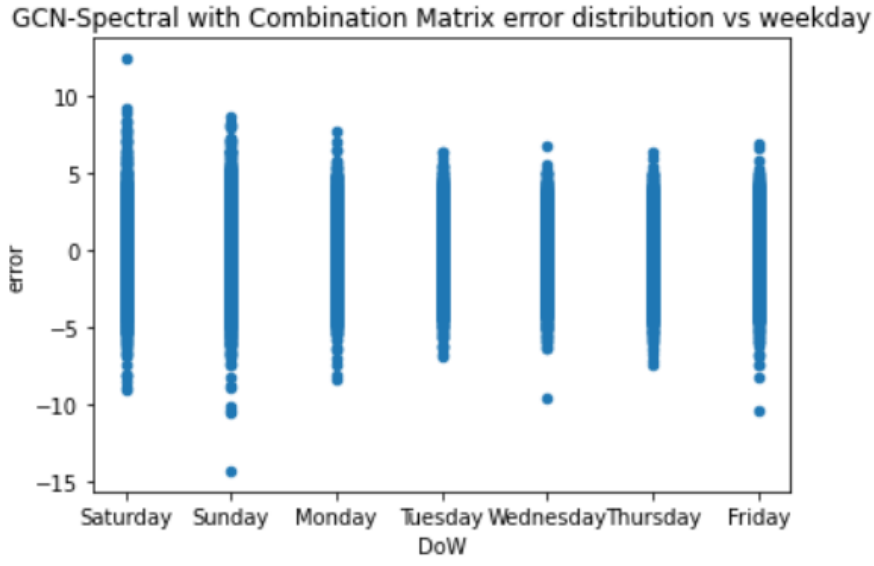


Figure 75 GCN-Spectral with Combination Matrix model's error distribution with the day of week parameter

4.3.5 Analysis by percentage error in prediction hour and day of week

The percentage error analysis is aim to compare the pattern of error in in the time of day and day of week separated by each road segment. The mean percentage error is calculate using the equation below to mean the percentage error in each epoch to get the represent percentage error of the hour period.

$$Mean\ Percentage\ Error = Mean(\frac{Prediction - Actual}{Actual}) \times 100$$

The limitation of percentage error is the bias of actual data problem. The low amount of actual data may make the percentage error extremely high or low if the actual data is very small or large respectively. The fivel models with separate day of week and time of day average percentage error result are showed in *Table 9* to *Table 43* in the appendix section. From Table 9 to Table 43, the percentage error of each timestep and road segment were average and color with green to red. The lower of percentage error shows the better prediction result.

However, since the traffic speed in the actual data are very various and may depend by day and time in the same road segment. Some percentage error of prediction result can be high and up to over 500 times compare with actual data. This is because the average of speed data in the day of week and time of day in a road segment is very low.

For example, if the actual speed calculated and get 0.01 m/s value and the prediction value is 2 m/s. The percentage error in the case can be 200 times higher than the actual. Therefore, only percentage error in the timestep itselves cannot be used as a validation of predictive power for the model. The percentage error only shows cause of in accurate prediction i.e. which segment or time step raise the overall model RMSE to be high.

For the summary in the percentage error analysis, it can be conclude that the MLP model prediction return good percentage error on every road segment and time of day in everyday of week. While GCN models show the pattern of inaccurate and bad prediction in the early morning and in some week day afternoon timestep.

For the improvement of the model in the future, the road segment which cause high prediction error could be removed from the road network or the cleaning step in the data preparation process should be done using weighted average to average and comapare the small segment which the small number of vechicles pass in some timestep. To reduce the noise of these effects from the small data bias situation.

4.4 Experiment II: Travel time Prediction Task

Experiment II used speed prediction from the model in experiment I. The results were multiplied by road segment length and compared with actual travel time. The actual travel time in the road segment is calculated by average time from the first point in the road segment to the last point in the road segment grouped by driver id in a time step.

As shown in *Table 7*, the high RMSE result appears on every model. In this experiment, the MLP model, which previously performed the best RMSE in speed prediction task, the RMSE result performs not as well as expected, at 4th rank among the five models.

Model	RMSE (s)
MLP	7798.245
GCN-Spatial	**7574.835**
GCN-Spectral with LSTM layers	7805.800
GCN-Spectral with GRU layers	7622.613
GCN-Spectral with Combination Matrix layers	7617.712

Table 7 Overall RMSE result on travel prediction from each speed prediction model

The best model in the travel time prediction task is GCN-Spatial with 7574.835 seconds. Even though 7574.835 seconds is the best value among the experiment results, this is not close to the worst RMSE development in a single road segment predicted from the LSTM model (Jakteerangkool & Muangsin, 2020) with 222.1707 seconds.

Thus, further analysis will be examined on RMSE between road segments, as shown in *Table 8*. In the case of some road segment are long and the travel time calculated with multiply speed prediction results with length, the error will be larger than reality. And the caused road network to have high RMSE results, so the overall RMSE effect performs worse than expected.

Road Segment	MLP	GCN_ Spatial	GCN_ LSTM	GCN_GRU	GCN_CM
AA_1	3767.539	3401.181	3519.659	3382.842	3361.201
AA_2	2924.764	2576.888	2706.37	2635.849	2608.273
AB_1	8317.601	7974.104	8154.097	7983.623	7750.445
AB_2	2871.139	2185.931	2248.511	2871.886	2183.079
AC_1	1804.694	1700.936	1725.205	1829.469	1695.137
AC_2	7921.262	7988.011	8201.797	8005.394	7911.534
AD	2784.287	2720.152	2845.507	2555.509	2766.852
AE	14573.27	14105.22	14472.52	14120.42	14076.33
AED	15357.53	15093.4	15460.68	15026.42	14958.1
AF	7906.047	7929.093	8175.097	8146.553	8049.996
AG	6871.085	7001.843	7186.903	7182.332	7078.739

Road Segment	MLP	GCN_ Spatial	GCN_ LSTM	GCN_GRU	GCN_CM
AH	9751.835	8727.148	9144.304	8847.3	8731.747
AI	8520.036	8533.47	8682.204	8527.993	8639.02
AJ_1	11812.74	11454.48	11703.34	11439.35	11536.08
AJ_2	5956.227	5796.397	5999.881	5844.984	5932.938
AK_1	4328.002	4047.681	4189.816	4041.464	4102.595
AK_2	2486.102	1922.533	1983.994	2080.661	1945.132
AL_1	2708.332	2255.57	2286.564	2227.582	2255.232
AL_2	2733.7	2585.282	2613.007	2735.681	2559.201
AM_1	2176.295	2112.66	2171.978	2351.325	2135.462
AM_2	7330.054	7173.792	7337.976	7186.846	7175.471
AO	6852.5	6680.096	6888.953	6805.899	6704.616
AP	5131.469	4915.224	5059.005	5208.527	4892.126
A_1	6405.064	5828.489	6113.69	6029.738	6000.639
A_2	3511.451	3232.129	3356.986	3483.763	3253.787
B_2	5693.592	4951.419	5274.199	5109.078	5095.989
C_1	8069.708	7520.621	7847.457	7634.451	7691.662
C_2	10319.17	9998.715	10414.6	10206.71	10182.82
D_1	25839.33	25893.3	26830.05	26179.16	26642.02
D_2	19172.76	18626.78	19051.72	18415.59	18476.24
E_1	12614.95	12557.01	12981.7	12610.56	12716.91
E_2	11294.29	10815.38	11460.84	11065.25	11114.94
F_2	7439.973	7376.964	7480.034	7340.769	7392.009
G_1	3714.008	3607.57	3657.489	3623.887	3559.649
G_2	2182.913	1972.081	2016.126	1950.238	1969.351
H_1	2145.806	1998.958	2053.749	2210.493	2004.753
H_2	2586.084	2229.728	2288.638	2319.683	2206.827
I	4781.205	4609.235	4749.998	4628.517	4679.869
I_1	4515.248	4630.707	4741.51	4574.441	4662.605
I_2	4279.743	4245.239	4290.563	4225.166	4148.663
J	4668.187	4180.938	4326.192	4132.555	4216.228
K_1	9368.505	9171.666	9504.522	9257.336	9244.643
K_2	2347.384	1795.741	1818.419	1970.191	1785.828
M_1	5032.964	4987.421	5068.974	4781.041	4972.12
M_2	6701.229	6203.807	6468.852	6451.109	6208.75
N_1	11128.53	10804.42	11003.02	10855.48	10647.04
N_2	12051.45	11216.98	11427.47	11106.04	10887.61
O_1	10675.03	9860.189	10254.09	10022.26	9828.866
O_2	5663.358	5448.264	5605.891	5425.498	5494.478
P_1	4684.71	4366.48	4590.307	4446.306	4438.909
P_2	1394.103	1636.871	1653.809	1582.792	1624.015
Q_1	915.367	1067.871	1075.844	914.968	1068.179
Q_2	1940.159	1601.524	1633.165	1847.822	1605.248

Road Segment	MLP	GCN_ Spatial	GCN_ LSTM	GCN_GRU	GCN_CM
R_1	2823.897	2713.831	2804.527	2687.205	2713.008
R_2	4898.428	4815.329	4895.428	4828.801	4779.892
S_1	2482.742	2981.515	3029.765	2519.864	2972.976
S_2	10425.21	10442.13	10786.08	10558.87	10572.21
T_1	6252.106	5699.284	5896.201	5843.562	5732.533
T_2	6128.34	6137.806	6265.032	6072.081	6114.405
U_1	7721.867	7633.791	7870.716	7653.016	7559.252
U_2	9110.431	9082.711	9256.219	9045.409	9042.085
V_1	7740.383	7697.66	7884.654	7688.084	7743.522
V_2	7613.628	7087.406	7270.143	7094.571	6969.77
W_1	6634.899	6193.861	6459.42	6226.916	6276.674
W_2	6259.733	6092.918	6238.134	6049.746	6026.875
X	3056.755	2448.952	2565.416	2747.05	2488.787
Y	1917.378	2285.514	2324.581	2192.07	2285.139
Z_1	1701.221	1086.488	1100.644	1503.186	1089.831
Z_2	3448.787	3314.501	3375.753	3118.596	3282.915

Table 8 Travel time RMSE by road segment

The top 10 highest RMSE results are on-road segments D_1 and D_2 (from Asoke-Petchaburi junction to Klong-ton junction), highlighted in orange, which is also the longest road segment in the model. Since the travel time was calculated using speed multiplied by road segment length, this is no surprise that the longest road segment performed the worst RMSE.

However, for the top 10 best RMSE results, the P_2, Q_1, and Z_1got the best result. P_2 road segment is from Asoke-Montri junction to Rama IV – Ratchadapisek junction. Q_1 is from Rama IV – Ratchadapisek junction to Rama IV – Phrakhanong junction. And Z_1 is from Ploenchit to Asoke-Montri junction. The three of them are among the top five shortest intersections in this study scope.

Chapter 5: Conclusion

From the two experiments done in this study, it can be concluded that the graph convolutional neural network technique is suitable for predicting traffic indicators in a road network. Because graph neural network can predict the speed of each road segment in the focus network with end to end process and without separate model to fit in a single segment. However, the assumption of the performance of non-spatial related features will perform worse than the spatial features included is wrong.

As seen in the model results of each experiment, even the MLP model performs the best in speed prediction tasks while applying speed prediction values with the travel time prediction task. However, the model did not perform as well as it should be. Thus, its lack of explanation makes it unsuitable for applying to the application level.

The empirical result shows that this work lacks the road segmentation process. The current process done in this study is to divide road segments using the main junction. The further intersections are separated, the longer the road segment will be. Moreover, since the prediction models predict speed per timestep in the road segment, if the road segment is long, the error of speed prediction will be emphasized, as happened in this study. Therefore, the current criteria of road segmentation is suitable with only speed prediction task where the distance of the road segment is not involving with the calculation concept.

For the model performance, GCN-Spatial is the best model to explain the relationship between error and spatial relationship among the type of GCN. However, since the performance of GCN-Spectral models is not significantly different from GCN-Spatial, the GCN-Spectral model can be adapted to the traffic prediction task in case of a non-spatial relationship. And the GCN-Spectral with combination matrix should encourage to use in the application level because it collected all the spectral and spatial relationship and performed best in speed prediction task.

The data preparation process is the most important. This study uses average speed in each road segment, skewness, kurtosis, standard deviation, and day of the week as features of the models. As shown in Chapter 4, the RMSE in travel time prediction is very high and not close to the previous study from Jakteerangkool & Muangsin, which predicts travel time directly from travel time on each timestep in a single road segment. The higher RMSE result come from the road network which some road segment cause high error which can be seen in the appendix. And in the production period, the model should use GPU assist for faster prediction result because the model should be retrained to collect the newer pattern of traffic.

The temporal layer type has no siginificantly result that improve the model RMSE. Thus, the GRU which perform better in training time measurement should be used in th ereal business application.

In conclusion, the model performance should measure with experiment I result because in the second experiment, the result of road segmentation will disturb the model performance. Thus, the best model that should selected to use is GCN-Spectral with combination matrix with LSTM layer because the model give the lowest RMSE amoung all candidate models.

For the future study in this project, the other adjacency matrix development method should be done. For instance, adjacency matrix with direction of the road. In addition, the adjacency matrix should concern about traffic flow. And the expected adjcacency matrix should not be mymmetric matrix. Also the other techniques such as attention layers should be applied to the model.

For data preprocessing improvement, if the main task is travel time prediction, the model input should be the same values as the prediction result. Therefore the travel time prediction model should receive the input as travel time from each timestep and the road segmentation concept should not be bias. So, the travel time prediction result will be clearly predict and the error analysis of the model part can deliver more information than the previous shown in the study that focus on speed prediction before converting to travel time prediction. Other methods should do the road segmentation, e.g., griding or dividing road segments into shorter parts. Thus, the more clarify of experiment discussion will also be. And the road segment choosing criteria should be selected by amount of the data based. Some of high null data segment can be removed.

For the data collection improvement, more data with more vehicle types should be added. The various vehicle types can reduce the behavior of driver such as the taxi will drive slow to seek their customers etc.

Appendix

Tables of mean percentage error by road segment, time of day and day of week mention in Chapter 4: Result.

A.1 MLP Model

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	59.52	19.85	33.89	21.80	21.37	55.33	27.81	39.87	22.42	48.49	30.19	40.46	24.00	34.23
A_2	148.47	50.79	36.10	28.64	20.25	19.78	20.76	33.14	20.35	23.94	36.37	25.87	50.12	39.58
AA_1	244.29	20.70	14.45	13.86	11.50	10.86	8.50	14.45	17.51	23.13	23.61	20.13	45.88	36.07
AA_2	91.98	11.04	15.81	23.47	18.32	23.06	13.51	13.55	25.27	23.53	24.07	26.09	60.49	28.47
AB_1	122.62	21.73	30.13	15.85	10.59	13.22	14.53	14.26	16.75	36.55	19.48	70.49	27.40	31.82
AB_2	180.27	24.49	29.35	19.53	23.93	13.27	26.45	26.49	11.40	35.44	20.73	29.01	21.83	35.55
AC_1	74.66	38.03	22.59	23.74	28.39	20.49	14.19	19.41	16.79	22.15	18.56	47.08	19.73	28.14
AC_2	83.24	20.47	32.05	20.38	20.38	17.04	20.62	29.09	15.56	13.50	18.67	17.22	13.06	24.71
AD	95.97	450.94	49.87	37.45	64.34	46.65	35.67	24.14	25.89	30.66	24.87	37.04	57.69	75.47
AE	45.80	36.91	24.89	28.41	19.51	25.94	29.06	26.93	24.95	17.56	21.31	25.42	21.88	26.81
AED	72.43	33.27	22.03	29.99	25.71	20.12	27.88	15.84	23.19	19.52	13.50	23.94	36.19	27.97
AF	111.68	100.63	65.62	34.73	30.70	33.65	25.22	49.51	25.87	44.14	35.94	22.83	27.28	46.75
AG	53.52	37.40	19.32	13.52	19.72	18.43	20.40	23.30	14.63	19.38	27.64	18.63	22.10	23.69
AH	153.12	56.32	35.26	26.71	22.69	24.55	23.52	18.17	21.04	14.10	17.26	30.00	19.14	35.53
AI	22.53	23.70	31.01	11.90	18.38	14.90	14.54	11.97	16.90	22.95	19.02	17.80	14.56	18.47
AJ_1	34.45	16.83	19.66	22.07	17.34	20.73	27.61	28.73	18.28	26.48	17.91	16.34	11.77	21.40
AJ_2	43.58	18.69	14.43	22.21	19.25	19.20	23.78	35.99	19.60	32.01	27.37	18.88	11.17	23.55
AK_1	58.45	49.84	20.16	17.85	18.46	15.66	17.05	16.40	10.09	23.38	18.20	29.88	14.64	23.85
AK_2	64.01	1,329.75	32.47	32.55	25.89	46.74	32.48	47.47	43.76	25.77	24.99	29.58	28.88	135.72
AL_1	42.97	26.38	21.97	16.13	9.02	19.05	12.18	14.39	13.98	28.17	15.65	11.86	12.08	18.75
AL_2	29.47	39.64	21.01	29.77	22.63	11.33	18.73	19.69	8.98	14.03	16.83	25.44	14.22	20.91
AM_1	56.65	17.33	12.72	13.30	4.66	10.81	12.08	10.36	11.50	23.99	21.08	26.57	22.04	18.70
AM_2	37.68	31.13	15.59	14.91	11.48	14.05	15.74	12.21	14.22	20.24	19.56	17.90	7.53	17.86
AO	200.83	51.98	42.33	58.88	34.53	22.72	29.52	12.77	28.35	28.08	22.72	34.26	33.64	46.20
AP	60.13	34.41	24.04	19.45	19.90	20.20	15.00	16.93	29.19	26.04	20.62	19.91	21.17	25.15
B_2	125.08	52.95	45.96	74.04	56.66	65.17	44.17	34.64	59.40	55.30	111.17	82.42	66.09	67.16
C_1	85.92	14.93	16.84	29.24	8.43	14.72	17.26	10.32	9.01	21.76	13.63	24.02	33.76	23.06
C_2	32.23	33.14	15.18	16.73	16.22	22.07	17.18	20.73	14.33	27.50	12.34	18.40	10.31	19.72
D_1	18.54	20.61	24.00	15.21	12.18	15.16	14.47	10.68	14.16	9.14	12.32	17.79	13.89	15.24
D_2	28.16	19.85	11.77	19.35	12.00	11.65	11.80	17.92	12.28	22.20	17.50	14.54	16.86	16.61
E_1	35.95	35.91	22.12	38.31	29.99	21.62	14.83	17.66	21.16	19.53	20.74	35.16	26.77	26.14

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
E_2	28.99	18.49	16.54	14.45	10.33	14.77	10.67	21.03	13.18	13.91	11.58	10.95	11.22	15.08
F_2	109.60	19.86	15.22	13.76	11.86	12.87	13.33	9.04	10.65	15.18	11.13	9.65	16.80	20.69
G_1	32.83	19.02	14.80	22.72	9.46	16.68	13.52	17.22	13.43	23.12	18.69	26.07	14.70	18.63
G_2	73.28	21.73	29.99	21.46	19.86	18.26	21.06	17.48	14.85	14.44	11.27	12.23	14.15	22.31
H_1	43.26	66.96	18.36	35.40	28.54	10.80	23.35	24.88	19.58	31.71	18.09	20.02	17.97	27.61
H_2	102.63	26.11	22.45	27.12	39.35	27.14	18.38	35.85	28.37	27.70	27.87	43.62	36.36	35.61
I	17.03	21.57	22.39	27.93	14.38	18.38	18.13	20.49	29.64	32.31	29.58	17.86	17.64	22.10
I_1	87.59	42.62	33.72	17.22	12.54	18.32	26.56	33.98	28.38	26.89	26.05	43.26	33.76	33.15
I_2	68.29	43.20	21.70	13.89	11.24	24.34	24.32	66.91	24.02	27.95	32.37	57.02	23.22	33.73
J	201.38	27.92	21.91	19.23	34.16	21.76	15.42	61.77	20.14	17.64	25.81	42.52	23.46	41.01
K_1	87.52	42.48	22.34	19.08	17.32	35.11	37.76	32.30	35.19	48.55	60.04	34.84	28.81	38.57
K_2	99.35	39.88	43.35	24.37	24.06	22.71	23.94	76.07	21.63	61.75	33.72	27.12	31.40	40.72
M_1	66.07	66.09	75.69	28.80	38.03	35.99	16.69	20.65	23.00	27.71	25.18	25.74	60.76	39.26
M_2	114.41	78.35	74.64	23.80	24.59	29.66	24.62	25.09	43.55	41.17	56.38	50.43	68.19	50.37
N_1	62.00	106.92	25.13	22.36	24.80	25.04	22.24	9.28	19.20	30.03	31.29	27.99	23.50	33.06
N_2	71.42	22.07	13.68	38.78	36.77	34.50	29.10	31.27	21.53	59.35	99.38	69.89	57.32	45.01
O_1	31.36	344.69	23.50	61.94	16.55	17.64	28.48	17.56	14.50	46.30	107.25	34.27	30.47	59.58
O_2	29.89	18.33	20.91	64.05	17.83	24.27	38.62	13.66	19.19	31.28	61.82	37.97	51.88	33.05
P_1	275.36	54.58	29.00	16.52	38.67	22.89	36.92	33.07	44.08	41.59	57.08	59.02	61.97	59.29
P_2	117.89	107.35	20.69	15.24	18.09	17.52	25.09	41.52	28.17	30.20	19.98	36.82	48.56	40.55
Q_1	42.87	18.24	16.28	11.96	12.96	19.85	13.27	12.99	24.72	13.05	20.69	19.28	29.57	19.67
Q_2	47.90	22.03	18.22	12.39	12.28	12.16	15.33	13.51	14.22	19.71	21.29	15.35	12.33	18.21
R_1	26.20	14.01	16.19	17.03	9.70	20.69	18.52	9.56	21.23	12.84	22.67	26.32	78.26	22.55
R_2	71.69	18.64	11.01	14.86	20.39	16.36	15.05	17.03	17.85	40.17	18.09	28.65	31.06	24.68
S_1	43.09	841.28	27.31	9.71	21.77	28.56	17.75	18.65	15.34	32.06	27.62	24.54	20.21	86.76
S_2	27.79	100.82	18.15	24.26	21.45	7.99	19.69	11.64	9.89	47.05	23.75	13.84	27.92	27.25
T_1	57.98	35.62	33.41	25.26	29.41	20.56	26.67	45.03	16.80	18.00	19.60	26.56	16.95	28.60
T_2	25.97	25.38	17.92	33.89	11.44	20.67	22.74	25.65	18.55	20.72	28.79	18.52	19.65	22.30
U_1	41.29	16.98	16.33	14.15	14.60	10.69	7.41	12.32	25.91	18.85	20.44	29.94	19.50	19.11
U_2	45.32	30.84	20.69	23.12	15.94	29.30	18.33	29.00	14.89	14.70	15.47	15.78	23.67	22.85
V_1	28.62	39.44	53.87	65.27	20.13	20.65	35.09	26.58	15.08	13.08	20.13	22.12	27.52	29.82
V_2	58.14	24.49	16.40	17.91	42.14	13.84	21.91	17.41	22.10	16.85	20.05	59.78	38.48	28.42
W_1	40.11	9.59	13.90	19.54	11.04	30.03	27.96	22.95	25.36	18.14	24.55	17.21	28.90	22.25
W_2	29.36	17.26	11.28	16.09	13.82	17.43	17.22	16.54	14.35	12.84	20.22	10.17	8.43	15.77
X	158.15	30.88	33.32	38.29	44.13	42.16	61.44	36.64	48.18	46.57	69.14	73.09	77.08	58.39
Y	320.91	19.62	30.56	21.58	19.38	25.50	20.08	21.38	28.40	24.16	52.93	31.68	39.16	50.41
Z_1	232.77	29.84	27.66	18.05	20.02	24.39	31.16	25.77	55.64	19.82	34.81	34.86	40.22	45.77
Z_2	77.41	11.90	19.24	256.72	12.39	18.56	19.78	27.40	19.83	34.19	40.80	40.98	34.64	47.22
Total Avg.	**81.30**	**75.87**	**25.95**	**28.38**	**21.39**	**22.26**	**22.09**	**24.44**	**21.85**	**27.10**	**29.12**	**30.01**	**29.74**	

Table 9 MLP: Average percentage of error by time of day in Sunday

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	38.59	17.50	36.93	26.37	37.11	24.67	12.97	25.65	23.00	17.66	27.50	23.16	30.95	26.31
A_2	65.09	60.69	43.40	20.89	27.21	18.28	24.13	16.14	30.21	11.50	23.00	28.12	24.21	30.22
AA_1	13.51	19.97	32.76625	36.67	39.54	13.77	17.90	19.21	15.25	8.95	23.73	14.74	35.72	22.44
AA_2	31.20	24.61	89.10	81.23	32.43	22.64	20.71	23.55	28.57	34.94	14.18	11.53	14.53	33.02
AB_1	19.38	43.69	22.45	38.15	22.48	26.26	24.45	30.11	16.45	18.08	24.24	11.17	19.24	24.32
AB_2	40.15	21.56	51.12	76.94	20.68	19.54	19.17	16.60	22.37	19.28	12.25	26.88	22.71	28.40
AC_1	43.18	24.24	27.50	87.81	41.07	23.82	27.82	12.37	14.53	26.45	24.15	18.95	20.84	30.21
AC_2	22.24	14.38	29.41	117.20	19.35	23.91	27.19	26.89	14.98	17.01	34.31	12.98	18.13	29.07
AD	45.83	34.75	22.85	79.19	46.73	63.25	29.50	23.55	38.02	25.62	45.69	33.03	37.68	40.44
AE	60.81	22.87	14.12	31.10	28.40	23.13	38.36	19.76	20.84	40.88	81.14	25.32	16.43	32.55
AED	18.75	56.49	37.07	25.46	31.57	12.41	29.90	21.43	23.89	19.11	24.05	28.77	16.63	26.58
AF	90.42	18.65	21.01	34.14	36.06	46.29	30.51	29.37	37.31	13.03	34.57	23.31	26.83	33.96
AG	24.33	62.60	18.68	16.87	16.95	9.56	25.65	15.63	27.47	9.87	11.83	19.25	37.49	22.78
AH	122.90	41.62	36.75	29.71	20.44	15.29	18.05	24.88	17.51	22.76	18.46	34.10	29.02	33.19
AI	13.03	25.67	19.50	46.62	12.62	22.80	11.87	12.59	19.72	13.18	8.76	15.64	12.14	18.01
AJ_1	78.24	18.51	38.58	18.54	22.88	8.54	10.13	13.74	9.81	8.89	18.78	18.10	14.52	21.48
AJ_2	36.85	17.65	20.74	15.66	20.23	8.49	15.72	20.02	10.71	16.78	23.42	29.86	12.25	19.11
AK_1	61.22	22.00	24.89	20.32	16.40	15.76	16.20	15.94	18.94	27.62	32.46	27.37	48.24	26.72
AK_2	32.43	36.27	30.99	26.84	15.96	19.87	18.73	13.70	38.13	29.87	36.51	26.14	21.98	26.72
AL_1	26.14	27.15	12.71	49.98	10.66	18.91	14.12	11.90	28.23	25.99	12.74	16.55	26.37	21.65
AL_2	31.64	24.14	34.74	59.45	17.36	12.40	14.30	23.14	25.99	32.84	39.63	37.12	45.75	30.65
AM_1	21.48	15.11	12.52	10.44	31.48	10.12	10.10	10.12	22.12	15.97	17.07	17.64	18.56	16.36
AM_2	12.93	38.62	23.19	9.55	17.40	12.57	15.86	21.49	13.61	10.87	24.33	23.05	27.15	19.28
AO	59.18	25.56	26.34	17.16	15.17	24.64	19.98	25.57	45.54	37.23	34.82	77.83	41.55	34.66
AP	26.01	17.51	18.72	12.49	17.33	8.25	22.77	31.57	20.15	12.75	12.85	41.11	18.46	20.00
B_2	68.06	52.62	358.31	36.74	29.55	55.34	15.88	56.49	63.04	49.22	62.75	50.28	56.15	73.42
C_1	21.77	13.87	12.18	25.89	11.69	34.10	23.11	16.19	15.05	26.03	19.96	22.40	12.81	19.62
C_2	63.90	20.55	31.14	48.32	21.93	35.35	16.44	9.38	14.40	10.93	17.10	25.58	30.62	26.59
D_1	41.13	22.68	18.69	8.87	26.51	15.38	14.11	9.10	10.01	8.95	18.52	22.57	27.13	18.74
D_2	38.37	18.55	24.18	22.90	18.99	21.14	13.72	15.53	21.93	13.27	26.05	14.58	21.89	20.85
E_1	32.89	39.18	34.22	40.26	19.17	31.48	17.29	20.44	16.95	21.64	30.00	27.21	54.97	29.67
E_2	39.52	34.32	56.90	39.73	32.62	59.22	25.84	16.85	39.68	28.24	24.10	32.70	60.85	37.73
F_2	19.43	29.99	15.48	24.15	22.10	15.45	18.16	14.38	14.20	13.01	15.13	11.73	12.16	17.33
G_1	241.88	21.33	20.11	22.87	38.16	20.45	27.35	11.60	20.45	19.06	21.19	18.87	25.03	39.10
G_2	23.89	17.58	10.97	47.21	20.73	16.13	25.40	11.11	9.93	8.62	15.13	16.55	19.27	18.65
H_1	28.49	22.05	28.80	27.90	24.01	18.58	21.01	17.16	23.68	12.63	14.69	27.58	21.29	22.14
H_2	49.12	34.37	36.05	26.11	16.94	15.76	17.50	26.69	22.31	19.70	24.84	26.52	32.08	26.77
I	20.89	35.70	82.31	108.36	58.65	22.96	17.17	24.38	23.20	25.36	23.88	9.79	10.85	35.65
I_1	15.20	19.56	27.53	22.30	19.32	23.64	22.96	17.32	17.55	25.22	21.44	22.91	43.91	22.99
I_2	23.49	13.66	12.33	15.58	20.15	8.76	19.49	14.43	12.22	15.05	19.38	34.28	17.68	17.42
J	72.65	24.30	31.84	30.98	39.04	17.47	25.51	24.77	33.46	20.18	26.81	22.46	41.03	31.58

K_1	51.93	18.73	31.23	19.61	13.76	15.67	12.56	12.43	18.69	12.43	24.75	17.23	15.39	20.34
K_2	33.76	33.19	108.14	22.96	18.12	18.53	19.25	21.31	30.61	21.23	21.97	16.67	22.42	29.86
M_1	29.14	36.90	17.95	35.94	24.62	9.31	20.16	25.14	32.62	29.14	61.24	37.94	33.77	30.30
M_2	55.68	247.03	29.52	3,560.76	24.25	14.78	26.33	24.89	15.78	30.41	32.08	63.91	22.98	319.11
N_1	33.43	37.41	61.96	29.26	32.42	11.85	13.01	22.32	17.68	28.06	39.36	29.51	18.21	28.81
N_2	372.75	17.25	14.55	15.27	40.62	31.20	41.08	32.11	39.90	65.68	66.48	37.09	34.45	62.19
O_1	34.84	28.30	36.56	18.74	50.05	19.00	26.03	17.11	43.06	28.30	24.25	24.85	36.50	29.81
O_2	20.98	20.49	14.64	16.25	12.20	19.18	27.36	21.55	27.22	24.40	33.29	31.77	12.40	21.67
P_1	57.36	29.06	16.64	40.60	30.02	11.17	19.37	20.37	22.82	30.75	39.09	17.49	54.61	29.95
P_2	36.40	112.04	33.39	31.06	14.57	9.65	16.38	24.67	40.81	40.37	30.57	35.66	13.42	33.77
Q_1	25.48	17.65	24.36	33.04	19.11	17.31	18.24	28.85	20.32	18.17	15.54	26.25	18.15	21.73
Q_2	22.94	12.76	13.24	13.41	16.73	11.71	12.80	15.51	11.00	11.11	19.54	17.30	18.57	15.12
R_1	48.81	23.80	39.96	27.98	19.80	15.70	30.74	13.37	5.84	22.35	34.91	17.24	20.63	24.70
R_2	40.91	14.24	19.71	22.04	18.79	11.63	16.28	22.27	9.35	16.99	18.51	19.34	48.92	21.46
S_1	32.68	52.03	17.64	18.20	49.40	27.89	21.69	24.71	40.36	30.95	15.47	38.05	47.81	32.07
S_2	40.08	17.48	15.96	19.50	24.41	20.47	11.96	22.46	13.62	22.09	20.12	20.41	26.32	21.14
T_1	37.30	40.09	26.26	36.67	22.58	11.26	15.58	21.37	31.03	51.86	84.44	34.10	31.36	34.15
T_2	63.91	20.33	31.31	33.78	23.06	19.54	13.93	16.64	14.51	35.14	65.07	27.85	24.51	29.97
U_1	25.02	42.10	17.33	55.24	31.16	13.55	15.35	19.29	21.39	34.68	32.00	30.63	53.27	30.08
U_2	34.43	11.26	14.16	10.92	21.72	15.45	16.78	19.34	27.32	49.67	59.12	44.26	28.69	27.16
V_1	49.21	58.48	21.27	24.69	13.32	19.20	27.45	29.47	35.61	30.88	70.55	54.76	20.26	35.01
V_2	23.53	21.69	37.06	29.32	52.62	12.64	15.85	28.25	21.26	30.02	39.58	77.43	50.79	33.85
W_1	42.74	23.58	14.41	9.16	57.42	52.01	42.65	16.67	57.38	23.86	24.27	26.52	75.36	35.85
W_2	33.38	13.76	20.91	22.51	16.49	10.65	23.06	15.60	23.21	17.33	30.30	24.98	50.92	23.31
X	85.23	46.01	57.78	31.18	26.78	25.94	32.70	43.95	44.75	42.25	60.03	95.51	110.83	54.07
Y	29.29	38.05	16.26	22.17	18.61	12.18	20.36	21.45	23.66	35.89	59.77	150.40	36.86	37.30
Z_1	43.77	49.27	36.66	39.22	21.26	24.02	20.61	24.44	35.43	19.48	26.63	41.78	16.81	30.72
Z_2	22.78	21.18	40.01	18.70	23.83	14.26	21.89	18.02	22.87	18.35	16.80	18.82	32.56	22.31
Total Avg.	**47.30**	**32.70**	**34.43**	**83.99**	**25.72**	**20.46**	**20.82**	**20.79**	**24.48**	**24.00**	**30.54**	**30.51**	**30.46**	

Table 10 MLP: Average percentage of error by time of day in Monday

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	256.17	41.98	18.11	26.15	14.27	16.82	15.97	14.09	21.03	26.08	38.81	43.07	23.86	42.80
A_2	102.69	46.22	32.58	22.01	25.58	19.72	16.93	17.47	18.94	24.06	38.54	23.80	35.14	32.59
AA_1	13.31	14.74	24.31	14.77	10.61	18.01	16.02	17.58	14.03	15.75	17.26	17.83	28.01	17.09
AA_2	27.75	28.80	32.67	25.34	12.14	23.86	26.00	16.28	64.58	47.75	31.03	20.33	29.56	29.70
AB_1	32.15	41.67	17.44	14.68	15.37	19.19	31.60	15.61	18.22	23.62	17.57	17.33	19.03	21.81
AB_2	18.18	36.77	29.04	30.36	28.28	40.20	31.95	74.91	22.21	18.11	22.60	11.07	33.08	30.52
AC_1	40.81	19.92	27.06	33.23	18.01	19.93	27.35	16.80	20.96	31.55	24.04	26.93	24.69	25.48
AC_2	22.85	15.39	19.96	14.48	13.37	11.88	13.41	23.44	37.24	10.76	15.03	26.08	20.07	18.77
AD	37.21	60.00	56.87	29.36	42.62	40.04	41.25	31.03	28.83	32.27	36.84	25.54	76.21	41.39

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AE	41.52	59.31	34.15	26.98	22.66	53.34	43.84	29.89	39.16	47.06	50.86	34.30	56.13	41.48
AED	73.73	33.82	27.92	23.81	23.57	32.39	18.80	16.82	57.37	31.38	23.63	23.82	31.44	32.19
AF	27.07	26.19	19.39	34.32	56.25	100.09	31.69	40.84	47.53	65.80	40.65	31.28	26.97	42.16
AG	31.00	22.54	20.20	19.39	15.74	12.89	25.87	22.10	11.65	21.36	13.93	14.02	15.84	18.96
AH	80.91	39.99	18.78	28.11	14.51	24.27	22.42	17.61	19.18	23.52	25.23	29.49	18.97	27.92
AI	17.14	51.68	25.47	20.43	20.39	32.05	9.51	16.20	17.59	16.62	8.98	14.12	11.54	20.13
AJ_1	31.06	17.87	21.42	15.43	17.71	32.23	18.92	13.03	32.66	32.64	32.41	17.36	23.41	23.55
AJ_2	20.18	26.49	12.73	20.79	13.56	21.72	23.54	19.89	18.63	17.58	27.94	16.23	11.62	19.30
AK_1	79.38	32.45	15.96	10.46	15.42	23.18	22.60	19.75	22.39	24.32	28.67	25.27	52.53	28.64
AK_2	45.93	25.95	28.97	18.70	27.51	22.39	33.33	28.08	31.97	57.12	28.65	28.24	49.54	32.80
AL_1	90.89	33.92	14.52	12.66	39.73	21.44	23.69	11.80	23.36	23.06	32.49	44.42	37.34	31.49
AL_2	98.39	41.83	19.89	19.77	22.08	12.17	18.91	15.47	27.91	36.02	37.65	35.09	55.48	33.90
AM_1	23.99	22.62	22.45	18.90	29.95	21.82	10.12	16.85	19.58	24.90	12.87	21.09	21.22	20.49
AM_2	49.91	15.71	18.68	15.04	17.73	19.54	38.77	17.04	14.38	29.47	40.15	24.06	35.62	25.85
AO	45.54	86.10	45.03	23.68	21.49	31.35	32.68	25.77	15.95	32.20	31.39	14.53	39.47	34.24
AP	46.17	30.22	20.25	14.24	23.59	17.49	31.21	19.79	13.39	19.78	25.79	21.86	22.88	23.59
B_2	129.90	127.21	49.60	43.12	50.31	32.16	47.23	40.96	78.33	48.44	82.42	43.27	29.17	61.70
C_1	26.12	26.78	18.98	23.71	17.35	14.18	13.59	18.20	10.34	21.99	15.81	21.90	33.93	20.22
C_2	52.52	28.48	26.42	17.35	22.07	15.55	18.12	19.78	30.66	23.86	19.99	29.82	16.88	24.73
D_1	25.45	29.24	22.46	16.46	13.99	20.38	27.90	15.24	7.91	15.92	12.14	14.18	12.55	17.99
D_2	29.24	30.01	38.14	5.62	17.88	15.94	19.04	26.16	25.91	11.65	22.07	24.18	18.77	21.89
E_1	152.78	56.49	58.92	31.04	56.58	43.38	28.95	25.36	15.60	25.95	19.25	18.00	23.61	42.76
E_2	34.93	30.25	26.43	29.61	35.29	104.25	86.43	18.41	28.87	15.56	25.14	40.35	36.12	39.36
F_2	15.20	26.46	22.47	13.34	6.38	12.19	27.89	9.45	12.65	13.71	11.01	17.58	13.50	15.52
G_1	21.59	24.72	20.09	27.24	23.55	37.94	23.26	17.55	21.07	27.28	22.32	23.18	25.46	24.25
G_2	15.13	10.72	21.27	12.87	10.99	8.54	13.43	14.40	12.07	18.27	15.94	10.95	20.18	14.21
H_1	36.69	14.28	14.64	16.87	19.45	19.86	23.70	23.28	17.75	15.45	20.70	22.21	22.34	20.56
H_2	45.32	30.80	42.52	20.28	21.28	23.49	25.92	27.83	13.85	26.16	25.61	51.48	24.33	29.14
I	35.81	31.14	36.82	55.67	26.75	13.22	31.40	44.99	36.88	21.04	12.37	25.96	10.52	29.43
I_1	32.60	27.02	36.31	11.68	9.16	18.91	14.87	16.73	84.39	27.37	18.41	31.54	15.00	26.46
I_2	15.44	32.83	12.40	19.69	13.16	10.91	10.26	19.92	19.54	17.42	21.74	37.47	38.23	20.69
J	83.67	46.90	19.54	49.21	22.27	21.69	22.27	18.55	30.83	28.68	32.39	26.77	25.44	32.94
K_1	14.42	26.06	27.51	39.09	12.76	20.08	13.68	17.74	33.47	20.97	17.72	20.49	49.81	24.14
K_2	29.66	53.25	45.39	31.47	25.31	28.70	26.67	19.57	22.04	17.51	31.66	27.33	23.70	29.41
M_1	27.75	27.01	31.13	33.64	25.63	42.73	17.95	14.86	13.53	24.32	29.95	13.53	18.37	24.65
M_2	88.13	65.87	14.17	18.54	21.04	17.04	14.30	16.95	26.04	23.30	24.46	34.29	22.96	29.78
N_1	358.05	60.94	31.41	26.16	15.61	24.38	19.14	24.71	14.49	48.34	18.60	40.72	42.91	55.81
N_2	43.80	60.17	10.66	19.41	23.78	22.52	20.28	35.88	37.47	52.26	33.31	48.24	70.50	36.79
O_1	80.38	90.92	21.09	12.23	21.16	15.37	29.15	35.27	55.40	22.25	26.14	26.09	79.21	39.59
O_2	32.07	27.21	9.19	8.05	12.11	14.56	36.18	21.38	17.27	29.52	32.81	31.20	19.37	22.38
P_1	43.96	62.85	38.54	43.57	23.29	29.35	34.74	28.76	17.01	21.81	31.88	29.12	32.64	33.66

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
P_2	23.90	74.42	20.97	18.81	22.29	22.25	39.31	15.83	20.98	24.43	36.32	17.51	33.16	28.47
Q_1	12.30	14.18	10.41	33.84	17.44	8.56	17.11	22.53	32.66	23.37	18.91	15.73	19.26	18.95
Q_2	16.90	18.25	15.91	18.57	15.27	21.53	10.76	10.34	15.45	18.79	19.41	50.36	9.30	18.53
R_1	18.65	19.65	12.70	12.84	23.19	26.07	24.60	13.41	24.50	20.52	58.23	28.61	19.59	23.27
R_2	20.05	16.73	30.15	33.82	26.16	16.27	19.20	22.04	16.22	18.84	19.87	25.91	18.05	21.79
S_1	34.76	47.26	122.03	55.68	76.18	21.80	43.65	29.25	21.16	36.32	20.40	59.89	58.86	48.25
S_2	25.16	24.94	21.58	23.87	18.93	14.49	16.53	34.67	16.42	58.05	18.30	26.76	30.95	25.43
T_1	208.54	61.81	24.09	42.45	22.62	14.08	21.99	14.73	29.13	53.34	57.73	19.78	44.52	47.29
T_2	21.67	61.79	14.41	20.10	17.09	18.86	17.97	16.47	19.99	26.23	36.97	22.70	26.82	24.70
U_1	89.86	37.98	48.18	61.89	19.98	20.87	32.27	40.48	20.46	35.78	32.27	43.44	41.48	40.38
U_2	220.60	43.57	7.95	16.02	17.19	19.97	17.72	17.62	41.82	37.14	50.61	19.16	26.82	41.24
V_1	91.17	56.70	46.60	43.11	19.20	19.96	50.18	19.17	24.52	43.24	63.29	54.56	56.56	45.25
V_2	112.37	32.04	44.93	117.94	22.79	17.60	21.74	18.75	11.25	34.19	34.50	53.97	126.06	49.86
W_1	54.76	22.46	37.58	44.95	25.03	31.02	15.66	15.38	26.46	30.58	14.93	61.31	75.11	35.02
W_2	89.25	28.48	30.53	16.83	33.90	16.93	18.08	17.91	25.77	21.63	40.84	39.86	58.36	33.72
X	84.07	102.78	41.47	23.76	29.26	24.40	19.22	26.19	62.71	36.23	65.47	31.36	39.58	45.12
Y	54.74	27.63	15.49	19.11	16.80	19.31	26.89	14.18	37.65	25.21	23.33	26.41	27.09	25.68
Z_1	34.11	51.19	69.43	26.24	31.00	18.39	32.19	16.11	16.73	33.00	30.28	45.05	33.81	33.66
Z_2	39.92	14.53	22.78	18.26	13.62	12.45	13.99	21.47	13.30	28.75	10.43	17.83	29.79	19.78
Total Avg.	**59.09**	**38.78**	**28.36**	**26.19**	**22.86**	**24.35**	**25.10**	**21.98**	**26.37**	**28.37**	**28.68**	**28.66**	**33.34**	

Table 11 MLP: Average percentage of error by time of day in Tuesday

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	106.03	39.29	23.27	18.19	12.46	25.27	19.35	12.33	16.75	12.21	37.06	49.45	38.80	31.57
A_2	74.40	86.93	34.93	33.17	24.29	22.43	39.37	18.74	32.51	25.06	35.52	32.04	42.24	38.59
AA_1	77.84	19.25	38.12	21.04	15.93	29.60	22.62	16.89	22.00	20.92	31.02	32.17	59.41	31.29
AA_2	70.18	49.64	40.02	10.37	14.85	25.77	29.29	11.04	23.60	18.76	45.58	18.61	50.77	31.42
AB_1	41.14	62.29	39.75	14.06	22.41	41.38	15.98	13.67	23.99	21.12	23.47	30.52	44.40	30.32
AB_2	47.73	36.81	27.35	18.21	26.84	21.08	26.24	31.17	35.76	19.52	38.20	20.36	27.74	29.00
AC_1	37.69	47.38	15.61	29.87	26.30	74.73	29.16	32.71	23.46	42.16	20.65	29.43	30.07	33.79
AC_2	24.48	21.24	14.59	24.06	17.25	23.86	19.86	17.48	25.08	50.31	30.60	12.68	13.92	22.72
AD	431.59	71.76	53.60	28.06	46.49	20.66	13.21	40.74	37.86	42.75	29.72	36.32	97.98	73.13
AE	116.09	35.51	26.38	15.09	21.15	45.57	23.46	26.21	40.52	31.23	43.21	37.36	115.70	44.42
AED	58.98	18.27	42.69	30.34	20.37	20.21	24.88	18.25	21.73	29.68	20.14	21.69	22.64	26.91
AF	44.35	44.49	23.54	31.93	76.20	26.82	75.36	32.65	25.74	25.78	26.41	31.81	27.54	37.89
AG	25.98	14.66	17.41	12.99	16.34	19.70	10.29	24.98	30.10	16.90	19.14	11.24	19.48	18.40
AH	125.44	43.16	27.43	17.17	15.79	18.48	16.03	11.53	26.56	23.05	40.40	31.95	18.04	31.92
AI	28.76	10.14	15.14	17.20	12.57	15.74	12.63	19.81	17.80	31.02	25.14	17.93	15.27	18.40
AJ_1	43.06	25.85	23.89	22.01	10.79	27.27	18.53	22.26	20.94	19.48	25.47	28.23	63.31	27.01

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AJ_2	29.10	24.04	25.12	19.65	22.90	20.65	30.57	26.96	9.26	13.54	13.88	14.21	12.93	20.22
AK_1	91.68	29.81	43.07	20.33	16.33	25.14	24.85	14.78	13.03	27.84	29.84	30.11	20.02	29.76
AK_2	64.47	23.16	18.56	16.98	15.27	20.70	34.08	12.34	30.62	33.36	21.70	38.28	88.65	32.17
AL_1	49.69	33.99	19.37	10.34	11.00	14.79	19.75	11.54	27.54	23.31	19.28	26.80	26.20	22.58
AL_2	98.53	91.46	17.19	16.48	12.57	7.63	19.07	27.69	10.15	26.74	25.71	28.26	49.85	33.18
AM_1	49.78	34.70	13.38	21.38	11.54	18.81	9.33	18.66	20.37	23.99	16.93	17.20	19.52	21.20
AM_2	16.80	24.15	16.45	13.92	15.88	14.14	13.67	14.27	26.60	23.92	33.14	41.71	54.47	23.78
AO	61.28	127.77	60.91	16.09	15.39	23.33	23.99	30.69	27.52	54.25	40.09	30.22	51.06	43.28
AP	49.41	38.80	12.57	9.61	10.61	19.92	22.36	14.59	11.88	26.76	34.14	43.41	26.67	24.67
B_2	157.92	109.73	62.38	44.67	27.20	39.27	46.52	89.14	55.45	43.84	30.94	40.81	28.44	59.72
C_1	32.69	23.05	16.13	21.69	16.63	18.23	16.03	12.89	15.01	22.59	39.27	17.71	11.36	20.25
C_2	30.17	10.34	31.03	22.68	11.30	15.35	22.47	30.33	23.38	29.16	26.20	34.73	27.31	24.19
D_1	26.27	22.08	27.32	14.51	7.82	13.29	12.88	14.75	19.55	25.08	21.91	15.82	17.83	18.39
D_2	17.01	26.95	26.86	13.02	10.56	12.99	21.54	21.21	15.60	3.74	16.71	12.50	33.48	17.86
E_1	32.60	22.76	66.99	29.19	27.53	43.59	32.73	13.86	17.24	37.87	27.40	19.20	56.06	32.85
E_2	44.58	29.85	18.17	35.57	23.96	98.06	47.38	30.47	41.96	20.39	36.81	35.10	68.96	40.87
F_2	14.41	23.86	18.10	16.79	12.60	12.79	21.18	24.23	15.65	15.51	15.03	15.80	12.09	16.77
G_1	35.20	25.17	27.97	14.31	12.39	17.46	7.28	19.09	8.56	22.03	24.43	16.53	17.25	19.05
G_2	60.75	25.51	15.45	17.86	18.31	16.58	18.56	21.40	15.63	12.56	15.53	15.13	32.55	21.99
H_1	43.96	36.71	25.93	21.94	13.79	13.05	18.83	13.17	30.92	29.91	10.10	30.03	29.21	24.43
H_2	98.00	35.83	30.67	19.62	14.66	27.76	44.85	18.42	26.92	34.73	17.08	27.00	43.85	33.80
I	24.68	54.45	26.04	74.19	20.90	14.93	29.19	50.98	40.11	50.32	49.49	63.89	90.49	45.36
I_1	40.40	31.34	28.70	17.28	15.05	16.41	22.60	26.10	17.86	27.49	25.60	37.67	18.86	25.03
I_2	54.65	38.08	11.43	13.61	10.87	21.49	20.06	8.34	11.90	30.86	18.97	42.90	24.32	23.65
J	158.68	56.81	23.53	19.80	33.19	32.84	42.77	33.40	24.12	23.55	35.89	36.41	28.24	42.25
K_1	61.73	31.99	22.66	18.69	12.37	19.67	25.44	22.42	22.20	17.98	18.41	17.50	28.64	24.59
K_2	55.55	34.71	69.95	32.25	39.03	36.82	41.43	25.83	27.95	18.36	20.48	36.34	30.61	36.10
M_1	32.49	18.00	67.61	20.92	12.06	11.32	23.90	19.52	20.46	22.82	50.83	55.13	31.09	29.70
M_2	131.22	92.94	22.90	24.33	17.02	23.55	18.95	39.52	21.88	27.66	31.67	73.24	29.38	42.64
N_1	111.83	21.01	23.68	20.96	18.77	15.28	25.79	16.59	15.88	26.54	20.41	36.53	16.79	28.47
N_2	222.46	74.90	22.00	26.91	21.67	13.68	14.19	33.81	55.08	68.17	39.34	72.49	57.89	55.58
O_1	280.77	17.10	21.02	19.08	19.19	20.84	37.72	36.56	40.61	30.44	40.45	34.99	49.35	49.86
O_2	114.91	22.59	11.47	11.59	15.98	26.78	42.70	27.86	32.51	27.48	47.55	30.14	34.05	34.28
P_1	102.32	48.51	50.62	17.93	24.28	20.18	29.07	35.68	29.89	32.17	23.34	50.33	39.03	38.72
P_2	43.13	54.37	46.12	26.98	20.15	21.02	37.33	12.74	19.69	33.95	43.90	51.78	46.84	35.23
Q_1	44.60	24.35	23.83	22.86	18.05	14.54	20.11	16.81	14.23	15.38	21.88	28.33	20.00	21.92
Q_2	49.24	20.18	20.31	11.08	7.75	12.59	19.39	10.29	16.16	23.50	13.11	20.80	11.45	18.14
R_1	33.06	37.14	23.92	24.18	12.73	13.96	22.36	21.22	23.64	28.29	47.32	30.81	30.86	26.88
R_2	63.48	19.74	15.45	24.23	13.24	20.54	20.42	14.98	20.97	31.12	22.43	25.36	34.37	25.10
S_1	45.95	29.44	49.26	34.49	29.51	19.55	55.78	26.32	26.24	27.32	19.53	21.37	53.68	33.73
S_2	40.62	17.83	24.09	22.12	12.93	9.24	13.25	27.58	52.76	15.68	39.15	37.17	59.33	28.60

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
T_1	27.12	55.16	74.02	12.19	35.03	20.69	21.31	27.03	31.12	52.74	83.68	35.13	34.23	39.19
T_2	31.00	33.72	41.98	22.23	67.40	21.67	13.35	28.17	12.71	25.86	49.83	62.78	18.86	33.04
U_1	158.91	32.43	40.13	22.91	13.67	30.52	60.92	25.97	26.71	27.30	47.53	44.03	51.05	44.78
U_2	31.25	21.97	30.45	15.13	7.42	7.42	15.51	12.75	27.08	50.22	73.03	26.78	23.13	26.32
V_1	77.49	30.18	101.27	13.99	15.43	19.91	16.78	30.12	29.05	25.41	48.21	38.18	16.39	35.57
V_2	136.06	22.81	22.24	47.49	20.46	15.18	21.51	16.15	20.35	31.88	19.91	46.54	55.63	36.63
W_1	52.01	26.32	42.69	16.95	23.14	25.88	23.09	39.86	29.12	22.65	29.62	24.77	48.61	31.13
W_2	118.48	54.15	31.25	17.36	9.36	14.99	25.23	42.72	14.86	53.24	52.80	24.16	91.31	42.30
X	268.27	228.94	47.59	27.66	19.55	24.71	30.04	38.30	34.34	42.19	40.04	41.99	42.32	68.15
Y	137.56	49.81	22.84	23.55	15.86	25.10	14.30	37.79	24.76	145.49	59.60	19.95	37.34	47.23
Z_1	121.03	48.88	32.21	24.98	16.25	30.22	10.10	27.24	27.91	25.96	22.75	49.46	133.73	43.90
Z_2	166.08	14.83	12.10	20.84	9.41	26.28	15.70	17.29	31.69	37.49	24.37	16.19	46.54	33.75
Total Avg.	**79.64**	**40.74**	**31.31**	**21.87**	**19.36**	**23.19**	**25.14**	**24.36**	**25.09**	**30.44**	**31.72**	**32.25**	**39.85**	

Table 12 MLP: Average percentage of error by time of day in Wednesday

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	66.37	30.79	19.49	24.33	24.40	17.58	16.33	14.24	16.19	31.23	19.93	26.56	40.87	26.79
A_2	86.87	33.56	39.66	34.97	14.90	26.61	21.31	23.19	22.35	20.99	27.86	25.24	41.34	32.22
AA_1	39.84	33.89	26.27	52.02	15.90	18.99	14.99	19.80	23.23	24.47	11.72	40.19	58.07	29.18
AA_2	32.33	34.68	20.65	51.63	21.39	21.46	35.80	25.83	37.24	33.44	53.39	72.33	58.03	38.32
AB_1	67.45	51.58	16.80	40.17	17.31	29.73	25.24	30.66	19.39	16.66	24.05	32.02	34.24	31.18
AB_2	39.55	18.00	28.65	18.99	36.56	16.07	20.80	32.01	19.60	31.58	40.91	39.17	48.25	30.01
AC_1	40.37	27.18	29.56	27.48	26.28	14.76	19.84	27.04	10.57	18.58	33.05	21.85	35.08	25.51
AC_2	21.66	15.83	19.20	16.51	12.59	19.09	10.18	41.27	22.86	33.86	44.21	19.49	40.07	24.37
AD	26.59	44.91	235.96	74.75	34.11	24.74	24.74	34.02	33.31	40.60	119.77	26.26	50.41	59.25
AE	61.23	10.06	20.67	9.40	18.12	28.81	35.75	21.35	45.51	46.05	22.96	26.27	45.87	30.16
AED	23.10	34.18	35.11	47.14	28.33	21.06	23.13	19.61	23.13	26.50	48.81	24.47	25.18	29.21
AF	36.95	28.60	17.67	42.88	43.48	45.65	53.61	30.50	34.66	20.75	14.75	24.90	21.09	31.96
AG	18.92	14.80	26.08	22.99	16.47	23.86	13.87	18.96	15.56	15.68	47.91	35.05	19.26	22.26
AH	76.52	70.12	28.30	28.97	14.89	14.03	13.14	20.74	25.30	35.98	15.11	31.85	34.42	31.49
AI	21.22	24.72	57.92	29.36	12.82	12.56	17.49	15.40	11.83	13.66	27.33	20.83	18.65	21.83
AJ_1	36.22	32.50	57.25	35.44	13.00	16.62	18.63	15.62	10.78	48.02	41.58	31.15	48.07	31.14
AJ_2	27.10	30.00	23.88	24.45	19.93	16.26	20.79	13.14	23.16	14.63	21.75	20.19	26.01	21.64
AK_1	24.28	22.90	47.83	38.93	18.01	15.61	20.04	12.88	20.21	34.92	62.45	44.99	31.45	30.35
AK_2	41.54	53.33	24.09	38.49	16.69	19.56	21.87	27.77	45.19	28.24	25.66	28.89	19.93	30.10
AL_1	23.27	90.51	36.29	12.49	10.27	12.13	9.52	18.63	21.98	29.13	14.45	35.41	34.53	26.81
AL_2	78.01	37.24	277.90	15.47	10.13	14.01	7.93	18.73	25.98	26.64	27.40	42.27	70.34	50.16
AM_1	36.96	18.08	24.12	29.61	33.08	13.27	14.60	19.73	18.86	37.25	24.67	16.68	16.00	23.30

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AM_2	58.55	16.55	19.71	6.91	29.17	29.16	16.49	20.95	18.91	21.52	30.00	33.44	39.30	26.20
AO	106.61	47.79	18.38	25.21	26.43	26.22	17.48	29.13	27.10	39.12	26.83	47.42	68.82	38.97
AP	48.37	32.00	35.64	12.19	21.69	26.78	11.96	26.58	24.99	16.51	15.87	30.30	20.27	24.86
B_2	336.57	45.64	31.18	46.76	41.63	24.42	18.22	44.49	53.81	28.16	28.08	55.09	47.12	61.63
C_1	37.49	30.75	20.24	17.59	22.53	20.22	69.29	28.71	15.31	27.14	32.37	25.46	23.88	28.54
C_2	35.11	42.40	39.62	22.50	25.67	28.76	59.84	53.20	15.41	19.85	34.05	32.49	21.89	33.14
D_1	14.21	34.10	22.51	20.52	27.19	18.43	4.80	24.97	24.40	32.24	33.07	24.96	20.31	23.21
D_2	20.30	45.01	14.62	13.00	20.13	16.01	24.41	13.24	19.61	20.98	27.11	16.62	22.91	21.07
E_1	35.10	123.80	63.48	55.37	29.59	42.43	11.02	24.44	21.30	25.76	15.42	31.93	55.30	41.15
E_2	32.26	38.16	22.63	17.18	23.68	48.47	27.41	39.78	34.39	29.56	44.12	42.06	117.92	39.82
F_2	8.86	22.62	16.66	10.90	14.09	15.02	24.07	21.06	17.61	18.50	19.29	10.04	10.85	16.12
G_1	22.44	27.49	31.32	19.86	32.22	22.87	14.60	23.97	17.82	25.75	38.97	26.12	18.68	24.78
G_2	22.06	16.79	27.96	13.75	19.37	12.20	15.53	16.54	16.95	20.66	19.27	26.16	31.31	19.89
H_1	32.23	36.69	23.45	31.53	17.03	14.01	10.55	24.13	29.25	33.81	12.12	30.19	36.67	25.51
H_2	105.46	30.55	96.30	50.99	28.51	19.54	16.32	20.05	18.87	22.53	16.69	29.97	46.99	38.68
I	38.93	32.03	46.18	112.57	52.04	50.01	33.32	63.66	35.06	45.50	35.24	38.41	58.26	49.32
I_1	18.43	23.43	32.53	70.41	10.42	10.09	15.05	21.99	27.11	27.99	42.18	22.56	40.74	27.92
I_2	48.03	22.93	25.08	18.50	14.22	14.54	8.82	17.56	23.66	37.36	27.35	64.31	15.08	25.96
J	118.52	33.68	35.02	49.33	38.04	29.93	24.57	23.62	16.16	17.95	23.46	45.39	16.84	36.35
K_1	48.64	36.00	26.00	27.78	17.17	13.78	34.91	21.09	23.47	24.91	22.73	24.89	17.33	26.05
K_2	111.80	55.99	43.95	64.62	32.29	23.52	26.03	31.67	17.73	22.80	37.12	30.04	36.56	41.09
M_1	22.61	25.67	34.34	21.26	24.95	22.43	19.57	16.81	30.62	28.29	37.78	107.40	37.01	32.98
M_2	66.28	37.62	31.28	20.91	14.74	16.98	23.59	36.15	27.98	32.61	35.03	95.43	25.49	35.70
N_1	60.47	27.50	916.64	14.84	28.17	17.62	9.81	16.75	26.93	22.82	55.39	53.44	71.38	101.67
N_2	134.27	65.36	47.56	39.85	23.42	13.72	23.01	39.52	47.72	44.02	44.35	76.51	31.48	48.52
O_1	98.04	44.83	39.69	35.84	34.92	19.47	26.59	50.52	25.27	16.36	39.49	82.33	76.45	45.37
O_2	50.52	34.93	18.07	23.16	25.31	15.57	32.02	30.31	41.38	21.63	42.80	86.61	20.62	34.07
P_1	66.31	24.32	32.54	15.84	57.48	24.12	23.57	21.00	29.08	38.65	21.43	40.35	49.12	34.14
P_2	40.64	110.03	24.81	24.63	26.81	24.82	14.77	25.96	19.36	26.57	34.01	131.47	45.30	42.24
Q_1	19.27	18.93	22.42	40.27	15.10	14.87	16.06	18.05	32.89	17.35	12.92	22.71	51.25	23.24
Q_2	39.26	18.98	9.47	24.99	13.39	10.62	14.34	16.31	14.00	4.98	10.26	14.10	13.65	15.72
R_1	38.73	22.10	36.75	26.03	9.75	15.42	22.08	20.24	36.66	5.42	36.17	28.31	40.45	26.01
R_2	31.28	29.32	24.63	31.54	13.25	26.40	15.04	36.98	23.05	35.25	29.12	27.90	41.99	28.14
S_1	55.75	39.50	107.28	102.03	35.13	24.30	18.15	29.33	37.80	20.95	43.50	32.00	77.60	47.95
S_2	25.53	81.53	73.68	34.64	10.03	12.22	19.45	24.57	40.70	16.43	25.73	19.74	23.60	31.37
T_1	35.40	70.23	76.43	23.86	33.21	16.81	19.08	29.85	22.87	63.37	87.41	98.86	57.02	48.80
T_2	22.24	93.95	91.50	7.00	14.14	17.21	8.16	14.25	28.88	35.78	24.53	49.06	36.58	34.10
U_1	89.13	25.59	44.56	75.21	17.08	26.16	36.64	32.53	23.84	32.87	40.60	39.37	45.83	40.72
U_2	24.25	42.90	41.96	26.28	8.41	14.24	15.95	15.26	29.12	33.37	90.64	58.92	29.79	33.16
V_1	83.05	64.60	4,167.40	90.05	26.77	28.21	18.36	24.25	24.84	47.30	42.01	27.37	70.07	362.64

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
V_2	94.37	36.02	59.89	75.41	25.29	21.54	25.85	28.69	39.65	42.40	39.03	45.48	104.50	49.09
W_1	33.15	21.33	41.25	14.54	16.37	26.33	19.12	16.45	15.68	20.44	49.08	36.21	24.97	25.76
W_2	25.15	61.95	22.49	19.26	16.70	22.97	16.56	20.54	18.58	36.01	48.93	36.80	58.86	31.14
X	330.43	95.27	16.02	76.27	23.05	43.63	61.90	47.95	54.29	57.60	56.07	66.05	61.96	76.19
Y	74.59	26.13	26.54	18.00	11.67	20.80	22.85	46.29	25.93	14.50	33.36	50.89	26.99	30.66
Z_1	69.53	60.88	38.42	21.82	33.45	22.79	27.21	54.65	42.23	25.54	34.03	30.05	80.37	41.61
Z_2	59.69	31.01	16.66	23.86	20.68	20.93	12.82	13.30	19.98	10.89	30.67	29.67	19.52	23.82
Total Avg.	**56.76**	**40.03**	**114.03**	**34.08**	**22.91**	**21.58**	**21.84**	**26.35**	**26.16**	**28.10**	**34.71**	**40.01**	**40.67**	

Table 13 MLP: Average percentage of error by time of day in Thursday

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	104.77	134.70	50.20	24.45	26.02	18.46	16.68	19.94	22.62	20.50	25.56	56.06	44.14	43.39
A_2	176.44	49.20	39.03	15.05	24.47	30.35	15.93	19.89	22.70	26.63	33.77	74.83	39.18	43.65
AA_1	78.31	27.37	27.14	22.76	18.39	23.10	21.42	24.05	22.77	21.20	42.25	43.65	54.47	32.84
AA_2	53.61	55.21	30.01	49.99	25.68	30.77	20.51	51.50	26.83	24.19	88.51	46.10	28.87	40.91
AB_1	40.21	88.56	34.72	31.43	21.65	23.30	30.10	24.99	16.77	30.48	25.50	66.03	43.04	36.67
AB_2	100.78	20.58	32.65	41.52	25.09	23.18	15.67	70.46	60.00	59.14	100.97	117.94	64.88	56.37
AC_1	74.51	24.39	27.64	19.82	41.29	37.76	12.48	20.42	12.76	34.95	31.47	42.05	52.65	33.24
AC_2	36.28	13.09	19.07	17.10	13.01	27.87	16.72	16.81	119.69	53.32	54.53	114.59	60.48	43.27
AD	123.86	60.16	43.48	31.26	25.30	31.68	29.30	34.21	18.37	25.29	65.10	49.40	53.87	45.48
AE	276.80	52.86	20.86	18.61	29.32	26.38	32.82	53.38	39.28	27.57	43.31	69.37	107.67	61.40
AED	36.30	70.61	37.70	50.64	18.67	22.34	23.19	28.55	22.76	26.00	38.19	35.89	32.69	34.12
AF	72.21	23.37	26.02	43.71	39.06	28.66	24.14	29.77	26.35	24.96	34.02	17.51	25.36	31.93
AG	28.26	17.11	17.77	11.00	14.61	22.67	19.15	20.56	12.27	27.68	26.65	46.88	29.79	22.65
AH	118.47	50.06	31.43	13.76	26.03	14.65	18.04	23.93	14.14	16.14	80.86	23.81	24.74	35.08
AI	23.33	30.79	27.65	15.43	17.07	14.75	22.42	14.67	13.37	10.98	21.05	55.39	15.69	21.74
AJ_1	38.26	44.15	18.39	31.75	32.07	8.63	17.38	21.99	26.85	22.23	49.04	22.39	68.23	30.87
AJ_2	34.05	45.58	21.67	28.66	15.83	11.32	9.54	18.77	30.41	22.17	21.37	32.56	26.00	24.46
AK_1	82.82	45.54	33.17	29.19	18.12	18.94	32.81	17.64	29.96	18.40	24.82	45.94	31.95	33.02
AK_2	56.91	43.47	30.28	28.99	21.53	18.43	20.53	23.58	67.44	58.93	23.82	79.16	90.38	43.34
AL_1	33.23	121.83	31.78	18.18	17.44	12.59	16.10	16.50	24.53	25.50	32.44	22.24	91.46	35.68
AL_2	71.79	46.75	29.73	16.43	14.49	19.87	28.47	15.86	27.34	23.43	26.27	18.54	58.42	30.57
AM_1	23.04	38.64	20.02	15.50	25.56	16.71	14.07	14.52	24.80	32.06	20.66	38.03	48.06	25.51
AM_2	78.41	47.32	27.32	25.01	16.94	15.62	17.84	31.04	24.71	20.25	32.36	39.88	63.77	33.88
AO	75.45	196.70	44.20	55.34	17.79	24.77	28.12	17.94	30.61	39.24	83.98	39.97	39.35	53.34
AP	15.66	37.10	19.28	25.16	26.66	25.75	7.55	19.46	32.35	28.73	67.03	89.90	50.36	34.23
B_2	165.82	67.93	45.31	69.89	64.29	50.82	60.29	56.85	51.54	26.03	54.08	66.01	62.42	64.71
C_1	104.43	40.78	19.14	19.96	27.29	17.86	32.59	36.70	31.15	24.74	15.76	22.01	24.59	32.08

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
C_2	32.88	21.80	30.51	17.11	22.80	33.40	17.00	42.29	19.78	19.83	25.60	12.33	39.63	25.77
D_1	31.25	10.19	24.72	50.37	19.37	19.60	16.28	18.46	15.84	25.94	22.79	38.17	25.95	24.53
D_2	27.64	24.01	29.30	16.05	16.41	14.11	13.72	20.42	27.13	22.01	32.96	23.67	28.65	22.77
E_1	42.24	22.42	43.90	58.64	41.44	36.87	11.36	18.57	19.56	17.70	24.97	30.96	45.84	31.88
E_2	61.61	24.15	19.04	31.24	41.34	57.73	20.99	28.10	50.41	43.18	40.02	29.82	46.12	37.98
F_2	19.91	35.14	24.28	25.41	8.82	15.23	7.86	20.88	19.12	12.82	15.64	21.44	31.00	19.81
G_1	36.79	33.22	19.62	29.65	33.11	15.97	16.08	16.95	20.08	21.30	39.67	23.40	34.06	26.15
G_2	69.16	60.13	26.52	7.40	16.53	11.71	10.61	15.52	8.90	12.47	17.55	24.72	43.97	25.01
H_1	38.08	32.70	22.60	14.93	24.67	16.84	43.22	23.38	10.39	31.78	17.65	23.31	23.35	24.84
H_2	58.84	61.96	38.10	38.33	36.12	12.87	19.62	13.60	13.10	19.27	36.23	42.32	22.29	31.74
I	55.89	31.09	55.70	93.79	40.15	52.58	21.64	47.66	55.32	12.75	35.23	53.72	101.68	50.55
I_1	37.37	43.04	33.88	36.39	15.45	18.67	13.78	26.18	23.54	36.06	33.60	52.03	24.19	30.32
I_2	53.48	53.42	33.43	34.94	30.14	14.74	17.26	22.98	52.74	39.57	13.12	52.72	41.77	35.41
J	165.72	61.47	18.66	25.21	18.84	33.17	33.21	27.56	31.65	36.35	23.15	56.79	38.95	43.90
K_1	56.10	44.70	20.08	55.02	24.81	16.74	13.95	17.07	38.54	42.03	28.56	21.96	49.25	32.99
K_2	97.00	47.58	59.40	41.41	52.15	32.70	26.67	29.86	18.56	17.95	44.12	29.19	37.43	41.08
M_1	69.97	48.59	20.81	19.54	13.19	16.35	28.16	20.93	26.19	29.23	41.60	44.49	76.78	35.06
M_2	204.03	19.02	35.06	24.67	26.48	19.12	9.95	31.58	28.99	57.19	35.61	29.63	28.76	42.31
N_1	97.48	58.70	312.82	29.88	13.34	18.49	17.06	29.94	45.69	34.30	70.71	31.75	82.88	64.85
N_2	108.59	187.17	25.99	18.42	18.45	31.57	14.34	38.14	35.16	35.84	42.42	51.78	124.21	56.31
O_1	108.18	84.69	19.93	22.81	21.63	15.87	18.19	34.90	41.04	31.24	58.90	56.70	32.47	42.04
O_2	140.01	74.03	16.23	20.90	18.95	30.21	14.23	24.68	28.21	44.41	51.70	43.78	35.41	41.75
P_1	84.27	89.25	35.12	26.28	25.47	16.35	19.41	28.75	29.04	14.00	33.23	38.56	42.09	37.06
P_2	49.73	29.59	51.25	22.00	24.80	24.69	17.20	30.19	23.19	31.59	25.80	26.74	43.06	30.76
Q_1	25.32	18.70	19.64	13.50	9.87	17.87	8.58	19.10	30.88	47.66	34.42	22.15	22.34	22.31
Q_2	43.00	19.86	13.10	25.17	13.27	13.69	20.16	19.61	12.43	15.54	20.87	16.56	24.95	19.86
R_1	37.57	14.26	12.98	25.05	15.92	20.12	16.34	23.42	19.03	27.28	30.91	18.18	30.38	22.42
R_2	58.37	24.32	20.05	24.37	17.24	18.41	23.00	24.09	17.88	16.27	30.80	29.64	41.01	26.57
S_1	51.34	32.85	62.39	90.41	23.47	21.65	32.77	29.79	34.99	52.23	46.53	212.62	111.32	61.72
S_2	65.05	90.92	28.49	39.25	15.72	23.83	21.75	21.58	34.56	23.97	36.47	41.52	48.82	37.84
T_1	50.63	201.38	64.37	53.35	18.99	14.16	16.88	29.21	59.17	37.92	52.93	30.54	48.17	52.13
T_2	65.99	185.30	43.80	27.67	18.67	48.34	36.32	19.96	37.26	28.10	57.74	173.04	74.47	62.82
U_1	103.50	23.87	33.63	48.38	31.31	23.47	23.02	30.42	25.83	14.33	49.54	19.78	25.08	34.78
U_2	50.46	66.25	105.89	24.47	17.97	15.78	24.70	20.39	15.86	44.78	45.76	68.50	27.57	40.64
V_1	102.06	78.70	32.09	37.58	16.09	19.01	31.59	31.55	52.87	24.53	60.60	103.54	184.56	59.60
V_2	76.86	69.14	149.46	38.56	23.48	19.37	27.00	33.67	80.47	34.81	42.20	149.64	118.02	66.36
W_1	73.29	32.44	28.14	16.23	21.64	23.83	24.91	21.66	16.91	26.20	41.48	29.92	29.46	29.70
W_2	50.01	136.77	15.44	16.29	27.84	15.53	14.97	18.54	20.28	41.92	30.77	45.30	111.97	41.97
X	207.88	58.92	32.61	38.12	26.97	57.69	32.08	28.92	46.87	36.61	115.49	53.75	85.93	63.22
Y	75.70	119.96	30.99	25.05	79.49	27.27	32.19	21.60	21.92	20.69	46.78	65.08	86.95	50.28

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
Z_1	72.72	41.39	39.52	23.77	40.75	25.33	29.55	40.53	36.05	23.12	35.54	60.95	61.34	40.81
Z_2	98.00	68.83	18.11	18.73	13.82	19.65	20.57	15.98	20.89	21.57	27.76	48.80	59.44	34.78
Total Avg.	**75.04**	**57.62**	**37.29**	**30.68**	**24.65**	**23.45**	**21.48**	**26.41**	**30.71**	**28.94**	**40.30**	**49.65**	**52.52**	

Table 14 MLP: Average percentage of error by time of day in Friday

Road	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	156.10	28.13	24.13	25.51	25.10	19.22	28.27	26.81	23.52	34.00	30.41	36.81	73.83	40.91
A_2	210.14	293.62	30.91	32.46	32.04	24.52	16.78	21.66	19.16	22.86	21.75	21.02	41.97	60.68
AA_1	96.04	19.79	15.48	18.77	12.28	16.70	11.88	15.52	18.46	39.39	46.95	22.48	75.09	31.45
AA_2	156.27	9.28	13.09	14.73	20.59	12.37	13.75	24.03	38.17	36.80	17.22	22.07	37.54	31.99
AB_1	161.10	22.02	23.42	10.95	10.41	15.13	17.23	24.99	24.29	27.51	35.29	27.30	35.84	33.50
AB_2	216.14	22.13	28.81	21.76	24.83	15.92	21.37	44.50	20.28	58.38	41.60	26.51	59.34	46.27
AC_1	36.80	29.60	29.92	22.68	18.91	12.23	16.60	21.02	20.68	33.28	33.08	14.70	34.28	24.91
AC_2	108.40	9.25	17.46	12.70	12.31	11.29	14.27	9.66	13.22	25.26	36.43	23.63	24.51	24.49
AD	157.78	645.97	73.24	35.68	31.24	19.90	21.76	21.90	38.53	34.72	28.27	19.33	53.80	90.93
AE	93.11	32.54	39.20	30.39	26.50	39.10	35.17	27.44	24.54	23.06	41.19	26.09	21.04	35.34
AED	68.76	36.33	27.66	29.95	15.63	24.25	29.55	17.29	18.57	23.11	17.58	32.02	25.67	28.18
AF	31.75	32.95	27.87	31.43	29.82	34.88	49.49	39.87	23.89	28.49	44.42	17.83	32.21	32.68
AG	24.80	18.64	20.85	10.66	14.78	13.48	18.27	20.80	23.86	23.99	20.95	21.89	17.30	19.25
AH	212.48	44.13	27.05	30.36	27.36	14.86	18.98	13.33	16.47	26.67	30.98	22.86	26.10	39.36
AI	20.73	13.83	21.42	18.36	13.95	14.25	21.08	12.64	14.77	16.15	19.74	10.30	12.90	16.16
AJ_1	81.45	38.65	63.95	24.81	16.84	14.31	15.40	16.16	23.72	16.80	17.36	14.64	15.63	27.67
AJ_2	34.76	21.08	17.18	17.57	12.88	15.16	15.07	18.75	27.00	25.42	20.99	22.51	21.46	20.76
AK_1	183.79	23.63	23.39	20.28	18.04	12.37	11.47	14.09	12.23	14.47	20.39	17.36	8.61	29.24
AK_2	147.34	358.29	66.46	24.03	22.00	21.75	20.01	31.93	26.00	25.39	19.24	27.28	70.42	66.16
AL_1	47.96	30.74	26.75	24.42	23.46	15.30	13.69	10.76	23.41	11.71	22.41	13.82	17.67	21.70
AL_2	59.28	37.20	15.25	15.29	14.21	16.66	16.39	14.20	19.95	19.81	11.70	31.40	25.25	22.81
AM_1	70.40	18.18	23.70	12.56	9.23	25.49	20.42	18.98	26.58	19.81	24.09	17.98	41.35	25.29
AM_2	88.90	24.05	19.69	16.67	16.00	11.79	16.03	9.31	8.63	20.59	18.36	13.06	24.01	22.08
AO	72.40	27.91	36.96	736.23	25.78	20.04	22.71	37.08	56.05	50.93	49.47	48.57	81.61	97.36
AP	62.07	16.43	21.64	18.68	22.58	18.94	19.57	16.64	22.76	29.02	23.43	18.76	22.89	24.11
B_2	399.38	854.13	76.45	227.83	51.91	52.93	64.75	30.14	47.48	37.30	73.18	65.02	35.41	155.07
C_1	103.58	32.58	30.02	20.59	12.21	10.73	15.65	12.84	30.25	24.92	18.69	16.18	23.90	27.09
C_2	127.74	29.34	27.67	24.49	19.88	14.31	16.64	19.54	44.74	12.72	14.42	15.57	21.68	29.90
D_1	89.35	43.60	20.34	15.51	17.63	16.68	23.81	13.11	22.91	19.53	15.34	22.16	11.93	25.53
D_2	86.47	27.68	21.85	36.72	16.51	19.26	24.73	20.97	16.54	21.39	16.74	16.03	15.14	26.15
E_1	103.96	28.04	16.72	29.34	28.32	23.58	13.67	21.03	22.98	25.07	22.02	21.87	12.77	28.41
E_2	121.69	9.38	31.97	20.78	17.01	23.12	28.63	24.26	29.04	26.50	33.57	26.46	11.54	31.07

F_2	37.55	29.46	11.92	18.61	10.55	15.95	14.41	9.82	11.78	11.39	11.98	16.57	14.77	16.52
G_1	97.97	35.09	17.23	22.73	17.64	17.84	15.11	20.07	11.83	12.34	27.86	18.08	15.33	25.32
G_2	206.85	68.31	20.71	17.79	18.31	9.50	14.28	6.99	18.65	26.04	16.66	25.09	16.47	35.82
H_1	95.03	1,917.80	23.61	16.57	16.13	25.71	17.90	27.63	32.57	22.95	26.66	22.91	27.74	174.86
H_2	264.79	47.75	38.20	20.17	33.02	26.73	34.92	43.11	24.44	24.50	37.48	31.61	40.19	51.30
I	83.67	10.92	25.95	19.71	13.21	16.04	17.75	31.81	74.89	41.69	36.16	36.67	16.05	32.66
I_1	35.39	29.12	26.03	12.88	12.92	28.56	15.88	41.50	25.58	18.37	15.85	16.78	26.30	23.47
I_2	171.22	44.69	34.07	16.89	15.41	22.85	25.50	17.17	29.27	21.45	24.27	39.97	80.03	41.75
J	215.82	66.50	29.79	28.75	33.40	21.82	33.18	24.29	26.05	20.62	20.01	28.37	27.06	44.28
K_1	91.97	43.29	18.39	22.80	26.65	22.79	33.87	26.54	22.41	22.07	12.03	36.67	21.91	30.88
K_2	173.73	39.33	32.35	26.15	32.67	18.60	29.76	17.02	28.09	39.41	28.29	31.16	27.45	40.31
M_1	55.25	27.35	35.90	53.94	22.77	31.21	24.45	18.99	17.71	32.64	26.26	21.86	53.56	32.45
M_2	267.24	34.21	44.46	31.73	44.92	32.88	34.20	26.11	42.17	33.38	45.38	22.44	107.67	58.98
N_1	77.52	1,740.95	30.09	21.60	18.23	31.57	26.38	22.23	39.33	22.97	22.26	21.98	20.37	161.19
N_2	75.95	17.14	24.83	27.77	29.91	46.89	23.11	22.29	67.95	56.90	33.21	38.99	24.85	37.68
O_1	209.02	71.29	24.34	43.87	27.56	38.63	42.79	30.99	79.04	48.38	26.09	52.45	38.48	56.38
O_2	144.53	19.85	24.32	36.16	16.54	36.34	39.90	37.98	51.59	65.17	31.70	45.10	16.48	43.51
P_1	354.19	105.58	53.47	38.60	36.83	28.43	31.18	25.97	35.73	35.80	51.00	25.23	46.61	66.82
P_2	111.25	43.55	22.32	13.85	21.54	31.90	40.39	50.54	33.47	55.29	33.80	55.73	36.27	42.30
Q_1	84.23	18.63	10.46	16.45	16.87	15.41	12.15	15.43	12.36	20.70	16.77	12.17	24.19	21.22
Q_2	59.84	17.05	20.92	11.64	9.13	17.87	13.78	14.66	16.65	12.86	17.43	20.37	38.26	20.80
R_1	66.73	11.26	22.06	25.72	36.89	18.15	16.01	16.72	21.44	25.21	15.47	11.85	29.50	24.39
R_2	195.12	17.57	15.07	19.06	17.42	19.01	22.21	34.58	24.77	13.65	19.24	30.33	41.01	36.08
S_1	178.03	27.68	17.92	91.69	23.33	18.23	24.27	25.69	27.40	25.58	16.55	20.45	24.99	40.14
S_2	122.31	24.70	23.12	17.68	22.30	33.65	23.77	29.65	24.36	18.84	21.02	26.21	25.81	31.80
T_1	77.73	56.02	35.47	22.47	27.95	14.59	34.95	21.96	42.97	25.92	29.82	38.16	27.02	35.00
T_2	22.83	29.19	12.22	18.69	21.16	39.24	20.83	19.25	83.40	27.98	22.57	21.61	15.52	27.27
U_1	198.00	55.47	37.79	17.49	15.59	8.93	17.26	23.63	28.32	17.28	26.95	39.20	45.88	40.91
U_2	61.22	23.75	15.47	23.69	20.23	13.06	19.91	15.79	13.25	30.11	23.23	21.22	20.92	23.22
V_1	38.01	65.10	30.93	35.09	41.26	21.87	28.28	19.08	31.78	18.67	36.10	34.77	10.10	31.62
V_2	292.98	35.78	31.07	17.36	18.73	21.56	19.12	11.37	16.21	27.77	36.82	31.64	18.59	44.54
W_1	196.63	20.37	25.07	18.90	14.18	19.19	21.39	21.91	21.28	15.56	19.31	32.18	68.00	38.00
W_2	106.69	29.37	25.89	15.26	15.05	13.22	12.61	12.61	27.71	17.96	13.96	14.51	46.26	27.01
X	391.85	132.86	100.75	41.44	34.52	49.59	27.25	47.07	42.08	51.87	66.45	83.36	69.46	87.58
Y	140.42	31.89	74.48	24.89	20.67	23.54	26.47	19.82	99.78	39.68	57.31	30.21	62.40	50.12
Z_1	437.92	34.41	16.93	27.26	24.11	22.66	51.04	27.91	51.13	28.03	38.54	48.34	53.35	66.28
Z_2	198.22	24.36	21.38	20.00	12.03	25.88	29.86	34.54	32.32	31.55	38.24	28.16	54.62	42.40
Total Avg.	**134.33**	**114.88**	**29.50**	**37.50**	**21.74**	**22.03**	**23.61**	**22.96**	**30.27**	**27.76**	**27.97**	**27.33**	**34.29**	

Table 15 MLP: Average percentage of error by time of day in Saturday

A.2 GCN Spectral with LSTM Layer

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd.
A_1	17.87	32.46	60.07	60.44	43.98	24.26	58.67	25.63	24.85	22.02	19.97	11.48	33.47
A_2	19.18	39.05	56.66	44.53	47.92	63.63	65.36	62.18	64.43	46.15	31.90	31.26	47.69
AA_1	14.38	18.43	12.78	17.92	13.94	16.51	33.65	25.47	26.93	31.66	35.88	15.43	21.91
AA_2	13.83	16.44	17.92	8.75	27.08	30.23	16.66	32.01	21.84	21.92	24.11	14.42	20.43
AB_1	12.61	11.64	14.07	15.02	10.39	16.74	15.63	18.35	31.93	68.50	29.82	15.99	21.72
AB_2	19.98	8.94	11.88	34.13	24.82	23.95	30.21	15.52	27.03	17.65	24.02	23.62	21.81
AC_1	49.46	52.98	27.08	19.35	17.94	23.41	18.82	32.95	39.42	45.99	26.06	33.57	32.25
AC_2	35.29	31.71	26.23	30.89	16.98	16.38	14.18	19.37	13.61	21.47	20.13	15.83	21.84
AD	48.74	64.72	31.56	39.29	17.05	38.36	18.65	36.51	28.39	13.27	19.79	37.31	32.80
AE	30.18	38.18	29.53	28.43	40.70	49.28	27.31	23.36	19.89	20.09	19.03	20.74	28.89
AED	39.17	13.44	27.57	27.18	24.56	31.78	11.72	16.44	16.36	31.13	22.22	12.53	22.84
AF	25.12	28.68	20.71	60.61	31.54	27.24	27.22	79.81	42.31	32.64	33.79	68.03	39.81
AG	44.85	29.67	15.64	14.87	20.59	29.62	20.96	12.81	16.48	12.43	30.50	13.55	21.83
AH	28.80	17.50	28.26	50.14	65.42	55.95	50.95	97.17	100.3	79.74	89.16	76.81	61.68
AI	6.93	33.62	15.06	20.95	7.07	16.53	16.09	28.21	16.14	10.31	8.93	11.96	15.98
AJ_1	17.62	11.46	13.38	27.88	26.80	118.1	14.72	17.11	24.83	23.45	18.25	14.07	27.31
AJ_2	28.23	20.71	18.30	20.76	43.63	70.04	16.69	16.56	22.12	22.04	17.45	16.15	26.06
AK_1	73.70	21.41	26.36	23.28	17.88	21.48	12.96	11.98	14.64	13.63	13.01	9.35	21.64
AK_2	70.09	17.76	23.34	29.10	30.25	67.04	24.49	21.09	25.50	17.78	26.39	18.68	30.96
AL_1	36.43	28.61	18.57	9.10	12.59	17.68	15.55	18.65	23.04	12.94	17.21	18.63	19.08
AL_2	45.96	18.52	14.04	21.15	15.43	16.38	17.92	19.22	21.62	19.21	14.04	12.04	19.63
AM_1	13.14	10.76	9.32	10.10	19.36	14.24	16.08	40.25	16.38	28.86	15.10	17.03	17.55
AM_2	11.93	8.79	14.98	12.13	17.30	11.60	17.68	13.48	14.85	6.56	14.20	8.54	12.67
AO	60.94	63.08	27.98	22.57	23.00	27.60	24.28	28.43	22.72	24.11	42.58	20.40	32.31
AP	24.13	13.43	15.88	9.50	16.78	17.22	12.69	25.45	22.16	16.52	12.43	12.54	16.56
B_2	70.60	129.3	122.7	83.00	44.10	75.24	106.4	77.43	80.46	133.4	29.22	66.52	84.86
C_1	12.92	12.58	19.96	12.70	21.51	28.18	17.47	17.14	14.09	9.24	10.34	11.88	15.67
C_2	28.88	27.01	12.38	20.32	19.28	22.46	19.79	16.93	12.59	14.63	11.80	18.91	18.75
D_1	22.02	15.57	13.63	8.07	14.40	10.30	16.42	15.97	14.04	10.64	11.69	11.97	13.73
D_2	15.59	14.41	15.07	12.36	14.67	18.56	16.67	18.14	16.14	20.94	18.74	21.38	16.89
E_1	44.17	34.08	26.76	15.32	14.57	21.21	19.74	13.71	24.37	55.12	20.19	24.08	26.11
E_2	18.19	10.62	12.72	13.61	16.95	21.11	17.76	13.62	22.50	19.72	18.28	6.57	15.97
F_2	21.45	14.03	14.11	12.58	18.04	14.23	18.62	17.80	14.61	13.54	13.91	11.87	15.40
G_1	21.43	11.76	14.94	11.93	8.83	9.61	13.43	16.75	17.20	16.29	15.83	14.41	14.37
G_2	13.55	17.76	11.35	15.30	6.18	15.57	14.25	19.36	13.75	14.34	19.83	18.49	14.98
H_1	27.74	22.38	33.43	28.71	15.62	22.06	20.17	12.52	18.76	13.03	14.84	21.13	20.87
H_2	26.87	16.20	38.16	25.50	45.22	40.36	22.89	31.21	32.56	41.55	16.74	23.19	30.04
I	53.72	21.43	14.89	16.60	27.37	18.42	57.10	54.17	25.51	16.73	15.22	20.07	28.44
I_1	25.50	11.17	15.13	11.59	11.06	59.66	49.57	67.23	88.25	66.22	53.79	34.18	41.11
I_2	15.44	40.96	12.05	14.99	41.84	69.76	31.55	87.13	42.99	80.83	13.97	16.86	39.03

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd.
J	23.54	28.37	40.89	32.31	52.71	39.10	31.60	33.08	56.96	38.66	32.44	45.64	37.94
K_1	19.88	49.42	21.19	50.59	117.4	112.5	71.57	141.6	112.2	41.15	22.71	15.97	64.67
K_2	58.43	39.01	38.34	26.87	38.73	59.60	57.17	55.86	58.44	45.44	43.65	32.14	46.14
M_1	205.5	89.40	73.30	21.70	37.84	47.55	44.50	20.05	41.45	26.81	58.97	16.08	56.93
M_2	28.61	35.00	45.14	48.79	88.39	98.67	186.0	242.9	262.7	150.0	134.8	75.02	116.3
N_1	43.50	42.42	50.71	18.08	44.34	33.79	56.56	53.71	23.08	13.66	11.90	18.59	34.20
N_2	43.00	16.82	50.06	117.9	61.45	125.38	175.65	311.5	131.8	50.22	33.24	15.26	94.35
O_1	130.1	110.9	73.87	60.39	80.24	60.65	58.41	36.01	20.44	34.33	46.84	45.84	63.17
O_2	183.1	110.6	164.7	71.22	75.13	56.80	84.71	83.84	134.5	17.46	14.31	31.40	85.64
P_1	94.83	41.82	33.75	20.37	50.97	65.22	77.69	88.31	125.4	75.27	70.23	85.11	69.08
P_2	34.42	15.83	21.74	27.16	28.07	50.63	26.88	47.51	47.56	54.29	38.47	16.65	34.10
Q_1	9.23	12.26	9.41	15.10	24.42	32.55	18.55	15.43	19.51	14.87	22.30	13.45	17.26
Q_2	16.01	13.86	9.81	10.13	13.62	14.89	11.69	12.53	17.67	25.58	15.88	13.19	14.57
R_1	15.24	16.22	18.26	17.27	19.11	23.41	19.00	16.52	15.86	21.26	24.52	19.99	18.89
R_2	13.06	12.53	10.39	18.01	16.31	20.54	15.82	25.13	12.94	22.42	14.49	13.89	16.29
S_1	15.27	14.12	16.01	13.62	21.80	32.73	27.31	30.96	30.14	39.84	17.64	16.20	22.97
S_2	11.70	14.89	24.77	15.55	30.30	27.58	18.61	18.30	15.02	10.57	23.20	38.09	20.71
T_1	80.89	33.91	14.67	22.79	23.23	36.13	24.29	28.25	18.16	18.43	25.12	21.25	28.93
T_2	72.75	25.23	11.90	21.94	27.19	24.48	16.12	40.33	30.47	18.66	20.60	23.94	27.80
U_1	19.87	21.72	15.22	13.57	23.73	17.39	17.93	14.70	36.96	17.97	15.83	13.82	19.06
U_2	23.21	21.98	19.83	9.91	64.99	84.63	17.47	19.13	16.91	18.57	13.69	12.81	26.93
V_1	89.42	55.95	17.79	21.68	12.38	16.63	28.49	28.36	17.14	27.93	15.28	31.11	30.18
V_2	23.56	21.00	21.33	9.43	19.06	21.42	20.77	24.42	18.38	29.50	11.27	12.69	19.40
W_1	9.06	11.97	18.74	37.07	48.70	27.14	21.91	21.73	19.51	14.70	24.81	22.15	23.12
W_2	14.54	11.64	13.47	13.80	16.10	21.34	16.42	25.51	19.27	21.43	15.49	17.15	17.18
X	45.21	20.19	92.98	173.5	140.7	132.1	62.39	137.7	239.4	148.5	83.43	89.37	113.79
Y	15.22	18.69	20.74	36.09	35.99	35.17	50.78	97.28	95.02	49.10	28.57	16.41	41.59
Z_1	24.26	26.78	16.02	33.97	40.65	27.77	74.07	64.88	60.43	68.82	69.10	60.20	47.25
Z_2	221.6	18.40	19.74	18.45	30.92	37.68	94.35	26.19	20.97	22.25	21.14	27.07	46.57
Total Avg.	40.46	29.02	28.10	28.37	32.42	38.77	35.76	43.17	41.36	33.68	27.25	25.10	

Table 16 GCN Spectral with LSTM layer: Average percentage of error by time of day in Sunday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	31.95	30.23	54.88	37.31	54.27	63.30	59.26	64.21	72.50	26.49	23.10	23.68	45.10
A_2	36.13	16.22	36.56	20.10	35.17	48.64	27.23	28.45	18.51	27.70	32.78	39.75	30.60
AA_1	16.20	31.59	19.09	18.17	9.32	11.62	20.72	22.16	16.85	19.84	7.53	21.54	17.89
AA_2	17.77	97.50	16.89	18.31	8.45	24.80	18.31	19.81	31.77	25.94	28.79	30.16	28.21
AB_1	25.00	14.26	22.19	17.81	22.52	12.62	18.91	24.12	32.82	28.90	23.42	53.93	24.71
AB_2	29.47	119.54	38.12	18.53	15.80	13.31	22.02	28.99	25.53	21.50	13.51	26.71	31.09

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AC_1	14.93	31.77	30.30	46.98	16.42	31.34	14.21	26.85	29.11	24.65	22.86	23.88	26.11
AC_2	10.94	44.42	41.85	28.04	17.86	16.51	16.08	18.75	35.02	23.49	19.63	20.07	24.39
AD	24.35	21.71	84.92	14.05	23.39	59.46	21.93	94.08	58.14	38.70	53.43	52.16	45.53
AE	21.54	22.62	24.08	49.96	47.82	22.70	35.17	60.97	44.28	19.45	61.26	32.66	36.88
AED	78.48	13.81	17.13	22.67	14.60	17.93	18.08	20.50	22.14	38.95	32.00	18.50	26.23
AF	60.30	19.67	45.38	33.10	24.00	30.02	22.98	28.36	19.52	75.86	31.25	16.99	33.95
AG	17.72	10.09	27.67	18.79	23.14	12.82	19.04	10.71	19.83	10.76	16.16	13.71	16.70
AH	19.45	26.00	23.02	23.46	27.93	11.81	26.66	27.95	31.04	33.89	21.35	48.29	26.74
AI	16.34	13.53	10.92	10.83	9.90	16.66	9.01	18.44	19.27	12.22	15.98	11.35	13.70
AJ_1	32.76	22.16	12.50	9.77	13.80	15.62	17.47	16.44	24.32	24.48	22.61	22.23	19.51
AJ_2	41.13	4.59	11.45	12.23	9.83	16.28	12.06	12.77	18.39	16.01	10.48	16.33	15.13
AK_1	19.80	10.81	17.08	15.31	23.23	38.75	25.63	56.39	54.58	36.20	44.08	55.76	33.14
AK_2	43.93	24.76	26.17	22.41	24.63	40.43	58.08	24.15	30.33	22.30	38.91	57.87	34.50
AL_1	15.45	8.57	15.18	9.25	9.72	18.39	19.35	22.43	25.13	51.65	79.14	64.08	28.19
AL_2	20.27	19.48	21.08	14.43	12.22	17.54	19.11	25.25	72.95	11.56	110.75	41.57	32.18
AM_1	17.39	10.67	18.29	14.59	10.42	21.55	15.73	25.64	28.03	53.39	54.87	26.97	24.79
AM_2	19.98	19.26	7.02	7.50	15.62	26.21	11.92	12.07	10.72	26.71	56.94	18.04	19.33
AO	31.54	15.05	24.04	15.75	21.91	21.28	35.61	25.83	60.37	123.9	63.38	62.02	41.72
AP	25.08	13.30	18.63	32.24	21.07	22.13	14.52	24.23	18.74	56.53	26.02	37.99	25.87
B_2	44.90	25.87	94.05	92.76	72.45	33.55	87.93	131.7	94.24	103.3	100.4	107.0	82.34
C_1	19.84	24.28	33.33	12.58	18.12	15.31	16.22	16.10	13.17	29.15	13.30	12.81	18.68
C_2	18.39	25.74	31.45	11.40	18.64	10.05	17.46	12.42	11.96	21.70	13.05	19.44	17.64
D_1	31.29	20.44	21.63	15.44	12.22	7.42	9.96	7.54	11.52	18.60	21.22	16.88	16.18
D_2	34.57	14.75	30.49	21.98	9.92	11.54	18.00	25.40	16.04	28.00	17.72	31.51	21.66
E_1	56.08	51.73	27.94	21.42	17.72	22.57	16.95	18.95	16.34	31.21	30.08	7.67	26.55
E_2	45.35	34.77	59.12	41.67	16.40	17.82	38.28	22.92	18.89	88.07	28.92	22.47	36.22
F_2	15.98	30.78	22.23	15.41	10.64	10.73	9.17	22.82	15.50	10.88	14.67	13.22	16.00
G_1	21.28	15.97	52.02	22.92	12.09	11.38	20.70	18.94	26.53	28.91	15.98	23.53	22.52
G_2	13.37	10.47	19.94	17.81	27.60	12.84	10.32	16.82	16.01	35.88	19.23	17.32	18.13
H_1	17.48	18.18	19.54	25.95	17.76	24.76	11.05	17.44	18.34	19.84	17.03	12.80	18.35
H_2	41.77	18.77	19.87	30.30	12.64	29.28	47.98	15.97	39.33	54.59	56.67	36.47	33.64
I	43.74	141.7	27.45	29.42	19.60	22.98	25.90	22.83	19.27	14.20	21.44	19.45	34.00
I_1	13.67	24.07	16.73	15.34	20.85	14.00	16.27	22.71	41.30	41.68	22.06	16.16	22.07
I_2	17.88	16.08	17.18	16.68	18.72	11.83	12.87	11.55	15.98	17.33	15.71	8.61	15.03
J	33.02	32.61	17.36	18.81	63.37	48.56	49.24	88.75	61.17	109.0	64.42	41.19	52.29
K_1	23.02	11.05	18.83	22.32	15.56	10.11	15.35	17.04	23.54	15.67	21.57	21.12	17.93
K_2	79.79	20.24	18.33	22.22	23.16	42.09	26.95	32.84	26.80	21.07	20.34	23.12	29.75
M_1	58.74	32.20	23.88	12.41	8.64	24.43	12.21	32.35	48.63	28.08	30.60	15.64	27.32
M_2	44.89	37.00	29.16	22.65	26.17	50.30	22.75	25.66	62.75	60.25	31.38	33.45	37.20
N_1	29.43	15.28	23.14	19.58	25.28	41.20	20.27	19.57	34.87	20.83	41.14	66.65	29.77
N_2	29.28	34.74	24.92	64.22	72.58	87.07	81.55	90.33	65.12	20.37	20.30	20.16	50.89
O_1	31.98	23.54	18.64	23.82	22.06	29.91	62.90	29.15	39.08	23.01	45.45	49.58	33.26
O_2	17.96	22.71	14.23	12.73	27.80	31.01	13.03	20.80	53.88	17.07	15.18	27.53	22.83

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
P_1	30.92	21.76	10.35	26.06	27.24	19.78	54.48	36.72	36.18	44.75	23.03	33.86	30.43
P_2	26.49	9.45	16.57	8.74	30.84	35.10	47.22	31.99	25.47	25.06	16.40	21.54	24.57
Q_1	15.07	14.18	14.51	12.16	10.85	17.16	11.43	18.30	12.08	16.14	26.90	9.73	14.88
Q_2	12.16	22.70	12.64	14.45	9.95	7.01	9.63	14.71	10.84	16.25	20.63	9.25	13.35
R_1	26.97	28.62	22.45	58.64	27.40	22.49	17.75	37.76	37.25	7.90	20.95	19.74	27.33
R_2	15.82	28.64	16.79	14.30	17.87	12.14	13.49	16.12	13.04	7.77	29.34	36.13	18.45
S_1	88.86	23.44	17.42	33.26	11.58	25.70	21.86	30.07	29.71	43.37	111.49	66.78	41.96
S_2	13.12	24.27	17.33	18.86	13.36	15.04	36.34	32.57	24.49	25.16	16.84	28.69	22.17
T_1	19.48	20.87	26.61	18.02	29.02	23.56	10.91	108.2	178.2	23.21	54.70	77.73	49.21
T_2	29.83	12.48	19.15	18.13	14.48	18.86	25.35	71.20	91.51	20.10	17.34	23.46	30.16
U_1	47.88	18.94	16.03	21.28	20.08	22.76	26.04	27.75	49.21	71.52	165.1	62.33	45.74
U_2	24.81	10.91	10.87	14.78	13.66	23.12	12.54	90.54	89.28	34.43	37.68	40.32	33.58
V_1	36.02	11.24	30.46	19.85	31.72	19.22	33.05	56.46	30.16	23.07	23.49	60.24	31.25
V_2	25.12	29.68	14.33	13.11	15.64	21.44	17.48	28.85	48.95	26.24	91.32	82.71	34.57
W_1	25.04	31.21	25.81	32.51	18.94	41.98	21.95	21.34	13.19	75.49	65.49	22.47	32.95
W_2	25.10	18.54	17.28	11.11	22.20	12.89	17.39	22.39	24.50	95.53	143.0	111.2	43.43
X	61.98	56.23	16.30	21.12	41.40	46.95	43.96	51.05	68.34	50.40	38.39	101.4	49.79
Y	16.97	11.85	18.39	10.13	24.53	17.08	37.04	20.24	44.01	26.93	18.22	24.40	22.48
Z_1	26.54	17.79	37.57	30.52	62.54	34.98	28.24	35.05	19.91	26.38	34.50	42.03	33.01
Z_2	19.29	51.65	11.71	16.31	14.81	18.65	19.55	17.91	27.49	38.98	30.34	15.23	23.49
Total Avg.	29.84	26.51	24.90	22.53	22.63	24.76	25.33	32.60	36.00	34.90	37.58	34.63	

Table 17 GCN Spectral with LSTM layer: Average percentage of error by time of day in Monday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	34.32	16.77	25.53	38.55	46.65	58.94	51.50	70.25	62.93	4.56	20.72	18.03	37.39
A_2	26.75	22.69	23.02	28.13	19.54	34.60	41.90	44.28	40.16	36.53	19.16	12.82	29.13
AA_1	18.51	27.85	20.11	13.98	17.77	25.79	69.64	44.20	48.86	29.65	46.11	74.21	36.39
AA_2	19.57	39.79	17.34	23.43	56.27	23.68	64.14	20.16	40.96	17.28	40.75	38.90	33.52
AB_1	24.06	27.67	24.68	19.55	17.47	24.17	29.75	30.29	31.64	38.55	44.65	33.40	28.82
AB_2	29.96	24.54	22.82	20.54	68.72	42.19	15.80	31.71	14.83	30.43	19.63	49.54	30.89
AC_1	25.17	17.07	23.09	25.96	17.99	20.84	16.13	31.43	31.35	22.75	24.65	20.60	23.09
AC_2	19.20	17.80	32.97	24.03	21.15	24.37	15.60	27.92	31.58	21.43	23.40	20.11	23.30
AD	56.25	39.32	53.21	25.93	26.40	23.79	52.90	92.30	19.82	18.79	106.48	51.64	47.24
AE	37.12	28.14	40.21	53.03	49.43	28.26	26.49	43.09	75.95	70.95	89.17	46.79	49.05
AED	44.99	25.76	32.84	25.26	24.83	33.23	29.81	20.38	45.52	10.52	20.39	23.42	28.08
AF	22.58	20.24	60.52	44.36	23.21	38.24	71.88	11.93	23.26	38.39	41.11	26.12	35.15
AG	15.03	19.55	14.19	21.48	21.47	14.49	22.39	19.07	19.13	22.68	15.99	16.08	18.46
AH	23.35	23.95	30.09	18.19	17.93	16.51	11.36	12.76	12.28	33.48	17.68	20.65	19.85
AI	16.34	25.31	35.31	18.12	14.53	22.80	21.65	9.14	13.76	15.14	21.38	12.37	18.82
AJ_1	38.81	41.47	41.26	23.66	39.44	24.95	17.50	23.42	27.91	22.62	11.92	29.60	28.55

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AJ_2	19.47	35.14	33.49	10.82	9.98	16.45	17.83	14.34	10.16	7.68	14.70	16.18	17.19
AK_1	16.61	17.78	19.80	40.13	46.16	20.81	40.53	92.51	45.26	81.24	99.25	49.49	47.46
AK_2	42.92	53.99	36.49	45.39	48.33	50.03	42.01	38.42	18.82	32.79	29.82	24.54	38.63
AL_1	16.16	9.14	22.77	23.15	18.92	14.77	11.29	16.33	42.23	87.69	88.69	57.03	34.01
AL_2	20.37	25.57	17.05	12.13	18.42	11.10	20.22	18.86	46.50	86.74	145.24	46.89	39.09
AM_1	18.90	18.59	17.81	17.30	13.46	10.12	14.51	26.45	44.75	58.13	48.07	31.19	26.61
AM_2	22.60	25.49	14.93	32.92	23.74	13.28	15.71	15.18	35.88	75.37	29.74	41.91	28.90
AO	27.04	24.64	13.76	32.57	25.74	24.44	19.70	30.32	39.96	38.04	112.66	78.20	38.92
AP	10.26	12.09	21.12	28.16	31.84	17.36	11.39	22.59	33.62	55.72	40.75	29.27	26.18
B_2	37.60	65.18	35.61	26.26	36.08	45.93	76.29	57.15	86.59	35.01	38.59	39.13	48.28
C_1	15.02	27.73	30.81	11.04	31.45	19.94	22.51	19.54	28.86	15.18	26.66	21.89	22.55
C_2	20.68	9.68	18.61	26.99	26.51	15.53	27.97	17.68	10.41	6.94	48.43	18.58	20.67
D_1	33.07	29.74	25.19	20.95	21.12	13.32	14.46	13.19	11.10	44.48	21.21	17.08	22.08
D_2	36.98	33.88	47.12	37.74	34.92	17.11	10.60	16.07	26.32	10.53	32.16	11.69	26.26
E_1	97.46	63.73	89.55	25.83	20.54	19.61	29.01	20.39	29.13	23.71	50.38	25.29	41.22
E_2	93.23	84.22	117.16	118.93	12.40	16.86	23.80	25.22	28.31	67.00	59.56	22.71	55.78
F_2	13.27	8.68	13.44	21.90	17.98	13.57	16.01	13.18	21.55	18.21	11.09	14.98	15.32
G_1	32.07	23.68	44.74	32.94	21.04	13.29	10.92	17.64	21.43	10.47	19.38	21.28	22.41
G_2	16.72	16.00	17.10	25.86	23.47	11.41	16.43	21.38	22.57	10.69	26.88	19.53	19.00
H_1	12.19	15.82	19.12	14.77	27.01	26.21	10.86	11.99	17.87	18.92	21.00	30.02	18.81
H_2	30.73	21.96	25.26	19.10	41.45	38.41	42.08	33.05	49.53	134.38	53.93	70.91	46.73
I	65.78	23.36	18.43	15.02	11.52	18.55	18.35	38.79	19.72	22.71	20.88	27.06	25.01
I_1	14.39	15.81	19.20	13.14	20.36	36.13	26.23	22.63	29.63	22.63	21.35	35.90	23.12
I_2	14.88	20.95	20.48	23.84	16.11	14.69	14.74	14.36	12.71	149.24	63.32	18.73	32.00
J	34.84	37.26	14.59	17.51	27.92	52.91	74.85	30.15	24.97	84.01	50.17	35.75	40.41
K_1	21.77	30.13	22.41	20.90	17.32	26.05	19.21	23.39	23.14	26.77	27.24	65.05	26.95
K_2	31.85	27.98	27.99	31.81	33.92	45.29	50.83	32.30	33.10	26.64	20.76	26.16	32.38
M_1	25.16	21.64	41.42	15.67	10.36	20.52	11.67	21.22	36.83	23.50	20.79	51.38	25.01
M_2	34.45	18.82	23.74	25.46	19.34	22.85	16.83	29.25	22.68	36.09	38.66	58.71	28.91
N_1	12.92	25.56	7.73	15.29	19.09	23.74	10.19	21.92	60.10	59.64	88.38	68.59	34.43
N_2	39.98	33.12	21.22	21.88	16.85	31.34	87.95	133.7	48.90	56.63	52.21	51.32	49.59
O_1	16.88	21.65	27.40	17.58	30.75	77.41	30.73	24.56	12.27	23.47	172.7	72.19	43.96
O_2	18.57	11.29	19.41	17.01	19.81	29.13	17.96	22.03	31.23	36.48	49.79	17.22	24.16
P_1	21.93	20.65	46.62	15.03	26.32	45.31	33.86	59.22	37.10	52.82	74.55	46.16	39.96
P_2	20.12	16.05	25.69	27.32	16.58	18.50	48.03	64.02	65.28	30.52	39.27	19.96	32.61
Q_1	24.36	48.05	11.56	27.14	26.21	20.84	6.28	18.88	41.89	14.87	26.86	26.85	24.48
Q_2	12.27	8.72	13.64	9.38	9.19	8.10	12.33	9.10	14.52	45.46	23.88	22.24	15.74
R_1	39.58	45.23	47.86	42.20	61.97	18.20	37.86	54.20	57.01	10.78	18.49	37.82	39.27
R_2	24.35	43.40	20.53	16.64	17.44	27.07	25.56	15.18	19.12	59.48	37.22	57.52	30.29
S_1	122.7	27.95	32.26	48.11	44.57	16.39	45.92	44.87	32.40	122.2	147.9	68.82	62.85
S_2	26.47	30.11	11.92	19.09	13.46	38.72	14.67	47.79	14.67	35.44	21.28	20.98	24.55
T_1	39.98	9.08	25.85	18.98	22.16	17.34	21.83	126.9	117.4	111.4	50.55	60.26	51.81

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
T_2	16.60	17.98	14.97	21.91	12.91	13.78	19.53	58.88	30.59	17.22	19.11	28.86	22.69
U_1	63.95	30.92	26.14	21.91	17.55	40.11	48.86	25.23	34.87	137.7	129.0	93.92	55.85
U_2	28.31	25.79	20.83	28.99	18.68	11.79	13.05	102.0	81.59	37.34	54.71	24.02	37.26
V_1	123.8	31.44	19.83	25.62	14.92	24.05	48.59	50.38	105.6	79.11	84.41	68.84	56.38
V_2	85.01	96.55	27.77	16.84	21.72	21.84	16.91	19.87	57.02	283.7	179.9	87.28	76.20
W_1	43.26	54.47	54.01	50.97	37.05	42.44	54.04	35.15	38.19	14.51	45.73	59.61	44.12
W_2	18.70	29.77	20.76	10.42	16.13	14.36	15.13	20.20	39.46	153.3	199.8	107.0	53.75
X	30.10	27.48	20.73	28.82	31.37	31.27	30.86	34.29	24.17	112.3	136.7	93.04	50.09
Y	16.28	21.82	20.59	22.71	15.72	48.52	30.40	25.28	11.85	26.17	69.92	52.02	30.11
Z_1	22.08	24.49	33.85	39.51	33.95	30.80	21.94	38.04	30.33	22.19	48.12	52.70	33.17
Z_2	13.40	24.18	29.56	18.20	21.09	25.16	20.16	34.52	26.48	52.51	97.95	52.22	34.62
Total Avg.	32.03	28.44	28.51	26	25.44	26.08	28.96	34.38	35.44	48.40	53.81	40.44	

Table 18 GCN Spectral with LSTM layer: Average percentage of error by time of day in Tuesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	43.19	19.89	18.13	39.21	49.49	53.98	64.20	67.17	58.48	38.83	29.63	12.34	41.21
A_2	32.72	26.90	22.78	15.42	17.98	36.01	23.80	33.38	25.61	30.25	17.77	22.04	25.39
AA_1	13.68	21.82	18.60	15.03	21.48	19.57	62.77	58.34	52.51	67.29	54.00	53.76	38.24
AA_2	16.08	14.34	17.10	18.58	43.09	57.99	66.07	36.24	21.32	38.86	55.31	32.50	34.79
AB_1	26.77	22.57	18.96	23.66	10.61	16.96	28.28	30.46	41.89	35.84	62.32	31.90	29.18
AB_2	20.78	21.22	16.81	11.98	43.63	22.34	69.71	61.05	38.44	35.73	22.74	13.83	31.52
AC_1	23.85	25.90	24.13	49.12	11.10	10.92	11.83	19.52	28.11	18.96	13.45	12.12	20.75
AC_2	19.85	17.32	30.02	34.35	20.17	10.67	17.88	47.66	17.71	26.53	27.64	26.57	24.70
AD	40.67	37.83	15.83	33.79	49.74	24.27	35.52	22.33	43.14	82.36	75.10	17.64	39.85
AE	27.81	21.07	38.68	30.48	38.95	14.89	25.43	60.25	60.44	135.88	135.40	22.81	51.01
AED	28.88	26.88	17.67	20.01	17.66	37.83	49.32	29.35	21.43	21.66	35.35	32.72	28.23
AF	24.15	255.00	94.21	77.02	52.42	11.74	18.25	19.31	25.58	39.35	12.88	12.36	53.52
AG	19.84	14.85	24.41	11.69	13.09	11.80	20.53	20.77	14.70	16.85	28.95	19.00	18.04
AH	35.29	19.84	24.97	19.39	15.63	17.37	22.07	37.51	30.82	18.18	11.71	36.28	24.09
AI	42.39	20.47	11.81	17.53	9.77	11.23	9.00	18.25	15.87	10.43	12.28	16.83	16.32
AJ_1	47.97	24.72	22.23	23.44	30.93	35.37	24.04	19.67	20.95	50.42	34.67	23.55	29.83
AJ_2	13.61	18.43	17.94	28.40	18.58	15.06	12.54	12.16	15.76	12.07	19.03	14.89	16.54
AK_1	20.26	20.69	19.57	26.98	41.98	32.38	63.89	47.67	39.21	46.57	37.87	50.84	37.32
AK_2	29.34	31.25	26.77	70.73	72.11	50.99	90.80	57.56	26.42	33.81	113.09	16.86	51.65
AL_1	18.00	14.77	9.61	17.15	26.70	15.09	18.19	16.13	17.30	20.47	55.22	56.75	23.78
AL_2	14.94	14.19	16.41	12.41	18.16	5.66	11.76	19.80	62.37	63.20	104.96	78.12	35.17
AM_1	29.64	32.00	16.16	8.57	14.14	12.61	12.41	23.59	61.57	39.22	30.20	39.63	26.64
AM_2	18.18	13.76	14.24	18.86	16.19	25.80	22.14	21.62	38.93	81.62	110.89	16.07	33.19
AO	14.68	23.00	22.20	19.07	32.35	23.67	38.63	57.77	86.89	92.81	105.05	123.30	53.28
AP	9.69	14.13	35.79	22.98	26.79	25.50	38.39	31.34	92.92	62.15	47.08	15.90	35.22

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
B_2	36.13	26.80	38.27	47.86	26.01	47.78	38.24	67.23	53.36	45.19	88.43	51.05	47.20
C_1	16.59	18.46	18.90	15.37	29.86	25.27	9.71	21.15	16.82	32.41	13.93	15.89	19.53
C_2	34.44	16.97	22.30	14.98	53.48	12.41	16.37	17.62	17.29	36.41	20.26	21.32	23.65
D_1	33.62	25.12	16.71	26.67	9.27	12.16	14.17	20.34	15.28	17.49	21.63	14.95	18.95
D_2	42.14	20.77	24.44	17.03	15.71	16.38	20.32	15.75	31.03	38.12	47.83	18.92	25.70
E_1	68.93	50.46	30.82	44.00	34.54	30.50	21.52	41.86	35.83	58.82	31.01	19.48	38.98
E_2	84.97	100.07	81.72	66.49	25.27	21.31	29.42	29.66	37.72	60.33	36.79	25.76	49.96
F_2	9.18	16.27	10.26	16.00	10.97	12.61	13.68	10.10	18.08	7.12	7.62	4.23	11.34
G_1	48.22	33.24	33.27	27.87	19.43	9.99	21.03	18.74	11.89	28.35	18.12	18.07	24.02
G_2	26.47	12.56	10.75	16.88	42.99	25.96	19.46	23.83	22.29	20.68	12.45	11.67	20.50
H_1	19.04	17.39	10.11	12.56	30.94	12.11	19.12	25.73	22.17	22.85	15.29	24.43	19.31
H_2	40.67	20.12	26.57	20.40	14.04	20.52	35.85	46.43	37.43	52.67	71.61	65.85	37.68
I	82.81	149.22	19.68	13.29	17.86	49.33	20.51	21.89	28.81	67.42	68.70	23.62	46.93
I_1	15.13	19.42	19.12	28.58	20.74	43.92	49.53	21.09	37.94	37.83	18.03	18.52	27.49
I_2	19.35	19.50	15.90	20.93	24.33	16.86	21.06	16.44	45.82	24.06	19.39	34.80	23.20
J	36.69	25.92	23.38	23.94	24.34	46.25	65.07	30.81	34.18	31.16	45.02	58.30	37.09
K_1	15.98	29.61	18.04	16.63	20.22	28.49	20.87	18.59	20.13	16.08	18.74	34.70	21.51
K_2	47.28	35.81	40.42	24.76	46.20	36.14	33.08	30.92	40.31	20.96	62.22	51.24	39.11
M_1	22.11	14.76	13.96	20.42	17.32	19.13	11.55	18.84	30.67	64.74	26.31	13.66	22.79
M_2	27.72	31.00	32.89	27.84	28.91	28.86	21.04	68.93	20.06	46.96	41.62	38.38	34.52
N_1	16.03	27.38	13.90	26.34	16.69	18.67	16.59	28.89	28.21	22.84	93.85	16.48	27.16
N_2	44.60	41.56	53.92	75.24	39.42	46.49	79.73	104.11	48.88	31.31	67.40	57.09	57.48
O_1	34.98	21.55	14.44	46.51	54.85	45.34	56.57	22.21	24.58	86.90	86.09	27.60	43.47
O_2	23.50	13.15	18.10	52.29	26.25	32.05	21.86	12.52	24.59	57.92	46.66	20.13	29.08
P_1	26.53	13.22	45.28	26.80	22.51	30.45	17.81	47.30	35.64	72.99	36.34	25.57	33.37
P_2	17.29	21.38	19.70	35.79	25.45	23.14	28.24	59.53	39.73	47.07	40.28	67.86	35.45
Q_1	14.88	13.70	9.55	14.02	13.59	15.90	24.12	28.92	17.13	22.50	25.27	21.24	18.40
Q_2	8.85	7.73	13.44	6.83	10.72	18.76	4.73	18.08	25.16	25.35	15.91	14.45	14.17
R_1	48.43	35.30	35.23	27.78	49.36	54.37	37.59	38.72	54.11	32.44	27.29	30.27	39.24
R_2	10.90	17.96	15.75	22.05	37.12	12.93	25.20	19.36	15.74	22.90	20.59	49.48	22.50
S_1	59.03	30.81	17.34	34.03	19.19	23.41	77.19	46.10	53.51	66.87	80.83	53.32	46.80
S_2	19.01	29.89	12.21	3.92	12.04	14.41	30.80	48.23	31.02	94.43	105.41	22.18	35.29
T_1	27.78	23.15	15.69	11.28	14.51	28.80	20.78	51.00	66.18	38.41	48.17	42.39	32.35
T_2	18.70	16.89	23.12	25.96	15.23	17.17	39.14	46.15	43.96	23.87	26.48	36.61	27.77
U_1	33.86	23.43	16.66	14.77	64.83	40.05	42.58	59.95	66.61	133.25	144.69	87.29	60.66
U_2	68.05	27.21	12.04	8.61	30.77	17.74	10.76	49.52	56.21	14.33	12.89	25.95	27.84
V_1	21.47	24.52	14.81	21.07	14.11	16.10	43.62	32.13	70.90	20.18	40.75	18.21	28.16
V_2	30.13	24.92	21.05	19.93	12.42	11.67	38.03	30.42	88.06	150.75	119.12	58.52	50.42
W_1	12.51	23.92	23.23	47.30	50.77	33.72	34.50	14.04	49.77	67.67	90.72	20.24	39.03
W_2	30.20	24.83	12.52	21.37	30.25	13.78	17.52	24.13	78.57	126.1	140.4	68.32	49.01
X	38.37	32.90	22.05	23.30	18.73	19.28	46.41	110.45	39.88	54.71	66.72	174.7	53.96
Y	21.58	14.49	13.89	21.22	24.59	24.12	42.80	213.8	39.50	22.08	19.03	76.46	44.46

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
Z_1	24.90	22.49	24.09	32.71	33.91	37.56	42.81	26.17	67.08	61.06	107.5	118.9	49.93
Z_2	13.93	14.26	10.74	21.61	26.04	40.78	34.52	63.39	34.06	49.71	25.49	31.93	30.54
Total Avg.	29.35	393.8	22.91	26.21	27.37	25.39	31.78	38.11	38.18	46.29	49.64	36.64	63.81

Table 19 GCN Spectral with LSTM layer: Average percentage of error by time of day in Wednesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	18.07	17.49	23.95	17.07	13.08	30.45	52.48	73.05	54.73	51.17	24.93	18.48	32.91
A_2	43.32	26.64	21.63	18.29	13.35	35.53	23.72	44.24	35.01	25.56	24.16	14.44	27.16
AA_1	14.96	29.07	24.06	17.98	21.61	14.47	58.39	65.50	63.13	54.69	60.73	75.34	41.66
AA_2	49.27	13.81	13.92	30.73	70.27	70.85	104.3	62.36	99.74	93.48	101.6	34.44	62.07
AB_1	28.67	26.05	19.37	33.41	16.04	11.91	43.24	43.47	40.33	60.63	81.94	96.95	41.84
AB_2	32.31	25.24	18.19	15.08	22.07	39.02	22.45	26.33	41.85	34.13	151.5	25.43	37.80
AC_1	39.33	27.25	25.98	31.07	18.28	12.93	14.67	20.68	21.03	24.88	27.16	41.15	25.37
AC_2	18.43	14.23	28.56	32.84	10.60	21.09	22.16	17.95	35.08	26.05	57.16	21.81	25.49
AD	45.55	31.49	18.19	24.80	18.68	21.87	43.80	67.03	88.07	51.70	78.29	100.7	49.18
AE	23.47	34.02	19.08	33.32	35.13	26.75	24.47	36.73	122.8	106.8	168.6	54.18	57.12
AED	57.47	31.71	19.16	23.56	29.63	21.61	18.53	20.16	27.37	16.76	13.74	30.24	25.83
AF	27.56	32.92	137.1	89.06	57.23	38.54	20.32	27.85	23.51	25.40	35.44	27.32	45.19
AG	26.16	13.98	20.12	17.02	7.66	12.71	9.65	35.23	16.62	15.58	21.74	21.48	18.16
AH	31.79	30.89	23.72	21.56	13.12	19.74	31.51	69.39	25.63	17.74	20.36	33.71	28.26
AI	18.93	16.22	19.24	17.47	16.22	21.91	9.32	23.57	12.84	11.80	27.30	13.66	17.37
AJ_1	61.89	19.19	23.14	12.47	21.44	18.04	19.46	28.22	42.85	27.76	125.8	22.32	35.21
AJ_2	20.59	18.86	14.16	13.15	11.95	11.03	17.69	17.80	13.37	10.80	16.99	11.37	14.81
AK_1	38.98	11.18	18.98	12.88	21.57	25.72	33.73	54.92	54.92	45.39	71.22	42.59	36.01
AK_2	22.61	35.24	49.32	41.13	71.71	60.84	75.92	44.94	31.10	19.10	56.44	30.93	44.94
AL_1	17.65	16.49	17.07	16.19	22.02	17.82	20.89	18.41	20.50	48.54	38.11	71.04	27.06
AL_2	20.49	19.16	15.98	16.52	20.21	18.30	15.52	65.65	64.72	96.50	122.6	48.23	43.65
AM_1	16.05	29.67	15.60	19.62	19.79	15.12	22.52	30.67	37.24	61.72	28.19	31.78	27.33
AM_2	4.94	15.09	41.31	16.49	17.95	17.07	25.97	17.46	50.13	61.57	125.9	90.59	40.37
AO	50.77	18.97	15.35	15.04	23.87	24.98	21.89	23.22	76.25	59.85	55.55	112.8	41.55
AP	11.91	14.27	15.73	33.23	23.31	16.12	15.70	21.72	35.27	53.32	15.16	23.20	23.24
B_2	39.13	43.50	75.82	25.75	27.87	51.39	38.16	27.78	36.00	25.46	40.72	36.99	39.05
C_1	59.50	23.11	36.13	65.71	95.12	27.17	43.23	40.96	40.66	54.35	69.29	96.61	54.32
C_2	46.01	15.69	40.46	38.35	67.13	31.35	14.97	17.15	31.99	26.77	52.94	38.17	35.08
D_1	45.71	34.01	23.39	20.49	4.49	12.78	18.51	20.56	23.91	17.85	28.19	46.04	24.66
D_2	41.46	29.99	22.39	27.66	29.69	18.33	15.53	45.02	40.57	36.97	30.53	36.03	31.18
E_1	32.73	64.11	117.5	17.53	13.48	25.85	35.29	24.25	24.62	54.33	48.89	16.58	39.60
E_2	74.02	50.26	106.4	66.34	20.69	33.74	22.27	27.63	40.97	194.9	77.19	45.70	63.35
F_2	13.88	10.85	11.82	23.54	16.21	8.00	14.11	21.23	9.18	21.77	15.44	6.17	14.35
G_1	52.36	38.71	48.46	22.00	9.29	16.33	14.20	16.64	22.64	17.90	29.73	31.01	26.61

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
G_2	18.02	12.46	14.55	19.04	36.70	22.99	15.22	22.73	18.35	45.64	41.42	55.28	26.87
H_1	18.59	18.69	26.04	25.41	22.44	23.03	27.68	39.54	27.01	15.75	38.81	12.15	24.59
H_2	51.63	19.51	19.14	30.62	19.23	18.47	55.05	77.58	43.48	41.76	31.00	41.89	37.45
I	143.6	158.9	42.47	116.0	165.5	57.03	68.01	100.7	116.5	93.34	47.25	27.75	94.75
I_1	39.47	20.70	17.58	29.72	16.16	14.19	32.11	30.84	30.00	40.98	51.46	35.03	29.85
I_2	23.03	16.58	19.13	18.72	19.58	21.19	14.92	37.86	54.53	49.94	31.61	32.37	28.29
J	46.85	35.39	31.59	11.58	3.25	25.92	40.68	51.07	38.41	71.87	26.55	38.99	35.18
K_1	29.50	15.35	16.97	20.41	24.08	21.62	20.18	31.86	38.69	21.48	18.99	22.33	23.45
K_2	43.66	28.29	25.30	40.74	32.79	22.97	34.41	67.59	28.75	33.56	20.53	31.02	34.13
M_1	24.11	23.05	21.73	17.44	21.32	17.50	32.75	26.16	96.33	128.9	32.90	45.63	40.65
M_2	36.53	37.22	24.92	30.21	22.85	34.06	33.00	73.34	82.36	60.52	47.47	89.41	47.66
N_1	16.00	23.29	31.22	13.95	13.08	10.37	16.10	36.97	170.1	148.7	87.80	66.30	52.83
N_2	37.03	42.31	52.89	51.93	16.60	19.20	64.15	61.34	86.73	83.46	32.76	48.42	49.73
O_1	14.08	24.98	25.98	39.65	16.32	47.64	17.52	46.51	55.30	107.1	63.78	71.83	44.22
O_2	20.08	16.23	26.08	81.00	28.71	60.11	27.44	57.49	91.50	82.77	65.62	92.46	54.12
P_1	28.55	41.34	22.79	27.81	36.77	26.01	30.44	51.49	62.70	60.71	43.43	86.02	43.17
P_2	25.76	24.83	17.07	15.71	19.08	27.20	35.32	86.57	76.71	86.85	83.64	61.53	46.69
Q_1	21.55	35.15	8.59	16.49	21.24	17.62	36.30	43.29	15.78	19.06	17.05	12.59	22.06
Q_2	18.56	16.77	17.99	10.27	16.06	13.48	11.83	16.10	15.11	16.60	22.09	19.31	16.18
R_1	50.83	32.10	35.55	29.08	52.65	53.07	44.05	41.42	22.02	20.84	31.89	29.46	36.91
R_2	11.69	17.86	26.44	24.30	9.10	16.56	12.45	24.76	35.91	40.81	63.37	56.78	28.33
S_1	139.9	42.94	20.84	33.11	14.78	21.75	38.34	36.39	60.13	101.58	46.62	51.78	50.69
S_2	22.03	17.10	16.13	26.59	32.88	47.96	32.43	29.26	44.20	109.26	70.15	34.18	40.18
T_1	46.24	13.33	36.95	13.02	21.13	25.09	31.04	24.93	167.6	94.78	68.13	36.10	48.20
T_2	26.38	13.45	13.63	12.62	11.13	15.96	17.82	27.66	90.59	58.70	51.19	16.24	29.61
U_1	45.16	24.05	27.88	26.57	38.10	26.40	33.57	32.85	71.97	131.4	119.2	162.9	61.67
U_2	28.29	25.69	16.11	18.05	23.85	21.87	39.24	20.02	49.56	10.49	32.24	18.82	25.35
V_1	30.86	22.39	19.47	17.72	18.58	19.20	20.83	54.38	108.5	142.4	91.70	66.17	51.02
V_2	74.16	33.06	12.20	18.12	12.53	21.56	31.40	22.89	113.3	168.8	162.9	161.7	69.40
W_1	22.95	44.39	31.66	41.39	37.90	54.22	42.20	60.07	55.07	65.29	79.04	86.21	51.70
W_2	18.44	17.39	26.31	14.44	18.85	14.71	11.27	19.29	76.83	186.8	124.2	52.46	48.42
X	45.23	35.48	22.54	59.12	44.90	61.60	38.89	138.2	78.95	32.35	67.54	60.20	57.09
Y	25.29	18.34	10.29	38.02	133.9	24.98	33.73	64.77	57.53	93.98	57.97	39.71	49.88
Z_1	26.97	26.85	22.53	30.69	18.33	35.18	23.71	28.28	30.32	105.8	56.77	145.1	45.88
Z_2	25.63	11.99	22.31	59.95	28.70	39.57	48.70	53.36	65.19	94.14	91.33	36.44	48.11
Total Avg.	607.5	27.34	28.46	29.08	28.54	26.80	30.39	41.09	53.34	61.12	57.41	49.16	86.69

Table 20 GCN Spectral with LSTM layer: Average percentage of error by time of day in Thursday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	31.20	23.18	35.25	13.98	23.58	51.03	52.32	39.77	50.53	37.50	36.41	49.64	37.03
A_2	39.95	24.02	23.95	17.66	14.96	16.07	17.96	29.49	28.47	56.51	43.03	80.82	32.74
AA_1	17.50	27.64	11.66	16.84	23.56	29.37	44.37	74.32	67.28	35.57	80.01	15.40	36.96
AA_2	30.35	16.35	40.24	24.76	55.19	42.48	56.12	128.4	161.9	32.58	68.52	25.49	56.87
AB_1	18.84	24.94	17.98	22.30	14.84	27.91	49.43	48.53	51.47	34.50	51.89	50.21	34.40
AB_2	21.29	21.38	23.35	36.54	55.93	36.16	27.46	102.45	70.66	52.65	127.3	79.15	54.52
AC_1	28.53	23.23	6.85	16.76	24.14	31.00	24.56	24.19	43.19	29.24	22.14	12.04	23.82
AC_2	20.21	14.95	7.36	29.85	24.39	39.80	15.05	70.59	85.72	32.60	85.26	35.15	38.41
AD	24.29	21.09	44.32	29.63	25.64	29.67	32.57	74.25	60.96	50.02	101.1	22.54	43.01
AE	22.20	18.12	14.45	20.22	32.23	61.85	28.33	25.66	48.85	172.4	124.6	25.96	49.56
AED	32.91	29.77	26.53	15.65	9.36	23.13	18.09	20.84	44.32	49.03	48.72	12.26	27.55
AF	23.63	48.05	21.28	28.69	43.10	27.09	20.00	26.39	33.18	27.81	31.66	23.05	29.49
AG	14.57	13.71	17.99	30.94	19.07	17.03	21.27	22.38	39.28	22.29	24.28	15.44	21.52
AH	27.47	14.58	5.85	9.71	20.02	15.96	28.59	42.50	68.66	15.75	40.81	81.22	30.93
AI	12.12	20.66	4.01	28.77	24.60	12.65	9.92	44.72	42.55	18.14	13.56	19.28	20.92
AJ_1	38.90	25.44	10.42	12.88	13.74	8.28	18.77	25.79	17.97	110.5	76.75	40.20	33.30
AJ_2	14.49	21.24	8.65	8.69	23.02	15.25	15.06	35.28	57.76	20.59	20.92	22.08	21.92
AK_1	23.14	16.47	16.33	22.90	33.19	30.67	48.08	32.15	19.57	42.77	71.61	27.07	31.99
AK_2	16.57	34.65	41.23	49.42	62.47	61.48	39.39	39.88	23.30	59.61	73.39	28.38	44.15
AL_1	22.84	8.93	9.70	10.52	6.25	17.60	17.46	17.44	20.67	79.79	102.4	51.39	30.41
AL_2	18.50	14.98	6.92	10.20	11.45	12.00	41.36	52.37	51.39	29.83	76.41	51.56	31.41
AM_1	16.40	15.66	11.70	18.87	24.21	14.73	18.04	55.02	60.62	30.46	25.80	38.93	27.54
AM_2	10.82	11.78	9.82	41.06	10.71	40.69	19.91	27.28	73.46	133.2	77.76	27.61	40.34
AO	27.36	28.10	108.2	48.99	21.82	22.40	16.48	53.62	54.34	58.76	36.58	105.46	48.51
AP	14.08	15.20	41.78	20.95	30.26	25.49	20.79	41.94	61.38	34.97	27.35	25.03	29.93
B_2	34.46	42.11	13.63	56.30	23.44	52.93	47.73	44.50	33.68	56.79	52.41	108.33	47.19
C_1	22.88	25.44	59.50	26.02	29.62	37.48	35.02	17.25	29.62	51.51	65.11	23.46	35.24
C_2	24.34	16.97	80.85	16.50	39.05	39.43	34.79	18.65	36.00	60.15	122.1	16.55	42.12
D_1	34.11	21.10	26.01	13.40	6.43	14.99	25.17	57.72	39.54	52.95	96.88	75.06	38.61
D_2	30.07	14.91	20.32	20.36	34.11	22.72	30.72	58.32	35.37	25.86	67.82	16.73	31.44
E_1	103.42	53.55	85.12	34.09	15.43	32.64	19.44	27.61	24.96	51.85	109.5	87.10	53.73
E_2	56.15	77.56	101.47	67.24	16.31	44.17	37.33	77.26	74.93	62.34	119.3	56.83	65.90
F_2	11.95	10.34	8.69	16.63	15.06	10.70	15.26	13.41	21.41	22.53	23.12	24.95	16.17
G_1	60.63	30.94	37.46	30.49	15.89	11.89	19.64	13.05	30.77	31.94	91.79	31.48	33.83
G_2	21.13	11.57	12.84	12.02	24.74	12.18	28.13	42.42	23.18	45.01	88.54	71.98	32.81
H_1	23.05	10.95	29.40	23.06	15.26	35.39	17.50	47.94	65.20	48.88	25.41	29.60	30.97
H_2	23.20	24.37	4.61	14.03	15.61	21.58	22.39	81.21	74.34	31.43	34.06	65.71	34.38
I	41.41	52.60	86.14	39.08	23.85	34.34	44.38	23.16	33.19	171.9	206.6	38.62	66.27
I_1	29.87	15.94	12.36	9.06	17.89	30.28	25.78	34.22	26.15	31.45	13.85	42.23	24.09
I_2	19.29	24.00	33.28	20.31	24.72	16.68	12.35	144.3	174.9	266.9	162.8	70.98	80.87
J	20.17	23.12	2.60	22.91	29.23	40.43	29.37	77.97	47.32	29.99	24.05	29.95	31.43
K_1	31.70	49.62	14.99	19.34	13.06	18.48	19.34	44.91	94.55	8.93	48.80	103.0	38.89

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
K_2	36.06	30.40	17.70	22.70	29.20	30.64	25.67	28.91	56.33	17.61	44.81	29.65	30.81
M_1	28.79	26.92	18.65	20.04	24.46	13.25	35.08	16.89	97.30	115.0	74.14	26.91	41.45
M_2	28.96	30.96	29.36	28.25	29.51	40.10	84.65	67.52	80.88	57.60	53.95	112.24	53.66
N_1	19.39	21.58	19.66	16.66	34.10	26.62	21.71	35.71	70.00	37.14	53.52	11.49	30.63
N_2	40.68	35.22	153.0	25.95	80.87	48.04	65.21	125.8	121.0	62.76	37.11	17.65	67.77
O_1	14.52	21.07	24.99	22.72	56.84	86.36	22.69	41.69	61.44	60.65	38.35	17.79	39.09
O_2	15.86	18.23	32.82	31.29	109.6	54.75	20.25	92.07	70.27	47.21	78.34	21.47	49.35
P_1	26.18	15.06	29.70	35.58	17.22	27.93	37.64	40.65	25.58	32.27	51.38	36.20	31.28
P_2	29.51	35.54	12.19	58.03	34.43	25.76	28.84	65.79	98.50	73.47	63.50	45.85	47.62
Q_1	6.57	18.54	15.48	12.58	30.44	23.83	59.56	29.70	22.33	30.53	32.50	11.41	24.46
Q_2	15.46	26.04	10.58	8.67	13.77	22.90	11.68	21.02	45.62	100.48	68.82	21.03	30.51
R_1	39.92	47.74	14.90	38.87	22.47	55.90	38.65	44.52	36.12	51.46	44.77	30.26	38.80
R_2	18.58	40.60	38.37	10.30	29.86	23.05	26.71	19.35	16.95	36.44	56.66	65.44	31.86
S_1	118.8	31.87	6.20	32.99	24.69	33.22	22.38	35.08	91.95	39.69	68.76	23.83	44.12
S_2	46.71	25.82	14.50	11.95	59.02	18.20	43.08	44.85	103.8	65.29	119.2	12.96	47.11
T_1	36.52	12.87	28.19	18.48	20.78	20.00	21.64	43.99	286.0	40.70	57.25	28.67	51.26
T_2	21.53	15.48	29.27	9.67	22.84	18.00	16.67	13.99	347.0	218.8	162.7	14.25	74.19
U_1	55.13	19.77	20.21	19.66	24.94	87.18	53.38	55.96	101.6	105.6	150.8	108.8	66.92
U_2	23.63	14.30	17.78	17.16	25.32	15.73	14.98	43.90	109.3	139.7	86.10	16.63	43.71
V_1	16.14	44.15	16.20	20.80	36.82	25.14	46.95	45.80	52.89	281.6	33.83	18.49	53.24
V_2	56.60	48.12	52.08	19.17	17.38	43.15	22.81	18.68	74.14	288.4	204.7	24.83	72.51
W_1	36.17	34.34	13.43	31.64	27.62	49.13	32.74	48.89	37.22	70.58	86.49	46.60	42.91
W_2	18.46	15.70	11.70	9.40	16.55	12.35	10.34	15.45	173.8	106.7	92.56	85.53	47.38
X	49.64	33.39	27.19	32.21	50.05	29.35	71.01	131.9	127.8	121.6	76.07	173.9	77.01
Y	15.91	16.52	25.08	39.42	15.39	31.86	41.18	92.97	182.1	77.61	95.88	84.36	59.86
Z_1	34.42	16.03	29.75	25.18	26.98	22.43	14.75	45.40	39.02	48.52	84.98	51.12	36.55
Z_2	28.28	15.44	17.55	13.25	61.14	29.93	44.10	77.79	111.67	99.00	54.43	21.28	47.82
Total Avg.	29.48	25.37	27.84	24.06	28.25	30.44	30.43	48.17	70.19	68.75	71.19	43.72	41.49

Table 21 GCN Spectral with LSTM layer: Average percentage of error by time of day in Friday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	13.11	27.81	38.26	41.82	23.09	19.21	49.28	66.09	47.21	23.42	49.11	18.77	34.76
A_2	16.47	39.48	61.63	46.71	25.41	29.65	40.40	33.72	52.85	26.61	40.27	23.03	36.35
AA_1	16.77	8.20	23.12	23.80	19.01	24.17	47.20	51.72	64.26	156.45	108.79	100.87	53.70
AA_2	11.19	11.78	16.44	19.06	24.24	31.67	73.48	66.85	52.10	46.07	39.23	52.67	37.06
AB_1	8.20	17.88	11.44	17.28	18.74	18.21	24.39	71.52	52.79	119.35	60.17	55.59	39.63
AB_2	17.20	25.99	14.68	36.32	42.77	50.03	22.88	54.25	37.05	39.56	33.58	114.86	40.76
AC_1	41.24	31.82	18.51	24.70	22.49	12.46	11.40	24.90	26.63	75.92	18.48	26.53	27.92
AC_2	31.19	34.70	40.32	27.96	18.48	14.86	11.16	10.22	35.52	24.36	29.43	39.54	26.48
AD	50.68	80.34	34.72	20.02	24.26	22.35	31.55	29.44	39.70	17.17	22.27	27.11	33.30

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AE	46.67	12.49	42.80	52.67	25.67	32.33	27.30	13.72	25.34	13.72	26.78	27.08	28.88
AED	57.89	22.93	23.82	16.94	40.43	21.14	34.86	17.97	20.79	33.04	39.70	13.66	28.60
AF	33.08	27.06	44.60	39.95	34.56	22.24	75.76	65.70	22.79	29.07	12.47	127.75	44.59
AG	27.10	22.95	39.37	28.81	17.08	25.51	16.25	41.51	21.77	21.49	21.33	33.23	26.37
AH	19.95	20.04	19.17	24.75	31.84	37.21	57.17	94.96	52.84	57.31	66.51	97.55	48.27
AI	35.03	22.93	32.23	26.30	18.83	26.18	17.37	13.66	12.68	27.52	11.56	13.18	21.45
AJ_1	21.26	30.41	13.95	17.60	25.66	21.00	17.98	16.93	15.32	9.79	23.29	20.74	19.49
AJ_2	15.52	12.12	14.09	22.72	11.83	22.00	28.71	13.25	28.89	21.14	17.48	22.56	19.19
AK_1	18.53	15.27	23.25	19.51	14.87	14.54	15.14	19.64	23.12	18.30	20.65	16.77	18.30
AK_2	81.11	22.28	22.00	18.39	18.13	14.15	38.93	15.17	28.36	17.20	29.18	23.30	27.35
AL_1	37.02	18.62	16.52	10.70	13.14	14.39	16.60	17.67	19.20	15.32	18.29	14.19	17.64
AL_2	18.93	29.38	17.45	12.90	19.97	14.40	12.65	22.15	14.94	18.99	24.34	20.90	18.92
AM_1	12.43	13.14	15.94	15.58	21.37	19.83	13.57	25.96	36.37	45.24	33.63	51.07	25.34
AM_2	18.09	15.44	12.64	14.13	14.83	15.15	13.30	10.39	21.39	21.32	24.19	18.47	16.61
AO	49.45	44.12	27.94	38.08	44.41	31.42	29.70	33.80	59.60	129.34	49.45	44.23	48.46
AP	19.63	13.33	10.84	17.41	26.35	25.34	33.34	20.95	15.70	17.83	6.84	14.98	18.54
B_2	45.52	22.06	165.48	49.60	57.97	41.31	69.52	59.00	60.59	92.30	32.32	80.36	64.67
C_1	29.33	24.41	9.78	22.36	15.06	14.21	13.28	27.29	11.01	12.22	33.07	22.28	19.52
C_2	16.89	30.06	21.35	18.97	13.46	41.88	18.58	25.77	18.36	31.78	46.20	13.91	24.77
D_1	16.58	18.80	15.69	21.04	23.35	15.19	32.96	16.76	10.44	8.51	18.37	9.59	17.27
D_2	36.26	15.70	9.35	35.24	15.33	12.36	44.84	16.84	20.68	17.06	21.01	22.69	22.28
E_1	54.51	20.10	20.00	15.66	15.59	16.17	19.43	19.71	23.47	28.95	18.96	15.51	22.34
E_2	16.11	13.57	25.08	18.17	26.65	27.06	28.63	31.09	23.02	20.35	21.16	16.80	22.31
F_2	15.71	16.40	10.43	19.02	7.90	11.46	17.16	14.68	13.73	10.15	19.81	5.46	13.49
G_1	19.32	21.17	24.10	18.75	14.14	13.90	15.14	14.54	17.80	11.72	10.90	14.01	16.29
G_2	19.13	15.79	21.70	13.69	25.22	16.56	12.09	20.10	11.27	35.99	20.75	10.10	18.53
H_1	21.26	19.44	20.34	24.95	18.16	22.99	10.60	21.52	20.51	28.35	21.81	24.33	21.19
H_2	27.56	44.54	36.62	44.50	34.50	36.27	29.87	16.61	25.47	42.78	32.43	19.54	32.56
I	32.95	26.94	14.43	16.27	20.35	25.01	39.57	38.29	21.04	30.31	30.99	19.98	26.34
I_1	23.00	10.67	25.60	16.45	41.89	90.25	32.00	62.22	55.08	62.27	59.70	44.80	43.66
I_2	33.54	13.43	18.84	12.17	55.60	108.70	90.00	151.63	148.48	141.92	53.70	19.60	70.64
J	24.22	20.95	37.20	33.28	28.13	33.10	69.29	45.99	42.95	62.56	43.84	37.11	39.88
K_1	73.42	14.90	14.61	36.59	36.01	84.50	88.76	136.22	107.96	73.20	59.70	35.64	63.46
K_2	119.98	43.48	32.07	15.03	38.08	45.13	24.92	42.27	25.34	32.61	26.89	26.22	39.33
M_1	53.10	26.65	32.57	19.72	21.28	32.53	28.49	20.29	49.03	31.86	25.46	29.66	30.89
M_2	18.14	27.17	41.30	58.16	98.34	105.85	164.92	235.65	199.17	229.22	151.88	185.37	126.26
N_1	34.60	19.01	19.91	24.12	27.43	37.28	78.32	19.72	15.53	25.30	23.69	19.32	28.69
N_2	19.58	16.96	60.05	82.67	87.96	113.05	190.71	122.16	57.37	48.70	45.23	37.01	73.45
O_1	27.17	21.45	26.09	60.12	52.14	40.70	102.78	12.60	41.81	32.80	43.65	19.37	40.06
O_2	16.47	58.55	82.60	72.12	109.45	110.68	136.47	67.15	33.17	27.26	31.07	45.59	65.88
P_1	44.12	37.97	27.43	29.55	49.13	59.28	51.47	62.81	115.70	89.28	74.61	125.59	63.91

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
P_2	39.02	19.53	57.29	22.11	25.46	37.50	26.11	22.87	78.05	56.91	72.05	107.10	47.00
Q_1	9.02	16.52	11.92	8.52	21.72	19.44	18.66	30.59	18.44	13.52	24.40	14.89	17.30
Q_2	11.67	19.81	7.60	13.16	17.81	15.42	12.00	14.69	18.00	50.65	32.99	32.08	20.49
R_1	9.74	36.69	12.83	18.28	17.81	24.55	22.54	14.89	17.24	18.72	18.83	31.40	20.29
R_2	14.18	20.37	16.22	18.73	26.70	31.97	16.37	12.35	43.69	28.24	55.03	17.05	25.08
S_1	13.03	21.16	20.84	15.51	28.45	20.16	26.26	25.18	25.21	17.05	30.67	23.72	22.27
S_2	16.37	31.46	23.98	42.45	22.55	31.11	18.39	36.39	25.25	21.18	28.06	15.14	26.03
T_1	42.94	32.86	27.42	24.37	24.28	26.66	17.89	15.57	14.66	18.07	30.55	39.84	26.26
T_2	48.19	16.71	19.26	63.71	27.17	45.42	16.35	20.82	26.35	23.11	11.86	14.41	27.78
U_1	23.50	13.65	18.73	24.77	20.27	33.41	23.43	23.57	51.88	35.59	34.66	22.07	27.13
U_2	44.15	15.46	18.03	13.30	14.34	17.23	19.76	21.87	26.91	16.63	38.62	15.26	21.80
V_1	32.02	59.02	19.73	33.38	26.12	23.88	21.40	22.81	20.49	22.32	29.28	20.31	27.56
V_2	21.25	21.94	8.50	21.26	20.99	25.43	20.24	22.11	30.86	40.95	28.75	15.51	23.15
W_1	19.84	19.98	15.34	23.71	32.00	26.55	24.55	19.90	23.20	39.51	31.45	26.90	25.24
W_2	15.33	12.43	17.09	14.57	11.24	18.38	21.61	18.33	34.18	15.94	23.60	21.35	18.67
X	18.51	24.79	72.18	122.85	114.96	144.19	72.04	146.93	182.10	317.85	58.63	63.88	111.58
Y	13.85	20.24	19.41	19.82	29.74	31.66	104.83	59.07	133.63	126.87	36.41	30.69	52.18
Z_1	23.31	10.59	17.04	26.32	44.87	39.16	30.83	37.50	113.96	90.86	106.84	118.26	54.96
Z_2	24.42	26.47	24.33	14.21	41.48	25.38	50.42	59.92	42.44	68.56	67.62	22.07	38.94
Total Avg.	28.93529	24.063	27.19	28.309	30.414	34.382	39.621	40.267	42.358	47.471	37.022	37.252	34.77

Table 22 GCN Spectral with LSTM layer: Average percentage of error by time of day in Saturday

A.3 GCN Spectral with GRU Layer

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	21.68	23.88	38.82	34.99	35.55	22.16	47.91	34.59	15.77	25.45	12.69	17.68	26.70
A_2	20.76	26.32	49.10	45.17	24.95	47.08	46.87	52.45	44.18	70.04	29.74	40.20	40.90
AA_1	14.02	15.36	15.22	15.35	16.45	15.14	38.70	55.60	41.46	16.04	26.46	19.90	23.92
AA_2	12.95	18.08	18.28	18.49	15.50	29.65	29.29	45.70	57.95	14.45	24.95	24.56	25.16
AB_1	10.98	9.06	15.01	18.37	21.76	17.90	30.22	34.13	31.10	101.81	28.40	13.18	27.17
AB_2	12.34	20.03	21.16	37.83	16.88	29.32	25.17	17.91	18.12	19.50	15.06	12.34	20.71
AC_1	47.09	39.89	37.60	22.90	15.31	19.79	21.81	23.41	31.97	77.87	28.51	29.36	33.45
AC_2	36.30	42.34	22.12	21.44	8.60	17.30	12.72	15.14	15.99	21.18	11.66	32.82	22.42
AD	29.92	28.38	24.84	34.79	23.42	21.88	38.05	25.09	18.75	15.80	28.31	25.25	83.97
AE	28.28	39.63	19.26	38.38	26.40	51.56	39.56	27.02	15.29	17.00	19.65	13.11	28.49
AED	37.74	18.99	28.21	19.46	19.04	27.21	13.24	14.90	14.20	24.43	22.27	19.58	26.77
AF	15.23	45.57	48.28	31.41	55.37	16.40	21.95	25.22	35.77	16.98	44.91	53.42	32.77
AG	32.79	21.20	13.16	11.78	16.68	23.66	13.18	12.38	17.59	11.70	30.60	15.91	19.10
AH	26.52	24.70	32.08	35.36	41.70	40.28	55.98	77.17	86.02	78.35	78.38	77.35	52.07

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AI	20.19	24.60	14.64	11.12	14.38	22.05	14.97	15.75	27.86	10.45	17.62	10.93	17.54
AJ_1	16.78	22.89	13.59	21.45	20.38	104.18	10.99	16.27	21.66	17.07	18.31	16.94	25.27
AJ_2	18.17	12.78	21.67	32.27	44.24	54.20	26.43	19.93	20.86	14.30	14.34	16.40	24.35
AK_1	60.72	17.07	20.17	18.18	23.18	20.90	20.76	9.64	11.32	16.42	13.57	8.91	26.08
AK_2	49.35	18.08	24.09	20.80	27.19	36.23	36.09	31.94	27.08	17.95	22.00	18.02	28.38
AL_1	22.94	22.20	12.69	9.50	16.10	15.01	19.16	24.00	22.47	14.51	17.11	9.31	18.25
AL_2	25.02	25.93	13.49	15.24	18.12	17.09	17.14	21.47	22.12	14.78	19.34	15.85	22.71
AM_1	8.68	10.89	14.38	17.54	13.41	15.84	14.52	26.89	25.01	10.64	10.52	16.22	15.17
AM_2	9.09	14.13	9.56	16.23	24.40	17.33	16.35	13.37	12.83	12.85	9.80	8.90	16.53
AO	49.38	63.37	29.91	23.52	21.42	27.11	29.62	27.62	24.41	26.55	369.74	23.51	58.20
AP	23.46	20.20	13.79	10.07	19.90	13.81	15.20	16.01	23.03	20.50	19.82	17.22	18.89
B_2	44.80	44.68	113.32	95.68	49.90	130.79	82.26	46.33	57.40	63.37	26.49	69.67	69.76
C_1	20.33	17.10	15.83	21.55	18.40	31.36	18.30	11.85	18.52	14.53	8.54	12.89	17.64
C_2	18.03	27.71	12.66	16.73	19.12	32.36	16.63	20.39	21.49	14.82	14.79	10.76	19.73
D_1	16.36	15.25	15.34	13.59	17.81	14.09	18.72	13.78	14.58	15.66	13.88	17.36	15.51
D_2	20.92	21.55	18.52	19.07	19.20	15.69	22.66	19.08	16.29	20.59	19.60	21.87	19.59
E_1	20.76	20.75	23.34	28.33	15.22	22.68	22.10	18.94	12.00	26.31	16.81	19.06	20.81
E_2	10.72	10.00	16.13	20.02	24.50	23.70	17.58	19.55	14.06	15.77	12.15	9.69	16.70
F_2	26.88	16.59	12.03	9.32	16.91	15.19	18.96	16.93	21.83	15.09	12.69	12.91	17.34
G_1	13.69	10.85	12.08	20.20	18.56	16.42	11.43	16.62	19.23	15.71	20.23	21.31	16.79
G_2	18.63	20.92	13.04	15.60	16.70	13.78	22.12	14.09	14.82	12.53	10.13	11.71	16.30
H_1	31.19	25.06	27.60	15.39	17.68	18.43	20.42	21.86	19.34	13.02	17.67	15.88	20.66
H_2	30.06	34.44	27.02	25.98	35.73	31.36	40.82	51.98	16.12	29.96	22.62	24.18	30.57
I	21.53	31.50	15.89	13.85	13.07	20.16	48.92	72.82	24.04	14.50	15.23	17.75	25.53
I_1	38.33	20.02	13.11	14.23	25.50	33.74	20.70	80.90	49.39	58.77	37.08	28.25	35.14
I_2	15.35	22.76	15.14	15.92	26.58	65.52	15.61	77.61	24.94	58.97	17.49	10.50	30.15
J	21.42	25.51	44.39	28.66	25.21	48.59	45.79	46.26	53.06	31.02	43.58	34.51	36.17
K_1	14.71	18.92	17.09	36.31	60.47	114.44	50.38	139.01	133.31	33.24	19.39	35.16	53.15
K_2	27.78	24.45	19.15	15.78	43.48	55.33	60.21	41.49	45.49	21.59	37.22	33.69	34.68
M_1	157.14	52.24	25.52	27.41	22.44	40.42	34.09	28.90	49.03	27.51	75.34	15.96	54.51
M_2	59.70	25.76	44.16	132.68	133.37	99.14	187.62	200.51	289.13	173.17	151.95	74.10	140.67
N_1	45.18	35.93	50.36	41.29	51.75	55.90	44.46	40.47	19.50	18.16	15.88	18.81	51.61
N_2	20.96	21.60	28.15	108.64	92.25	199.96	205.62	181.99	150.54	55.34	37.83	20.72	90.15
O_1	61.05	28.89	43.26	41.54	50.96	84.15	64.34	195.50	61.38	23.76	51.23	35.61	85.23
O_2	65.44	68.76	65.61	28.79	62.39	59.52	127.71	163.14	82.90	17.31	17.51	12.84	62.04
P_1	44.25	20.06	24.96	28.94	16.05	105.95	85.13	71.04	51.72	78.71	87.86	65.93	55.22
P_2	27.07	24.43	23.20	21.28	23.31	41.91	33.17	41.26	53.59	52.77	49.49	32.82	43.01
Q_1	13.68	18.09	7.40	9.31	13.00	22.22	23.74	19.38	30.59	14.18	19.31	17.06	17.44
Q_2	14.64	13.21	13.46	8.08	12.22	15.65	17.41	17.39	19.21	8.64	10.46	11.53	13.60
R_1	14.30	19.26	17.02	18.87	14.22	30.09	25.45	19.53	20.00	18.36	24.95	29.10	20.64
R_2	14.37	17.59	16.10	14.77	11.63	24.31	16.06	14.12	17.17	25.56	12.75	27.89	18.03
S_1	26.61	14.03	22.04	41.94	39.59	119.69	28.11	28.99	14.25	27.12	20.74	17.43	37.28

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
S_2	25.69	11.64	27.88	14.04	20.13	21.91	10.77	24.35	30.24	17.07	15.21	30.72	45.05
T_1	42.54	31.13	18.79	22.22	23.25	28.42	15.71	14.38	23.93	28.83	20.82	26.79	28.46
T_2	48.19	16.76	14.99	14.41	16.26	65.50	21.22	21.75	46.01	18.54	14.31	44.12	30.17
U_1	17.77	23.03	16.42	12.61	23.57	28.15	21.18	22.24	23.01	16.08	16.74	11.86	19.22
U_2	19.46	19.38	14.12	7.92	17.20	75.90	24.25	20.30	15.59	21.35	13.75	19.53	23.18
V_1	580.10	40.27	25.67	21.30	17.51	65.82	15.40	32.42	16.47	17.77	26.25	18.54	88.06
V_2	26.45	32.09	20.36	19.18	25.35	24.49	16.55	19.76	14.35	50.65	20.93	13.61	35.31
W_1	13.69	15.74	18.51	22.30	36.90	26.34	17.34	30.10	24.42	15.22	22.64	25.54	21.92
W_2	13.57	15.51	12.13	15.66	15.76	24.17	23.41	16.97	18.39	15.94	19.37	15.34	17.21
X	39.53	22.60	135.22	90.51	119.08	86.30	145.08	96.44	270.87	172.01	69.58	93.04	107.59
Y	23.16	20.50	11.78	23.56	16.24	99.91	49.42	60.62	94.82	66.03	28.25	15.37	40.87
Z_1	28.87	14.94	17.76	26.43	49.97	27.60	37.15	71.72	39.63	80.43	52.24	39.65	39.19
Z_2	18.18	24.74	22.04	19.97	23.06	74.75	86.43	251.89	25.30	22.32	18.30	21.89	50.18
Total Avg.	36.57	24.37	25.21	26.69	28.87	43.11	37.48	45.19	40.01	32.53	32.07	24.92	

Table 23 GCN Spectral with GRU layer: Average percentage of error by time of day in Sunday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	24.78	27.77	39.04	48.23	83.45	61.98	57.85	60.64	68.66	38.53	31.05	17.73	46.45
A_2	32.11	30.88	19.35	17.65	27.18	40.01	25.51	39.69	19.34	16.02	25.52	30.16	27.81
AA_1	15.65	39.81	21.62	15.38	14.09	18.10	20.44	23.48	18.67	22.40	16.44	27.43	21.19
AA_2	63.32	80.70	18.35	22.19	17.72	25.02	26.21	16.17	21.56	27.44	38.14	32.94	32.15
AB_1	25.35	19.98	22.87	18.49	12.85	18.38	15.63	22.61	18.71	37.41	47.59	22.05	23.02
AB_2	25.97	225.70	34.63	18.14	19.06	15.91	17.12	17.73	21.41	26.12	15.58	11.04	36.79
AC_1	21.37	52.40	24.39	27.97	6.96	19.78	15.04	15.41	28.23	28.92	25.96	18.16	24.31
AC_2	14.25	89.68	31.74	30.17	14.42	10.46	23.02	12.98	13.61	19.85	28.84	17.55	24.53
AD	37.19	21.82	25.41	34.79	19.67	53.69	26.81	51.08	53.77	34.84	48.30	38.84	46.02
AE	19.76	17.98	33.36	39.67	33.69	35.82	28.82	15.49	10.87	19.90	28.43	36.84	27.86
AED	48.18	18.86	16.35	28.12	19.92	16.44	18.16	16.90	33.29	26.28	20.86	27.28	24.00
AF	23.31	13.97	55.58	55.05	61.21	27.56	36.12	67.07	40.10	23.68	19.43	22.98	36.23
AG	9.42	19.80	25.52	23.99	12.23	16.97	20.36	17.08	7.64	14.54	15.76	23.67	18.67
AH	22.31	28.35	20.46	22.13	27.32	20.85	22.82	39.59	28.28	34.34	29.68	49.40	29.11
AI	22.79	11.37	10.96	10.32	30.95	14.19	14.27	14.80	19.42	14.83	10.17	16.43	16.45
AJ_1	26.98	23.85	15.53	12.39	16.20	17.25	19.38	15.06	25.91	22.26	18.16	21.40	22.81
AJ_2	30.26	16.56	18.74	17.89	11.59	19.61	11.70	15.19	22.99	16.63	14.84	9.86	18.37
AK_1	15.84	34.70	22.65	11.13	17.33	21.78	23.71	29.50	70.76	47.10	73.63	47.77	33.53
AK_2	74.76	16.70	33.13	22.18	17.34	41.17	56.53	20.55	15.77	28.65	27.79	22.31	31.02
AL_1	10.62	8.73	15.85	8.93	13.47	13.37	20.66	14.43	18.84	25.52	53.45	41.02	21.18
AL_2	14.93	22.88	21.04	12.57	12.85	13.16	18.49	16.40	90.91	18.14	96.62	82.28	35.28
AM_1	18.32	12.63	20.45	16.12	21.99	18.95	15.63	28.76	29.59	63.40	38.04	49.77	28.15
AM_2	14.68	21.18	9.65	11.46	13.17	28.08	14.82	13.89	23.48	50.55	49.82	17.79	22.35

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AO	14.46	14.99	43.89	15.06	28.13	33.30	19.61	12.81	43.61	89.58	47.48	61.65	35.31
AP	10.31	12.03	21.33	21.35	14.48	12.68	11.17	15.89	18.35	53.79	11.07	39.04	28.00
B_2	410.26	34.59	62.72	40.32	57.04	69.49	74.56	178.14	105.82	98.67	39.11	91.90	101.19
C_1	16.17	22.15	34.24	15.10	19.80	16.06	15.50	18.80	13.12	21.66	12.25	13.10	19.59
C_2	18.28	27.05	27.15	18.46	29.64	15.29	13.45	11.12	14.00	28.28	14.61	13.58	19.51
D_1	20.18	10.16	19.34	14.19	22.57	12.98	12.49	12.86	10.54	25.67	23.02	17.39	19.10
D_2	27.56	15.10	30.50	33.84	14.62	15.23	18.20	28.09	12.82	23.94	25.36	22.42	24.25
E_1	53.64	73.14	28.54	23.75	14.90	23.65	18.81	14.28	28.21	44.46	49.75	14.10	33.39
E_2	99.87	43.73	43.39	34.43	14.86	26.98	31.71	18.33	27.77	67.26	25.00	21.45	49.07
F_2	20.92	11.79	16.75	13.95	24.04	14.11	13.84	14.32	9.45	9.90	14.08	18.39	15.31
G_1	25.15	22.20	26.62	27.19	4.72	15.15	14.91	18.86	10.14	22.54	19.20	19.35	20.30
G_2	14.13	13.52	17.06	10.74	24.43	14.88	9.26	14.80	7.90	31.88	15.84	13.84	15.25
H_1	22.18	19.55	11.35	18.27	21.41	19.52	13.04	16.92	16.79	14.23	21.02	19.50	19.25
H_2	29.70	17.66	17.95	31.20	18.58	28.87	37.10	33.40	53.38	46.95	29.16	38.28	37.94
I	108.51	124.14	31.53	13.48	20.02	31.89	28.60	16.79	22.97	35.63	23.49	12.27	38.54
I_1	15.27	28.37	17.51	17.51	25.96	22.37	14.97	19.23	21.77	41.64	15.03	16.54	22.02
I_2	15.56	15.22	13.15	18.62	15.13	20.06	14.70	9.64	25.91	19.49	15.09	11.90	20.42
J	31.57	28.30	25.50	14.05	42.94	60.97	66.34	121.35	44.01	69.16	50.31	57.85	49.50
K_1	12.56	7.38	20.30	14.85	21.03	21.53	12.99	11.87	12.03	16.48	20.48	18.65	15.70
K_2	22.44	28.76	21.15	25.83	16.30	33.57	48.89	27.17	20.39	22.50	21.28	21.48	25.40
M_1	16.06	24.76	14.83	14.16	19.58	21.44	14.02	26.15	25.27	28.45	38.93	10.81	30.06
M_2	26.68	27.13	20.76	23.71	31.84	38.24	28.29	156.30	30.80	49.26	30.01	50.55	41.80
N_1	27.58	21.20	11.07	20.22	31.37	34.98	26.98	13.72	85.04	29.86	37.48	104.78	37.10
N_2	26.27	35.64	26.91	53.40	75.66	94.02	87.06	140.31	83.93	34.42	29.01	21.39	57.56
O_1	18.86	22.40	25.78	21.35	21.35	31.93	45.07	17.04	40.05	28.97	72.55	120.94	39.61
O_2	15.70	11.38	13.18	15.35	26.19	21.98	29.96	28.23	32.35	19.99	13.04	16.52	23.97
P_1	18.85	21.45	25.08	31.17	20.58	14.46	23.08	23.98	26.84	35.11	43.05	27.10	26.53
P_2	36.62	17.76	18.38	16.75	34.45	15.63	26.00	17.65	27.95	27.63	21.34	17.28	28.61
Q_1	21.06	18.44	19.58	9.63	9.09	18.91	18.55	20.51	16.83	20.59	34.21	8.39	19.31
Q_2	19.90	12.22	11.68	7.54	12.64	12.58	9.88	8.23	11.23	18.34	19.77	17.95	13.66
R_1	31.69	36.66	23.58	48.03	36.68	26.55	13.04	17.30	29.22	12.80	20.46	21.19	27.43
R_2	18.56	21.55	23.06	10.84	21.51	19.87	17.55	10.48	13.51	21.15	31.34	28.67	20.15
S_1	44.26	14.31	25.73	42.77	19.71	18.38	13.56	26.05	17.49	60.82	105.18	171.71	46.59
S_2	13.83	25.15	32.69	12.58	13.22	17.12	23.07	18.48	20.24	20.74	31.74	18.25	20.80
T_1	20.11	18.65	20.45	19.47	22.92	20.41	18.31	30.82	142.88	24.46	49.93	53.02	54.56
T_2	14.91	9.71	17.35	11.05	11.87	11.71	16.17	24.96	28.90	18.99	20.41	46.37	24.21
U_1	20.28	16.78	21.28	21.51	21.02	14.73	20.32	15.61	38.40	70.84	150.52	120.62	41.95
U_2	8.99	24.87	29.77	9.84	17.76	20.25	9.69	33.46	72.22	28.20	51.59	49.66	31.38
V_1	32.72	18.91	28.97	22.56	22.20	24.13	25.08	20.39	109.60	27.80	37.42	94.42	44.09
V_2	32.07	14.66	23.03	19.11	17.67	12.80	26.62	120.11	41.61	53.64	131.53	167.50	52.80
W_1	18.58	44.38	23.24	23.15	54.29	30.91	26.91	10.70	8.79	68.74	33.43	25.86	33.18

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
W_2	11.76	14.46	12.48	9.65	34.18	15.76	20.06	22.67	38.78	124.35	146.82	111.31	46.26
X	30.30	42.78	19.41	23.36	46.66	44.06	51.85	111.29	103.26	151.45	58.85	49.88	61.49
Y	18.31	17.55	12.75	15.94	29.86	16.47	46.71	22.59	34.08	91.84	26.63	27.07	30.48
Z_1	22.44	24.50	45.76	30.24	50.29	53.52	50.53	38.30	27.64	25.82	33.84	45.74	37.90
Z_2	31.82	26.79	19.26	19.72	19.10	16.09	13.64	18.46	18.12	44.11	20.96	14.23	22.09
Total Avg.	31.87	29.13	23.95	21.74	24.59	25.28	25.24	31.78	34.00	37.38	37.05	38.67	

Table 24 GCN Spectral with GRU layer: Average percentage of error by time of day in Monday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	35.00	24.96	28.64	31.75	47.13	44.65	50.03	21.50	37.69	24.21	22.54	25.61	33.99
A_2	36.25	25.31	12.14	25.76	14.69	29.47	28.66	19.71	22.77	26.98	14.13	17.46	23.98
AA_1	21.22	22.24	19.26	15.96	12.78	25.74	74.59	39.03	52.76	40.08	50.04	37.83	32.62
AA_2	18.36	19.88	6.14	7.27	44.95	31.36	55.67	8.87	25.20	25.29	35.95	26.33	26.83
AB_1	22.96	22.30	21.67	14.62	20.23	36.93	56.61	26.94	25.11	50.48	55.61	33.63	31.96
AB_2	37.30	19.18	21.11	13.22	67.17	61.66	15.15	30.38	25.40	18.28	23.78	33.45	30.02
AC_1	26.17	18.84	15.66	16.61	18.30	14.45	13.96	44.36	21.66	23.37	26.03	16.99	22.21
AC_2	14.30	18.39	25.95	31.75	28.84	19.85	11.58	25.62	33.43	29.29	27.06	24.36	23.50
AD	87.21	32.37	29.11	39.43	41.65	9.94	42.36	90.76	30.86	61.33	108.80	107.00	56.62
AE	17.52	17.34	55.93	61.28	53.72	34.26	27.75	69.91	52.72	44.77	79.27	34.00	46.80
AED	39.23	38.66	16.83	25.06	16.42	13.81	28.27	25.84	17.40	19.65	18.94	23.56	25.01
AF	69.04	28.39	120.18	45.33	25.84	30.38	35.71	9.32	18.78	25.00	41.64	22.98	39.00
AG	8.82	22.17	16.29	21.08	12.80	12.44	26.34	23.40	18.17	18.70	11.34	12.89	18.44
AH	24.07	26.55	35.32	15.33	19.68	14.72	14.87	13.11	20.62	24.39	24.34	33.01	22.38
AI	14.16	13.75	11.81	12.47	19.56	22.62	10.20	13.67	14.34	12.74	20.24	15.33	16.23
AJ_1	31.45	27.60	24.91	22.98	27.47	29.08	17.08	24.94	25.92	17.67	20.64	24.77	26.85
AJ_2	9.12	29.64	16.52	11.96	13.76	19.53	13.61	16.59	19.46	28.74	9.39	14.76	17.48
AK_1	8.82	13.60	11.82	35.52	36.05	45.16	46.43	41.41	31.57	56.68	125.25	45.28	39.68
AK_2	18.55	27.10	22.71	42.82	47.67	34.52	44.26	19.35	44.05	44.51	27.12	30.37	34.39
AL_1	12.37	11.95	20.19	17.58	13.74	12.33	22.46	25.96	25.76	72.23	59.13	48.23	31.15
AL_2	16.57	26.44	17.05	28.26	19.98	14.06	16.38	19.76	78.72	103.40	130.88	55.79	42.46
AM_1	19.48	24.22	22.20	13.81	14.46	15.70	14.23	40.81	34.16	51.64	57.79	31.92	27.48
AM_2	13.67	12.20	12.80	23.07	12.32	11.63	31.56	11.18	38.75	67.74	40.22	28.83	24.61
AO	14.41	23.52	21.35	36.35	32.57	20.59	35.40	41.77	70.49	102.76	94.58	72.60	48.41
AP	14.71	11.75	26.91	33.39	52.30	25.74	13.67	29.99	44.18	63.82	36.31	29.12	32.71
B_2	38.76	42.74	45.51	42.35	37.83	55.02	232.60	48.88	59.05	35.63	22.15	65.78	58.18
C_1	20.72	21.05	20.89	12.91	13.12	16.10	5.96	15.03	19.97	15.61	31.31	16.70	18.65
C_2	20.16	24.53	21.57	20.41	15.48	14.96	35.28	9.48	16.84	43.11	59.50	15.74	24.75
D_1	26.55	16.72	14.25	13.09	11.83	17.59	12.20	16.13	14.83	16.82	20.48	12.11	18.04
D_2	22.82	22.11	32.20	29.70	15.00	10.86	10.32	14.90	15.17	30.96	33.16	15.48	22.79

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
E_1	50.82	65.49	36.93	16.46	22.38	20.22	20.32	29.23	35.55	31.06	27.46	23.07	39.59
E_2	75.81	80.87	99.97	114.00	22.02	28.91	30.81	41.47	30.76	38.61	74.35	22.64	56.30
F_2	18.79	8.73	15.50	17.97	14.11	13.40	16.14	5.65	10.01	11.99	8.67	15.69	15.27
G_1	34.94	25.09	56.90	46.70	25.37	16.58	14.91	9.15	18.24	32.44	14.80	17.27	26.42
G_2	16.26	12.04	6.69	14.38	22.80	14.38	14.72	14.30	15.23	23.11	17.28	29.78	16.75
H_1	10.27	27.62	11.58	13.49	21.19	31.47	19.94	22.56	18.21	29.75	21.15	28.37	21.63
H_2	44.42	13.85	29.33	18.42	22.20	41.82	53.32	54.50	39.30	110.05	50.07	65.96	45.54
I	106.23	52.92	17.75	15.78	17.14	30.12	27.63	26.36	28.52	31.68	35.14	30.69	35.24
I_1	18.54	30.21	13.89	18.00	21.95	28.29	21.29	27.26	32.01	30.34	23.65	34.53	24.66
I_2	16.43	15.67	22.32	25.43	18.34	19.30	15.87	14.46	18.39	50.30	71.09	27.31	25.97
J	37.51	35.27	18.47	25.50	35.77	39.17	43.57	25.39	21.43	63.36	53.85	52.46	37.59
K_1	18.50	22.01	26.04	26.50	18.83	18.42	25.79	17.23	21.95	30.12	29.35	57.96	26.01
K_2	26.79	26.52	25.82	27.10	26.73	42.52	32.64	19.75	26.83	18.25	20.77	18.48	27.23
M_1	34.71	15.65	19.40	13.30	19.66	22.07	25.63	23.38	58.02	31.45	17.54	22.42	25.64
M_2	27.84	28.22	29.13	24.64	19.64	29.43	31.90	32.71	19.23	24.69	37.49	77.32	32.20
N_1	24.78	37.59	13.61	12.87	20.02	17.45	15.91	16.90	36.63	19.91	80.29	96.61	34.32
N_2	33.77	35.92	26.82	14.92	19.32	26.43	92.23	123.60	38.82	65.48	57.13	50.73	47.75
O_1	12.86	15.19	47.34	29.34	22.61	77.63	21.51	18.48	19.07	40.25	159.18	59.09	41.67
O_2	23.74	14.91	15.44	22.06	25.73	64.08	16.80	35.50	17.80	16.72	47.09	24.28	26.46
P_1	45.47	24.93	18.86	15.59	23.76	21.48	21.36	24.36	45.16	45.59	69.34	34.00	34.36
P_2	17.72	25.71	15.25	19.04	18.33	42.93	17.95	47.13	38.73	16.38	27.06	30.80	31.91
Q_1	18.08	26.92	9.98	21.02	22.94	20.78	26.52	57.35	24.52	23.24	24.85	27.63	24.36
Q_2	9.74	17.61	13.50	22.64	11.06	8.21	16.22	10.30	15.73	34.98	22.60	21.01	17.13
R_1	23.88	47.94	43.74	32.45	47.71	33.82	67.40	52.48	33.86	17.36	19.74	28.03	37.60
R_2	35.51	32.23	37.72	16.33	25.59	28.18	21.12	15.37	17.96	24.46	37.35	42.66	27.40
S_1	112.88	27.82	77.17	37.64	17.54	28.20	41.71	27.41	51.93	82.22	73.83	54.04	62.08
S_2	29.50	37.35	33.76	27.91	13.19	43.39	13.10	7.50	25.02	27.77	25.75	20.81	24.94
T_1	55.52	27.79	17.21	12.64	17.20	14.57	28.41	96.64	61.74	52.67	87.31	57.31	48.61
T_2	15.42	18.01	13.96	20.67	13.46	15.99	18.68	47.34	28.89	24.02	20.13	25.24	24.60
U_1	44.74	24.49	23.02	22.96	20.90	19.39	45.91	38.48	46.84	101.69	141.89	87.97	50.09
U_2	16.22	21.73	40.45	23.71	19.28	26.16	27.66	102.27	64.33	29.20	55.44	31.01	39.50
V_1	91.89	16.27	36.45	47.08	20.34	17.73	59.85	43.89	24.60	136.16	114.27	59.24	86.54
V_2	78.30	122.35	14.95	17.38	18.75	25.78	16.77	24.18	36.83	124.85	178.25	90.96	67.67
W_1	43.26	51.66	21.11	52.52	19.03	54.62	48.12	42.03	53.13	54.55	49.44	48.60	44.02
W_2	17.47	21.81	25.73	9.62	17.38	18.58	24.15	25.38	73.10	108.54	184.85	91.71	51.78
X	44.90	28.97	23.59	21.63	26.51	40.43	29.38	28.41	38.48	59.46	142.49	119.88	49.39
Y	17.68	20.72	19.01	25.70	29.06	23.33	26.81	26.87	25.78	20.31	70.01	48.01	28.90
Z_1	12.67	25.30	14.91	43.86	29.30	26.00	22.18	25.16	34.27	16.87	51.58	68.83	32.94
Z_2	10.92	17.21	24.99	17.04	13.27	16.49	10.17	20.04	21.35	64.84	74.63	51.78	27.65
Total Avg.	30.94	27.33	26.45	25.58	23.88	26.85	31.41	31.29	32.23	42.91	52.82	40.09	

Table 25 GCN Spectral with GRU layer: Average percentage of error by time of day in Tuesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	43.77	16.86	21.74	20.77	51.35	78.55	60.53	56.95	64.75	37.57	22.01	22.19	41.92
A_2	28.21	32.98	24.10	22.23	27.68	27.31	24.29	42.98	20.14	31.12	22.43	36.18	29.12
AA_1	15.73	18.19	27.06	17.13	14.52	18.00	52.26	72.47	47.70	93.63	55.16	46.55	38.18
AA_2	23.62	9.83	16.60	18.20	29.76	45.37	70.79	56.85	34.59	35.54	38.74	32.51	35.13
AB_1	21.87	21.38	22.80	28.79	16.98	13.04	24.93	44.15	68.47	37.20	30.01	51.37	31.96
AB_2	25.03	26.13	15.29	11.62	21.46	28.13	39.19	32.10	128.72	55.36	32.48	36.28	36.15
AC_1	28.28	24.63	27.78	23.87	16.30	10.09	15.75	35.64	35.37	12.73	18.83	124.06	30.71
AC_2	22.73	24.81	19.37	22.48	24.60	16.60	50.61	35.94	26.43	30.02	29.05	165.31	36.72
AD	43.15	28.04	30.03	32.14	18.73	23.16	42.11	80.97	65.56	73.52	66.58	30.41	45.28
AE	29.41	10.52	21.52	29.08	39.01	36.91	26.28	49.18	58.99	88.93	124.25	31.91	44.11
AED	51.87	40.63	22.40	28.83	9.53	14.42	40.42	28.33	45.50	31.84	29.97	28.16	30.28
AF	31.96	34.26	24.80	97.65	65.46	17.43	29.49	21.85	30.41	29.38	21.02	19.17	34.51
AG	16.12	12.20	33.01	18.20	9.22	18.87	11.56	14.94	21.90	18.23	20.24	13.39	16.99
AH	30.41	25.52	21.24	21.85	10.02	17.77	15.91	31.33	25.74	14.21	18.64	34.83	22.66
AI	28.72	18.95	23.01	20.42	14.02	26.22	17.26	14.20	33.27	13.06	12.62	11.92	21.36
AJ_1	34.53	34.49	41.85	47.29	12.32	23.11	22.44	23.23	26.64	43.79	51.08	28.04	32.39
AJ_2	9.23	17.71	15.08	19.80	29.82	14.32	14.16	15.37	28.61	23.04	9.69	15.00	17.73
AK_1	25.76	12.72	12.36	11.28	55.03	32.88	59.22	69.39	21.81	24.88	21.82	39.74	33.16
AK_2	26.20	33.93	31.30	38.42	56.05	44.49	47.57	26.07	11.65	27.33	103.17	24.54	39.52
AL_1	16.67	15.55	12.80	23.75	13.50	13.67	15.80	23.03	19.74	49.30	40.33	41.21	23.87
AL_2	21.80	17.35	16.09	15.23	16.20	20.27	19.07	15.38	51.85	41.63	82.25	84.22	32.13
AM_1	23.44	34.98	12.41	15.70	20.85	12.96	13.28	21.91	53.92	42.74	47.45	38.99	28.18
AM_2	14.91	9.61	10.13	17.42	20.99	15.12	20.63	15.43	24.74	65.98	158.55	57.29	34.83
AO	19.13	16.44	12.01	17.21	23.97	40.81	43.75	34.51	107.38	75.51	91.46	119.42	51.44
AP	9.05	11.58	12.84	26.62	32.31	28.41	36.53	24.34	53.32	50.31	41.94	27.80	29.53
B_2	18.42	31.38	40.97	58.33	24.34	115.41	83.96	53.69	23.42	34.11	58.49	50.77	50.41
C_1	17.32	23.82	14.35	23.30	32.99	42.69	10.68	38.61	21.74	37.85	21.52	19.61	24.81
C_2	21.04	21.55	17.14	11.78	17.04	17.88	14.73	26.86	17.06	25.59	20.90	16.93	20.53
D_1	30.71	16.62	22.51	32.30	4.22	19.02	16.10	25.03	17.05	20.36	12.28	19.92	21.67
D_2	36.09	16.38	14.29	18.42	14.48	12.93	14.79	18.93	19.38	34.86	24.02	27.39	24.68
E_1	58.33	72.12	37.40	39.53	28.66	21.31	29.81	28.31	36.81	43.60	27.07	18.42	39.06
E_2	81.48	80.92	123.32	54.97	21.74	20.75	20.14	26.75	37.48	83.40	24.28	22.99	49.57
F_2	14.06	15.37	23.40	16.73	12.08	10.83	14.85	9.12	17.91	14.97	9.33	13.42	14.79
G_1	38.24	43.36	35.05	21.15	18.63	15.64	28.23	18.19	29.03	18.10	18.51	18.87	25.74
G_2	25.51	14.60	12.01	27.75	20.64	6.43	15.18	17.41	24.55	21.68	15.17	10.60	18.36
H_1	18.35	14.23	21.21	19.50	28.06	9.74	22.45	21.65	21.38	25.35	29.70	22.29	22.94
H_2	32.60	16.64	26.29	33.14	15.33	23.44	41.89	28.20	36.49	70.99	69.65	71.21	42.80
I	105.02	222.48	24.42	16.10	33.39	159.95	25.95	31.33	49.95	48.55	66.75	23.54	67.16

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
I_1	31.83	16.80	20.63	26.70	17.55	29.19	34.95	24.85	15.39	37.88	28.94	17.21	25.21
I_2	26.92	18.03	20.29	21.42	15.69	14.13	18.04	30.68	16.99	18.18	24.90	33.61	21.37
J	34.06	26.19	31.92	27.46	37.06	32.73	60.59	28.66	36.47	45.14	41.60	50.74	36.91
K_1	26.11	27.69	21.65	21.60	21.37	14.38	21.22	16.11	26.92	19.00	15.53	39.92	23.62
K_2	38.22	40.93	24.89	36.58	42.68	66.28	28.36	24.93	28.12	29.13	39.38	29.98	36.46
M_1	38.50	17.00	26.92	14.35	18.11	26.88	18.94	22.49	25.92	62.15	23.95	19.65	27.31
M_2	27.77	34.33	20.80	21.55	20.23	21.28	27.37	34.60	32.83	35.75	45.68	60.74	31.63
N_1	15.34	10.81	24.08	10.54	20.18	18.12	16.20	16.53	20.92	29.82	53.14	21.30	21.76
N_2	36.91	24.62	52.29	92.33	63.86	68.47	68.49	104.22	54.00	35.82	44.82	57.22	56.76
O_1	19.33	35.09	20.35	40.50	42.83	30.95	41.73	35.75	38.18	56.60	49.53	49.11	37.52
O_2	20.52	17.41	32.92	41.12	41.78	38.07	24.27	18.84	35.57	73.64	46.04	50.83	35.76
P_1	36.84	44.87	19.13	20.01	19.65	21.10	16.24	35.46	59.36	58.23	21.28	20.62	33.14
P_2	17.44	17.45	23.33	19.68	24.67	21.12	33.91	49.93	48.50	58.26	26.16	63.80	39.98
Q_1	16.62	11.75	14.23	20.36	10.50	15.97	16.99	41.19	14.30	11.30	14.32	25.22	17.50
Q_2	7.62	17.07	15.16	11.05	10.16	7.83	8.68	20.41	16.92	25.33	16.96	21.88	15.33
R_1	40.73	56.63	20.65	18.28	49.24	59.20	45.60	49.45	77.59	27.18	22.02	27.79	41.01
R_2	14.82	12.87	17.26	14.92	24.05	12.00	9.36	12.87	22.34	31.17	22.24	31.21	19.07
S_1	99.92	25.85	37.75	41.62	21.01	21.68	65.05	28.11	66.58	51.93	69.11	41.82	49.80
S_2	20.31	27.11	12.12	16.73	19.60	25.54	28.46	35.51	49.55	53.69	80.03	40.61	33.16
T_1	37.70	21.46	26.34	20.11	37.78	20.86	12.93	124.45	84.67	63.08	33.59	33.43	47.87
T_2	24.64	14.42	10.29	17.54	13.16	15.73	37.13	49.88	45.59	24.90	23.59	19.86	25.44
U_1	39.00	27.20	20.17	28.58	67.31	23.50	35.50	31.29	51.56	102.64	115.94	71.32	49.92
U_2	54.50	22.89	11.74	10.02	11.75	16.53	23.26	93.73	91.75	19.22	14.75	16.93	34.07
V_1	25.93	16.83	29.03	18.62	19.55	16.01	19.22	22.63	64.35	11.87	28.11	37.40	39.69
V_2	31.37	47.95	13.53	22.01	21.64	16.83	38.33	21.62	64.59	103.22	110.61	77.81	47.59
W_1	20.00	36.00	34.75	20.94	41.95	39.78	22.39	32.72	30.99	86.06	88.14	25.06	38.93
W_2	25.08	12.99	18.99	13.74	14.91	14.75	21.22	22.32	84.18	130.32	80.51	59.21	42.02
X	36.79	30.64	26.61	33.17	13.27	32.39	34.19	55.89	64.76	87.68	69.54	219.43	56.51
Y	23.43	16.25	17.73	15.55	34.67	28.47	45.42	108.95	19.43	25.27	21.15	40.78	32.87
Z_1	21.00	19.77	24.19	20.24	36.14	19.97	27.31	21.24	25.85	50.59	103.46	59.79	35.32
Z_2	14.23	22.47	11.39	19.73	20.35	40.23	23.54	91.18	43.25	62.52	20.09	13.40	30.42
Total Avg.	29.89	27.68	23.78	25.74	25.71	28.17	30.11	36.77	40.82	44.26	43.23	41.65	

Table 26 GCN Spectral with GRU layer: Average percentage of error by time of day in Wednesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	32.93	19.50	19.33	16.98	33.84	40.71	49.28	61.54	61.54	29.58	41.76	27.84	36.60
A_2	34.91	18.71	34.29	13.64	24.89	17.59	18.82	42.17	32.14	14.72	22.39	38.38	27.02
AA_1	25.23	27.06	25.14	14.84	15.78	21.32	51.42	47.63	49.10	101.94	70.90	40.24	39.77
AA_2	42.42	21.36	27.00	30.05	57.93	40.20	69.97	94.65	86.49	80.89	44.90	27.12	50.93

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AB_1	23.77	24.06	22.32	24.89	14.42	12.68	30.54	48.30	35.39	20.42	80.01	59.98	33.34
AB_2	27.90	20.35	19.87	17.45	20.66	22.11	29.96	53.30	64.57	33.04	110.03	21.33	35.25
AC_1	32.70	22.19	30.24	23.43	17.01	14.27	16.44	30.89	20.97	19.73	39.44	47.95	25.59
AC_2	21.39	11.86	37.10	25.25	29.78	21.09	9.62	33.59	45.25	34.75	84.28	27.02	29.93
AD	54.13	40.70	38.53	19.95	27.24	20.20	37.15	90.37	85.00	46.87	41.73	70.67	48.17
AE	23.92	28.21	44.43	47.78	44.06	46.82	26.80	43.42	76.47	62.16	66.80	134.45	51.53
AED	84.04	22.50	22.92	20.78	24.00	22.76	32.55	19.65	18.51	18.74	22.81	29.92	31.61
AF	36.84	18.08	122.99	65.42	14.54	25.66	14.89	23.08	30.31	31.56	28.20	21.92	35.11
AG	21.70	13.37	10.15	13.37	15.61	18.49	25.56	21.38	16.21	17.29	23.01	23.94	17.96
AH	19.24	28.92	21.78	24.93	18.13	24.95	17.45	50.31	28.65	22.67	37.18	34.18	27.34
AI	30.46	17.48	18.94	22.38	13.63	28.44	9.06	20.46	14.35	12.04	15.84	20.92	19.41
AJ_1	39.23	31.08	13.74	18.03	16.57	17.72	13.47	26.25	45.04	61.01	67.46	51.15	35.60
AJ_2	15.97	21.08	16.60	23.61	9.81	9.45	16.45	19.15	14.18	15.16	18.89	16.00	16.39
AK_1	16.22	9.66	12.04	22.52	18.49	20.52	36.48	62.60	43.47	35.33	81.70	49.56	33.13
AK_2	24.73	33.95	29.69	63.46	68.70	52.55	63.41	23.53	36.05	18.18	39.06	28.34	41.58
AL_1	12.90	16.51	10.88	6.70	9.35	12.67	23.97	15.81	20.86	46.99	36.15	29.49	26.60
AL_2	15.14	19.52	21.68	8.96	22.07	15.95	22.92	38.45	66.50	34.91	102.70	41.10	34.45
AM_1	27.39	20.95	19.62	11.29	13.99	13.56	14.63	28.19	31.91	43.52	31.65	37.04	23.65
AM_2	10.48	17.07	11.12	58.74	16.61	15.60	36.25	16.93	55.05	62.11	61.95	113.59	37.74
AO	16.67	23.61	24.22	22.52	23.36	22.60	30.18	25.56	73.84	76.68	108.16	86.41	44.34
AP	13.58	13.33	23.11	37.18	28.11	23.72	14.25	29.19	25.80	25.72	18.21	21.30	22.36
B_2	39.08	77.75	34.14	17.70	53.36	31.88	46.74	23.91	42.07	33.38	30.82	24.02	37.59
C_1	27.53	31.97	65.54	38.24	45.41	13.07	36.94	39.29	74.50	50.71	60.85	96.08	45.63
C_2	15.26	17.09	64.32	20.06	58.07	15.27	17.06	11.25	42.19	41.73	31.03	41.29	32.37
D_1	58.33	23.62	28.93	12.05	21.27	13.33	15.93	37.04	17.19	15.97	29.69	24.01	25.94
D_2	28.32	25.39	36.68	19.93	17.09	19.51	22.22	56.57	32.47	31.25	35.22	29.96	29.62
E_1	50.31	85.92	51.75	20.00	28.65	31.14	26.99	25.39	24.66	30.74	57.55	31.23	46.91
E_2	63.16	55.74	77.47	68.80	43.17	31.72	23.34	34.51	37.39	86.72	46.07	93.94	57.12
F_2	11.96	10.05	11.06	24.66	7.55	10.31	12.50	8.32	11.05	7.86	14.21	8.68	12.40
G_1	26.11	54.44	34.01	35.96	14.00	21.88	18.22	26.27	31.39	12.22	22.63	55.22	28.89
G_2	18.34	9.41	10.30	14.14	24.59	16.93	15.25	27.15	17.55	36.71	41.32	38.16	22.10
H_1	18.66	19.77	18.99	25.86	30.36	18.52	26.51	35.50	36.91	32.60	35.77	26.33	26.87
H_2	47.97	21.99	25.60	33.11	17.86	28.55	31.72	67.19	52.92	16.36	28.44	38.54	33.69
I	95.76	105.44	131.64	55.39	83.07	20.51	45.51	110.17	75.45	93.36	73.78	24.74	72.94
I_1	25.59	21.53	17.31	27.91	21.34	17.55	27.26	20.94	31.86	29.02	37.09	16.26	24.85
I_2	21.28	14.76	15.81	24.46	18.92	18.65	12.57	28.87	48.37	67.86	36.37	20.66	27.22
J	37.08	34.24	37.08	28.71	16.57	22.98	39.50	53.71	31.75	32.89	24.83	26.34	32.22
K_1	29.16	15.33	29.77	22.57	22.05	38.55	24.30	39.69	59.73	31.50	20.11	17.54	30.64
K_2	30.28	23.46	23.65	37.07	25.88	44.86	23.20	68.83	20.97	18.02	21.85	22.41	32.61
M_1	20.34	20.81	35.05	14.82	24.83	14.99	25.70	35.19	100.72	77.36	46.28	41.54	37.39
M_2	45.03	32.59	27.02	32.98	34.95	23.19	23.58	103.28	51.20	67.03	46.68	75.43	45.47
N_1	22.60	17.72	22.53	14.11	17.21	12.99	18.49	24.87	114.18	43.19	111.57	57.14	39.17

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
N_2	29.93	28.33	65.23	22.03	14.14	16.54	48.96	41.96	58.28	48.37	54.50	35.53	38.44
O_1	20.43	15.58	32.55	19.64	20.81	51.42	30.98	47.67	59.82	90.76	54.90	104.57	44.29
O_2	16.31	20.99	43.75	28.29	40.61	48.57	27.03	50.29	83.71	81.21	66.50	160.57	53.48
P_1	66.91	40.47	24.21	23.44	23.76	40.42	26.27	39.24	47.19	38.31	44.08	42.48	43.14
P_2	27.89	28.39	10.65	23.52	13.76	21.42	38.48	49.05	101.77	48.81	70.64	51.61	43.56
Q_1	47.69	16.66	29.29	12.22	9.56	15.21	38.58	23.92	27.20	25.59	16.21	17.01	23.21
Q_2	21.15	16.33	15.43	8.88	14.42	8.58	18.24	10.71	15.87	16.51	23.94	22.01	16.55
R_1	41.73	46.94	16.10	25.74	48.37	69.55	39.01	32.19	22.61	29.89	25.41	30.60	36.94
R_2	24.79	14.56	18.56	27.63	14.81	19.10	21.83	17.00	36.05	31.89	51.79	63.31	27.95
S_1	123.31	49.30	38.80	10.91	31.53	34.46	45.16	45.21	84.00	49.41	63.79	58.04	53.34
S_2	33.72	24.67	12.40	14.25	18.67	31.84	16.94	22.77	38.11	91.42	136.82	62.97	41.52
T_1	15.37	14.27	14.87	13.51	14.93	21.68	24.12	68.22	123.68	39.76	82.93	60.92	43.84
T_2	26.42	17.26	12.10	17.44	14.47	15.55	20.53	26.25	44.23	21.00	83.51	29.09	30.93
U_1	49.91	22.70	26.96	27.47	45.59	32.40	51.68	46.31	84.10	93.32	124.27	128.39	58.73
U_2	24.56	25.00	16.75	14.89	14.80	16.92	44.74	43.92	45.07	23.72	37.52	19.93	29.54
V_1	23.46	20.35	25.85	16.64	13.17	15.04	21.85	45.54	157.04	18.19	110.05	46.47	47.86
V_2	41.41	35.91	19.73	14.39	22.63	16.46	16.78	16.06	95.48	128.99	194.03	185.31	62.24
W_1	52.72	17.65	22.18	45.99	20.65	33.46	62.37	53.67	57.75	65.50	44.22	68.11	42.97
W_2	15.50	10.29	20.25	12.99	15.39	15.29	25.55	25.25	84.36	129.00	104.91	38.70	43.73
X	27.75	28.46	104.94	31.58	60.57	27.44	43.68	101.33	113.10	103.29	65.54	109.83	69.93
Y	18.22	25.59	10.91	33.64	53.66	18.13	35.50	58.95	51.03	60.24	94.08	42.90	39.87
Z_1	20.73	22.72	23.01	35.12	23.17	47.81	36.63	21.13	46.46	65.79	118.65	69.56	42.66
Z_2	18.92	7.52	16.78	28.60	22.64	29.30	31.83	28.48	51.41	56.60	91.68	29.20	33.26
Total Avg.	32.24	26.23	30.40	25.38	26.04	24.56	29.16	39.99	51.60	46.09	56.63	49.08	

Table 27 GCN Spectral with GRU layer: Average percentage of error by time of day in Thursday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	33.50	24.31	27.04	21.01	16.86	45.10	41.26	20.96	62.34	47.45	28.22	45.10	35.28
A_2	34.94	21.90	32.83	25.23	18.70	32.78	34.26	19.99	49.23	62.73	23.95	39.42	33.36
AA_1	18.04	19.94	7.59	13.49	28.51	12.86	48.66	66.86	69.23	55.73	117.08	10.13	37.90
AA_2	31.84	13.39	21.21	51.95	84.34	36.55	54.58	118.63	95.83	114.55	35.34	50.26	58.73
AB_1	14.89	24.73	27.13	29.53	23.04	20.74	31.28	54.28	91.32	62.28	78.17	60.36	42.32
AB_2	12.77	21.58	18.12	50.53	38.75	72.55	41.29	57.19	133.05	221.34	49.98	72.03	63.01
AC_1	17.29	29.24	22.86	20.92	18.50	12.01	23.39	20.43	50.59	16.56	37.10	27.78	25.13
AC_2	20.52	13.34	23.01	21.13	17.56	23.43	53.56	18.27	20.97	45.91	23.36	41.24	25.92
AD	18.14	17.39	24.49	23.05	43.14	33.54	32.59	46.78	38.76	39.81	82.44	38.50	37.37
AE	25.04	18.81	16.18	15.58	44.94	48.79	25.79	58.01	27.91	96.99	131.98	24.69	43.18

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AED	36.75	14.61	25.29	21.97	13.23	30.67	25.10	29.04	54.11	45.32	24.91	16.04	29.01
AF	284.41	22.79	32.95	36.68	36.55	28.71	33.07	60.63	17.11	31.73	18.89	46.68	63.47
AG	13.58	14.16	12.86	22.75	10.94	15.80	25.17	30.32	42.48	23.13	24.95	15.06	20.58
AH	18.91	23.05	18.53	15.05	19.31	16.23	27.83	65.20	17.67	20.23	43.02	52.90	28.22
AI	13.42	22.55	6.12	17.38	12.49	10.80	27.60	44.02	9.23	13.29	14.46	12.10	17.93
AJ_1	49.54	26.66	18.07	20.40	15.61	20.21	20.70	37.01	20.35	66.28	81.04	26.09	33.13
AJ_2	11.34	10.10	11.57	15.47	16.41	13.35	11.38	34.36	53.61	26.22	13.68	23.70	20.26
AK_1	25.28	14.83	14.98	20.53	43.44	34.35	69.76	47.54	30.97	43.58	65.24	24.42	35.26
AK_2	22.07	26.74	22.40	43.78	34.77	44.93	49.98	24.54	42.83	28.15	57.46	27.90	35.07
AL_1	24.50	8.09	11.00	17.67	11.94	14.19	23.90	21.90	22.53	34.35	72.47	37.60	27.00
AL_2	16.80	11.59	11.56	14.80	16.53	26.67	24.32	48.15	55.18	39.80	77.82	46.35	34.01
AM_1	12.76	21.23	8.20	17.74	15.32	15.81	13.69	45.77	43.11	27.57	20.02	37.34	22.87
AM_2	15.39	28.67	17.10	25.93	10.82	34.88	37.78	31.10	33.18	88.74	43.09	22.90	30.88
AO	19.50	25.42	16.40	51.07	16.67	26.84	24.15	85.19	83.00	48.71	39.50	92.54	44.63
AP	17.17	6.12	47.07	29.02	23.52	28.97	30.65	52.89	45.26	39.78	26.48	26.93	30.75
B_2	30.23	23.66	34.65	53.52	28.53	35.54	48.27	55.80	55.19	30.69	42.03	76.87	43.43
C_1	28.46	22.96	29.22	68.10	25.39	21.03	48.84	22.08	25.09	25.36	57.23	52.86	34.83
C_2	33.21	15.35	65.39	41.86	34.39	32.26	29.26	18.86	91.40	12.72	69.50	85.26	43.19
D_1	26.97	17.49	37.41	12.93	13.79	17.17	29.39	58.55	36.84	31.21	85.55	54.48	36.43
D_2	36.91	10.44	19.85	27.15	23.84	13.20	39.29	84.43	19.02	27.00	40.77	31.21	31.89
E_1	88.73	52.86	23.61	35.61	24.44	12.99	21.34	31.06	37.10	27.25	51.97	20.26	37.67
E_2	75.82	70.74	77.76	62.45	20.48	42.71	66.83	39.92	15.02	52.67	63.13	47.10	53.27
F_2	26.00	7.11	3.04	19.13	17.76	10.00	9.50	25.05	29.70	9.53	24.35	18.74	16.78
G_1	65.65	26.58	43.56	29.53	21.73	13.67	21.41	12.05	40.28	36.63	56.91	28.44	34.84
G_2	11.04	18.81	10.85	13.76	21.59	13.59	18.72	29.23	52.72	47.68	75.20	64.71	32.16
H_1	22.40	14.82	3.34	23.04	15.73	25.52	35.80	51.03	52.53	42.05	18.91	26.72	28.29
H_2	20.41	20.86	11.57	18.23	15.89	14.66	26.80	50.65	46.04	42.04	45.13	76.94	33.92
I	105.89	197.26	44.26	106.33	37.52	35.04	24.09	20.28	29.19	48.29	83.35	57.41	64.49
I_1	18.67	24.97	14.34	18.31	22.18	19.85	38.91	49.62	19.64	37.24	10.69	34.59	25.67
I_2	18.59	21.48	22.18	20.63	23.25	20.91	38.19	145.25	79.58	127.83	90.67	83.33	56.45
J	25.75	24.38	11.81	21.05	37.83	28.72	40.85	63.00	9.44	39.77	30.77	36.70	31.00
K_1	34.23	15.29	18.95	20.87	11.79	13.93	23.21	28.79	18.18	19.99	42.78	30.49	23.78
K_2	30.51	35.75	20.35	47.62	29.73	17.03	28.37	41.40	18.82	23.97	54.40	19.91	33.38
M_1	22.76	19.06	16.40	22.04	15.22	21.45	29.41	25.19	157.57	85.98	42.97	28.42	39.79
M_2	24.06	31.97	23.42	33.55	35.04	61.79	83.72	80.79	109.67	60.31	55.30	101.34	56.93
N_1	11.22	11.71	8.67	15.74	21.16	9.55	33.60	51.06	43.83	154.17	17.04	29.73	34.34
N_2	35.90	59.61	64.55	79.59	76.10	50.63	37.31	113.99	81.03	86.80	24.82	38.78	59.99
O_1	16.11	7.07	37.19	22.31	24.34	39.09	34.38	60.53	74.60	55.45	17.81	24.70	33.32
O_2	16.36	13.22	37.04	54.35	47.42	13.43	28.91	83.48	67.34	32.33	52.07	50.55	39.70
P_1	31.50	12.11	23.72	27.03	15.82	16.91	35.11	32.28	29.44	21.98	42.79	65.01	33.09
P_2	17.17	15.10	22.59	36.08	20.12	27.69	30.05	114.21	62.35	41.31	49.24	50.69	41.27
Q_1	8.49	31.95	9.28	18.79	15.37	26.54	50.39	19.41	19.75	22.71	20.55	20.36	21.70

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
Q_2	20.42	12.00	16.45	14.17	23.14	15.42	18.26	21.84	32.99	48.23	34.01	37.84	24.05
R_1	35.01	66.49	18.77	51.35	26.17	61.98	52.12	33.52	15.38	24.43	30.49	28.38	41.55
R_2	16.13	27.38	18.32	12.08	26.11	22.43	33.60	18.71	21.18	13.27	56.96	82.74	30.14
S_1	139.24	21.23	25.88	29.71	19.57	16.69	30.13	35.56	54.98	42.29	45.07	22.95	42.86
S_2	25.25	35.93	16.73	30.52	40.48	16.54	31.98	53.70	40.44	60.19	89.04	64.01	42.83
T_1	37.62	35.33	33.95	18.30	22.49	17.09	25.69	66.32	34.64	35.15	67.33	12.03	38.22
T_2	12.65	14.83	10.36	43.26	18.41	12.18	24.33	20.28	319.52	160.06	101.11	30.17	69.46
U_1	64.10	28.52	23.13	23.17	27.31	52.17	66.36	40.09	77.41	109.62	150.62	114.07	62.77
U_2	25.98	15.04	13.09	25.88	35.10	23.74	31.02	58.90	96.45	99.83	67.88	42.33	47.15
V_1	28.71	16.83	19.53	17.43	15.43	27.80	46.81	38.35	26.63	289.57	36.33	19.42	83.64
V_2	37.52	63.20	20.69	17.59	19.18	22.67	47.55	25.53	31.29	366.32	139.09	73.77	69.24
W_1	34.65	27.99	12.34	29.09	37.97	53.57	31.13	50.95	36.41	52.40	58.30	47.31	37.99
W_2	14.70	35.49	10.16	9.85	25.02	14.77	15.55	23.21	88.00	122.23	100.45	88.50	44.77
X	47.58	27.51	31.58	31.47	45.70	76.96	118.30	115.43	214.35	111.75	81.77	366.45	103.48
Y	14.82	127.16	19.27	28.12	21.55	29.41	45.74	55.58	62.12	50.18	93.75	125.64	53.59
Z_1	39.77	36.28	21.49	23.92	27.38	31.56	22.21	38.04	20.33	93.18	109.08	49.12	42.07
Z_2	29.65	26.74	28.01	31.21	41.47	17.46	43.46	76.45	78.29	74.83	28.09	50.35	41.29
Total Avg.	33.55	27.85	22.74	29.41	26.10	27.07	35.77	48.11	54.81	62.85	54.87	49.69	

Table 28 GCN Spectral with GRU layer: Average percentage of error by time of day in Friday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	15.14	39.19	34.74	46.27	24.81	23.50	62.17	55.49	29.76	39.41	38.67	24.43	34.69
A_2	27.11	38.26	36.93	37.76	38.13	37.50	38.94	24.23	41.56	31.60	48.44	46.97	37.12
AA_1	17.02	7.52	20.72	17.80	16.70	19.89	25.53	60.06	88.21	141.20	108.55	51.90	45.53
AA_2	12.98	13.84	23.56	17.51	23.69	21.21	31.44	32.54	30.79	46.13	48.40	33.64	27.49
AB_1	13.83	14.25	14.92	19.08	15.92	23.52	39.94	48.63	58.95	95.63	68.75	65.38	38.25
AB_2	18.28	22.47	25.15	54.82	42.88	24.61	18.78	32.46	74.91	47.31	36.20	24.11	34.40
AC_1	39.75	32.62	19.70	14.78	14.84	18.11	17.99	24.82	35.87	40.33	51.77	25.96	30.86
AC_2	37.23	19.39	32.41	22.69	19.70	11.55	11.58	9.48	75.61	26.26	20.79	25.29	26.25
AD	60.00	61.99	40.10	20.76	21.97	18.17	32.66	24.13	36.25	32.46	29.15	41.59	41.02
AE	31.02	23.24	34.16	33.51	18.48	26.58	16.82	21.90	18.91	22.31	19.82	24.50	25.54
AED	25.88	13.37	11.99	25.16	22.42	18.22	29.06	13.48	25.06	22.17	23.33	12.37	20.95
AF	29.73	45.22	119.55	32.87	47.08	16.01	30.70	24.65	22.72	15.64	28.57	64.29	68.97
AG	14.30	18.92	18.79	23.26	15.90	15.40	37.29	16.33	12.57	18.61	23.55	28.80	20.03
AH	21.64	20.27	23.99	18.76	27.55	28.33	52.67	77.01	39.27	49.58	72.77	49.74	40.02
AI	16.18	16.08	9.84	19.01	15.48	17.38	13.72	10.82	8.83	24.98	17.57	27.43	17.70
AJ_1	60.79	15.39	12.75	15.85	9.36	10.70	16.01	23.86	13.24	15.63	15.91	17.79	21.43
AJ_2	21.16	13.86	16.44	24.56	15.40	19.76	27.15	17.83	27.50	19.37	23.16	14.92	19.89
AK_1	14.55	33.21	28.47	16.01	22.06	23.48	19.56	17.79	39.45	18.54	17.11	16.10	22.80

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AK_2	31.38	40.36	18.54	14.26	14.32	16.41	22.94	23.80	30.31	27.39	20.04	19.27	24.40
AL_1	15.43	20.77	19.34	14.49	13.83	16.85	16.74	27.45	22.63	18.00	13.19	19.34	20.23
AL_2	13.69	23.95	25.53	13.32	13.52	15.95	19.21	23.37	20.79	32.96	24.72	12.45	21.82
AM_1	17.44	16.22	18.63	21.25	21.97	24.59	18.49	12.85	78.33	39.31	46.74	23.63	27.17
AM_2	18.93	17.74	8.28	17.12	18.10	18.65	11.20	14.27	21.51	14.25	25.31	26.84	17.45
AO	146.61	48.83	26.37	25.25	32.23	49.20	28.79	47.63	62.34	94.49	59.14	37.36	52.33
AP	21.19	16.40	11.08	15.30	27.14	24.95	18.65	23.05	22.04	15.46	10.82	16.00	18.98
B_2	99.36	42.91	60.33	56.16	39.32	31.16	39.23	81.37	81.97	82.64	88.79	63.28	62.00
C_1	24.09	19.33	13.68	23.82	13.27	22.25	20.90	17.06	16.41	17.74	34.77	23.76	20.63
C_2	23.78	41.83	22.30	13.56	12.34	43.95	19.15	34.42	16.43	22.99	50.42	13.97	25.67
D_1	18.95	16.85	11.32	17.98	15.19	13.15	18.20	9.46	15.88	22.49	21.49	15.42	16.09
D_2	17.77	18.51	13.50	20.53	16.27	13.05	26.46	15.38	17.38	16.29	20.49	21.45	19.91
E_1	47.38	19.84	23.15	19.93	16.28	19.71	22.00	23.52	24.39	19.48	21.59	21.23	23.22
E_2	14.71	16.87	13.34	29.37	33.31	33.48	23.50	17.07	40.83	29.64	19.77	20.79	26.39
F_2	12.62	15.65	11.90	11.64	9.78	9.70	19.73	12.87	8.94	11.27	18.05	8.10	12.76
G_1	14.92	16.77	18.37	18.75	18.86	15.75	16.24	18.73	22.39	16.87	13.15	12.71	17.00
G_2	14.17	23.63	17.07	15.38	19.28	10.14	9.99	12.51	19.34	27.97	15.52	11.84	16.90
H_1	14.90	24.90	23.51	15.21	45.08	47.01	14.19	18.57	15.58	19.42	23.50	24.64	23.41
H_2	30.35	24.36	26.90	34.88	31.50	57.18	25.25	14.44	34.81	23.48	23.05	20.13	29.06
I	25.59	24.99	15.47	19.33	22.34	19.18	25.54	66.18	17.11	31.09	26.31	26.04	27.92
I_1	27.63	10.88	37.89	18.04	30.92	48.62	41.95	48.40	65.53	74.86	44.13	21.93	37.91
I_2	25.90	11.28	22.77	11.03	37.72	88.31	103.72	105.43	107.24	122.87	46.28	28.49	56.48
J	36.63	19.11	23.68	28.07	25.49	31.46	43.04	37.15	37.01	44.81	29.65	35.10	32.06
K_1	43.57	11.06	13.76	24.24	42.23	68.53	45.89	98.48	107.56	61.25	64.17	87.20	52.67
K_2	72.44	33.05	26.42	29.40	24.12	37.62	27.02	31.96	33.84	37.33	28.43	33.11	33.94
M_1	25.37	22.09	16.45	33.28	23.34	31.66	17.31	57.50	24.13	35.35	19.59	19.80	29.74
M_2	24.87	34.34	35.74	55.42	90.35	121.59	132.64	205.64	177.01	154.94	149.11	70.38	98.85
N_1	36.15	27.07	12.54	18.43	27.81	30.63	54.95	18.97	17.80	16.01	19.40	19.97	32.62
N_2	25.64	24.60	45.25	85.95	71.54	106.68	147.28	150.58	73.91	42.45	39.43	39.49	67.65
O_1	53.26	20.46	25.31	49.75	66.49	42.10	98.68	294.87	54.78	42.79	35.60	31.56	65.36
O_2	124.44	22.06	68.09	59.60	111.35	76.61	124.45	68.20	56.17	98.68	35.68	64.38	71.25
P_1	61.00	23.28	34.85	22.89	39.28	32.39	59.27	49.04	63.16	124.44	96.10	106.66	59.16
P_2	15.15	16.91	33.98	26.04	25.40	29.48	19.11	33.73	89.61	127.21	103.05	70.75	48.16
Q_1	13.96	8.65	14.95	11.29	13.18	12.92	17.06	24.38	17.33	11.93	23.99	16.65	16.05
Q_2	17.65	14.75	14.47	12.27	14.85	11.77	8.62	16.48	21.61	42.19	29.78	17.22	18.74
R_1	17.03	33.00	16.86	19.57	15.23	23.61	22.63	13.39	18.40	20.57	25.04	27.94	20.69
R_2	14.46	16.50	16.16	17.10	16.45	37.44	20.97	12.57	20.24	31.62	36.40	10.81	21.10
S_1	30.86	30.04	21.97	19.33	22.49	24.82	30.55	28.99	38.09	19.71	23.36	26.01	25.92
S_2	21.87	16.83	24.45	26.90	14.87	18.16	24.93	70.22	49.16	55.44	26.95	15.51	30.04
T_1	43.86	20.77	29.73	23.06	20.08	33.29	18.69	27.20	27.09	31.92	28.94	17.81	29.17
T_2	19.02	25.06	14.61	41.23	32.05	26.89	24.42	17.85	17.73	16.82	17.64	15.68	21.73
U_1	24.45	17.74	24.13	27.41	25.33	33.85	19.28	25.23	43.68	36.38	44.06	21.63	30.62

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
U_2	51.87	17.21	24.62	16.33	24.77	26.24	26.15	24.74	19.96	15.92	33.61	14.53	24.82
V_1	62.25	90.76	33.08	27.16	26.26	19.73	18.69	48.80	19.07	22.93	19.95	17.26	35.29
V_2	21.64	21.04	18.04	24.41	23.04	24.14	16.71	24.02	20.66	42.07	31.10	26.25	24.44
W_1	24.14	16.24	15.17	21.15	32.52	23.85	17.63	30.73	20.77	38.83	31.64	28.86	24.72
W_2	13.33	19.68	24.08	13.77	16.87	20.38	25.44	41.12	29.95	21.71	33.36	23.96	24.97
X	21.68	22.50	71.60	97.61	90.96	88.54	81.38	115.79	208.73	277.15	67.84	103.60	99.21
Y	23.59	21.32	18.25	15.05	25.46	23.96	54.81	152.80	180.56	103.33	24.35	42.25	54.80
Z_1	20.92	22.51	15.32	16.69	22.87	25.36	43.66	21.83	41.51	128.41	110.02	70.02	43.56
Z_2	29.50	25.37	20.24	18.63	44.30	25.11	45.14	107.12	39.49	55.75	35.51	18.20	37.61
Total Avg.	31.07	24.00	25.18	25.93	28.17	30.75	34.35	44.24	43.63	47.04	38.02	31.54	

Table 29 GCN Spectral with GRU layer: Average percentage of error by time of day in Saturday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	15.14	23.95	47.61	50.04	40.95	22.59	52.45	24.71	23.93	21.40	22.93	15.43	30.09
A_2	28.90	30.36	42.57	34.82	41.35	59.62	61.12	55.26	58.50	44.16	28.52	27.35	42.71
AA_1	19.58	23.64	17.40	18.46	13.97	17.06	32.82	24.83	24.93	26.87	33.83	17.60	22.58
AA_2	25.02	22.28	20.07	13.80	24.34	30.09	15.79	32.29	23.01	21.86	26.28	19.18	22.83
AB_1	18.89	11.47	13.03	16.38	11.34	17.23	15.99	16.91	28.11	66.96	28.58	14.61	21.62
AB_2	20.82	13.63	11.63	29.13	21.89	21.69	28.13	12.80	24.72	16.06	22.00	21.70	20.35
AC_1	37.98	38.62	21.80	15.65	16.59	21.14	17.43	29.75	34.26	42.95	22.70	28.00	27.24
AC_2	24.63	23.60	20.70	27.72	16.04	15.13	15.02	19.64	13.43	20.87	18.34	15.43	19.21
AD	31.37	56.84	28.70	37.17	15.41	37.22	18.68	34.73	26.25	13.03	19.33	36.61	29.61
AE	27.87	32.18	22.57	25.75	40.41	46.69	27.10	23.92	20.23	20.10	19.63	20.33	27.23
AED	32.78	11.24	25.40	23.23	20.35	28.59	11.50	16.58	15.28	28.36	23.15	13.06	20.79
AF	23.97	24.62	15.40	56.04	30.46	25.49	26.31	71.79	38.27	30.16	31.95	64.52	36.58
AG	40.93	28.14	13.56	11.68	18.22	27.72	18.63	10.68	15.63	14.47	28.31	13.35	20.11
AH	26.99	13.99	18.10	39.61	55.01	49.36	43.21	85.12	89.68	73.13	82.54	72.00	54.06
AI	11.19	32.16	12.55	21.81	7.70	15.66	15.80	26.45	15.79	9.79	9.46	12.16	15.88
AJ_1	13.60	13.46	14.73	26.15	24.84	114.62	14.79	17.58	25.54	23.26	20.32	14.65	26.96
AJ_2	16.21	16.11	15.87	17.38	36.70	65.14	14.74	13.64	17.09	17.35	17.24	14.96	21.87
AK_1	66.65	24.49	21.49	22.42	19.26	21.40	13.56	13.94	16.17	14.95	12.87	9.18	21.36
AK_2	56.43	17.48	23.56	28.49	30.21	60.55	22.93	19.84	26.07	19.16	28.23	19.46	29.37
AL_1	29.25	23.25	14.01	9.29	14.28	19.74	19.43	22.24	26.41	15.16	17.41	18.01	19.04
AL_2	31.86	20.07	13.53	17.92	18.38	17.83	19.38	21.66	23.15	20.80	13.75	11.78	19.18
AM_1	20.01	15.23	13.19	13.88	17.85	16.26	17.94	35.64	12.37	24.99	13.34	19.50	18.35
AM_2	14.06	11.51	14.23	11.28	15.79	12.04	16.65	16.44	16.57	7.85	15.98	9.46	13.49
AO	45.07	45.93	26.41	20.48	26.65	29.60	24.63	29.64	25.52	25.21	43.07	21.13	30.28
AP	31.64	18.78	17.82	10.70	17.62	18.01	14.01	26.22	25.12	15.99	13.91	12.52	18.53
B_2	49.32	93.93	99.31	70.22	35.48	72.29	94.20	64.86	68.27	117.54	28.43	61.14	71.25
C_1	22.26	15.62	24.68	17.40	19.57	28.09	18.35	16.39	10.83	10.47	10.87	12.46	17.25

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
C_2	21.20	17.75	12.83	18.57	17.11	21.87	21.21	22.15	14.00	15.27	12.10	17.81	17.66
D_1	15.48	14.73	15.43	8.77	17.37	9.97	17.01	18.54	16.33	11.42	12.16	12.86	14.17
D_2	25.44	21.42	20.34	16.49	14.78	18.78	17.16	19.78	18.06	22.50	19.73	23.18	19.81
E_1	34.32	28.42	26.61	16.23	13.77	21.55	20.16	14.97	24.72	54.36	20.56	25.45	25.09
E_2	15.27	6.42	17.03	17.86	21.22	23.78	20.68	16.98	26.85	23.01	18.41	8.73	18.02
F_2	14.74	13.46	13.11	14.09	20.01	14.82	19.79	19.11	15.12	14.16	13.23	12.09	15.31
G_1	20.83	11.71	14.56	11.46	9.02	8.83	13.20	17.37	17.86	16.85	15.97	15.16	14.40
G_2	24.08	16.72	16.32	14.31	6.86	14.70	13.14	18.46	14.71	14.75	19.56	18.27	15.99
H_1	25.49	23.19	28.42	25.53	13.38	21.30	19.96	14.24	18.90	11.82	15.38	20.36	19.83
H_2	32.93	15.15	33.10	23.30	42.57	36.97	23.94	27.30	30.55	38.38	16.22	22.14	28.55
I	40.20	17.60	12.79	12.34	25.86	17.99	53.44	47.41	24.62	18.29	15.91	20.64	25.59
I_1	19.39	15.95	19.46	14.65	7.85	57.10	46.31	60.16	83.01	64.40	52.36	33.59	39.52
I_2	10.67	38.14	14.88	14.66	39.36	67.22	30.23	82.40	40.83	76.76	13.07	17.15	37.11
J	22.65	25.78	37.61	29.88	50.62	39.19	29.52	29.97	52.80	36.50	34.50	43.62	36.05
K_1	10.62	44.36	18.37	49.73	106.12	106.94	64.90	129.07	104.09	37.91	22.31	15.89	59.19
K_2	46.76	35.57	36.05	23.68	35.12	55.79	52.53	52.23	55.88	44.68	41.89	32.57	42.73
M_1	161.43	76.56	65.94	18.51	35.96	45.94	43.16	17.72	38.77	26.62	58.11	15.24	50.33
M_2	26.18	31.74	37.89	44.29	88.45	92.73	173.90	222.17	243.05	141.84	129.33	73.16	108.73
N_1	37.49	34.02	41.93	14.49	39.79	31.40	52.92	48.83	22.25	13.31	11.86	19.08	30.62
N_2	28.25	21.91	41.38	104.76	56.05	120.90	167.41	290.62	125.60	47.79	33.36	16.38	87.87
O_1	106.34	99.49	66.51	56.15	74.82	59.30	55.39	37.00	22.21	34.25	45.17	48.35	58.75
O_2	145.25	97.50	155.99	68.74	71.19	55.35	81.19	85.74	132.80	16.77	13.99	31.77	79.69
P_1	71.57	39.90	31.28	21.55	47.71	64.03	73.05	82.29	121.86	72.47	70.58	81.35	64.80
P_2	24.48	15.45	19.28	26.01	27.17	49.97	26.43	48.30	46.70	54.34	36.91	17.73	32.73
Q_1	15.04	15.59	10.27	14.32	24.88	31.64	17.55	16.61	18.72	13.33	22.81	13.47	17.85
Q_2	17.95	13.85	10.20	11.47	13.38	15.04	11.02	13.58	15.69	25.11	14.94	14.07	14.69
R_1	19.16	20.61	21.79	19.22	20.73	24.25	20.29	19.07	17.77	22.85	25.59	20.71	21.00
R_2	23.15	15.89	11.65	18.50	16.11	20.80	15.06	24.02	14.02	20.65	15.15	14.29	17.44
S_1	19.54	21.37	18.26	17.03	21.15	33.11	26.87	28.24	27.71	37.34	16.24	17.38	23.69
S_2	13.26	14.23	22.08	14.75	28.40	28.64	20.11	17.80	15.13	11.24	21.15	37.74	20.38
T_1	61.48	25.70	16.71	23.33	25.43	35.48	23.35	25.61	18.04	19.56	24.46	20.56	26.64
T_2	56.43	22.78	11.92	22.97	27.41	24.43	15.90	40.81	31.44	19.26	20.35	23.87	26.46
U_1	12.03	19.10	16.60	16.96	24.62	17.48	18.05	14.47	37.29	18.94	16.18	15.25	18.91
U_2	20.23	20.02	17.96	9.74	65.31	81.97	18.74	20.41	18.70	19.03	13.82	12.55	26.54
V_1	64.35	44.18	13.81	20.30	13.24	16.20	27.67	28.34	18.57	29.67	14.68	30.41	26.79
V_2	17.79	18.32	21.06	12.65	17.69	21.25	22.54	25.97	17.17	29.72	11.77	14.23	19.18
W_1	19.94	15.35	20.70	34.61	48.50	26.50	22.44	21.80	21.05	15.72	25.40	22.68	24.56
W_2	14.05	15.37	17.47	14.63	15.56	21.96	17.67	28.19	18.67	20.66	16.10	17.67	18.17
X	29.03	20.31	81.52	161.52	135.27	130.47	57.30	125.48	229.94	136.52	83.53	89.24	106.68
Y	28.74	19.47	20.10	31.42	36.61	34.07	46.81	89.55	91.18	46.97	27.50	16.64	40.76
Z_1	28.18	23.55	18.56	30.30	38.62	25.94	65.63	58.55	55.68	63.70	66.15	59.16	44.50
Z_2	195.07	22.21	22.14	18.53	28.08	35.99	89.08	23.30	20.94	19.46	19.43	26.35	43.38

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
Total Avg	35.06	26.57	26.08	26.74	30.92	37.57	34.25	40.99	39.77	32.48	26.82	24.99	31.85

Table 30 GCN Spatial with LSTM layer: Average percentage of error by time of day in Sunday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	31.99	27.88	49.36	36.02	51.40	62.76	55.29	55.60	65.33	22.27	22.39	26.72	42.25
A_2	33.37	16.64	32.57	19.46	31.56	47.47	25.19	23.91	16.66	22.98	33.21	39.45	28.54
AA_1	15.95	32.59	22.02	20.20	8.09	12.52	20.14	20.53	14.98	16.94	8.25	23.35	17.96
AA_2	20.18	95.06	18.76	19.07	8.37	24.60	18.67	20.81	33.23	28.24	30.73	33.63	29.28
AB_1	21.81	12.17	24.44	17.45	22.88	11.89	18.35	23.85	34.97	27.68	23.40	52.32	24.27
AB_2	28.28	116.72	35.76	18.04	16.01	12.57	20.35	28.62	25.13	20.47	12.38	27.74	30.17
AC_1	15.86	30.91	26.62	44.94	17.29	30.87	14.90	25.68	28.00	23.93	22.27	22.66	25.33
AC_2	13.05	41.36	40.49	27.77	18.07	16.50	17.05	19.23	34.08	26.23	20.63	19.32	24.48
AD	23.15	22.33	76.80	12.94	22.19	59.75	22.83	84.66	50.04	29.67	42.02	52.09	41.54
AE	22.88	24.82	25.62	52.04	46.54	23.52	35.60	59.20	41.44	20.08	56.87	32.09	36.73
AED	78.75	15.30	16.19	23.23	15.26	17.76	17.75	20.11	21.60	34.98	30.20	18.83	25.83
AF	64.76	18.37	41.92	33.80	24.07	28.96	22.69	27.32	19.94	74.46	30.17	16.79	33.60
AG	19.42	10.80	25.05	18.58	22.92	12.52	18.92	12.33	19.28	12.75	16.15	14.93	16.97
AH	17.84	24.99	22.43	21.61	25.49	11.17	24.25	27.11	27.92	30.63	23.21	48.95	25.47
AI	15.46	12.68	11.56	12.14	10.35	16.52	8.09	17.29	19.56	12.97	15.04	11.20	13.57
AJ_1	34.75	21.83	12.16	10.05	12.98	15.81	18.01	16.71	24.82	25.23	24.49	22.48	19.94
AJ_2	42.12	4.96	10.49	13.00	9.19	16.36	14.14	15.58	19.80	15.86	8.90	15.72	15.51
AK_1	19.80	10.63	16.11	15.56	21.91	37.23	26.70	52.87	51.74	31.29	38.63	54.91	31.45
AK_2	47.27	23.75	22.67	24.06	24.67	41.40	56.15	21.43	27.49	18.11	34.44	55.12	33.05
AL_1	15.15	9.85	13.49	9.82	9.71	18.26	18.96	21.76	23.14	48.31	73.28	63.27	27.08
AL_2	17.03	18.21	19.92	13.49	11.73	18.14	18.40	25.59	75.61	12.42	109.74	42.60	31.91
AM_1	20.78	11.80	16.29	15.18	12.33	21.11	15.95	25.20	27.68	51.16	53.30	28.93	24.97
AM_2	20.33	18.35	6.43	7.11	16.32	26.33	12.63	13.03	11.61	27.01	51.65	18.47	19.11
AO	31.19	11.90	22.50	14.70	22.20	20.79	35.03	26.13	60.12	120.04	59.13	65.78	40.79
AP	27.32	14.51	18.13	34.24	21.95	21.27	15.55	21.97	18.38	54.61	26.02	37.59	25.96
B_2	46.72	27.86	82.79	87.24	67.50	30.41	78.33	119.37	90.26	91.26	85.12	105.92	76.06
C_1	22.60	25.71	35.08	13.52	19.29	15.20	14.12	14.63	14.23	28.97	13.28	13.56	19.18
C_2	19.89	23.23	29.22	12.40	20.31	10.00	18.99	12.93	13.73	20.06	13.93	19.21	17.83
D_1	33.76	21.86	19.61	16.09	13.99	8.21	11.37	9.99	12.45	16.44	17.94	17.08	16.57
D_2	39.67	16.56	31.25	24.34	10.51	12.53	18.74	25.42	16.44	27.47	18.51	35.09	23.05
E_1	58.67	47.35	29.48	22.51	19.27	21.80	16.94	19.54	16.32	27.40	26.18	9.37	26.24
E_2	49.60	29.17	55.46	41.96	18.96	18.95	38.82	26.88	23.95	75.26	23.43	23.13	35.46
F_2	15.15	29.40	21.89	15.41	10.69	10.90	10.03	22.12	15.86	10.75	13.98	12.35	15.71
G_1	23.25	16.72	50.28	23.56	11.31	11.97	20.09	18.96	26.97	28.88	16.16	22.37	22.54
G_2	14.01	11.48	20.81	18.28	25.88	13.01	8.88	15.58	15.38	32.88	19.32	16.80	17.69
H_1	18.41	15.79	18.82	25.37	18.28	24.99	9.53	18.16	16.18	20.63	17.30	13.31	18.06

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
H_2	42.54	18.33	19.40	31.93	12.24	29.07	47.04	14.21	36.49	49.58	52.89	34.83	32.38
I	46.19	138.79	24.61	30.90	17.94	22.09	26.28	25.76	21.48	16.10	22.92	18.58	34.30
I_1	17.34	25.91	19.16	15.41	21.96	12.64	15.59	22.24	41.72	41.17	19.32	14.83	22.27
I_2	14.15	16.05	16.99	16.48	18.93	10.60	13.90	11.35	16.52	16.92	17.28	11.36	15.04
J	32.23	34.39	17.64	19.99	61.43	49.76	47.04	82.27	59.29	98.84	59.21	42.31	50.37
K_1	24.35	11.41	21.48	22.81	15.48	11.39	16.92	17.74	24.15	16.25	23.51	21.35	18.90
K_2	81.35	22.52	19.35	23.17	24.06	41.92	26.62	31.49	26.49	18.13	19.20	23.17	29.79
M_1	56.51	29.44	24.68	11.63	9.16	24.19	12.53	31.31	48.06	26.72	31.58	14.60	26.70
M_2	40.22	38.21	29.46	23.18	25.41	50.21	22.91	25.75	57.62	56.47	34.31	33.56	36.44
N_1	27.23	13.34	22.69	18.29	24.52	40.21	20.81	19.03	35.48	20.68	41.91	66.95	29.26
N_2	28.28	35.63	22.76	65.00	68.10	87.85	80.05	89.87	69.04	20.30	19.80	18.38	50.42
O_1	30.70	21.24	20.00	22.98	22.22	29.37	63.49	28.09	34.75	20.97	41.38	49.90	32.09
O_2	16.66	20.23	16.51	13.13	26.91	31.02	13.12	20.16	50.72	19.60	16.74	30.38	22.93
P_1	34.62	24.05	11.53	26.62	28.42	19.17	51.76	33.36	33.08	43.66	19.42	36.63	30.19
P_2	29.86	11.79	16.30	9.11	30.91	35.56	46.01	31.84	25.36	25.61	17.76	19.78	24.99
Q_1	16.35	14.49	14.89	11.06	10.38	16.56	10.54	18.19	12.23	16.21	23.35	9.22	14.45
Q_2	14.67	22.71	14.00	15.02	10.63	7.33	9.97	14.76	11.58	15.90	17.39	9.75	13.64
R_1	32.68	29.03	20.71	58.17	25.47	20.58	16.26	33.48	35.82	10.70	21.36	17.97	26.85
R_2	16.27	29.89	16.89	14.43	17.32	11.59	11.91	15.89	12.93	8.16	26.74	37.36	18.28
S_1	94.30	22.04	18.87	31.83	11.98	25.08	19.93	30.06	25.96	40.48	99.05	60.52	40.01
S_2	11.39	23.46	16.99	19.05	14.22	15.43	36.45	28.90	23.53	22.73	15.17	29.65	21.41
T_1	20.44	19.62	25.36	17.53	27.86	21.17	12.00	104.15	166.42	21.91	47.68	75.31	46.62
T_2	28.70	12.69	18.86	17.11	14.42	19.17	24.60	68.29	85.16	20.84	15.86	23.39	29.09
U_1	52.33	20.80	15.40	20.07	20.08	22.32	24.07	25.30	46.24	61.06	146.72	57.98	42.70
U_2	29.69	11.88	10.98	15.14	12.67	22.37	11.98	88.67	85.15	32.09	35.54	40.09	33.02
V_1	29.04	12.88	28.38	19.74	31.50	19.58	33.16	54.36	28.25	22.15	25.04	57.55	30.14
V_2	23.83	28.97	14.33	12.05	16.38	22.39	17.96	28.73	47.55	23.20	89.12	79.40	33.66
W_1	28.90	32.17	25.94	32.00	17.60	41.30	19.64	25.20	15.58	62.69	56.70	23.20	31.74
W_2	26.39	20.18	17.62	10.24	22.69	11.67	17.50	23.97	23.15	89.09	135.45	111.18	42.43
X	60.07	56.08	13.07	20.02	38.78	48.51	39.52	48.06	62.66	46.00	42.45	111.44	48.89
Y	13.95	14.60	18.80	9.59	22.54	15.86	34.37	16.20	42.90	26.68	19.54	23.18	21.52
Z_1	29.29	17.40	34.06	29.45	57.74	32.28	25.34	31.69	19.86	29.27	36.81	41.02	32.02
Z_2	23.32	52.66	11.80	16.76	13.64	18.11	18.59	17.09	25.26	34.47	25.76	13.26	22.56
Total Avg	30.64	26.33	24.09	22.54	22.22	24.50	24.72	31.41	34.85	32.80	35.49	34.66	

Table 31 GCN Spatial with LSTM layer: Average percentage of error by time of day in Monday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	33.74	16.45	23.72	30.29	42.07	53.26	46.21	63.93	45.62	16.52	29.40	24.75	35.50
A_2	24.13	22.99	19.70	27.09	16.24	34.75	37.52	39.85	30.14	43.69	23.44	11.08	27.55
AA_1	18.40	29.09	20.54	14.52	16.46	24.47	67.59	43.98	49.92	32.63	49.74	77.62	37.08
AA_2	19.82	37.77	18.04	20.50	51.59	22.25	59.93	20.06	41.07	15.77	41.95	39.89	32.39
AB_1	22.23	27.47	24.53	20.92	18.05	24.28	28.87	30.92	30.99	33.59	37.04	30.34	27.44
AB_2	29.70	23.83	22.79	19.63	69.48	39.29	14.97	31.81	14.68	37.95	27.79	40.70	31.05
AC_1	25.21	17.32	23.20	24.66	17.48	21.13	16.46	30.98	30.41	16.16	22.97	21.82	22.32
AC_2	19.97	17.32	31.97	21.08	18.59	22.34	14.89	27.53	32.61	28.36	28.41	23.04	23.84
AD	58.44	39.24	52.63	23.54	25.42	21.72	49.19	79.16	15.67	34.09	67.21	35.04	41.78
AE	38.44	28.51	39.72	50.11	49.22	30.56	27.80	41.99	71.24	51.23	70.90	45.28	45.42
AED	45.56	25.57	30.86	25.68	24.65	29.96	28.40	20.34	40.83	1.33	17.38	20.02	25.88
AF	22.06	20.25	61.28	45.02	23.88	39.35	69.89	11.25	23.71	41.22	41.34	25.29	35.38
AG	14.86	19.62	13.07	20.53	20.02	14.63	20.86	18.03	19.53	28.60	19.23	18.68	18.97
AH	22.81	24.99	26.62	19.00	17.82	14.02	12.29	13.57	17.26	14.66	23.13	18.88	18.75
AI	16.05	25.73	33.19	17.95	14.61	21.91	20.95	9.39	14.62	14.93	22.39	12.44	18.68
AJ_1	40.96	41.97	41.23	22.02	37.43	23.35	17.12	24.09	25.84	20.41	9.50	28.55	27.71
AJ_2	19.50	32.67	32.10	9.94	9.94	14.24	19.96	16.69	12.48	14.96	18.22	18.27	18.25
AK_1	16.10	18.51	19.01	36.19	42.32	18.56	32.97	81.76	43.20	73.06	86.81	44.67	42.76
AK_2	42.52	50.55	37.46	38.47	45.21	46.02	38.81	36.34	17.38	22.41	27.63	23.49	35.52
AL_1	15.67	9.49	21.28	20.37	19.11	15.05	11.94	16.27	38.03	77.75	80.34	52.89	31.52
AL_2	17.98	25.55	14.80	13.40	19.46	11.89	20.42	19.65	47.77	82.00	139.87	48.13	38.41
AM_1	21.02	18.26	15.81	19.26	14.11	11.29	14.51	26.22	40.92	48.88	39.90	28.43	24.88
AM_2	23.41	25.14	11.53	29.93	22.22	11.41	15.01	15.51	33.92	64.44	29.10	39.22	26.74
AO	27.43	25.58	11.71	29.34	24.89	25.78	19.86	29.87	38.04	35.01	95.11	75.62	36.52
AP	10.24	12.09	19.17	26.35	31.37	17.57	10.56	22.54	30.24	43.39	32.85	27.65	23.67
B_2	42.07	68.58	28.23	24.71	37.50	47.06	71.39	53.05	75.78	28.26	36.10	39.25	46.00
C_1	15.30	27.65	27.98	7.96	28.41	16.77	19.12	19.27	24.06	21.25	21.42	21.42	20.88
C_2	21.09	9.59	15.98	23.47	23.41	14.07	27.54	17.88	14.52	15.39	38.06	23.30	20.36
D_1	34.04	28.77	23.35	18.75	17.38	16.14	15.42	14.36	12.10	32.22	15.92	13.15	20.13
D_2	42.43	35.74	46.22	36.15	35.11	14.83	10.96	16.21	27.50	10.37	28.05	11.98	26.30
E_1	103.85	65.42	90.05	24.36	19.93	20.27	28.12	19.84	23.88	30.97	43.02	26.12	41.32
E_2	96.85	80.31	109.15	105.61	14.23	21.40	28.22	27.94	35.15	44.61	43.87	26.18	52.79
F_2	13.45	8.84	13.68	18.57	17.87	13.37	16.13	13.28	21.85	17.57	10.25	14.52	14.95
G_1	34.51	23.19	41.82	31.86	20.55	12.94	10.31	17.79	20.98	13.77	19.87	21.32	22.41
G_2	15.33	16.33	16.68	23.32	22.99	10.28	15.48	19.72	20.46	2.65	20.85	16.88	16.75
H_1	12.08	15.77	17.75	14.64	29.10	24.87	10.76	12.14	17.76	11.58	20.31	29.80	18.05
H_2	31.16	21.88	23.97	17.69	39.90	34.88	40.95	29.79	42.29	111.29	41.79	65.79	41.78
I	70.73	24.57	19.97	13.87	14.18	15.77	20.32	37.75	22.96	20.76	25.47	30.15	26.38
I_1	17.12	15.34	20.94	15.65	19.04	31.72	25.51	23.00	28.21	21.34	19.75	36.23	22.82
I_2	13.90	20.12	17.41	25.61	16.60	15.53	15.79	15.15	13.60	131.06	54.47	19.85	29.92
J	34.83	36.66	18.14	18.47	24.63	45.72	71.61	26.88	21.80	54.41	33.80	31.97	34.91
K_1	21.53	30.29	20.49	23.60	17.14	23.74	19.16	26.24	24.59	25.33	28.26	61.82	26.85

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
K_2	33.28	28.25	27.30	31.08	34.87	40.18	50.63	31.09	29.51	24.57	20.33	25.92	31.42
M_1	25.47	21.91	41.03	16.71	10.00	19.49	12.08	21.27	36.29	17.89	21.21	52.72	24.67
M_2	32.62	19.16	26.03	30.56	22.13	25.84	17.90	31.39	26.49	30.97	39.01	49.84	29.33
N_1	11.73	25.20	8.62	16.90	19.81	22.90	10.56	22.02	59.29	57.70	83.34	71.05	34.09
N_2	36.62	33.68	21.89	23.50	16.35	28.22	92.61	138.42	49.49	52.60	41.82	54.97	49.18
O_1	15.06	20.75	25.87	13.42	31.58	72.45	29.63	23.17	9.56	21.06	145.32	63.33	39.27
O_2	16.66	12.18	15.88	16.23	19.32	29.82	18.97	19.91	28.03	42.44	36.59	19.50	22.96
P_1	21.40	18.51	38.74	16.64	21.09	37.53	30.21	53.04	28.58	25.91	53.73	34.33	31.64
P_2	18.22	15.94	21.08	27.53	16.99	18.93	46.66	63.36	64.16	29.73	37.04	21.71	31.78
Q_1	26.74	48.94	11.37	23.99	24.17	17.97	6.20	18.78	39.84	9.67	21.53	27.70	23.08
Q_2	12.75	8.65	14.04	10.84	10.23	8.03	12.72	9.84	13.23	37.22	17.85	20.50	14.66
R_1	41.53	44.89	43.43	34.66	61.88	13.44	33.87	47.32	49.85	17.33	22.42	37.70	37.36
R_2	25.33	43.05	18.97	16.85	18.28	25.58	23.96	15.31	17.80	50.26	30.70	55.90	28.50
S_1	129.87	27.45	35.82	44.49	40.77	15.48	44.12	38.63	25.17	108.09	119.39	59.40	57.39
S_2	26.72	29.92	9.58	18.33	11.30	37.09	15.32	45.05	16.19	32.61	24.09	19.99	23.85
T_1	41.24	9.62	26.19	19.33	23.06	19.03	20.24	118.36	102.37	89.85	43.41	56.01	47.39
T_2	17.47	18.62	13.80	19.15	12.78	14.71	18.33	55.90	26.71	22.97	17.76	27.98	22.18
U_1	69.96	32.69	21.87	23.52	20.23	39.55	45.91	22.70	31.70	111.62	105.77	85.27	50.90
U_2	30.23	25.24	18.72	29.89	19.05	12.79	14.06	98.71	76.40	35.05	47.85	23.29	35.94
V_1	129.14	30.71	17.36	25.42	14.59	21.53	45.91	48.94	98.44	75.79	79.95	66.74	54.54
V_2	90.00	96.92	26.07	16.00	20.93	19.40	15.78	18.06	52.21	252.79	157.54	79.82	70.46
W_1	46.21	53.74	47.74	41.31	31.99	37.02	48.49	31.87	25.67	13.72	36.75	58.83	39.44
W_2	21.64	29.11	19.00	10.75	15.27	13.37	16.45	20.52	36.11	131.68	176.87	98.76	49.13
X	29.04	28.53	19.60	34.12	32.92	33.38	30.90	36.63	24.13	73.87	96.15	87.69	43.91
Y	15.91	21.78	19.51	18.67	14.64	43.75	29.87	23.87	16.37	22.67	56.75	46.55	27.53
Z_1	23.60	25.09	36.63	31.03	34.81	27.09	19.42	34.56	25.33	26.69	42.70	52.40	31.61
Z_2	15.49	23.44	26.61	16.08	20.23	23.03	19.49	31.47	20.87	37.02	82.93	52.95	30.80
Total Avg	32.90	28.39	27.11	24.60	24.77	24.73	28.03	33.08	33.09	42.57	46.98	38.73	32.08

Table 32 GCN Spatial with LSTM layer: Average percentage of error by time of day in Tuesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	41.17	18.93	18.56	37.10	45.39	51.33	58.70	56.88	35.35	27.62	31.03	15.82	36.49
A_2	30.38	26.80	22.89	15.09	15.62	37.17	21.14	28.21	22.02	27.29	24.37	16.84	23.99
AA_1	13.37	22.09	19.27	14.74	22.53	19.03	62.59	59.36	54.03	70.05	55.04	53.08	38.76
AA_2	15.74	14.84	17.68	17.42	42.26	55.23	63.22	35.69	22.14	38.37	53.31	32.98	34.07
AB_1	27.20	21.61	18.50	24.37	12.01	17.51	28.44	31.31	38.69	31.40	53.54	28.64	27.77
AB_2	20.10	21.34	17.20	11.60	43.19	22.79	67.19	58.62	37.11	30.62	25.11	18.22	31.09
AC_1	22.46	25.96	23.35	49.36	11.55	11.11	11.87	19.58	30.72	21.56	12.64	13.34	21.13
AC_2	20.04	18.06	30.89	33.47	19.19	10.33	17.27	44.40	20.64	30.59	33.09	29.41	25.62

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AD	44.86	38.47	17.10	36.71	47.66	23.95	30.33	24.98	34.08	52.65	52.31	16.31	34.95
AE	30.85	20.67	41.23	31.39	40.90	15.08	25.16	58.10	49.63	115.14	120.19	21.57	47.49
AED	29.90	27.45	17.17	20.39	17.09	37.38	50.48	27.92	21.11	17.88	31.63	30.24	27.39
AF	22.70	462.35	95.13	76.04	51.40	11.83	18.40	18.09	26.52	39.39	16.14	13.07	70.92
AG	20.69	14.68	24.68	11.66	13.15	12.68	20.83	19.85	18.68	19.05	29.58	20.14	18.81
AH	34.27	19.71	24.28	18.67	15.63	13.57	17.75	31.98	26.96	17.36	15.95	29.94	22.17
AI	42.47	20.62	11.60	16.78	10.36	11.49	8.79	18.47	17.67	11.50	14.08	16.94	16.73
AJ_1	51.15	25.45	23.08	24.88	29.16	34.20	23.96	19.18	17.61	45.61	28.89	25.96	29.09
AJ_2	13.39	18.57	19.05	27.79	17.63	16.13	14.07	13.02	15.74	13.89	19.00	15.82	17.01
AK_1	22.76	20.96	20.24	25.02	33.57	28.28	56.52	42.95	32.59	41.81	33.38	42.70	33.40
AK_2	29.88	32.30	26.38	70.74	67.72	47.48	81.16	54.00	21.11	25.66	98.70	20.01	47.93
AL_1	16.76	14.32	10.31	16.85	25.21	15.98	16.86	13.69	12.54	18.15	46.66	52.39	21.64
AL_2	16.59	12.78	16.39	12.35	18.58	5.38	10.98	20.63	60.51	60.66	100.29	79.58	34.56
AM_1	31.23	33.81	16.46	9.90	14.42	13.19	12.70	24.03	53.49	31.85	25.37	38.64	25.42
AM_2	17.35	13.49	13.68	19.84	15.56	24.29	20.62	21.07	32.10	71.92	101.33	17.29	30.71
AO	14.68	23.00	22.35	19.81	30.61	23.79	38.33	58.26	76.41	76.77	90.06	121.06	49.59
AP	10.43	15.56	38.24	23.38	26.40	24.47	37.89	30.51	81.83	52.35	41.95	16.18	33.27
B_2	38.82	27.24	40.08	49.14	21.66	47.14	38.31	66.43	42.94	29.04	81.22	42.07	43.67
C_1	18.11	18.66	19.15	14.10	28.28	23.98	10.46	20.57	15.94	26.91	11.60	14.82	18.55
C_2	36.11	16.86	22.08	14.15	49.83	13.06	18.59	20.28	17.13	33.36	21.52	19.14	23.51
D_1	34.23	24.67	16.66	24.64	10.95	13.39	14.81	20.33	16.44	14.37	16.04	10.25	18.07
D_2	47.06	24.02	26.36	17.24	16.16	15.95	21.17	15.94	28.26	34.78	41.13	16.79	25.41
E_1	72.77	52.94	31.43	43.11	33.53	31.07	22.13	40.98	27.74	47.40	23.21	23.41	37.48
E_2	88.28	100.34	83.14	61.46	24.97	22.40	30.87	30.00	40.23	43.96	24.36	27.02	48.09
F_2	10.31	16.87	10.23	14.20	10.10	12.36	13.26	10.24	18.25	7.34	8.13	4.26	11.29
G_1	50.01	34.50	35.09	27.99	19.01	9.15	21.30	18.30	11.93	28.21	19.24	18.10	24.40
G_2	27.10	11.95	10.63	17.38	41.24	26.70	17.71	21.88	21.29	15.81	10.88	11.96	19.55
H_1	18.42	17.39	9.69	13.12	29.75	12.32	18.35	24.48	24.76	22.78	9.63	22.01	18.56
H_2	41.58	18.61	24.27	21.09	12.50	20.56	34.89	42.83	27.73	42.94	55.64	63.21	33.82
I	87.09	154.06	20.45	13.75	17.17	50.59	22.55	24.75	33.96	62.10	66.53	27.67	48.39
I_1	14.89	18.23	19.13	29.05	21.63	42.45	49.08	20.61	31.27	33.02	15.53	17.78	26.06
I_2	18.20	18.61	14.32	21.83	25.30	16.85	21.52	16.68	40.28	24.05	21.81	35.32	22.90
J	34.60	24.37	25.72	25.69	22.45	44.27	60.16	24.84	27.96	19.91	31.94	49.04	32.58
K_1	17.72	29.29	16.55	17.54	20.94	26.76	22.75	21.01	20.10	18.91	16.90	32.85	21.78
K_2	48.42	37.07	41.70	25.12	44.49	36.18	31.74	31.47	34.88	20.35	53.12	51.81	38.03
M_1	21.31	14.49	13.36	21.31	17.68	18.59	11.81	18.72	29.94	60.87	27.06	13.40	22.38
M_2	25.70	29.53	31.61	30.68	30.41	30.83	19.88	64.31	13.92	40.59	40.54	31.03	32.42
N_1	14.29	26.42	13.01	25.47	16.28	18.99	16.29	28.81	27.40	22.84	92.91	16.79	26.62
N_2	41.41	41.10	54.52	71.54	39.79	46.61	81.05	110.27	46.80	32.26	61.40	58.83	57.13
O_1	35.43	22.58	14.62	44.47	51.78	44.18	52.53	23.55	24.97	72.42	73.20	25.83	40.46
O_2	22.23	12.62	16.87	48.43	21.56	29.15	18.66	12.35	25.10	52.63	46.60	22.06	27.36
P_1	27.41	12.82	44.78	26.90	20.48	28.42	15.80	41.73	31.70	51.16	29.61	24.64	29.62

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
P_2	15.37	22.83	19.36	36.84	24.59	22.95	28.13	60.45	41.20	45.85	37.53	68.71	35.32
Q_1	16.11	15.08	10.40	13.55	13.82	14.50	22.24	27.56	17.50	19.45	21.83	21.49	17.79
Q_2	9.38	8.32	12.78	6.06	11.02	17.92	5.86	16.37	24.58	21.46	15.43	13.11	13.52
R_1	51.00	35.72	36.10	22.80	41.74	49.17	33.44	36.09	50.32	32.01	20.73	30.55	36.64
R_2	11.05	19.50	17.10	21.48	33.97	12.73	23.94	19.21	16.38	22.03	17.25	50.15	22.07
S_1	61.93	31.02	16.65	33.46	19.29	25.13	72.39	42.45	45.03	57.73	64.72	47.50	43.11
S_2	19.94	29.83	12.26	5.59	13.10	13.87	28.72	46.80	25.59	86.62	99.41	21.97	33.64
T_1	29.34	23.38	15.74	13.31	13.36	29.83	20.87	46.26	54.10	29.29	38.78	41.49	29.65
T_2	18.81	16.79	23.31	26.51	16.57	16.22	36.75	42.93	37.51	26.19	24.27	36.67	26.88
U_1	38.51	22.11	13.70	15.72	60.26	39.64	40.93	55.18	57.38	110.49	118.15	79.35	54.29
U_2	72.80	29.80	12.96	7.28	28.68	17.08	10.45	47.87	52.30	15.74	10.54	24.85	27.53
V_1	23.86	25.87	15.34	21.53	15.27	15.91	42.37	32.05	67.80	21.00	40.54	19.42	28.41
V_2	33.61	26.11	21.10	17.96	12.90	9.48	35.84	30.64	78.50	135.56	107.72	56.89	47.19
W_1	13.91	25.50	25.66	43.54	42.00	31.48	30.67	12.55	35.50	57.77	75.08	20.52	34.51
W_2	33.55	28.18	13.66	19.89	26.89	14.04	18.90	25.64	68.94	109.17	120.81	66.08	45.48
X	38.17	33.15	22.67	26.63	17.83	16.54	43.11	106.38	36.76	38.50	46.49	161.78	49.00
Y	18.72	15.09	15.01	18.90	22.49	23.80	41.20	212.71	34.32	24.34	19.92	72.94	43.29
Z_1	26.56	22.04	24.86	32.46	29.65	33.60	38.18	25.17	52.33	50.11	87.63	112.14	44.56
Z_2	17.56	16.75	8.34	20.24	23.60	39.90	31.19	61.56	27.22	39.67	20.64	32.81	28.29
Total Avg	30.18	32.41	23.16	25.92	26.11	24.77	30.52	36.96	34.25	40.44	44.07	35.43	32.02

Table 33 GCN Spatial with LSTM layer: Average percentage of error by time of day in Wednesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	18.25	16.62	23.25	17.45	12.14	30.70	43.23	51.33	30.22	26.47	14.44	20.11	25.35
A_2	41.38	25.54	21.54	18.23	13.65	35.93	20.88	36.09	24.98	19.18	23.50	24.72	25.47
AA_1	13.90	28.80	24.02	18.03	23.13	15.86	58.61	64.37	66.81	53.20	59.15	74.94	41.74
AA_2	49.97	13.90	13.46	31.49	68.15	70.62	102.12	59.78	103.33	87.10	95.73	30.89	60.54
AB_1	28.24	23.47	17.74	32.71	14.77	12.00	42.24	40.26	37.08	47.62	62.78	83.69	36.88
AB_2	30.88	25.60	17.06	14.50	21.92	40.32	20.03	22.58	41.10	27.97	123.64	27.34	34.41
AC_1	374.66	27.12	25.92	31.93	19.13	13.06	16.12	20.41	24.30	25.34	27.48	40.72	53.85
AC_2	17.92	15.38	29.07	33.29	9.35	20.99	19.67	21.46	38.79	29.83	57.05	26.30	26.59
AD	47.89	32.37	19.05	24.99	23.29	22.29	35.38	49.84	46.00	26.70	32.70	66.87	35.61
AE	22.31	34.37	22.14	35.89	37.19	27.99	24.05	34.46	97.39	79.71	135.90	40.07	49.29
AED	60.72	32.94	18.51	23.19	30.35	21.86	18.41	20.43	26.75	20.74	11.46	26.71	26.01
AF	27.54	32.74	138.55	88.00	56.21	37.91	19.42	27.12	25.79	24.95	35.16	29.12	45.21
AG	25.03	14.73	19.76	16.21	6.89	13.09	11.58	28.47	19.01	17.82	28.59	28.33	19.13
AH	30.85	29.89	23.42	22.00	15.79	20.00	25.05	50.97	18.69	20.54	25.53	25.04	25.65
AI	17.17	16.35	19.97	18.06	15.58	23.13	9.61	22.94	15.60	15.04	26.89	17.06	18.12
AJ_1	66.24	21.18	23.79	12.17	21.45	18.12	19.84	26.38	36.95	23.49	113.74	19.11	33.54

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AJ_2	20.12	18.85	14.14	13.89	11.85	11.97	19.82	18.13	16.44	14.49	19.10	14.25	16.09
AK_1	39.89	11.50	18.82	12.24	12.97	24.00	27.39	48.24	48.88	42.04	64.30	36.66	32.24
AK_2	21.57	37.47	50.91	39.05	64.79	59.50	66.88	32.50	29.10	16.45	50.19	34.10	41.88
AL_1	18.47	16.71	16.77	15.67	21.63	18.10	19.28	19.85	18.19	39.58	33.27	62.03	24.96
AL_2	17.59	19.02	15.69	15.54	19.33	19.56	15.68	63.73	59.99	87.23	114.27	43.80	40.95
AM_1	17.03	30.38	14.68	19.02	19.72	14.17	21.26	28.38	26.44	46.18	20.38	21.70	23.28
AM_2	5.02	14.77	42.03	16.79	19.22	17.28	24.82	15.62	46.32	50.06	111.55	79.10	36.88
AO	53.03	18.72	14.62	15.26	24.16	24.69	22.00	21.16	59.81	41.40	45.09	84.42	35.36
AP	11.51	12.80	16.87	35.18	22.27	16.50	14.91	21.89	30.99	37.86	14.53	25.62	21.75
B_2	36.05	44.80	75.17	25.84	22.29	47.35	34.69	32.20	27.82	31.96	38.05	25.70	36.83
C_1	59.24	24.66	36.45	64.90	94.32	27.80	39.99	35.59	35.58	44.00	58.85	82.15	50.29
C_2	47.53	15.96	39.95	36.12	63.94	31.43	15.12	19.29	30.57	22.80	42.37	29.67	32.90
D_1	47.90	34.35	21.74	20.18	5.03	14.24	19.29	17.54	22.01	9.10	20.03	32.99	22.03
D_2	45.38	34.75	25.72	28.08	29.10	18.41	15.87	39.24	30.65	23.73	20.14	26.28	28.11
E_1	35.80	68.55	119.44	18.28	13.88	25.39	35.79	26.80	23.11	40.05	39.95	23.22	39.19
E_2	73.39	51.81	102.96	60.82	19.24	34.64	22.92	27.42	35.69	136.76	56.63	36.76	54.92
F_2	13.67	11.89	9.91	23.71	15.68	7.76	14.15	19.95	9.79	19.95	15.11	6.73	14.03
G_1	56.28	40.55	50.20	23.43	8.49	16.98	14.69	16.60	22.09	18.96	28.28	26.24	26.90
G_2	18.71	12.29	15.38	20.33	36.69	23.99	13.80	18.37	17.40	31.19	30.38	41.58	23.34
H_1	17.75	19.19	26.84	25.07	22.03	23.48	26.13	34.66	21.38	16.82	37.54	6.18	23.09
H_2	55.54	22.48	22.22	29.61	19.58	19.59	51.05	69.57	21.65	20.85	19.41	27.29	31.57
I	153.64	166.87	43.25	112.12	156.36	56.03	62.72	92.04	108.82	82.92	40.56	29.67	92.08
I_1	44.29	18.75	16.32	30.00	17.55	14.61	30.44	26.40	30.03	35.93	45.50	31.94	28.48
I_2	21.80	15.87	18.26	18.29	19.55	20.66	15.33	35.20	42.94	38.90	32.14	23.61	25.21
J	50.23	39.67	35.00	11.32	4.95	27.44	33.55	36.64	38.10	35.58	23.88	21.09	29.79
K_1	29.12	13.42	16.16	21.23	23.10	21.89	18.06	26.91	33.61	25.05	20.31	20.98	22.49
K_2	45.27	25.85	23.42	39.80	32.20	23.95	34.58	59.02	25.10	28.87	15.24	20.70	31.17
M_1	21.54	21.66	20.22	17.47	21.89	17.22	33.07	23.44	88.88	114.45	32.73	39.34	37.66
M_2	35.25	35.01	23.04	29.65	21.72	34.17	30.23	57.51	56.43	38.53	27.68	65.06	37.86
N_1	15.91	24.64	31.21	14.14	12.78	9.78	16.00	34.27	159.16	137.06	78.91	60.48	49.53
N_2	35.05	42.12	51.07	52.42	17.05	18.84	66.08	60.18	76.23	57.82	25.22	38.09	45.02
O_1	12.83	24.16	26.11	36.74	13.31	45.61	15.71	34.97	41.52	76.59	47.16	56.19	35.91
O_2	21.16	16.70	25.25	79.07	27.37	57.46	25.93	46.96	74.95	60.95	52.17	76.14	47.01
P_1	30.45	39.76	22.30	27.52	34.99	26.32	28.95	37.47	37.63	25.19	29.48	53.84	32.82
P_2	24.45	25.75	18.08	16.36	19.89	27.75	35.83	79.70	72.00	76.97	77.24	57.19	44.27
Q_1	24.39	37.74	8.96	15.57	19.65	17.25	34.14	40.29	15.64	18.26	20.60	16.96	22.46
Q_2	20.04	16.17	17.35	10.26	14.19	12.78	11.03	15.55	13.45	11.47	17.88	15.47	14.64
R_1	53.19	32.58	37.21	25.63	48.32	50.15	38.98	34.88	15.01	29.34	26.35	26.19	34.82
R_2	10.31	17.75	28.42	24.99	8.76	16.21	12.61	22.04	33.35	36.07	48.45	45.55	25.38
S_1	146.12	45.28	22.77	33.33	12.16	19.97	37.63	36.46	45.56	68.48	35.95	37.38	45.09
S_2	22.89	18.32	16.43	25.58	31.11	47.39	29.90	22.54	34.97	87.61	61.73	29.93	35.70
T_1	47.98	13.31	35.80	13.78	22.19	26.20	31.48	25.04	138.49	66.19	49.05	21.98	40.96

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
T_2	27.57	12.06	13.12	12.04	11.91	15.94	17.07	25.98	75.29	50.09	46.02	15.87	26.91
U_1	50.90	22.70	26.94	27.34	37.84	26.99	33.38	28.41	52.33	98.23	91.37	133.42	52.49
U_2	27.38	27.35	17.84	16.93	22.13	20.96	37.07	21.22	41.91	13.22	26.94	20.41	24.45
V_1	34.74	22.57	17.73	17.81	18.74	19.87	20.42	49.27	101.25	134.17	86.02	61.32	48.66
V_2	79.38	35.12	12.11	18.42	13.16	20.90	31.15	25.72	95.30	135.39	134.10	136.42	61.43
W_1	26.63	48.27	34.02	38.74	32.77	50.63	33.64	46.81	35.07	39.64	53.69	70.38	42.52
W_2	22.56	20.47	30.39	15.22	17.66	14.84	11.69	20.41	59.50	145.62	95.00	43.19	41.38
X	43.92	34.43	23.62	58.01	42.75	59.62	34.73	119.90	57.31	38.30	43.06	57.81	51.12
Y	23.94	20.89	9.72	35.52	127.74	24.35	29.12	49.55	46.98	68.39	45.14	35.00	43.03
Z_1	26.98	27.50	21.98	30.48	16.06	34.46	22.76	22.29	31.28	67.00	48.90	126.81	39.71
Z_2	26.33	12.35	22.38	60.11	28.36	39.99	45.69	44.76	49.39	63.82	66.14	33.36	41.06
Total Avg Total Avg	41.17	27.94	28.61	28.74	27.59	26.68	28.71	36.31	45.13	48.45	47.79	41.58	35.73

Table 34 GCN Spatial with LSTM layer: Average percentage of error by time of day in Thursday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	30.75	22.12	32.25	14.28	20.35	44.06	39.90	38.29	24.47	44.10	40.30	38.13	32.42
A_2	40.23	25.08	22.58	18.53	15.81	17.75	17.31	27.04	34.61	56.10	46.32	69.99	32.61
AA_1	17.59	28.06	11.92	16.03	24.37	29.69	44.35	79.47	76.46	42.20	80.49	15.98	38.88
AA_2	31.19	17.06	39.33	24.51	54.24	42.81	53.85	139.63	189.42	60.64	72.99	27.09	62.73
AB_1	19.48	22.89	17.28	22.43	15.08	27.50	48.07	49.89	38.17	40.53	44.86	47.15	32.78
AB_2	21.63	20.49	23.21	35.94	55.77	35.84	25.11	86.79	53.99	38.08	83.57	67.35	45.65
AC_1	28.34	23.51	7.31	16.86	24.12	30.96	24.25	23.78	45.14	31.55	23.43	10.71	24.16
AC_2	22.06	15.76	7.33	30.73	23.32	38.06	13.07	64.36	73.68	31.41	75.62	30.66	35.50
AD	25.70	20.46	44.43	29.12	25.25	28.23	27.50	42.95	39.12	62.01	93.49	12.20	37.54
AE	22.37	17.38	16.30	20.27	33.83	58.77	25.58	28.06	44.19	157.36	109.86	28.73	46.89
AED	33.51	30.91	24.74	15.15	9.63	21.74	16.32	21.21	45.13	59.63	41.34	11.00	27.53
AF	22.90	48.43	19.35	28.68	41.95	26.75	20.56	27.09	35.24	22.09	34.50	19.46	28.92
AG	15.06	14.19	15.05	31.13	19.20	15.99	18.70	17.76	33.39	24.04	31.30	15.68	20.96
AH	28.25	14.11	3.50	9.57	17.40	12.93	24.90	31.43	49.94	16.00	26.74	73.04	25.65
AI	11.67	21.38	4.83	29.88	25.20	12.96	10.04	43.17	40.09	21.74	19.32	22.16	21.87
AJ_1	41.03	27.66	9.85	12.74	13.87	8.92	18.80	20.37	20.63	106.88	69.98	40.22	32.58
AJ_2	15.09	20.42	9.72	8.35	21.66	16.93	14.48	30.26	53.26	22.28	22.26	19.67	21.20
AK_1	24.75	15.25	15.13	22.50	27.50	27.78	45.42	25.96	21.20	39.39	64.92	23.24	29.42
AK_2	16.59	35.50	37.31	50.90	57.51	54.85	31.90	36.70	29.93	77.22	63.23	20.63	42.69
AL_1	22.90	8.57	10.26	10.57	6.73	17.72	16.01	17.08	20.26	82.07	93.68	46.41	29.36
AL_2	15.36	13.21	7.99	10.13	11.81	13.25	41.92	52.95	50.52	29.05	66.83	54.54	30.63
AM_1	16.05	17.53	12.03	18.17	24.44	15.21	17.38	49.90	47.27	26.63	28.92	36.32	25.82
AM_2	11.25	10.94	10.93	40.38	11.96	37.55	18.50	25.59	66.30	137.28	67.76	28.09	38.88

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AO	27.14	27.89	109.66	50.30	21.89	23.26	17.42	38.68	56.06	58.49	44.21	111.36	48.86
AP	13.68	16.94	43.06	22.52	29.81	24.92	19.43	35.24	50.65	32.53	34.15	27.21	29.18
B_2	35.09	44.19	15.92	53.67	22.11	50.04	43.55	47.07	40.24	60.74	54.08	97.27	47.00
C_1	23.01	26.20	60.76	25.34	29.37	32.63	34.01	16.36	20.95	43.59	48.11	22.12	31.87
C_2	25.44	17.36	79.34	15.63	37.51	35.69	33.91	21.09	35.89	54.25	95.88	18.62	39.22
D_1	33.45	20.96	23.26	14.29	6.00	13.17	21.84	44.80	28.00	36.42	79.06	62.67	31.99
D_2	31.67	15.93	21.03	20.32	33.97	21.86	29.02	46.90	26.86	14.42	41.30	17.34	26.72
E_1	106.90	56.28	84.99	35.75	14.73	31.19	18.18	26.63	26.28	45.40	82.99	78.83	50.68
E_2	56.30	80.31	97.74	65.49	16.70	37.80	34.49	53.93	51.89	31.69	67.74	50.45	53.71
F_2	11.91	10.12	8.61	16.52	14.99	10.23	15.00	12.71	20.82	24.89	22.50	24.48	16.07
G_1	61.81	33.15	37.14	32.02	15.54	11.07	19.64	15.50	27.16	27.38	77.20	30.44	32.34
G_2	21.70	10.31	11.71	12.03	24.09	11.89	25.12	34.33	19.42	36.11	70.55	68.86	28.84
H_1	23.07	10.56	28.97	23.58	15.07	33.80	16.70	39.84	49.48	36.05	17.64	28.57	26.94
H_2	24.31	22.32	4.28	13.29	15.31	19.42	18.65	61.49	45.43	38.86	34.47	61.46	29.94
I	43.97	55.58	85.67	38.93	25.12	29.71	43.18	27.29	34.81	176.68	184.88	36.59	65.20
I_1	31.14	14.91	11.86	8.87	18.02	27.47	23.48	30.40	25.65	29.72	14.78	42.49	23.23
I_2	18.91	23.55	34.32	19.86	24.94	15.62	12.60	125.81	145.29	217.73	126.69	68.73	69.50
J	20.32	21.32	2.32	23.92	27.05	33.60	23.48	55.16	24.41	21.21	25.15	27.23	25.43
K_1	31.74	51.25	15.49	18.92	14.81	17.48	20.53	42.97	96.77	15.59	47.28	95.74	39.05
K_2	36.68	31.36	20.92	24.76	29.26	28.35	24.12	25.11	44.16	20.70	35.16	28.28	29.07
M_1	28.54	25.35	22.13	20.85	24.28	13.07	35.12	16.71	84.19	90.91	62.21	25.58	37.41
M_2	28.37	28.36	29.98	27.72	30.55	38.39	78.35	41.47	66.14	87.27	46.84	99.35	50.23
N_1	17.81	19.62	19.00	16.27	33.47	25.09	21.98	30.21	54.71	34.95	44.04	13.22	27.53
N_2	39.51	32.50	144.94	27.24	81.69	42.96	69.46	113.83	70.11	81.38	47.33	15.78	63.90
O_1	13.91	22.84	24.39	22.15	51.92	77.30	21.53	27.74	50.45	54.84	35.59	10.80	34.46
O_2	15.29	16.48	32.05	29.61	101.90	47.55	20.35	69.90	45.26	29.78	46.60	17.23	39.33
P_1	25.70	14.29	29.90	33.64	17.72	26.15	35.11	34.09	36.08	55.72	46.00	31.62	32.17
P_2	29.02	38.63	11.32	58.71	34.52	24.82	29.68	59.46	82.21	57.23	48.54	46.85	43.42
Q_1	6.88	19.82	13.93	11.41	29.00	22.22	56.86	29.05	22.12	30.47	28.02	8.51	23.19
Q_2	15.59	26.51	10.07	8.73	14.57	19.17	11.53	18.36	39.59	92.55	58.51	19.74	27.91
R_1	40.03	50.64	12.63	37.95	21.37	47.59	34.43	40.91	26.01	34.05	28.24	32.47	33.86
R_2	18.75	44.00	40.52	11.06	28.73	21.73	26.03	18.05	17.75	34.58	54.09	62.86	31.51
S_1	120.86	34.51	5.13	32.78	23.71	31.95	21.01	36.68	66.73	38.58	41.21	25.47	39.88
S_2	46.53	26.22	13.51	12.16	55.22	16.27	41.98	40.94	94.25	64.89	107.99	14.15	44.51
T_1	36.38	11.25	26.09	18.90	20.12	19.38	23.21	39.82	240.72	38.92	54.47	31.43	46.72
T_2	21.03	14.72	29.87	9.13	23.21	18.97	18.18	13.58	320.20	202.83	137.72	17.31	68.90
U_1	57.09	20.15	19.03	18.75	24.75	81.93	46.74	47.45	81.32	90.29	111.17	98.67	58.11
U_2	23.32	14.95	20.52	16.84	24.46	14.33	15.30	41.99	98.66	129.62	73.48	19.18	41.05
V_1	16.50	46.11	16.03	21.24	35.21	23.86	46.66	44.36	54.54	285.32	34.08	20.94	53.74
V_2	56.74	50.50	48.85	17.42	18.66	40.96	22.12	21.17	69.86	182.52	135.53	27.14	57.62
W_1	36.46	37.54	14.03	32.60	24.49	45.29	27.26	36.41	35.15	49.54	50.35	39.69	35.73

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
W_2	19.41	17.35	8.92	9.93	14.72	11.58	11.72	16.97	137.81	76.98	83.04	77.62	40.50
X	48.85	31.21	28.84	31.67	48.83	25.20	66.58	53.64	74.64	143.96	65.75	146.47	63.80
Y	15.45	17.27	24.50	39.90	14.98	26.21	37.63	70.62	130.15	59.73	76.77	76.71	49.16
Z_1	34.80	15.14	29.62	25.83	27.05	19.17	19.10	37.73	30.21	43.50	73.11	42.73	33.17
Z_2	29.49	19.25	15.13	14.05	58.36	28.78	43.55	69.16	83.76	71.03	32.91	19.24	40.39
Total Avg	29.77	25.75	27.40	24.05	27.55	28.34	28.84	41.32	59.64	63.94	59.84	40.55	38.08

Table 35 GCN Spatial with LSTM layer: Average percentage of error by time of day in Friday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	16.82	23.22	33.17	39.99	22.72	19.27	44.22	58.99	37.80	20.30	44.96	18.82	31.69
A_2	18.85	29.48	57.38	46.30	22.47	30.46	39.85	30.55	43.43	19.96	38.24	23.71	33.39
AA_1	24.91	12.65	23.74	22.69	18.19	23.82	44.44	48.31	61.32	151.86	105.12	100.40	53.12
AA_2	23.67	21.11	15.54	18.44	22.34	29.70	68.25	61.52	48.25	44.16	38.65	53.32	37.08
AB_1	13.01	17.36	10.69	16.18	19.03	18.23	24.08	69.80	51.98	114.94	60.30	57.62	39.44
AB_2	16.58	24.06	13.98	35.63	41.46	48.64	21.97	50.46	34.22	38.13	34.03	117.34	39.71
AC_1	29.87	26.04	16.50	23.00	22.35	13.20	10.02	22.80	24.14	69.91	17.87	27.40	25.26
AC_2	24.90	29.88	37.23	27.30	17.38	15.46	11.39	8.55	34.66	25.57	30.06	40.29	25.22
AD	34.04	72.49	36.05	20.35	24.05	23.60	31.79	30.46	29.77	16.25	22.73	28.65	30.85
AE	39.34	14.27	40.48	53.81	25.26	33.82	28.17	14.03	24.03	16.36	27.33	26.24	28.59
AED	47.98	23.41	21.46	16.31	38.73	19.64	32.21	17.53	19.05	33.05	39.47	14.26	26.92
AF	31.55	24.26	41.07	39.65	33.76	21.88	72.42	60.90	21.94	27.65	13.10	129.68	43.15
AG	22.95	19.46	36.79	28.22	16.13	24.80	17.10	39.41	20.01	18.76	21.25	33.81	24.89
AH	22.74	24.48	16.34	22.74	26.09	33.56	50.67	87.32	46.21	51.05	65.77	99.97	45.58
AI	27.41	20.59	31.15	25.98	18.42	26.89	17.17	12.69	12.21	25.92	12.17	13.44	20.34
AJ_1	16.41	29.64	12.65	17.17	24.97	21.00	17.33	16.84	14.15	10.41	25.46	20.49	18.88
AJ_2	14.16	10.08	12.80	20.22	9.49	21.39	25.38	11.78	23.75	17.49	17.49	19.94	17.00
AK_1	24.68	19.74	23.38	20.00	17.62	15.59	17.47	21.50	25.05	21.40	21.93	16.87	20.44
AK_2	75.63	27.23	23.49	18.92	18.17	14.51	32.06	15.93	28.18	17.53	28.03	23.13	26.90
AL_1	33.24	17.06	15.13	10.82	12.97	15.52	18.40	20.33	22.74	17.21	19.35	14.05	18.07
AL_2	17.57	26.81	18.14	13.42	19.34	14.77	12.88	22.23	16.28	18.76	23.06	20.49	18.65
AM_1	11.08	14.86	16.68	16.93	18.86	19.69	14.51	24.68	32.04	41.62	34.53	49.05	24.54
AM_2	16.57	14.66	13.89	13.87	15.09	15.79	14.56	10.97	20.53	21.11	24.61	19.65	16.77
AO	32.85	36.96	26.20	36.70	42.97	31.63	27.83	33.96	55.74	123.77	51.48	44.77	45.40
AP	23.51	13.22	10.78	19.29	26.92	24.42	31.72	20.81	15.69	18.08	7.24	15.07	18.90
B_2	39.25	21.38	153.77	44.12	53.74	41.13	61.54	54.17	46.13	75.20	29.78	77.18	58.12
C_1	20.45	24.18	12.19	22.86	15.20	14.83	15.97	27.86	12.08	13.22	32.70	20.66	19.35
C_2	12.23	23.73	18.95	17.16	14.90	40.53	21.19	24.72	18.65	28.60	44.58	12.61	23.16
D_1	17.70	15.41	15.81	19.71	23.09	14.90	31.39	18.17	12.36	9.43	20.44	10.85	17.44
D_2	26.66	12.34	9.67	34.90	14.80	11.93	44.68	17.82	22.30	20.97	20.54	23.73	21.69

E_1	41.04	21.51	20.78	15.96	16.08	17.07	21.51	20.58	26.10	25.99	19.17	15.74	21.79
E_2	12.86	15.47	21.45	18.39	27.85	27.41	26.53	36.51	29.09	25.53	23.90	18.75	23.64
F_2	12.63	14.13	10.86	18.21	7.48	11.68	17.75	15.30	13.97	10.46	19.97	5.66	13.17
G_1	18.54	18.16	22.63	19.28	13.67	14.36	14.48	14.09	17.87	12.52	10.42	14.08	15.84
G_2	21.73	17.23	22.16	13.83	23.93	16.99	10.71	18.08	11.74	35.82	20.56	10.20	18.58
H_1	17.89	18.14	20.17	24.31	17.47	23.05	11.58	20.30	24.28	24.26	21.59	23.77	20.57
H_2	22.91	41.46	36.12	47.58	31.04	35.44	30.21	15.17	24.81	36.16	32.87	21.78	31.30
I	24.79	23.29	15.04	16.27	21.62	24.97	37.29	36.77	25.44	32.77	32.57	21.77	26.05
I_1	16.32	11.07	25.24	15.94	40.20	86.12	29.01	56.34	49.07	58.41	59.64	45.09	41.04
I_2	30.83	13.67	18.36	11.89	52.63	107.82	88.11	149.55	142.76	138.07	55.01	19.44	69.01
J	26.53	21.56	37.27	34.27	28.81	31.77	66.89	42.59	36.07	52.93	43.59	36.16	38.20
K_1	58.21	16.90	16.46	35.74	34.87	81.46	82.78	126.48	99.63	66.37	58.90	33.84	59.30
K_2	98.21	37.90	31.37	15.28	37.45	43.27	25.04	40.18	27.37	29.44	28.88	28.43	36.90
M_1	47.12	26.58	31.82	21.22	19.97	32.20	26.88	21.52	45.85	29.77	26.24	28.27	29.79
M_2	18.88	27.77	42.00	58.48	88.16	101.15	151.56	215.40	180.87	208.29	145.90	182.30	118.40
N_1	30.52	17.69	19.35	23.64	27.18	37.40	77.25	18.86	15.01	24.57	23.87	19.52	27.91
N_2	25.01	20.07	60.40	82.60	84.07	112.34	191.65	121.11	58.06	51.59	53.84	37.81	74.88
O_1	31.12	24.90	27.56	59.80	52.71	41.88	98.40	16.19	42.48	34.56	40.35	19.82	40.81
O_2	19.53	58.56	85.20	71.28	107.72	107.56	129.60	60.34	30.00	24.58	30.11	45.11	64.13
P_1	42.03	38.57	28.30	28.61	49.36	57.06	49.26	55.78	101.19	81.06	73.16	123.43	60.65
P_2	39.08	20.86	56.29	22.72	25.42	37.26	28.04	22.56	73.40	57.28	73.99	106.57	46.96
Q_1	12.53	18.10	11.13	8.51	21.47	18.84	19.09	28.46	16.37	13.18	23.50	15.16	17.20
Q_2	15.32	18.63	8.41	13.48	18.01	15.21	11.18	11.88	17.42	46.73	32.39	31.44	20.01
R_1	16.74	34.77	11.96	17.86	18.23	25.89	26.11	17.32	18.76	21.88	19.16	31.64	21.69
R_2	18.67	21.27	18.05	18.88	24.72	30.73	15.19	11.75	39.15	26.56	56.49	15.47	24.74
S_1	20.07	23.00	21.36	15.63	27.95	21.20	26.90	26.86	25.49	17.13	32.99	25.18	23.65
S_2	13.38	28.75	22.35	41.49	21.88	29.75	18.90	37.28	23.65	22.50	27.16	16.37	25.29
T_1	34.91	31.09	25.70	23.72	25.59	26.28	19.25	17.43	15.78	19.93	29.55	37.84	25.59
T_2	41.71	16.79	18.51	64.13	27.11	42.57	16.73	20.98	27.39	26.05	13.07	15.14	27.51
U_1	21.66	13.43	17.91	23.49	22.01	30.62	23.78	25.53	43.65	28.93	34.50	22.51	25.67
U_2	34.95	16.61	17.23	13.32	14.08	17.72	21.01	23.48	28.15	17.54	38.32	15.90	21.53
V_1	32.58	53.22	18.45	31.90	26.92	22.94	22.63	24.24	22.17	22.01	29.78	20.69	27.29
V_2	18.19	23.81	9.68	21.43	22.14	26.67	20.76	23.90	30.40	39.59	30.23	14.52	23.44
W_1	27.60	20.94	16.47	21.44	29.48	25.68	26.72	23.91	22.99	35.45	30.20	26.08	25.58
W_2	15.05	12.67	17.74	15.75	11.67	19.53	20.68	18.71	34.59	16.37	22.44	19.77	18.75
X	20.12	27.11	68.89	121.63	107.60	139.72	65.20	134.51	165.11	292.99	57.58	65.12	105.46
Y	23.99	24.07	20.87	20.41	28.28	32.47	100.95	55.58	126.10	118.32	35.67	28.56	51.27
Z_1	22.64	14.85	16.42	24.07	40.38	35.88	27.13	32.61	102.99	85.56	110.06	117.03	52.47
Z_2	29.24	28.26	23.76	13.67	39.37	23.97	48.98	58.12	38.23	64.07	69.54	21.89	38.26
Total Avg	26.84	23.52	26.50	27.95	29.44	33.83	38.35	38.72	39.83	44.98	37.09	37.27	33.69

Table 36 GCN Spatial with LSTM layer: Average percentage of error by time of day in Saturday

A.4 GCN Spectral with Combination Matrix

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	14.46	26.14	50.40	52.63	39.76	23.00	53.32	24.41	24.27	20.78	20.96	12.61	30.23
A_2	24.00	34.24	47.46	35.77	42.01	58.80	60.62	56.48	59.18	42.69	29.01	28.52	43.23
AA_1	19.03	22.21	16.47	18.00	14.05	17.73	31.09	24.18	24.79	26.39	34.09	17.05	22.09
AA_2	18.49	16.95	18.04	10.47	26.62	30.16	15.01	31.04	22.22	21.26	24.82	16.71	20.98
AB_1	17.26	10.60	12.93	16.71	13.04	17.78	18.20	15.98	25.96	62.39	26.98	15.04	21.07
AB_2	20.35	12.91	11.36	30.78	21.55	20.17	26.23	13.64	24.68	14.12	21.09	21.12	19.83
AC_1	39.22	42.45	21.76	15.12	16.10	20.30	16.96	29.82	34.36	42.21	22.96	29.61	27.57
AC_2	23.22	22.11	19.89	26.96	16.54	14.84	15.53	20.15	13.71	20.95	17.99	15.43	18.94
AD	33.39	58.67	28.21	36.70	15.98	37.01	19.10	33.50	26.24	14.03	21.44	37.71	30.16
AE	26.66	33.48	24.34	25.95	36.34	43.73	26.65	23.61	20.24	20.59	19.63	21.28	26.88
AED	31.98	11.08	24.88	22.50	22.56	28.42	11.11	17.38	15.88	30.65	23.60	12.57	21.05
AF	22.75	24.56	16.34	55.82	28.82	25.27	25.33	71.87	38.37	30.76	32.54	65.70	36.51
AG	40.86	27.77	13.43	11.76	19.46	28.72	19.91	11.94	16.02	13.00	29.49	12.97	20.45
AH	26.77	15.26	16.51	38.05	52.44	44.81	39.85	83.55	85.01	68.56	74.53	67.10	51.04
AI	8.80	32.35	13.13	21.25	7.86	15.92	16.05	26.90	15.82	9.83	8.82	12.32	15.75
AJ_1	14.17	12.88	13.77	26.76	25.21	113.38	14.37	17.20	25.17	22.78	17.26	14.10	26.42
AJ_2	20.26	17.22	16.68	18.38	39.98	65.94	15.47	14.61	19.87	19.26	17.02	14.95	23.30
AK_1	66.73	22.42	22.64	22.42	18.52	21.05	13.60	12.78	15.49	14.54	14.31	9.07	21.13
AK_2	58.04	16.67	23.38	29.08	29.67	62.25	25.26	20.52	25.74	18.82	28.67	19.15	29.77
AL_1	28.64	22.58	14.23	8.82	13.12	19.13	17.87	19.72	24.64	14.03	17.41	17.87	18.17
AL_2	32.35	20.21	13.90	18.81	16.09	17.08	19.00	20.18	22.59	20.39	12.40	11.91	18.74
AM_1	15.28	12.80	11.34	13.22	18.56	16.13	17.47	38.42	14.89	28.45	14.37	18.00	18.25
AM_2	12.46	10.71	14.10	10.96	15.34	12.34	17.09	16.86	16.35	8.30	15.24	9.73	13.29
AO	48.39	49.51	26.70	19.31	25.51	29.36	24.66	28.90	24.83	24.58	43.52	21.61	30.57
AP	28.07	16.13	17.09	11.13	17.96	18.42	14.67	26.74	24.69	15.28	13.17	13.17	18.04
B_2	55.64	108.28	104.83	70.54	34.05	70.96	97.04	68.59	70.46	115.76	26.42	61.86	73.70
C_1	17.91	11.26	21.83	15.41	20.56	28.16	17.49	16.66	12.36	9.74	10.85	12.48	16.23
C_2	21.41	21.59	13.13	19.40	17.83	21.42	20.09	18.64	12.93	15.35	11.17	18.49	17.62
D_1	17.37	15.28	13.59	8.25	17.36	9.66	17.12	17.50	15.02	11.01	11.82	11.51	13.79
D_2	24.79	20.89	19.98	16.01	15.15	18.83	17.86	20.47	18.26	22.06	19.59	22.90	19.73
E_1	35.93	30.72	25.93	16.20	13.32	21.90	19.94	14.31	23.81	50.37	20.13	25.41	24.83
E_2	14.73	8.45	14.44	16.44	20.88	23.15	19.36	17.32	26.15	21.17	17.12	7.07	17.19
F_2	16.10	12.91	13.72	13.64	19.60	14.98	19.57	18.55	14.95	13.67	13.37	12.09	15.26
G_1	20.81	12.14	13.76	11.97	9.79	7.71	13.78	16.13	17.48	18.14	17.31	16.54	14.63
G_2	21.19	16.42	16.50	13.83	7.83	14.42	14.04	18.14	14.55	15.17	18.79	16.55	15.62
H_1	24.87	23.30	29.15	25.94	12.84	20.79	19.88	13.75	17.91	11.16	15.13	20.53	19.60
H_2	33.25	17.61	31.59	21.89	37.78	36.73	23.24	26.63	32.00	42.59	16.53	23.29	28.59
I	42.65	18.73	13.50	13.67	25.94	18.34	55.22	50.12	24.26	18.07	15.96	20.41	26.41
I_1	19.13	13.23	18.18	14.20	7.96	54.47	46.73	59.81	82.93	61.97	52.17	32.97	38.65
I_2	10.39	37.51	16.34	15.14	36.89	66.93	29.59	81.57	39.80	78.67	12.96	15.76	36.80

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
J	22.45	25.46	38.14	30.48	46.27	37.95	31.00	31.44	54.24	35.31	33.97	46.19	36.07
K_1	11.05	44.89	18.66	49.03	106.86	104.96	66.42	130.58	105.91	37.02	20.65	16.13	59.35
K_2	48.25	36.33	36.30	24.59	37.14	56.74	54.70	50.71	54.29	45.54	42.31	31.63	43.21
M_1	168.63	75.76	66.02	18.59	35.94	45.85	42.44	17.87	39.19	24.97	57.55	14.63	50.62
M_2	25.88	31.55	38.05	44.61	86.32	94.69	174.50	224.12	245.56	142.49	128.92	73.20	109.16
N_1	38.01	34.58	39.71	13.30	38.72	30.61	53.65	49.36	21.30	11.75	11.97	19.83	30.23
N_2	27.86	22.63	37.46	99.66	54.50	114.63	163.02	285.09	119.62	43.46	31.98	18.38	84.86
O_1	107.88	103.63	67.70	55.75	73.84	56.93	55.59	37.27	22.57	35.94	44.25	46.50	58.99
O_2	152.54	101.35	156.52	68.47	71.37	56.10	79.88	80.73	128.62	18.97	15.43	31.59	80.13
P_1	78.17	38.52	32.42	21.11	45.57	63.85	70.51	78.49	122.19	66.21	68.12	82.67	63.99
P_2	25.06	16.56	19.31	26.27	26.63	49.74	25.96	47.26	45.43	50.75	36.75	17.10	32.24
Q_1	13.64	14.02	10.35	14.33	25.57	32.15	17.69	16.49	18.83	14.66	21.86	13.54	17.76
Q_2	17.18	14.09	10.27	11.67	14.24	14.98	10.86	12.92	15.68	23.83	15.39	13.68	14.57
R_1	18.30	20.96	22.42	20.05	19.41	24.91	20.45	18.04	17.84	20.99	25.83	21.18	20.87
R_2	22.68	17.83	12.09	18.40	14.36	20.75	15.55	24.93	14.66	21.53	14.74	14.41	17.66
S_1	19.98	21.37	18.60	17.17	21.35	32.18	26.91	26.38	27.28	37.59	15.57	17.83	23.52
S_2	12.31	14.24	22.81	14.64	28.99	28.79	19.35	16.99	14.72	10.96	21.74	38.37	20.33
T_1	64.52	26.40	16.82	24.09	26.70	34.90	24.01	24.81	18.48	17.43	23.93	20.16	26.85
T_2	57.09	23.40	11.64	22.98	28.87	23.35	16.63	38.66	32.24	17.45	19.47	22.66	26.20
U_1	13.30	19.93	17.63	18.34	28.09	18.60	18.63	14.61	36.69	19.28	17.28	16.13	19.88
U_2	20.56	19.36	17.12	9.96	64.41	81.40	18.55	20.61	18.22	19.13	13.77	12.95	26.34
V_1	72.22	48.84	15.50	21.38	14.25	16.27	29.32	29.11	17.48	28.20	14.27	31.14	28.17
V_2	17.66	18.13	21.82	13.08	17.60	21.16	22.84	26.74	17.98	29.22	13.19	14.82	19.52
W_1	17.09	15.24	21.02	34.15	46.14	26.47	21.83	22.66	20.08	14.88	24.67	22.94	23.93
W_2	14.19	16.35	17.77	14.54	14.93	22.66	18.30	28.19	18.85	23.36	17.09	18.75	18.75
X	32.65	18.94	81.80	165.40	132.45	131.47	61.87	133.55	232.76	145.83	86.15	92.39	109.61
Y	23.72	19.41	19.24	32.09	36.43	31.76	46.21	86.45	87.06	47.52	25.98	16.32	39.35
Z_1	29.64	24.17	17.94	31.71	39.34	26.19	69.43	58.10	53.27	62.81	68.52	58.93	45.00
Z_2	193.16	23.62	22.59	18.95	25.80	36.25	91.07	22.25	20.35	22.70	19.65	27.43	43.65
Total Avg	**35.27**	**27.07**	**26.13**	**26.73**	**30.62**	**37.19**	**34.38**	**40.77**	**39.50**	**32.16**	**26.55**	**24.99**	

Table 37 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Sunday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	30.01	28.23	51.45	36.02	51.43	63.01	57.11	61.57	69.25	24.87	22.10	24.58	43.30
A_2	34.41	16.25	34.24	18.28	31.72	45.67	24.91	24.99	17.00	23.36	34.45	41.18	28.87
AA_1	16.73	32.10	21.66	20.67	8.72	13.28	18.18	19.21	16.71	15.27	8.03	23.60	17.85
AA_2	19.97	97.56	17.89	18.30	7.80	24.83	18.73	20.30	33.59	28.62	30.52	30.69	29.07
AB_1	23.75	13.97	24.28	18.53	22.37	12.66	17.00	21.55	28.79	22.43	20.31	54.08	23.31
AB_2	28.42	117.89	35.51	17.76	14.86	12.08	20.73	28.62	24.51	20.08	12.87	28.08	30.12

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AC_1	15.70	32.07	29.52	44.88	16.01	29.35	13.93	25.65	28.02	25.59	22.50	23.52	25.56
AC_2	12.59	40.59	38.84	26.47	17.42	16.69	16.56	18.85	34.52	26.57	20.64	18.74	24.04
AD	24.84	22.52	81.77	13.44	20.25	57.58	22.02	87.74	55.70	35.69	49.64	50.03	43.44
AE	22.34	24.74	24.90	48.62	44.09	20.38	34.29	60.91	43.11	19.39	62.00	33.23	36.50
AED	78.51	14.80	15.66	23.28	15.56	17.69	17.62	20.06	22.13	36.03	30.32	17.97	25.80
AF	63.32	20.13	45.12	35.58	23.77	30.30	22.44	28.10	19.84	76.84	31.31	17.54	34.52
AG	18.93	10.31	25.92	18.11	23.09	12.25	18.98	11.40	19.88	11.71	16.50	12.94	16.67
AH	19.52	25.13	23.09	22.77	26.89	9.85	24.29	28.21	28.85	31.57	24.08	53.35	26.47
AI	16.70	13.69	11.34	10.84	10.04	17.41	8.90	18.06	19.96	12.18	17.10	11.96	14.01
AJ_1	35.29	22.05	12.60	10.01	13.26	15.92	18.31	16.94	24.75	25.34	22.07	21.67	19.85
AJ_2	42.20	4.52	11.61	13.05	9.55	16.20	12.31	13.10	18.26	15.73	10.17	16.81	15.29
AK_1	19.71	11.32	16.48	14.98	22.17	39.05	25.08	53.64	49.73	29.85	38.34	53.73	31.17
AK_2	46.40	25.81	22.71	23.08	23.13	37.79	55.88	24.42	30.53	22.34	38.70	58.96	34.14
AL_1	15.47	9.91	13.08	9.90	9.72	18.15	19.42	21.95	25.63	50.05	76.40	63.89	27.80
AL_2	18.31	19.15	20.60	13.63	12.36	16.50	18.65	26.00	73.52	11.36	105.54	42.38	31.50
AM_1	19.44	10.13	17.74	15.14	11.81	21.70	16.34	26.06	29.57	51.90	52.19	28.95	25.08
AM_2	21.63	17.70	6.73	7.02	16.21	25.64	12.45	12.45	11.58	26.84	50.21	17.23	18.81
AO	31.96	12.82	23.45	15.17	21.25	21.75	35.30	24.68	54.51	110.63	55.50	63.48	39.21
AP	27.05	14.22	18.07	31.53	21.28	22.56	13.35	18.90	18.25	50.54	26.27	37.45	24.96
B_2	46.40	26.43	92.25	91.52	71.45	33.40	84.12	125.40	97.59	98.33	96.65	114.03	81.46
C_1	21.50	23.56	33.74	12.60	18.15	14.18	15.29	15.99	14.61	28.69	11.03	11.77	18.43
C_2	20.00	23.78	30.30	11.64	19.46	9.62	18.09	11.73	12.70	20.41	14.34	18.09	17.51
D_1	34.18	20.87	21.30	15.56	12.91	7.41	10.23	8.71	12.01	17.44	18.79	15.90	16.28
D_2	38.48	13.63	29.71	22.21	9.19	11.06	17.70	24.17	14.61	25.47	17.40	31.67	21.27
E_1	60.27	50.64	28.03	21.98	19.41	23.17	17.35	18.62	16.58	30.09	28.02	8.31	26.87
E_2	48.71	32.70	56.40	40.78	17.90	18.30	38.30	24.41	20.21	80.55	26.24	20.93	35.45
F_2	16.31	30.27	22.66	15.52	10.53	10.87	9.69	22.03	15.84	10.26	13.58	13.33	15.91
G_1	23.11	15.85	50.15	23.32	11.18	11.09	19.94	18.07	27.72	27.15	14.11	24.31	22.17
G_2	13.04	11.26	20.71	17.24	25.77	12.72	8.71	15.83	14.61	31.03	19.72	16.87	17.29
H_1	17.92	16.62	19.21	25.06	17.93	24.88	9.87	18.39	16.93	20.63	17.51	13.70	18.22
H_2	43.59	16.88	20.03	29.36	11.24	28.05	44.11	16.08	38.10	48.28	50.74	34.97	31.79
I	45.13	138.28	26.17	29.03	19.03	23.26	25.34	23.42	19.29	14.78	21.36	18.34	33.62
I_1	15.35	24.73	17.70	15.83	20.83	13.09	15.86	23.66	41.62	42.51	20.64	15.31	22.26
I_2	15.31	16.53	17.31	18.26	19.59	12.59	14.49	11.37	17.96	14.86	18.12	9.72	15.51
J	31.19	33.54	18.04	20.16	62.35	48.53	47.99	82.98	61.13	99.92	61.43	42.94	50.85
K_1	23.63	12.36	21.02	22.96	15.90	11.42	16.60	18.14	23.56	14.91	23.52	23.23	18.94
K_2	81.88	23.33	19.30	23.06	24.42	40.15	24.19	28.19	23.26	17.14	18.72	24.83	29.04
M_1	58.22	29.65	23.45	11.94	8.65	24.53	13.21	30.83	46.07	25.71	32.40	15.18	26.65
M_2	39.44	38.82	29.73	23.77	25.56	49.63	21.82	25.11	59.42	56.18	34.02	34.42	36.49
N_1	27.53	15.24	22.36	17.96	23.18	39.64	20.22	18.47	32.78	20.94	42.32	65.06	28.81
N_2	29.33	36.98	24.20	61.64	66.84	82.54	78.07	83.78	58.86	23.90	20.58	18.53	48.77
O_1	31.45	21.16	19.15	23.28	21.72	30.27	59.71	28.42	33.40	20.73	42.38	48.00	31.64

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
O_2	16.59	19.67	14.37	13.18	26.54	29.76	12.18	19.99	50.19	18.56	16.64	28.07	22.15
P_1	35.85	24.53	11.81	26.86	28.60	19.05	50.58	33.35	32.18	42.57	19.84	36.58	30.15
P_2	28.98	11.97	16.57	9.18	30.66	35.62	45.13	32.92	25.84	25.55	19.02	20.34	25.15
Q_1	15.72	13.15	14.34	11.18	10.51	16.57	10.20	18.36	12.92	16.03	23.73	9.66	14.36
Q_2	13.50	22.27	13.17	14.52	10.22	7.86	9.51	14.35	11.45	16.27	18.53	9.24	13.41
R_1	31.19	28.68	21.67	58.25	26.20	22.46	17.22	33.77	35.81	13.45	22.92	16.68	27.36
R_2	15.64	30.01	17.90	14.70	17.47	11.19	12.53	16.99	14.06	8.24	26.15	35.51	18.37
S_1	94.07	23.75	17.92	31.61	12.07	25.09	20.01	31.65	26.65	38.06	102.82	64.47	40.68
S_2	11.23	22.74	17.36	18.88	13.72	14.54	36.41	31.92	24.83	23.98	16.09	28.94	21.72
T_1	20.60	21.51	26.33	17.82	28.31	21.25	11.60	100.97	167.20	21.37	44.78	77.34	46.59
T_2	27.93	12.82	20.21	17.04	14.57	18.46	24.07	68.20	86.13	20.88	16.15	23.09	29.13
U_1	50.79	22.23	17.18	21.79	20.44	23.11	24.40	27.02	49.16	65.14	156.19	59.93	44.78
U_2	26.24	12.60	11.10	14.20	13.03	22.29	12.73	87.44	84.30	32.13	35.97	40.63	32.72
V_1	32.60	13.32	29.48	19.94	31.09	19.83	33.58	54.53	28.19	22.37	24.85	59.44	30.77
V_2	22.54	27.41	14.34	11.89	16.81	23.31	17.16	28.03	45.77	22.74	85.37	75.95	32.61
W_1	28.46	32.09	26.45	32.14	18.05	40.97	20.46	22.24	14.98	66.85	58.61	21.22	31.88
W_2	26.41	20.97	18.14	10.88	22.08	12.48	17.32	23.82	23.07	88.61	132.83	110.78	42.28
X	66.01	55.97	12.69	20.90	39.41	47.25	41.30	47.24	67.76	47.02	41.96	104.76	49.36
Y	14.00	14.06	19.67	9.56	23.28	17.63	36.08	18.42	43.62	26.52	19.91	22.89	22.14
Z_1	27.84	16.79	35.88	30.19	60.01	33.55	27.19	33.12	19.85	29.94	36.82	42.11	32.77
Z_2	22.97	50.49	13.22	16.71	13.60	18.76	17.95	18.02	27.22	35.49	28.29	14.96	23.14
Total Avg	**30.64**	**26.49**	**24.59**	**22.36**	**22.10**	**24.34**	**24.51**	**31.44**	**34.90**	**32.99**	**36.07**	**34.61**	

Table 38 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Monday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	33.61	15.83	23.26	34.48	46.67	56.00	50.31	67.19	56.06	5.13	22.73	18.34	35.80
A_2	25.21	22.77	19.74	27.03	17.57	33.50	38.69	39.60	29.36	43.41	23.46	12.56	27.74
AA_1	18.94	28.51	20.86	15.35	14.30	23.48	62.12	38.53	40.52	23.07	39.21	67.72	32.72
AA_2	21.17	38.18	15.93	19.72	54.62	23.73	60.27	19.53	34.76	10.04	37.82	35.26	30.92
AB_1	23.87	28.44	25.94	22.20	20.63	25.59	26.92	27.05	21.38	30.33	29.54	27.92	25.82
AB_2	29.53	23.85	22.59	20.00	70.16	42.48	15.86	32.81	14.88	33.19	22.72	47.49	31.30
AC_1	24.98	17.26	23.81	23.18	16.23	20.11	15.57	29.83	28.56	15.13	22.36	22.05	21.59
AC_2	19.01	16.76	29.81	21.28	18.86	22.36	15.46	27.78	32.81	27.65	29.04	23.47	23.69
AD	60.57	41.60	50.60	24.85	24.84	22.51	49.97	84.48	13.77	24.03	83.35	43.04	43.64
AE	37.38	29.16	36.59	51.45	51.55	29.29	26.74	41.05	71.29	62.95	80.05	45.79	46.94
AED	47.76	26.65	31.00	26.10	25.09	30.37	28.86	20.22	41.87	2.15	17.18	17.59	26.24
AF	21.49	19.68	62.61	44.87	23.95	38.71	69.92	12.14	23.57	39.73	40.19	25.42	35.19
AG	15.29	19.69	12.06	20.89	20.17	14.52	21.24	18.38	18.76	25.78	17.49	16.38	18.39
AH	22.14	23.48	23.79	19.04	18.36	14.38	12.47	12.88	14.92	26.41	19.22	19.32	18.87
AI	15.82	25.76	31.35	17.37	14.48	22.13	20.75	9.16	13.72	15.14	21.91	12.39	18.33

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AJ_1	41.12	41.06	41.00	22.29	39.28	23.15	17.88	24.04	25.82	21.65	10.14	29.05	28.04
AJ_2	19.97	34.79	33.26	10.65	9.76	15.50	17.91	14.57	10.29	10.41	15.71	16.84	17.47
AK_1	15.86	18.56	16.96	36.24	44.51	21.34	37.94	87.28	39.41	70.10	84.03	44.80	43.09
AK_2	43.76	52.59	38.76	41.50	48.81	47.59	42.05	40.09	19.39	27.08	29.20	25.20	38.00
AL_1	15.79	9.48	22.36	21.36	20.38	14.63	11.15	16.68	37.98	75.92	80.58	53.70	31.67
AL_2	19.50	26.35	15.86	12.00	18.88	11.19	20.12	19.64	43.31	74.11	132.49	46.00	36.62
AM_1	20.06	17.84	14.70	18.70	12.81	11.12	14.36	26.61	41.77	47.27	40.25	27.99	24.46
AM_2	23.99	24.97	11.00	30.17	21.77	11.18	14.61	15.59	34.03	62.38	29.08	37.97	26.40
AO	27.01	25.26	14.20	29.60	24.46	27.44	20.78	27.98	34.88	35.29	95.71	73.55	36.34
AP	10.08	12.65	18.38	24.45	28.43	14.60	11.54	17.07	26.85	45.68	31.94	26.36	22.34
B_2	41.36	67.35	21.52	24.69	37.85	47.16	76.35	53.93	81.85	31.82	34.90	42.38	46.76
C_1	15.29	27.76	27.40	8.82	30.62	17.92	22.66	18.94	24.05	20.34	21.70	19.84	21.28
C_2	21.14	9.45	16.74	24.99	25.40	14.05	28.21	17.10	13.17	11.13	42.11	19.85	20.28
D_1	35.14	29.35	24.27	19.35	20.84	14.34	15.02	13.53	11.48	38.42	18.14	15.32	21.27
D_2	39.03	32.88	43.23	33.32	33.56	14.93	10.25	16.11	28.61	9.71	26.23	11.55	24.95
E_1	102.41	63.92	89.34	25.62	20.47	19.94	29.13	20.38	25.30	28.56	45.59	25.26	41.33
E_2	94.98	82.33	109.90	112.65	11.98	20.05	25.68	27.04	30.60	54.26	47.95	24.35	53.48
F_2	13.30	8.34	13.17	20.44	18.13	13.17	16.48	12.75	22.50	17.75	10.07	15.22	15.11
G_1	33.93	22.79	41.89	30.97	19.77	13.94	9.92	16.52	18.69	15.70	19.89	22.30	22.19
G_2	15.72	16.71	15.83	22.78	23.20	10.44	15.16	19.71	19.39	0.54	19.91	16.62	16.34
H_1	12.26	15.58	17.88	13.67	26.71	24.16	9.96	11.66	17.60	12.37	21.00	28.43	17.61
H_2	31.33	21.57	27.56	18.15	42.78	33.46	41.55	30.43	40.86	119.88	43.19	69.38	43.35
I	69.56	23.65	19.76	13.85	11.08	17.44	18.43	38.38	21.35	22.58	23.65	27.30	25.59
I_1	16.48	15.82	20.81	14.88	19.61	32.76	26.51	22.71	27.55	21.74	19.79	33.87	22.71
I_2	14.53	20.88	17.75	27.34	16.79	16.71	16.40	16.76	17.23	124.04	53.09	20.92	30.20
J	34.69	36.57	18.49	18.37	26.95	48.42	72.34	28.19	19.99	72.77	37.23	34.60	37.38
K_1	21.75	29.40	22.47	23.09	16.71	23.55	19.52	24.71	24.25	25.73	27.24	63.11	26.79
K_2	33.48	28.97	29.19	29.94	35.26	35.79	45.21	28.46	26.70	23.05	18.74	23.56	29.86
M_1	24.94	21.91	42.60	17.65	9.89	20.20	11.90	20.57	36.49	17.75	22.40	49.41	24.64
M_2	33.42	19.28	27.67	29.47	21.57	26.38	19.57	31.78	27.87	31.38	38.39	53.09	29.99
N_1	12.30	26.04	10.27	17.62	20.03	21.19	9.85	22.62	53.68	56.53	82.34	66.87	33.28
N_2	38.33	34.04	23.89	25.08	17.06	25.01	85.44	123.77	39.16	46.63	35.61	46.99	45.08
O_1	16.98	19.45	26.97	13.24	32.37	67.57	28.38	23.85	8.51	20.98	140.78	63.48	38.55
O_2	16.46	11.76	13.16	16.47	19.01	29.67	18.64	19.54	27.54	41.02	42.12	17.87	22.77
P_1	21.37	20.12	38.55	14.82	23.27	37.74	31.00	51.69	27.01	33.81	59.86	39.31	33.21
P_2	18.33	16.59	18.27	27.80	17.42	20.47	46.91	63.39	60.57	27.16	35.56	18.05	30.88
Q_1	26.91	48.48	10.76	23.95	25.42	17.92	6.07	19.12	38.64	8.86	20.31	27.64	22.84
Q_2	12.90	8.82	14.87	10.57	9.21	7.83	13.40	9.94	13.07	40.11	18.54	21.46	15.06
R_1	43.13	44.86	45.28	35.16	58.57	13.95	33.04	46.17	39.17	20.43	26.50	42.25	37.38
R_2	25.25	43.35	18.89	17.14	17.21	24.10	22.73	15.29	16.77	48.81	28.87	55.31	27.81
S_1	127.86	27.65	35.56	44.03	42.24	14.96	42.68	38.48	22.82	102.74	117.38	58.43	56.24
S_2	26.51	29.43	10.08	17.52	12.55	37.11	15.65	46.26	15.33	35.02	22.12	20.64	24.02

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
T_1	42.45	9.60	26.09	19.02	23.24	18.92	20.25	116.17	102.97	98.25	44.03	56.45	48.12
T_2	17.94	17.81	13.25	19.63	13.49	15.09	17.71	54.40	27.15	19.76	18.25	28.29	21.90
U_1	67.94	30.53	23.76	23.58	19.06	39.40	45.63	22.78	32.83	118.79	107.26	86.63	51.51
U_2	29.81	25.39	19.99	29.71	18.12	13.17	14.55	96.18	73.56	36.26	48.93	22.81	35.71
V_1	126.75	29.93	17.42	24.95	15.03	20.99	47.82	48.68	98.97	75.85	76.66	65.92	54.08
V_2	87.19	94.92	24.07	17.20	20.84	15.91	15.38	16.31	44.78	239.98	145.34	74.53	66.37
W_1	47.40	52.96	50.76	45.10	35.73	39.25	52.04	33.64	29.38	13.75	39.85	57.57	41.45
W_2	21.46	29.19	19.12	10.07	15.85	12.87	16.28	20.72	35.70	140.51	180.82	104.09	50.56
X	28.63	27.94	19.34	34.19	32.15	34.31	30.14	36.12	25.42	84.26	100.19	85.84	44.88
Y	14.45	22.16	20.08	18.40	13.79	40.40	29.71	23.81	16.80	22.70	55.72	44.39	26.87
Z_1	23.41	25.18	36.41	33.29	34.98	29.73	20.81	34.08	23.47	21.89	44.96	51.33	31.63
Z_2	14.10	21.75	25.20	16.21	21.09	22.18	18.81	30.45	19.97	44.34	79.89	49.53	30.29
Total Avg	**32.85**	**28.31**	**27.04**	**24.92**	**25.12**	**24.66**	**28.07**	**32.66**	**31.87**	**42.78**	**46.64**	**38.24**	

Table 39 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Tuesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	42.09	19.26	18.78	37.60	46.55	52.68	61.97	63.98	49.63	33.27	29.51	12.68	39.00
A_2	31.70	26.66	22.67	15.05	14.07	35.26	20.72	30.02	22.00	27.23	24.08	20.87	24.20
AA_1	13.20	22.00	19.82	16.11	20.67	17.42	56.51	51.96	42.72	55.99	46.61	48.82	34.32
AA_2	16.46	14.35	16.91	18.51	42.07	55.18	59.72	30.14	19.65	36.05	52.11	33.11	32.85
AB_1	25.69	22.94	19.10	23.86	12.22	18.36	25.22	24.26	29.59	22.39	45.86	24.33	24.48
AB_2	20.49	21.41	17.09	11.83	43.63	22.75	66.48	56.63	37.45	33.25	24.10	15.81	30.91
AC_1	23.83	25.87	22.98	48.24	10.57	10.99	11.80	18.66	30.74	23.43	13.40	12.80	21.11
AC_2	20.34	16.51	29.43	32.94	18.13	10.02	18.00	44.21	20.08	30.70	34.00	29.86	25.35
AD	45.36	38.93	16.39	33.82	46.92	24.51	33.12	23.52	39.66	64.32	57.34	15.92	36.65
AE	28.71	21.16	38.59	29.37	38.45	14.90	25.18	57.47	53.73	123.93	124.88	21.75	48.18
AED	29.32	27.52	17.69	20.57	16.70	35.18	48.21	28.00	22.58	16.42	29.56	28.48	26.69
AF	22.94	299.17	96.36	76.43	51.57	12.32	18.33	18.68	26.10	38.91	15.94	12.36	57.43
AG	19.66	14.46	24.46	11.49	13.46	11.81	20.70	20.12	16.88	17.60	29.83	20.71	18.43
AH	34.87	19.45	23.93	18.99	15.85	15.45	19.95	33.30	25.52	17.44	15.16	33.58	22.79
AI	42.52	20.28	11.32	16.50	10.33	11.42	8.84	18.55	16.50	10.62	13.09	16.56	16.38
AJ_1	49.80	25.13	22.95	23.74	29.66	34.73	24.30	19.73	19.11	46.62	29.81	25.02	29.22
AJ_2	13.69	18.16	18.34	28.01	17.90	14.81	12.29	12.07	15.44	12.73	18.89	14.49	16.40
AK_1	21.75	20.75	20.88	24.66	39.93	30.03	61.01	44.00	31.79	40.33	33.69	46.92	34.65
AK_2	28.90	32.24	26.43	64.99	69.39	50.81	92.03	59.68	24.86	26.37	103.45	16.50	49.64
AL_1	17.55	14.30	10.21	17.12	25.51	15.67	17.22	13.26	12.28	17.37	45.90	53.17	21.63
AL_2	15.50	13.92	16.48	12.72	18.57	4.94	11.43	18.37	53.15	53.75	93.59	77.56	32.50
AM_1	30.64	32.69	16.56	9.38	14.49	12.25	12.52	23.92	52.07	29.09	22.16	36.95	24.39
AM_2	16.95	13.65	13.88	20.65	14.98	24.07	20.42	21.35	31.28	68.53	97.52	18.64	30.16

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AO	13.87	23.17	22.59	21.28	28.94	24.19	35.42	54.74	72.89	80.35	93.31	112.32	48.59
AP	9.07	15.02	35.94	19.30	23.25	23.57	33.65	28.63	82.47	54.10	42.53	15.58	31.93
B_2	36.13	26.85	40.83	48.83	23.31	47.39	37.69	67.91	47.13	37.06	84.81	48.59	45.55
C_1	17.15	18.83	19.42	14.35	28.77	25.21	10.44	20.58	15.43	25.52	11.39	15.28	18.53
C_2	34.84	17.35	22.11	14.17	49.86	12.72	18.27	19.23	17.46	34.66	20.70	20.46	23.49
D_1	35.02	26.38	17.45	25.51	10.02	12.70	14.41	20.26	15.23	15.94	19.04	14.01	18.83
D_2	43.59	22.05	25.37	16.18	17.26	15.39	20.10	14.94	27.26	31.38	41.31	16.19	24.25
E_1	70.08	52.08	30.88	42.03	31.73	30.60	22.22	40.78	31.53	50.05	24.62	21.04	37.30
E_2	87.07	101.80	82.81	61.62	24.70	21.79	29.83	29.73	36.57	49.15	28.46	25.98	48.29
F_2	10.45	17.33	9.98	14.72	10.08	12.93	13.99	10.55	17.52	7.50	8.57	4.57	11.52
G_1	48.70	33.46	33.74	26.02	17.79	9.18	20.94	18.58	13.47	28.50	21.94	19.66	24.33
G_2	27.03	11.90	10.19	14.03	38.56	26.10	16.18	21.19	20.48	14.71	10.73	11.08	18.51
H_1	18.19	17.42	9.88	13.25	28.91	12.43	18.16	24.25	23.43	23.13	9.97	22.34	18.45
H_2	41.38	19.56	25.39	23.41	12.69	20.41	33.93	44.87	28.61	41.98	60.27	65.95	34.87
I	86.69	152.56	20.03	13.05	18.54	50.74	21.31	22.47	31.67	63.46	66.20	22.80	47.46
I_1	14.29	18.39	19.16	29.28	21.25	43.54	49.15	20.28	30.37	31.40	15.16	19.21	25.96
I_2	20.54	19.20	15.25	23.15	26.91	17.76	21.88	15.76	35.31	26.20	23.00	31.33	23.02
J	34.36	23.46	25.76	24.26	21.71	44.06	59.33	25.41	26.79	23.49	35.05	51.11	32.90
K_1	15.97	29.94	17.09	17.87	21.10	27.35	21.52	19.67	19.42	18.81	18.02	35.55	21.86
K_2	45.51	36.69	41.98	26.77	39.28	30.51	27.56	29.08	32.72	19.65	50.25	46.84	35.57
M_1	22.32	14.44	13.54	21.88	17.97	19.18	12.03	18.79	30.43	57.61	27.56	13.61	22.45
M_2	26.08	30.13	32.61	30.25	32.07	32.30	18.40	64.25	14.90	40.14	39.11	29.51	32.48
N_1	15.53	26.93	13.64	25.06	16.00	19.10	16.42	26.19	26.42	22.95	91.13	15.36	26.23
N_2	43.21	41.08	54.23	68.80	38.76	47.59	67.75	90.49	34.83	31.46	46.53	51.95	51.39
O_1	35.76	21.42	15.12	40.98	48.00	42.62	50.01	23.16	25.66	70.35	72.95	25.70	39.31
O_2	21.57	13.45	16.79	46.96	21.84	29.22	19.35	12.13	24.24	54.02	46.66	21.52	27.31
P_1	27.30	13.28	44.25	27.16	20.11	28.92	16.06	40.74	31.88	52.91	30.61	24.44	29.81
P_2	15.13	21.80	18.71	36.76	25.47	22.43	27.40	53.57	40.45	43.50	36.26	63.06	33.71
Q_1	16.26	14.74	10.51	13.44	13.72	14.99	22.03	26.29	15.73	18.78	21.06	18.67	17.19
Q_2	9.76	7.99	13.01	5.65	11.42	17.83	5.88	16.10	23.83	21.96	15.17	12.18	13.40
R_1	51.35	36.10	36.54	24.96	43.91	49.33	32.78	33.15	45.45	31.11	18.21	35.73	36.55
R_2	11.24	19.47	17.98	21.47	33.02	12.32	23.57	19.59	17.93	22.46	15.51	45.53	21.68
S_1	61.05	31.23	16.80	33.38	19.99	26.11	69.45	40.57	44.33	56.26	63.72	44.66	42.29
S_2	19.50	30.86	12.79	5.42	13.47	14.96	28.23	47.41	26.26	89.56	99.68	22.07	34.18
T_1	29.89	23.33	16.59	13.99	12.52	30.63	20.57	45.60	54.93	32.05	41.00	37.78	29.91
T_2	18.08	16.87	22.79	25.82	16.97	16.32	37.90	44.37	38.81	25.14	24.74	36.77	27.05
U_1	36.54	22.28	16.35	16.17	59.84	37.97	38.73	55.14	56.92	106.01	112.09	76.18	52.85
U_2	69.13	28.13	12.38	6.59	27.41	16.14	10.65	46.65	51.10	15.46	10.16	23.85	26.47
V_1	24.11	25.13	15.81	20.18	15.88	15.67	43.16	32.19	65.41	21.20	38.60	18.91	28.02
V_2	32.51	25.41	20.89	17.53	13.26	9.05	33.97	28.31	64.66	117.32	95.93	51.74	42.55
W_1	13.91	24.03	25.14	43.83	46.86	32.26	31.78	13.83	42.36	60.74	76.56	21.37	36.06
W_2	33.73	27.45	13.24	20.07	25.47	13.01	20.51	26.62	67.66	107.00	117.92	63.87	44.71

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
X	36.73	32.43	21.59	26.15	18.56	15.13	41.19	102.48	37.97	36.63	40.01	155.69	47.05
Y	19.64	14.27	15.15	18.41	21.34	22.84	40.90	204.34	35.35	24.82	21.83	67.16	42.17
Z_1	25.03	22.89	25.97	33.33	31.18	34.57	41.19	23.20	51.84	51.23	89.38	107.00	44.73
Z_2	15.42	14.54	8.78	19.62	23.12	38.53	31.82	60.45	24.83	36.74	17.29	29.65	26.73
Total Avg	**29.75**	**29.91**	**23.16**	**25.59**	**26.01**	**24.68**	**30.05**	**35.89**	**33.52**	**40.16**	**43.41**	**34.36**	

Table 40 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Wednesday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	16.88	16.85	23.58	19.02	13.38	31.41	47.54	62.73	42.31	37.80	17.43	18.06	28.92
A_2	40.74	26.25	21.54	18.00	13.62	34.73	21.38	36.35	25.56	18.41	23.08	23.14	25.23
AA_1	13.82	29.03	24.31	18.96	19.58	13.87	50.06	54.97	52.62	41.01	41.72	59.09	34.92
AA_2	51.94	13.52	13.46	30.51	64.26	67.61	93.30	51.02	88.62	83.94	90.86	28.32	56.45
AB_1	28.80	25.29	19.53	31.62	14.03	13.06	33.06	31.11	26.73	38.52	53.63	74.30	32.47
AB_2	30.94	24.81	17.85	14.82	20.74	38.14	17.67	21.85	43.76	30.30	139.60	25.26	35.48
AC_1	433.34	27.09	24.94	30.22	18.04	12.95	17.31	20.21	27.17	25.38	27.44	40.15	58.69
AC_2	17.74	14.36	28.20	32.10	8.80	20.22	18.56	20.93	38.97	31.06	57.03	26.82	26.23
AD	48.98	31.99	18.50	23.75	20.81	21.71	35.93	56.48	59.97	30.64	47.16	76.38	39.36
AE	22.53	33.83	18.74	33.25	35.26	26.63	22.79	33.68	101.98	82.83	142.75	45.35	49.97
AED	60.79	32.61	19.10	23.66	29.97	22.51	16.60	21.61	28.43	25.84	13.27	27.02	26.78
AF	27.33	32.83	139.82	86.88	55.63	36.75	18.99	27.11	27.80	26.08	36.91	29.33	45.46
AG	25.91	14.60	20.19	16.82	7.12	13.32	10.64	30.50	17.97	16.93	26.03	25.44	18.79
AH	30.69	30.25	23.56	21.92	14.62	20.23	26.04	53.24	19.19	19.41	25.00	26.40	25.88
AI	17.40	16.38	19.39	17.73	15.87	22.03	8.99	23.68	14.67	15.14	26.97	16.97	17.94
AJ_1	66.10	20.41	23.67	12.54	21.74	18.44	20.07	27.15	37.53	23.76	112.45	19.13	33.58
AJ_2	21.16	19.36	14.15	13.31	11.45	11.01	18.27	16.89	14.87	12.94	17.51	11.64	15.21
AK_1	41.00	11.32	18.85	13.60	21.41	25.86	30.66	48.00	47.96	40.98	61.70	39.73	33.42
AK_2	21.40	37.52	49.98	40.42	70.12	61.04	72.46	36.65	29.25	15.16	47.86	36.66	43.21
AL_1	18.40	16.74	16.72	15.96	22.20	18.21	19.14	19.93	17.00	34.91	30.92	61.36	24.29
AL_2	18.71	19.25	15.75	16.07	20.14	19.10	15.61	56.59	52.59	76.73	103.57	39.53	37.81
AM_1	18.02	29.78	15.02	19.42	19.74	14.90	21.23	26.25	24.87	43.08	18.94	19.44	22.56
AM_2	6.44	14.83	41.05	16.68	19.41	16.71	24.57	13.86	41.73	39.77	100.15	72.53	33.98
AO	52.35	18.79	15.67	14.42	24.64	25.14	20.33	21.26	65.70	46.62	49.91	95.04	37.49
AP	10.61	13.89	15.54	29.82	20.03	14.42	14.09	21.41	27.83	34.08	14.84	25.83	20.20
B_2	36.24	44.90	75.56	26.17	25.20	50.53	35.98	31.28	26.67	35.86	38.17	27.79	37.86
C_1	63.44	24.18	36.15	64.67	93.26	27.38	38.06	31.10	34.97	38.69	54.66	80.07	48.89
C_2	48.74	16.00	41.45	37.14	64.32	30.72	15.35	19.33	32.59	23.49	46.87	32.94	34.08
D_1	49.07	35.01	23.46	20.68	3.91	12.91	18.84	18.87	22.09	12.82	23.73	40.83	23.52
D_2	44.39	31.93	24.49	26.89	28.37	17.90	16.19	34.95	28.87	20.83	16.69	24.22	26.31
E_1	36.81	66.83	119.54	18.16	14.30	26.29	34.99	26.97	22.59	32.56	39.30	23.25	38.47

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
E_2	77.53	52.04	107.37	63.84	20.20	34.71	21.56	28.42	39.05	138.36	55.81	32.59	55.96
F_2	14.43	11.53	11.54	23.90	15.07	8.19	14.71	18.24	10.62	18.90	14.36	8.36	14.15
G_1	54.52	39.55	49.05	21.99	9.07	15.92	15.22	17.18	21.54	19.11	27.74	22.96	26.15
G_2	18.44	11.83	14.76	17.86	34.82	22.03	13.31	15.04	16.99	26.13	25.56	35.25	21.00
H_1	17.49	18.85	26.35	25.00	21.77	22.23	25.19	32.40	21.44	17.34	37.67	6.56	22.69
H_2	57.62	20.74	20.29	28.19	19.68	19.31	50.88	63.49	28.50	24.91	22.50	32.65	32.40
I	150.05	163.26	44.24	113.61	161.71	55.76	63.87	90.16	107.68	81.26	39.64	28.48	91.64
I_1	43.62	19.62	16.97	29.79	16.69	14.04	30.69	25.56	27.52	32.14	41.84	31.75	27.52
I_2	22.71	16.13	19.41	20.37	22.12	21.83	18.69	30.72	36.57	33.18	34.35	18.61	24.56
J	52.18	37.99	33.00	11.10	5.49	26.99	33.36	31.34	39.05	23.95	25.10	20.57	28.34
K_1	29.08	14.41	16.36	20.59	23.54	21.85	18.63	26.90	35.22	27.66	20.39	19.24	22.82
K_2	45.41	27.52	25.57	39.08	33.06	21.76	32.07	56.29	24.80	27.41	15.26	20.90	30.76
M_1	22.37	22.52	21.80	17.81	21.38	18.32	33.36	22.52	85.34	106.30	32.04	37.28	36.75
M_2	34.48	35.95	24.03	29.59	22.01	34.68	29.46	50.92	54.23	41.87	28.75	65.82	37.65
N_1	16.07	23.58	28.92	15.14	13.94	11.44	14.85	33.90	151.08	130.01	75.12	55.44	47.46
N_2	36.57	42.33	50.90	45.36	15.97	18.96	56.40	44.32	62.56	36.28	26.17	35.25	39.26
O_1	12.38	24.40	25.61	35.89	16.11	42.38	14.30	35.40	42.58	73.94	46.58	54.33	35.32
O_2	19.44	16.03	25.61	78.66	28.04	60.30	26.35	46.31	82.94	68.78	56.25	83.69	49.37
P_1	28.83	41.53	24.05	27.76	35.95	25.78	28.42	38.23	40.85	27.27	32.67	62.78	34.51
P_2	24.70	25.17	17.90	16.71	18.72	25.99	36.03	70.89	57.77	55.46	65.79	50.85	38.83
Q_1	24.25	36.92	8.42	15.95	20.37	17.12	32.64	37.55	16.29	20.28	22.85	18.42	22.59
Q_2	19.60	16.49	17.93	10.37	14.86	12.66	11.28	15.61	13.26	11.83	17.91	14.81	14.72
R_1	55.03	34.57	36.85	27.08	48.08	49.29	36.68	32.33	14.92	31.26	26.40	29.96	35.21
R_2	9.36	18.66	29.21	23.89	8.93	16.05	13.75	19.25	33.84	36.33	45.76	43.32	24.86
S_1	147.40	42.85	22.12	32.93	11.30	20.00	37.44	33.49	42.16	61.05	38.11	35.50	43.70
S_2	22.83	17.64	15.49	25.58	32.49	47.51	29.11	22.45	36.75	90.21	63.00	31.73	36.23
T_1	48.30	12.49	35.63	14.11	22.89	26.59	31.35	24.29	142.95	75.26	55.02	25.04	42.83
T_2	28.38	13.15	14.35	11.97	12.28	16.25	16.79	26.48	78.14	50.75	46.51	16.16	27.60
U_1	50.26	23.54	27.90	26.86	37.80	26.70	33.71	28.13	48.99	85.43	82.01	124.50	49.65
U_2	28.32	26.63	15.86	17.43	21.86	20.66	37.12	20.90	40.17	13.84	26.63	21.33	24.23
V_1	34.55	22.20	18.09	17.82	18.64	19.54	21.20	48.49	90.23	114.51	76.40	56.48	44.85
V_2	78.38	33.76	12.22	19.15	13.45	19.86	28.53	27.05	76.65	103.83	110.08	118.30	53.44
W_1	27.60	46.27	33.44	40.83	36.77	54.84	37.20	50.97	42.09	45.72	59.27	73.02	45.67
W_2	21.80	18.67	28.13	14.95	15.96	14.90	11.91	20.65	53.63	134.83	88.25	39.62	38.61
X	42.44	34.60	22.45	56.24	42.56	59.01	32.98	111.06	57.58	39.08	40.75	51.66	49.20
Y	24.02	19.16	9.52	35.08	124.30	22.78	27.80	51.84	46.90	64.61	46.25	33.89	42.18
Z_1	26.52	27.37	22.24	30.75	17.39	34.55	22.93	20.92	30.41	63.68	50.42	126.66	39.49
Z_2	26.22	11.58	20.44	57.95	27.13	38.83	41.58	38.60	40.28	47.52	55.82	30.05	36.33
Total Avg	**42.23**	**27.71**	**28.61**	**28.50**	**27.74**	**26.45**	**28.06**	**34.84**	**43.98**	**45.74**	**46.68**	**40.66**	

Table 41 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Thursday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	30.63	23.24	36.44	14.35	24.02	50.69	50.52	40.46	47.52	26.01	38.73	47.39	35.83
A_2	40.57	25.50	25.27	19.24	16.13	17.54	17.55	31.55	44.84	61.31	47.56	72.53	34.96
AA_1	17.52	28.46	12.01	18.45	22.21	27.02	37.61	49.20	69.49	105.48	104.08	16.85	42.36
AA_2	31.29	16.88	40.27	24.03	51.55	36.72	47.19	96.03	98.96	66.80	57.18	28.17	49.59
AB_1	18.37	25.14	17.91	23.42	16.75	26.54	38.29	40.22	37.24	28.22	32.82	33.80	28.23
AB_2	21.68	21.31	23.31	35.58	54.25	34.44	22.86	93.64	62.82	35.88	110.51	70.87	48.93
AC_1	28.59	23.38	7.73	16.39	23.59	30.11	23.78	24.63	43.89	31.28	24.23	11.31	24.08
AC_2	20.45	15.03	7.68	30.11	22.48	36.76	13.28	64.45	73.16	33.05	73.62	30.77	35.07
AD	25.72	20.45	45.27	29.59	25.91	28.96	30.15	59.04	39.75	47.29	83.82	13.28	37.44
AE	22.36	18.21	13.05	19.12	30.98	57.16	26.17	27.08	44.90	162.70	114.23	28.08	47.00
AED	33.60	29.85	26.46	15.68	9.30	21.42	15.40	16.69	27.04	35.77	30.45	9.82	22.62
AF	23.03	49.06	19.93	28.17	41.49	27.74	21.08	25.55	36.40	28.05	37.55	20.77	29.90
AG	15.07	13.73	18.17	31.47	19.04	16.28	19.95	20.24	35.36	22.32	27.68	15.56	21.24
AH	27.69	14.34	5.58	10.05	16.52	12.20	24.46	34.05	51.32	23.16	26.93	69.32	26.30
AI	12.04	20.99	3.95	28.94	24.74	12.90	10.09	44.20	40.76	20.70	17.91	20.98	21.52
AJ_1	40.55	26.21	10.86	12.48	13.27	9.15	18.50	22.38	18.90	103.27	70.43	39.96	32.16
AJ_2	14.85	21.44	8.88	8.72	23.10	15.49	14.79	33.38	53.95	21.92	21.26	21.71	21.62
AK_1	23.77	15.71	14.90	21.68	31.75	29.27	48.37	28.47	19.58	41.89	71.65	25.08	31.01
AK_2	18.19	34.72	36.49	46.99	59.47	55.36	36.79	43.25	27.81	54.10	39.56	23.10	39.65
AL_1	23.60	8.60	8.64	11.27	7.54	18.23	15.31	17.08	22.48	69.77	81.14	46.40	27.51
AL_2	17.90	14.74	6.62	9.97	11.38	10.62	41.22	47.82	49.72	28.44	61.92	49.98	29.19
AM_1	17.06	16.75	11.65	18.95	25.53	17.39	17.16	48.99	48.11	24.54	24.14	34.17	25.37
AM_2	10.52	11.51	11.76	40.01	12.38	35.14	18.45	21.99	55.26	111.50	58.75	27.28	34.55
AO	26.17	28.96	105.55	49.88	20.51	23.44	17.66	51.05	46.03	50.77	36.83	102.44	46.61
AP	14.11	16.04	37.24	20.11	27.29	23.15	20.08	31.32	61.62	40.56	36.57	27.51	29.63
B_2	35.23	42.26	15.28	54.65	23.32	50.17	44.33	56.41	57.84	74.83	56.33	100.31	50.91
C_1	24.52	26.33	57.67	26.47	29.79	33.51	34.08	14.54	18.30	48.22	51.87	22.83	32.34
C_2	24.84	17.62	79.31	16.33	36.79	36.18	32.99	18.87	39.16	67.08	112.64	16.22	41.50
D_1	35.16	22.25	25.53	13.86	6.25	14.65	25.25	56.46	37.55	57.28	91.76	73.27	38.27
D_2	31.24	14.91	21.31	20.97	31.30	18.89	27.09	47.24	21.23	17.85	46.11	16.04	26.18
E_1	107.12	56.00	85.29	34.28	15.24	31.26	19.41	23.58	28.68	45.27	76.02	84.91	50.59
E_2	57.09	80.39	98.16	64.37	16.32	39.79	36.56	60.03	53.98	37.54	72.94	51.05	55.68
F_2	12.06	10.00	9.14	16.56	13.77	11.14	14.78	12.45	17.24	22.99	23.61	22.58	15.53
G_1	60.74	31.72	36.39	29.40	15.93	12.83	17.74	13.53	28.91	31.55	74.10	26.76	31.63
G_2	20.98	10.01	12.51	11.92	21.80	11.46	23.38	31.76	19.63	32.31	61.08	64.31	26.76
H_1	22.97	10.24	28.76	23.51	14.64	32.58	17.29	45.25	65.44	46.10	21.63	28.43	29.74
H_2	25.19	22.40	4.60	13.17	14.82	19.70	21.48	75.77	59.40	19.96	32.13	64.79	31.12
I	43.62	54.45	83.56	39.23	24.96	32.55	44.43	25.23	35.76	185.04	180.38	35.38	65.38
I_1	30.92	15.09	12.53	8.85	18.65	27.17	24.88	28.23	21.77	28.29	16.80	43.08	23.02
I_2	19.43	24.32	35.47	21.38	26.00	16.01	13.43	109.68	120.35	193.60	112.05	66.25	63.16
J	20.37	21.51	2.05	24.29	27.12	35.17	24.82	39.34	39.43	41.63	33.18	26.41	27.94
K_1	31.15	51.10	14.64	19.07	14.11	17.15	19.45	43.22	82.91	13.16	39.58	95.73	36.77

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
K_2	36.27	30.66	19.67	22.34	28.70	23.03	22.36	25.10	50.08	21.39	37.24	25.59	28.54
M_1	29.53	26.31	18.70	20.81	23.69	14.12	34.95	18.14	82.88	107.87	60.61	25.53	38.59
M_2	27.75	29.75	29.66	27.30	30.53	37.80	79.00	43.11	37.07	37.15	27.57	92.63	41.61
N_1	19.01	20.45	18.41	15.73	31.15	23.87	22.67	29.13	59.67	32.95	46.87	12.99	27.74
N_2	40.20	34.52	145.06	25.45	69.53	34.11	54.92	94.20	47.43	63.45	46.52	21.88	56.44
O_1	14.64	22.85	21.01	21.23	48.70	69.72	20.98	24.92	50.79	53.10	39.25	14.43	33.47
O_2	15.11	16.53	30.02	30.80	103.33	48.05	19.78	88.83	69.01	58.50	73.15	17.73	47.57
P_1	26.32	14.77	29.15	35.04	17.88	28.35	36.43	32.82	33.74	36.38	38.62	30.61	30.01
P_2	29.11	38.62	12.26	57.61	32.72	21.52	26.48	49.51	59.90	46.86	42.03	46.18	38.57
Q_1	6.76	19.19	14.77	11.72	27.60	21.50	55.85	29.48	23.33	26.28	25.85	9.13	22.62
Q_2	15.91	25.92	10.08	8.33	15.00	18.49	11.53	16.16	33.35	88.34	55.10	20.23	26.54
R_1	40.85	51.49	10.11	37.40	21.06	48.29	31.55	38.13	22.40	44.79	35.11	32.88	34.51
R_2	19.35	44.11	39.75	10.88	27.41	19.61	22.49	13.89	19.50	36.87	51.71	60.97	30.55
S_1	120.88	34.08	7.22	32.25	23.59	30.53	20.32	36.28	63.33	39.84	40.08	26.41	39.57
S_2	47.33	26.28	15.36	11.99	56.52	16.83	41.83	41.39	90.83	66.94	108.16	13.51	44.75
T_1	37.19	11.61	25.56	19.62	20.62	18.36	22.56	41.80	288.32	36.34	57.43	30.01	50.79
T_2	21.72	14.28	28.78	10.45	23.67	18.98	17.33	14.86	308.80	211.87	142.74	15.45	69.08
U_1	55.38	21.16	20.25	20.57	24.21	78.38	46.37	47.05	78.52	88.26	107.21	96.82	57.01
U_2	23.38	15.54	19.89	16.17	24.63	12.72	14.97	41.24	92.71	137.02	75.11	19.34	41.06
V_1	16.21	45.94	16.41	21.15	35.81	24.21	46.88	47.16	37.42	204.77	31.77	20.43	45.68
V_2	56.11	51.10	49.37	18.12	21.06	34.42	22.54	26.76	65.59	136.21	118.14	28.73	52.35
W_1	38.29	36.43	13.46	31.71	26.70	47.75	30.86	41.64	33.00	60.42	64.96	41.84	38.92
W_2	18.83	16.41	9.73	9.48	11.39	10.07	13.14	19.82	116.18	69.32	75.12	73.69	36.93
X	50.16	31.21	30.05	30.97	47.49	27.16	69.36	67.32	63.61	156.33	53.12	159.13	65.49
Y	15.19	15.97	24.72	37.76	16.31	24.16	37.22	79.99	150.62	99.60	83.02	74.62	54.93
Z_1	35.63	15.91	29.95	24.96	27.02	19.00	18.52	36.06	28.48	41.75	74.43	47.37	33.26
Z_2	28.98	17.34	14.48	13.85	54.48	25.80	39.82	53.67	48.19	38.28	21.26	16.66	31.07
Total Avg	**29.91**	**25.79**	**27.27**	**23.86**	**27.14**	**27.69**	**28.53**	**40.77**	**57.38**	**62.00**	**58.90**	**40.58**	

Table 42 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Friday

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
A_1	16.70	23.60	36.03	40.71	22.34	18.86	48.40	64.50	44.68	22.20	50.48	18.81	33.94
A_2	17.33	33.75	57.49	46.41	21.43	29.02	38.18	28.66	43.16	19.14	40.27	22.78	33.13
AA_1	24.10	11.86	23.44	21.54	15.40	20.89	39.87	43.99	55.37	139.40	101.63	94.29	49.32
AA_2	18.04	16.74	15.08	18.03	22.06	29.11	67.41	61.43	47.08	42.03	37.64	47.93	35.22
AB_1	13.35	17.80	12.07	17.69	19.33	19.10	21.96	65.95	47.18	107.02	51.51	55.42	37.36
AB_2	15.99	24.23	13.60	32.30	39.03	46.19	20.83	49.07	32.88	37.88	32.29	109.17	37.79
AC_1	31.69	26.53	16.55	21.22	21.56	13.23	10.71	22.91	23.22	71.10	18.60	28.67	25.50

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
AC_2	21.08	26.80	36.62	25.87	16.93	15.61	10.24	8.48	34.10	26.09	29.38	40.59	24.32
AD	37.54	73.05	35.55	18.55	23.85	23.76	33.29	29.98	31.43	15.47	23.49	27.11	31.09
AE	40.14	14.43	39.19	49.01	25.20	29.95	29.45	17.52	25.47	15.66	26.97	27.51	28.38
AED	47.20	23.59	20.30	16.21	39.30	20.42	34.02	17.70	19.52	33.36	39.13	13.78	27.04
AF	31.85	24.36	41.54	38.56	32.41	21.71	73.36	61.37	21.89	27.32	12.71	134.88	43.50
AG	22.30	18.58	37.59	28.69	16.06	24.58	15.93	38.95	20.02	19.20	22.09	35.01	24.92
AH	21.81	25.79	16.29	20.61	25.78	32.70	50.24	85.63	43.18	46.94	62.39	93.33	43.72
AI	31.51	22.18	31.78	25.96	17.59	25.77	16.55	13.07	12.26	26.33	12.10	13.79	20.74
AJ_1	17.26	29.28	13.29	17.31	22.96	19.35	17.02	17.18	14.07	9.39	24.03	18.91	18.34
AJ_2	14.37	10.83	13.35	21.61	10.48	21.62	26.68	12.35	26.59	19.36	18.03	21.94	18.10
AK_1	22.27	17.11	23.38	19.70	16.92	15.94	16.55	20.79	23.91	19.65	19.78	15.53	19.29
AK_2	75.88	25.20	22.37	19.20	19.04	15.09	32.21	15.89	27.93	18.11	30.46	24.03	27.12
AL_1	30.95	15.78	15.96	10.36	13.01	15.42	18.03	19.95	22.03	17.73	19.02	14.00	17.69
AL_2	17.70	25.67	18.06	13.27	20.00	15.12	14.61	21.67	18.53	17.38	24.94	20.41	18.95
AM_1	9.40	14.84	17.35	16.32	19.52	19.41	14.13	24.39	31.29	38.52	32.46	49.28	23.91
AM_2	17.17	14.47	14.49	14.08	15.44	16.48	14.80	12.10	20.46	21.08	24.35	19.44	17.03
AO	36.50	36.23	25.61	36.84	43.73	31.17	26.78	33.92	55.48	117.58	49.25	43.50	44.72
AP	22.24	13.15	10.86	18.52	25.70	23.87	26.87	19.85	17.36	17.81	8.88	14.76	18.32
B_2	40.98	20.79	156.67	46.21	53.54	42.20	61.90	55.13	49.35	79.93	31.05	80.27	59.84
C_1	22.80	23.09	10.30	21.68	15.23	15.51	16.06	27.49	12.70	12.69	32.70	22.06	19.36
C_2	12.94	26.11	20.00	17.68	15.14	40.85	20.27	24.71	18.75	29.57	46.85	13.71	23.88
D_1	17.16	17.39	15.40	19.99	22.64	14.94	32.29	17.15	10.55	8.40	17.99	10.31	17.02
D_2	26.90	12.70	9.14	35.25	14.14	11.78	43.30	18.50	23.84	20.43	22.12	22.25	21.70
E_1	46.24	20.35	20.67	16.23	17.92	18.07	20.77	21.78	26.17	28.20	18.93	15.15	22.54
E_2	13.56	14.46	23.12	18.61	28.23	27.35	26.71	35.71	28.73	24.88	22.94	18.25	23.55
F_2	13.25	15.28	10.33	18.28	7.57	12.01	17.80	15.08	14.41	9.86	19.53	5.29	13.23
G_1	18.02	18.62	21.92	19.17	13.63	14.93	14.39	14.61	17.16	12.98	10.37	13.85	15.80
G_2	20.28	16.87	22.37	13.30	20.86	14.87	8.96	16.73	10.81	32.99	20.06	10.75	17.40
H_1	18.43	18.16	20.13	24.57	16.43	22.73	11.29	20.88	24.07	25.85	21.32	24.83	20.72
H_2	22.53	39.58	35.22	46.06	28.47	34.34	29.84	15.63	24.03	38.60	33.66	18.80	30.56
I	26.71	25.50	14.58	16.06	21.65	24.65	37.11	36.63	23.58	31.23	30.60	20.55	25.74
I_1	20.16	10.46	24.51	16.67	39.80	83.79	27.95	56.44	46.84	56.29	59.01	42.85	40.40
I_2	29.56	13.25	18.81	12.12	49.59	101.44	79.89	140.84	134.28	128.68	51.96	18.67	64.92
J	25.62	21.12	37.04	32.59	28.23	32.77	67.81	42.78	38.18	59.07	48.20	38.03	39.29
K_1	62.06	15.71	15.07	36.00	35.73	80.60	84.43	129.26	102.43	69.79	62.44	35.24	60.73
K_2	96.97	37.27	31.84	14.89	33.61	38.68	20.57	34.79	26.27	29.69	26.74	26.68	34.83
M_1	47.26	26.60	31.58	19.16	20.62	31.24	26.23	20.10	45.50	28.59	24.90	29.56	29.28
M_2	18.48	27.40	41.81	56.57	86.74	96.26	147.66	215.82	176.91	204.12	145.58	180.92	116.52
N_1	30.28	17.58	18.92	24.46	25.28	33.72	72.44	17.44	17.58	27.31	22.26	19.32	27.22
N_2	27.83	23.07	59.38	79.40	78.93	100.31	174.32	108.34	44.97	39.29	40.78	36.57	67.77
O_1	29.88	22.98	27.27	59.97	49.96	39.29	92.83	16.87	39.47	36.68	40.90	20.00	39.67
O_2	18.16	58.69	81.85	71.32	105.79	102.54	128.39	60.38	29.40	25.65	30.79	45.19	63.18

Road	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	Avg. by Rd
P_1	42.96	38.74	28.67	28.21	47.55	57.59	51.27	60.22	111.35	88.46	76.31	123.35	62.89
P_2	40.16	21.38	56.86	22.39	24.02	35.69	26.64	23.27	69.52	52.42	69.70	104.65	45.56
Q_1	11.19	17.24	11.36	8.80	20.15	18.15	18.61	28.78	16.59	12.23	25.03	15.44	16.96
Q_2	14.85	18.67	8.33	13.99	17.29	14.36	10.92	11.83	16.41	47.18	32.12	31.02	19.75
R_1	16.86	35.30	12.27	18.59	18.02	26.48	25.51	17.23	18.68	21.99	19.88	31.83	21.89
R_2	19.56	22.26	17.75	18.18	24.17	29.34	14.17	11.66	38.04	25.34	54.25	15.77	24.21
S_1	19.94	23.02	21.90	14.22	28.43	22.70	27.51	28.01	25.88	17.36	32.77	25.76	23.96
S_2	13.52	30.16	22.83	42.32	21.67	29.69	19.00	37.21	23.42	22.10	28.46	15.67	25.50
T_1	36.24	31.80	27.31	24.74	25.78	26.91	18.68	17.01	15.71	19.51	29.71	38.45	25.99
T_2	39.31	16.06	18.30	62.71	28.33	41.60	17.56	21.09	27.32	25.99	12.61	14.98	27.16
U_1	20.49	13.81	20.53	25.18	22.07	30.33	24.08	26.58	42.55	28.67	34.33	23.80	26.03
U_2	34.91	16.35	17.11	13.74	15.21	17.87	21.64	23.91	28.38	17.58	38.29	15.55	21.71
V_1	32.18	56.07	19.25	31.84	26.68	22.88	23.35	24.70	22.98	21.21	29.93	20.31	27.62
V_2	17.66	23.52	9.19	22.12	23.89	28.48	22.42	24.43	30.28	37.94	28.61	16.28	23.74
W_1	27.39	20.73	15.97	23.40	31.28	27.60	25.52	22.30	24.08	36.50	32.21	26.92	26.16
W_2	15.24	12.44	18.43	14.74	14.14	19.99	21.82	19.89	34.43	16.16	24.43	22.20	19.49
X	18.94	26.15	70.32	121.54	106.83	138.24	61.79	131.60	163.54	309.56	56.10	63.66	105.69
Y	20.63	22.38	20.06	20.50	25.52	30.64	94.39	51.81	118.96	117.15	34.41	29.19	48.80
Z_1	23.74	14.04	16.26	25.07	38.33	33.01	25.81	31.03	95.72	84.48	100.67	110.52	49.89
Z_2	31.02	29.30	24.13	14.58	36.39	22.05	43.65	55.94	37.42	60.07	63.46	21.36	36.61
Total Avg	**26.92**	**23.45**	**26.56**	**27.71**	**28.85**	**32.94**	**37.33**	**38.25**	**39.22**	**44.47**	**36.48**	**36.82**	

Table 43 GCN Spectral (Combination Matrix) with LSTM layer: Average percentage of error by time of day in Saturday

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