Comparison of Microscopic and Mesoscopic Traffic Modeling Tools for Evacuation Analysis

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
in
Civil Engineering

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March 06, 2017

Blacksburg, VA

Keywords: Evacuation Modeling, Microscopic Simulation, Disaster, Demand, Mesoscopic

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Abstract-Academic

Evacuation processes can be evaluated using different simulation models. However, recently, microscopic simulation models have become a more popular tool for this purpose. The objectives of this study are to model multiple evacuation scenarios and to compare the INTEGRATION microscopic traffic simulation model against the MATSim mesoscopic model. Given that the demand was the same for both models, the comparison was achieved based on three indicators: estimated evacuation time, average trip duration, and average trip distance. The results show that the estimated evacuation times in both models are close to each other since the Origin-Destination input file has a long tail distribution and so the majority of the evacuation time is associated when travelers evacuate and not the actual evacuation times. However, the evaluation also shows a considerable difference between the two models in the average trip duration. The average trip duration using INTEGRATION increases with increasing traffic demand levels and decreasing roadway capacity. On the other hand, the average trip duration using MATSim decreases with increasing traffic demand and decreasing the roadway capacity. Finally, the average trip distance values were significantly different in both models. The conclusion showed that the INTEGRATION model is more realistic than the MATSim model for evacuation purposes. The study concludes that despite the large execution times of a microscopic traffic simulation, the use of microsimulation is a worthwhile investment.

Comparison of Microscopic and Mesoscopic Traffic Modeling Tools for Evacuation Analysis

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Abstract-Public

In recent decades, evacuation processes have become very valuable to protect people's lives during disasters. Traffic engineers have developed different computer program tools to enhance the evacuation process. These tools can be categorized into three different groups: microscopic, macroscopic, and mesoscopic simulations. However, microscopic simulation tools have recently become more popular. The objectives of this thesis are to model multi-evacuation scenarios and to compare the INTEGRATION microscopic traffic simulation tool against the MATSim mesoscopic tool, given that the demand was the same for both tools. The demand describes the total number of vehicles that need to be evacuated. The tools were compared based on three indicators: estimated evacuation time, average trip duration, and average trip distance. The results show that, since the demand file has a large number of trips, the estimated evacuation times for both tools are similar. The average trip duration is generally computed by dividing the total travel time of all vehicles that need to finish their trips by the total number of vehicles. The results show that the average trip durations for the tools are different. The average trip duration using INTEGRATION increases with a decrease in the network capacity (number of vehicles within a specific distance). In contrast, the average trip duration using MATSim decreases with a decreasing network capacity. The average trip distance is computed by dividing the total travel distance by the total number of vehicles. The average trip distance values were significantly different for these tools. The results show that the INTEGRATION tool is more realistic than the MATSim tool and that it is able to capture the congestion effects in the network.

DEDICATION

الى أفضل رجل في هذا الكون، أبي: عبدالرحيم عبدالله الجمال

To the best man in this world, my Father: Abdulraheem Abdallah Aljamal

I dedicate this accomplishment to the best man in this world. I would like to thank him for all his support, his advice, his patience, and his faith. I am glad that I have the chance to show how much he means to me through this accomplishment. I love you, dad.

الى أفضل امرأة في هذا الكون، أمي: سلوى محمد الصنقر

To the best woman in this world, my mother: Salwa Mohammad Alsoungur

My mom has always been there for me. She is the biggest role model in my life and always be. I would like to thank her for all her support, her advice, her patience, and her faith. I dedicate this accomplishment to my mom because she is the best for me. I love you, mom.

أود ان أشكر والدي لاعتنائهم بي لأكون رجل قوي

I would like to thank my parents for raising me to be a strong man

I would like to dedicate my lovely wife (Lona) for her support. I would like also to dedicate my brothers (Anas, Odai, Dr. Qusai, Loai, Suhaib, and Shahed) for their support, their advice. Lastly, I would like to thank my lovely sisters (Raeda, Hana, Maram, and Liana) for their emotional support.

ACKNOWLEDGEMENTS

I would like to express my gratitude to my advisor, Professor Hesham Rakha, for giving me the opportunity to work with him. Many appreciations for his support, his guidance, and his patience. He always has been there for me.

My thanks also go to my committee member, Dr. Pamela Murray-Tuite. She is one of my best teachers that affected on me during My Master's. I would like to thank her for accepting to be in my committee.

I would like also to acknowledge Dr. Jianhe Du for writing the simulation file construction and calibration section. Also, I would like to thank her for helping me to understand the network characteristics and evacuation scenarios.

I would like also to thank my teachers that taught me during my graduate study at Virginia Tech.

Lastly, I must thank the MATS University Transportation Center for funding this research and allowing me to obtain my M.S. degree.

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CHAPTER 1: INTRODUCTION

The research presented in this thesis introduces an evacuation in a Knoxville, TN network using two different models. The first model is INTEGRATION, which is a microscopic traffic assignment and simulation model [1, 2]. It was mainly developed by the Center for Sustainable Mobility (CSM) at the Virginia Tech Transportation Institute (VTTI). The second model is MATSim, which is an agent-based traffic demand and mesoscopic traffic simulation model [3]. This chapter presents an introduction to the research, objectives of the research, and the organization of this thesis.

1.1. Background

In the last decade, evacuation modeling has become critical to help in keeping people away from disasters. In the United States in 2015, evacuations as a result of natural or human-made disasters cost insurance companies $16.1 billion to cover the damages [4]. In the same year, around 522 persons lost their lives due to different natural disasters such as severe thunderstorms, floods, storm surges, and wildfires [5]. In the event of a disaster, an evacuation process is needed to move people away from risk areas to the nearest safe zones.

Evacuation modeling is needed to help researchers in understanding the evacuation processes. It is also used to assess the evacuation scenarios and to predict the evacuation time for a given area. Many computer simulation models have been developed to examine the performance of the evacuation process. Ideally, an efficient evacuation process will minimize the total evacuation processing time and maximize the number of people that survive. Several evacuation processes have been modeled and evaluated especially that occurred in dangerous areas such as the Tsunami in Japan and Hurricane Rita in Houston TX. The evacuation models were developed and used to enhance the evacuation planning.

Transportation models are categorized into microscopic, macroscopic, and mesoscopic simulation models. This thesis used one of the microsimulation models and one of the mesoscopic simulation models to compare and contrast their performance.

1.1.1. Microscopic Model

Microscopic models track the movement of the agents modeled in any system [6]. Some examples of agents include the vehicles and pedestrians. Consequently, decision-making of individuals can be explained such as their routes from their origins to their destinations. Microscopic models represent a network in detail and simulate each vehicle movement accounting for the interactions between vehicles. These tools run using various component models such as car-following models and lane-changing models. The car following model depicts a relationship between two vehicles (a lead vehicle with the following vehicle). Researchers have developed and used the car following models in microsimulation software to capture the longitudinal interaction between vehicles, to capture their accelerating and decelerating patterns that result from the interaction between vehicles and to prevent collisions between vehicles.

Each microsimulation model produces different Measures of Effectiveness (MOEs). MOEs are used to evaluate model behavior. Some examples of MOEs are total delay, network travel time, fuel consumption and emissions.

Researchers have used different microsimulation models such as VISSIM [7], TRANSIMS [8], and CORSIM [9] for various applications. Algers et al. reviewed and analyzed the features for 32 microscopic traffic simulation models via a questionnaire sent out to each developer to find the gaps between the models (Figure 1) and identified user requirements for the 32 models [10]. They concluded that the gaps occur at both the modeling and the performance levels.

Model	Organisation	Country
AIMSUN 2	Universitat Politècnica de Catalunya, Barcelona	Spain
ANATOLL	ISIS and Centre d'Etudes Techniques de l'Equipement	France
AUTOBAHN	Benz Consult - GmbH	Germany
CASIMIR[4]	Institut National de Recherche sur les Transports et la Sécurité	France
CORSIM[5]	Federal Highway Administration	USA
DRACULA	Institute for Transport Studies, University of Leeds	UK
FLEXSYT II	Ministry of Transport	Netherlands
FREEVU	University of Waterloo, Department of Civil Engineering	Canada
FRESIM	Federal Highway Administration	USA
HUTSIM	Helsinki University of Technology	Finland
INTEGRATION	Queen's University, Transportation Research Group	Canada
MELROSE	Mitsubishi Electric Corporation	Japan
MICROSIM	Centre of parallel computing (ZPR), University of Cologne	Germany
MICSTRAN	National Research Institute of Police Science	Japan
MITSIM	Massachusetts Institute of Technology	USA
MIXIC	Netherlands Organisation for Applied Scientific Research - TNO	Netherlands
NEMIS	Mizar Automazione, Turin	Italy
PADSIM	Nottingham Trent University - NTU	UK
PARAMICS	The Edinburgh Parallel Computing Centre and Quadstone Ltd	UK
PHAROS	Institute for simulation and training	USA
PLANSIM-T	Centre of parallel computing (ZPR), University of Cologne	Germany
SHIVA	Robotics Institute - CMU	USA
SIGSIM	University of Newcastle	UK
SIMDAC	ONERA - Centre d'Etudes et de Recherche de Toulouse	France
SIMNET	Technical University Berlin	Germany
SISTM	Transport Research Laboratory, Crowthorne	UK
SITRA-B+	ONERA - Centre d'Etudes et de Recherche de Toulouse	France
SITRAS	University of New South Wales, School of Civil Engineering	Australia
TRANSIMS	Los Alamos National Laboratory	USA
THOREAU	The MITRE Corporation	USA
TRAF-NETSIM	Federal Highway Administration	USA
VISSIM	PTV System Software and Consulting GMBH	Germany

Figure 1. List of Micro-Simulation Models [10]

Microsimulation models are generally used to assess and analyze different traffic research areas such as:

- Modeling adaptive traffic signal control systems
- Modeling urban and rural road networks
- Modeling lane-changing and merging behavior on freeways
- Evacuation modeling

This thesis uses one of the microscopic simulation models, which is the INTEGRATION model to model different evacuation scenarios. The INTEGRATION is listed in the U.S. "Evacuation Management Operations (EMO) Modeling Assessment: Transportation Modeling Inventory" [11].

1.1.2. Macroscopic Model

Macroscopic models depict traffic stream behavior as a compressible fluid, such as aggregated traffic flow dynamics. Macroscopic models have the ability to simulate a large network, but they have no ability to capture individual vehicles behavior.

1.1.3. Mesoscopic Model

Mesoscopic models can track each part at an aggregate level of details such as vehicle platoon dynamics. Mesoscopic models are not able to describe the interaction between vehicles and their behaviors at a high level of detail. Mainly, mesoscopic models fill the gap between microscopic and macroscopic models. Some mesoscopic models have been developed to try to simulate real traffic conditions in medium to large networks such as CONTRAM [12].

This thesis uses one of the mesoscopic simulation models, which is the MATSim model to model different evacuation scenarios.

1.2. Thesis Objectives

The objective of this thesis is to evalaute the adequetness of the INTEGRATION and MATSim simulation tools for evacuation modeling. Specifically, the models are applied to a Knoxville, TN network. The first model is INTEGRATION, which is a microscopic traffic assignment and simulation model [1, 2]. The authors decided to use the INTEGRATION model microscopic traffic assignment and simulation software for the following reasons:

- The team has access to and is very familiar with the source code,
- INTEGRATION is the only software that models vehicle dynamics and uses state-of-the-art fuel consumption and emission models (VT-Micro),
- The model allows for the calibration of link-specific car-following models,
- INTEGRATION is designed in a modular fashion,
- The model can capture dynamic changes in the network including incidents and actuated and adaptive signal control,

- The calibration and coding of the INTEGRATION software is easier than other microscopic software given that the model does not require many of the microscopic parameters used in other microscopic models, and
- The software has been extensively validated and tested on realistic, large transportation networks.

The second model is MATSim, which is an agent-based traffic demand model and mesoscopic traffic simulation model [3]. The authors also decided to use MATSim because many researchers have used it especially for evacuation and have shown that the MATSim model performs very well for large scenarios [13-16].

1.3. Thesis Organization

This thesis is organized as follows. The first chapter presented an introduction to the subject matter discussed in the following chapters. The second chapter offers the previous related work. The third chapter is a paper entitled, “Comparison of Microscopic and Mesoscopic Traffic Modeling Tools for Evacuation Analysis.” The fourth chapter presents the conclusions of the thesis and provides recommendations for future work.

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CHAPTER 2: LITERATURE REVIEW

Evacuation modeling has become critical to protect people from certain risks. Researchers have developed emergency evacuation modeling in different ways. Many simulation models have been used to assess and evaluate evacuation planning. Moreover, these models have been used to predict the performance of an evacuation scenario. This chapter provides a review of existing research and experiences with the focus of evacuation modeling. The first section provides a quick overview of some existing models that have been used for the evaluation of evacuation processes. The second section describes previous work related to the MATSim model. The third section discusses previous work using the INTEGRATION model. The fourth section provides the conclusion of the literature chapter.

2.1. Evacuation Models

Many models have been used to predict and enhance evacuations such as TRANSIMS [1], CORSIM [2], DynusT [3], and VISSIM [4]. Table 1 presents some evacuation simulation models that have been used in analyzing evacuations. Alsnih and Stopher [5] describe different traffic simulation models and emergency evacuation models. They focus on describing the macroscopic and microscopic simulation models. This section reviews some evacuation models as follows:

Table 1. Some of Traffic Simulation Models Usable for Evacuation Simulation [6]

Name	Simulation Scale	Domain	Usage in evacuation context	Reference
VISSIM	Micro	Traffic simulation	- Hurricane event, Hampton Roads (Virginia, USA) - Nuclear plant emergency, Chattanooga (Tennessee, USA) -Hazardous Material emergency, Houston (Texas, USA) -River flood, Dresden (Germany)	[7-10]
PARAMICS	Micro	Traffic simulation	- evacuation scenario, Oakland Hills (USA) - forest fire, Emigration Canyon (Utah, USA) - hurricane event, Cape May Country (New Jersey, USA)	[7, 11, 12]
TRANSIMS	Micro/Meso	Traffic simulation	- evacuation scenario, Virginia (USA) - Hurricane event, New Orleans (Louisiana, USA)	[13-17]

2.1.1. TRANSIMS Model

TRANSIMS is an activity-based microscopic traffic simulation model. TRANSIMS was used to assess and evaluate traffic conditions with 6 different evacuation scenarios on Megaregion road networks. These scenarios reflect varying degrees in hurricane events. TRANSIMS computed an estimated evacuation time using the total number of evacuees passing the threat area at a given time. The total number of evacuees was used to evaluate the TRANSIMS model. The evaluation showed that the TRANSIMS model performed well in estimating the cumulative plot for evacuees [18].

2.1.2. CORSIM Model

The CORSIM model is a micro-traffic assignment model. Developed by the US Federal Highway Administration in the 1970s, it was used to model different evacuation methods, such as the contraflow method. As one of the more effective methods, contraflow has been increasingly used during evacuations on interstate highways. The CORSIM software was used to model contraflow freeway traffic during an evacuation, and it was used to assess planned termination designs and define the factors that make some designs more efficient [19]. However, the CORSIM is unable to model evacuation scenario with large network.

2.1.3. VISSIM Model

VISSIM, a microscopic simulation model, was developed by Planung Transport Verkehr [4] in Germany. It was used to evaluate the evacuation process and calibrate parameters of driving behaviors in a small and dense area that was evacuated due to a toxic material leakage in Houston, TX. This study tested the base traffic demand in a typical non-evacuation day. Some scenarios were tested based on including the options of Reserved-lane and other service rate of shuttles. The results showed that evacuations can be more efficient if appropriate operational strategies are implemented. The results also indicated that the reversed lane strategy can maximize evacuation efficiency by increasing the roadway capacity [8].

2.1.4. PARAMICS Model

PARAMICS, a micro traffic assignment model, was developed by Quadstone Paramics. It was used to model and assess the effectiveness of different types of road network structures under different population densities [20]. This study was applied to the city of San Marcos, Texas. The results showed that no evacuation strategy can necessarily be considered the best. The results also indicated that the performance of an evacuation strategy depends on both the road network structure and the number of evacuees.

2.1.5. NETVACI Model

NETVACI is a macro traffic simulation model that was proposed by Sheffi et al. for simulating traffic patterns during an evacuation [21]. The authors used the NETVACI model to estimate evacuation times for areas surrounding nuclear power plants. The results demonstrated that the NETVACI model can handle large networks.

2.2. MATSim Model

MATSim is an agent-based model that can be used to model an evacuation scenario [22, 23] and has been applied as an evacuation simulation model for many regions [24-27]. For example, MATSim was used to analyze an evacuation plan designed for Hamburg, Germany. It was needed to examine an evacuation plan in Hamburg since it was hit by flooding in 1961. The flooding destroyed most of the city and killed 315 people. The analysis showed that the current evacuation plan was sufficient to save people's lives [24]. MATSim was also applied to simulate the evacuation of a large-scale pedestrian area. The authors' objective was to allow evacuees to optimize their routes. They used the Nash equilibrium concept to reduce the congestion in the network and to achieve their objective. The results computed the predicted evacuation time and bottlenecks. The results also showed that the approach performs well for large scale scenarios and that the queue simulation used by MATSim was able to capture the congestion effects of bottlenecks [25, 26]. MATSim was employed to find the best evacuation routes for escaping a tsunami [27]. The author compared two different evacuation routing solutions: the shortest path approach and the Nash equilibrium approach. The author found that the Nash equilibrium routing approach is superior to the shortest path routing approach because it reduces total evacuation time.

Studies have compared MATSim with other models, such as VISUM (a transportation planning system [28]). MATSim produced a shorter travel time than VISUM. This result was not surprising because MATSim in its re-planning stage can change vehicle routes to decrease congestion problems. As a result, the MATSim model was free of congestion. MATSim and EMME/2 (a complete travel demand modeling system [29]) have also been compared [30]. Results show that MATSim has better performance with regard to travel time and link speed. Moreover, MATSim is more realistic than the EMME/2 model in terms of capturing congestion in the network.

2.3. INTEGRATION Model

INTEGRATION, which is a microscopic traffic assignment model [31, 32], has been used to optimize network traffic flows over time to improve evacuation planning by reducing delays and congestion and increasing the number of lives saved. INTEGRATION was used to depict the reduction in flow due to congestion [33]. The authors proposed a mixed integer linear program (MILP) that can capture the reduction in traffic flows due to congestion formations upstream of bottlenecks. They concluded that, after using a MILP with flow reduction, the model could give better accuracy in performing evacuation planning; therefore, it predicts more accurate evacuation times. They showed that INTEGRATION can capture the flow reduction and is able to demonstrate the effects of congestion on queue discharge flows. INTEGRATION was used for modeling hurricane events in the Central Florida region (Ormond Beach, Florida). The model tested three different loading curves that depict a departure rate. Two of the curves were based on S-curves with a normal distribution assumption while the third curve was linear. The results showed that the linear curve performed best since it produced lowest clearance time [34]. The authors also made a comparison between the INTEGRATION and ARENA models. The comparison showed that there were statistically significant differences in the results. They concluded that the INTEGRATION model produced better results because the ARENA model has no interaction between elements in the network (car-following and lane change logics).

INTEGRATION has also been compared with other software, such as VISSIM [4]. Both INTEGRATION and VISSIM were compared based on modeling a signalized approach. INTEGRATION includes a behavioral model, while VISSIM includes a statistical stop/go probability model. Both models captured the loss in capacity during queue discharge using acceleration constraints, but the losses in the capacity produced by the INTEGRATION software were more consistent with field data [7]. INTEGRATION and TRANSIMS were also compared in another study [35]. The comparison was based on emission estimation modules produced by INTEGRATION and TRANSIMS. The results showed that TRANSIMS underestimated the emission magnitudes when compared with the field data. In contrast, INTEGRATION model emission trends appeared to be more consistent with the in-field emission measurements.

2.4. Conclusion

The previous related works have used different computer models to estimate the evacuation time in specific regions, and some of these studies have made a comparison between different models. However, these studies are limited in scope by varying the degrees of disaster events. The proposed research extends the state-of-the-art in evacuation studies by making three major contributions, as follows:

- The study is extensive in that. It evaluates 11 different evacuation scenarios that capture seasonal variations (summer, winter), day-of-the-week variations (midweek, weekend), weather impacts (normal, adverse), roadway impacts, peak construction workforce, and future demand; which have not been studied to this level of detail before.
- Using INTEGRATION and MATSim models to evaluate and estimate the evacuation time for these 11 scenarios. Moreover, making a comparison between the two models. This study focuses on the simulation side that tests the consistency between the two models.
- This study tested the effect of congestion in INTEGRATION and MATSim, the test was achieved by using a 1.5 demand factor.

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CHAPTER 3: Comparison of Microscopic and Mesoscopic Traffic Modeling Tools for Evacuation Analysis

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3.1. Abstract

This paper models multiple evacuation scenarios to compare the INTEGRATION microscopic traffic simulation model with the MATSim mesoscopic model. The comparison was based on three indicators: estimated evacuation time, average trip duration, and average trip distance. The results show that the estimated evacuation times in both models are similar since the Origin-Destination input file has a long tail distribution for trips. However, the evaluation also shows a difference between the two models for average trip duration. The average trip duration using INTEGRATION increased with increasing traffic demand levels and decreasing road capacity, whereas the average trip duration using MATSim decreased with increasing demand levels and decreasing road capacity. Average trip distance values were significantly different in both models. In conclusion, INTEGRATION was able to capture the congestion effects in the network and thus provided a more realistic model for the scenarios than MATSim.

Keywords: Evacuation Modeling, Microscopic Simulation, Disaster, Demand, Mesoscopic

3.2. Introduction

In the United States in 2015, evacuations as the result of natural or human-made disasters cost insurance companies $16.1 billion to cover the damages [1]. In the same year, 522 persons lost their lives due to different natural disasters such as severe thunderstorms, floods, storm surges, and wildfires [2]. In the event of a disaster, an evacuation process is needed to move people away from risk to the nearest safe zone. Ideally, an efficient evacuation process will minimize the total evacuation processing time and maximize the number of people who survive. A large-scale evacuation depends on many factors, such as the network infrastructure and the number of vehicles are used by evacuees, and many complications can arise that will affect the efficiency of the evacuation. For example, if power is out due to the event, gas stations and traffic signals will be unavailable. These issues are beyond the scope of this paper, which assumes that evacuees have a sufficient amount of gas and can finish their trips.

Several evacuations have been modeled and evaluated, especially those that occurred for the tsunami in Japan and Hurricane Rita in Houston, Texas, using transportation models to enhance the performance of evacuation processes. Transportation models are categorized into microscopic, macroscopic, and mesoscopic simulation models. Microscopic models study the individual traffic elements in the system, for example, vehicles and pedestrians. Macroscopic models depict traffic stream behavior as a compressible fluid, such as aggregated traffic flow dynamics. Mesoscopic models can track each part at an aggregate level of detail, such as vehicle platoon dynamics. Alsnih and Stopher [3] have described different traffic simulation models and emergency evacuation models, including microsimulation models, which have become more popular in evacuation planning since microscopic simulation tools can track individual vehicle behavior [4] and the decision-making of individuals can be explained.

The objective of this study was to evaluate different evacuation scenarios in a Knoxville, TN roadway network using two models. The first model was INTEGRATION, which is a microscopic traffic assignment model [5, 6]. The authors decided to use INTEGRATION for the following reasons:

- The team has access to it and is very familiar with the source code,
- INTEGRATION is the only software that models vehicle dynamics and uses state-of-the-art fuel consumption and emission models (VT-Micro),
- INTEGRATION is designed in a modular fashion,

- The model can capture dynamic changes in the network, including incidents and actuated and adaptive signal controls,
- The calibration and coding of the INTEGRATION software is easier than other microscopic software given that the model does not require many of the microscopic parameters used in other microscopic models, and
- The software has been extensively validated and tested on realistic, large transportation networks.

The second model was MATSim, which is an agent-based traffic demand model and mesoscopic traffic simulation model [7]. The authors decided to use MATSim because many researchers have used it for modeling evacuations and have shown that it performs very well for large scenarios [8-11].

This paper evaluates INTEGRATION and MATSim for different evacuation scenarios and compares the performance of the two models. The paper is organized into five additional sections. The first section reviews previous related work. The second section describes the two models that were used to evaluate the performance of the evacuation scenario. The third section describes the study area, which is a Knoxville, TN area. The third section also describes the simulation network and demand file construction and calibration. The fourth section shows the results of the models. The fifth section presents the conclusions and recommendations for future work.

3.3. Literature Review

Evacuation modeling has become critical to steering people away from risk. Several evacuation simulation models have been developed to predict the performance of an evacuation scenario such as TRANSIMS [12], CORSIM [13], DynusT [14], and VISSIM [15].

TRANSIMS is an activity-based microscopic traffic simulation model. TRANSIMS was used to assess and evaluate traffic conditions during an evacuation in Megaregion road networks. TRANSIMS computed an evacuation time value using the total number of evacuees passing the threat area to evaluate the model. The TRANSIMS simulation model performed well in estimating the cumulative plot for evacuees [16]. One of the effective methods that has been increasingly used during evacuation is contraflow segments of interstate highways. CORSIM software was used to model contraflow freeway traffic during evacuation to assess the planned termination designs and to define the factors that make some designs more efficient [17].

MATSim is an agent-based model that can be used to model an evacuation scenario [7]. MATSim has been applied as an evacuation simulation model for many regions [8-11]. For example, MATSim was used to analyze an evacuation plan in Hamburg, Germany, since flooding in 1961 destroyed most of the city and killed 315 persons. The analysis showed that the current evacuation plan was sufficient to save people's lives [8]. MATSim was also applied to simulate a large-scale pedestrian evacuation. The authors' objective was to allow evacuees to optimize their routes. They used the Nash equilibrium concept to reduce the congestion in the network and achieve their objective. The results computed the predicted evacuation time and bottlenecks. The results also showed that the approach performed well for large-scale scenarios and that the queue simulation was able to capture the congestion effects of bottlenecks [9, 11]. MATSim has also been employed to find the best evacuation routes for escaping a tsunami [10]. The author compared two different evacuation routing solutions: the shortest path approach and the Nash equilibrium approach. The author found that the Nash equilibrium routing approach is better than the shortest path routing approach because the Nash equilibrium routing approach reduces total evacuation time.

Studies have compared MATSim with other software, such as VISUM (a transportation planning system [18]). MATSim produced a shorter travel time than VISUM. This result was not surprising since MATSim was free of congestion because its replanning stage can change vehicle routes to decrease congestion problems. MATSim and EMME/2 (a complete travel demand modeling system [19]) have also been compared [20] using Greater Toronto and Hamilton area network and actual demand data. Results were based on four indicators: travel time, travel distance, link volume, and link speed. The results showed that MATSim had better performance with regard to travel time and link speed. Moreover, MATSim was more realistic in terms of capturing congestion in the network than the EMME/2 model.

INTEGRATION, which is a microscopic traffic assignment model [5, 6], has been used to optimize network traffic flows over time to improve evacuation planning by reducing delay, congestion, and increasing the number of saved lives. INTEGRATION was used to depict the reduction in flow due to congestion [21]. Chamberlayne (2011) proposed a mixed integer linear program (MILP) that can capture the reduction in traffic flows due to congestion formations upstream of bottlenecks. They concluded that after using MILP with flow reduction, the model could give better accuracy in performing evacuation planning, and that therefore it predicts evacuation times more accurately. They showed that INTEGRATION can capture the flow reduction and demonstrate the effects of congestion on queue discharge flows.

INTEGRATION has also been compared with other software, such as VISSIM [15]. Both INTEGRATION and VISSIM are based on modeling a signalized approach. INTEGRATION includes a behavioral model, while VISSIM includes a statistical stop/go probability model. Both models captured the loss in capacity during queue discharge using acceleration constraints, but the losses in the capacity produced by INTEGRATION software have been shown to be more consistent with field data [22]. INTEGRATION and TRANSIMS have also been compared [23]. The comparison was based on emission estimation modules produced by INTEGRATION and TRANSIMS. The results showed that TRANSIMS underestimated the emission magnitudes when compared with the field data. In contrast, INTEGRATION model emission trends appeared to be more consistent with the in-field emission measurements.

3.4. Modeling

Several evacuation simulation models have been developed to predict the performance of an evacuation scenario in a particular region, such as VISSIM [22, 24, 25], TRANSIMS [4, 26], and AIMSUN [27]. This section describes the two models that were used to evaluate the performance of the evacuation scenario in this study. These models represent two different genres of models. INTEGRATION is a trip-based model, and MATSim is an agent-based traffic demand model. These two simulators were originally implemented using two separate programming languages; INTEGRATION uses FORTRAN, while MATSim uses Java.

3.4.1. INTEGRATION Simulation Model

INTEGRATION is an agent-based microscopic traffic assignment and simulation software [28-35] developed by the Center for Sustainable Mobility (CSM) at the Virginia Tech Transportation Institute (VTTI). INTEGRATION was initially developed in the late 1980s and continues to be developed at VTTI [5, 6, 36]. It was conceived as an integrated simulation and traffic assignment model and performs traffic simulations by tracking the movement of individual vehicles every 0.1 s. This allows the detailed analysis of lane-changing movements and shock wave propagations. It also permits considerable flexibility in representing spatial and temporal variations in traffic conditions. In addition to estimating stops and delays [37, 38], the model can also estimate the fuel consumed by individual vehicles and their vehicular emissions [39, 40].

Finally, the model also estimates the expected number of vehicle crashes using a time-based crash prediction model [41]. INTEGRATION software incorporates a variable power model that computes the vehicle's tractive effort, aerodynamic, rolling, and grade-resistance forces [42, 43]. The INTEGRATION model has not only been validated against standard traffic flow theory [32, 38, 44, 45], but has also been utilized for the evaluation of large-scale real-life applications [46-48]. The INTEGRATION lane-changing logic has been described and validated against field data in an earlier publication [33]. Furthermore, Rakha and Zhang [49] demonstrated the ability of the INTEGRATION software to estimate the capacity of weaving sections by comparison to field-observed weaving section capacities.

Due to all the features available in INTEGRATION, it was used as a base model in this paper.

3.4.1.1. Traffic Simulation Model Input

The input data for INTEGRATION are divided into fundamental data and advanced data. Fundamental data are essential to run the software. Advanced data are optional depending on which file are you interested in.

Table 2 summarizes the fundamental input data. The network modeled included 794 nodes, 1,465 links, and 68 signals. A lane striping file was also included to define turning movements assigned to each lane at intersections.

3.4.1.2. Traffic Simulation Model Output

The INTEGRATION model provides many output files depending on what the user needs, such as vehicle delay, vehicle stops, traces of individual vehicle movements, fuel consumption, and emissions. The output file can be ordered by link, by vehicle, and by time sequence. In this paper, the output file needed to compute the total evacuation time was file number 15, which provides a vehicle probe listing that chronicles the trip arrival and departure statistics of vehicles [5, 6].

3.4.2. MATSim Model

MATSim was developing jointly at TU Berlin, ETH Zurich, and Senozon Company. MATSIM is an agent-based model. It is a microscopic model of demand that tracks each agent by having a detailed daily plan. MATSim is capable of simulating vehicles and public transport in large detail, and it also can simulate pedestrians or cyclists. MATSim is able to simulate large scenarios with several million agents. Moreover, the simulation process is very fast.

This study used the Java Deterministic Event Driven Queue Based Simulation model (JDEQSim). This simulator has many features that produce more realistic traffic modeling compared with other models such as QueueSim [50]. QueueSim was the first simulation that used MATSim, and it was developed by Raney [51]. Waraich et al. developed the JDEQSim model by adding some new features. They described and implemented some features of the JDEQSim simulation model:

- JDEQSim considers gaps between vehicles. During a queue, vehicles spill backward instead of forward. This makes the model more realistic [52].
- Traffic simulation is based on a queue model (FIFO: First In First Out).
- Gridlock is prevented by having a squeezing-vehicles parameter in the configuration file.
- A large scenario can be run during little time.

MATSim uses evolutionary optimization to optimize individual agent's choices for each plan. The optimization process maximizes the daily utility of agents. Each plan contains the start and the end time of each person, the location of the activity, and the choice of mode.

3.4.2.1. Traffic Simulation Model Input

MATSim has to have at least three input files to be able to run a scenario. The input files of the simulation include the following:

- The configuration file provides an easy connection between the user and the software.
- The network file describes the node coordinates and link characteristics, such as length of the link, free flow speed, and capacity of the link.
- The demand file describes the daily activities of each agent.

MATSim proceeds through five major stages to model a scenario [53], as shown in Figure 2. The first stage is initial demand. The initial demand can be generated either from one of the open source maps (http://www.openstreetmap.org, http://www.geofabrik.de), or the input files can be created from code using any programming language. In this study, the MATSim input files were created from the INTEGRATION input files (to have the same input files). The second stage executes the initial demand based on the configuration characteristics. The traffic simulation is implemented as a queue simulation, which is considered FIFO. The third stage evaluates each agent based on a fitness function. Each agent gets a score based on his or her daily activities. The fourth stage, replanning, improves the average score for agents by using an evolutionary algorithm as an optimization tool. This stage continues until a predefined number of iterations is completed. For this study, the replanning stage was not considered since MATSim changes O-D file in this stage. Moreover, the input files in two models should be the same in order to make a good comparison. Finally, stage five allows the user to analyze the output files.

3.4.2.2. Traffic Simulation Model Output

MATSim generates some output files during the execution process in order to allow the user to perform the analysis. Some of the output files needed to compute evacuation time, average trip duration, and average trip distance are the event, trip duration, and travel distance stats files.

3.5. Study Area

A total of 11 scenarios were evaluated for an evacuation of an 814-km^2 area in Knoxville, TN (Figure 3). This area could be exposed to a natural or man-made disaster that would impact both communities and transportation infrastructure. In Knoxville, TN in 2015, a car on a CSX train carrying acrylonitrile material derailed and caught fire, and the county mayor asked residents to leave the area [54]. Figure 4 shows the simulated network.

The definitions of the 11 scenarios are presented in Table 3. These scenarios were created based on seasonal variations, day-of-the-week variations, weather impacts, roadway impacts, and the peak construction workforce in the city [55]. The differences between scenarios are in road capacity, free-flow speed, and demand level. The scenarios' roadway characteristics were obtained from an ArcGIS network file. Features such as number of lanes, lengths, and free flow speed were extracted from the network file and exported to simulation input files. Some scenarios had no adjustments to the network parameters such as scenario 1, scenario 3, scenario 4, scenario 5, scenario 7, scenario 8, scenario 10, and scenario 11. In contrast, adverse weather scenarios such as scenario 2 and scenario 6 had some adjustments to the network parameters. These adjustments were based on the U.S Department of Transportation's Highway Capacity Manual (HCM) 2010 [56]. The capacity of the roadway will be impaired. At the same time, free flow speed, which will be impacted by the weather condition is also decreased. Table 4 presents the reduction factors that were made to the roadway capacities and free flow speeds. Scenario 9 intended to represent a variety of conditions that may impact a roadway segment such as construction and vehicle accidents. This scenario assumes that during a summer midweek normal weather daytime scenario, one section of an eastbound lane of I-40 is shutdown. Then the section capacity will definitely be reduced. Scenario 10 represents a typical normal weather midweek daytime period, the difference between scenario 10 and the other normal scenarios is in the demand file. A large number of evacuees are expected. The scenario 10 assumes that the peak number of construction workers are on-site. Scenario 11 predicts the future demand. The existing roadway system was used for this scenario and no roadway improvements were considered. According to the census data in the area, permanent resident and shadow populations were extrapolated from 2015 to 2024 with a 2.64% annually increasing rate.

3.5.1. Simulation File Construction and Calibration

The road network needed for the simulation input files was constructed from a Geographic Information System (GIS) shapefile. A detailed field survey was conducted to obtain the characteristics of the primary roadways and validate the original coding of the network. Roadway characteristics obtained during the field survey included the number of lanes, lane width, intersection configuration, lane channelization and striping, geometries (curves and lengths), speed limit, and other necessary characteristics.

The demand file was composed of two parts: background/pass-through traffic and evacuation traffic. Background and pass-through traffic will exist at the time an order to evacuate is issued. To estimate the background and pass-through traffic, QUEENSOD [57], a software application developed by the Virginia Tech Transportation Institute (VTTI), was used. QUEENSOD is a model for estimating origin-destination (O-D) traffic demands based on observed link traffic flows, observed link turning movement counts, link travel times, and, potentially, additional information on drivers' route choices. QUEENSOD iteratively minimizes errors between observed link volumes to estimated link flow using a Least Relative Error (LRE) model and generates an O-D matrix. The latest published traffic statistics, provided by the Tennessee Department of Transportation (http://www.tdot.state.tn.us/traffichistory), were used to as the input data for QUEENSOD. The count stations and network in the area are shown in Figure 5.

To validate the results of QUEENSOD and calibrate the network configuration, the output of the QUEENSOD, the O-D matrix, was used in INTEGRATION as the input demand file. The simulation was then run and the link traffic counts were recorded and calibrated against the observed traffic count data. Attributes of the network, such as speed limits and lane configurations, were modified and adjusted accordingly to match the observed traffic volumes. Figure 6 shows the relationship between the observed link volume and the simulation volume. As can be seen, the results of the simulation were very accurate, with R^2 close to 1.

Evacuation traffic demand was modeled based on the population in the area, locations of major employers, and locations of parks, hotels, and other important landmarks. The demand file for each scenario was customized, taking into consideration the variation of traffic volume by time, season, day-of-the-week, and other impact factors.

3.6. Results and Discussion

This section discusses two different demands for each model, the base demand and the demand with a 1.5 scaling demand factor from the base demand. The two models were evaluated based on traffic assignment outcomes given the same demand. INTEGRATION was able to analyze the traffic in much more temporal detail since it generates high-accuracy output for each vehicle every 0.1 s. The comparison between models was based on estimated evacuation time, average trip duration, and an average trip distance. The idea was to have same input files for both models during running simulations in order to make a good comparison, as follows:

- Both models had the same demand files.
- Both models had the same network characteristics such as node, link, and signal.
- Each vehicle had the same O-D locations in both models.
- The starting time for each vehicle was the same in both models.
- No rerouting was considered since the study focuses on the simulation side that tests the consistency between the two models.
- The replanning stage was not active in the MATSim model since this stage changes the O-D information including departure time, activity location/duration, path, and mode choices [53]. The two models must have same information in their input files to make a fair comparison.

3.6.1. Base Demand

The base demand describes the current demand for all scenarios considering the seasonal variations, day-of-the-week variations, weather impacts, roadway impacts, and the peak construction workforce in the city. The scenarios for base demand were evaluated based on the estimated evacuation time, the average trip duration, and the average trip distance values in both models as follows:

3.6.1.1. Estimated Evacuation Time

In general, evacuation time is the time from when the first evacuating vehicle enters the road network to the time when the last vehicle finishes its trip [58]. In this paper, the estimated evacuation time considered 10 end times' values. The 10 values were found by excluding the last trip with a maximum end time and then taking the end time among the maximum remaining 10 end time values. The estimated evacuation time was computed by taking the average of these 10 values, then subtracting the background time (pre-evacuation time) from the average value. The pre-evacuation time was approximately 45 minutes for all scenarios. This method was used to avoid randomness in the system. This method was also used since the O-D file generates a long tail for trips, resulting in the estimated evacuation times in both models being very close to each other. Table 5 shows the estimated evacuation time. It also indicates that the percentage differences between both models are negligible. Figure 7 presents the results as a bar chart for both models. Figure 8 shows a screenshot of the Scenario 10 simulation in the INTEGRATION interface. It shows that roads were free most of the time because the capacity of roads was greater than the demand.

3.6.1.2. Average Trip Duration

Average trip duration was computed by taking the travel time of all vehicles that needed to finish their trips and dividing by the total number of vehicles. The average trip duration for both models is shown in Figure 9. The percentage difference between both models is given in Table 6. The table indicates that the average trip duration derived by INTEGRATION was longer than MATSim for all scenarios. This reflects the congestion effect produced by INTEGRATION. For example, Scenario 10 in both models needed the longest evacuation time since it assumed that roads had the peak amount of construction workers on-site. Consequently, Scenario 10 should have a large average trip duration value in both models. However, the average trip duration for Scenario 10 in MATSim had the lowest value. Considering a comparison between Scenario 10 with the normal scenarios such as Scenario 3 and Scenario 4, and knowing that these models have the same network characteristics, but they are different in terms of demand levels. The comparison showed that the average trip duration value for Scenario 10 in INTEGRATION was larger than the normal scenarios (Scenario 3 and Scenario 4). While the average trip duration value for Scenario 10 in MATSim was the lowest value. Finally, Table 6 shows that Scenario 6 in both models had the largest average trip duration, which was caused by the reduction of free-flow speeds and road capacities values in the network.

3.6.1.3. Average Trip Distance

Average trip distance was computed as the sum of the total travel distance of all vehicles divided by the total number of vehicles. In Table 7, the average trip distances for the base scenarios show that there is a significant difference between the two models. In Table 7, Scenario 11 had the largest value in both models since it depicts the future demand, and the future demand is expected to be greater than the current demand for other scenarios. Although INTEGRATION generated much higher average trip distance values than MATSim, INTEGRATION was able to capture fluctuating congestion on the network. The INTEGRATION used Microscopic Dynamic Traffic Assignment method to define the minimum path for vehicles, in view of the link travel times anticipated in the network at the time the vehicle will reach these specific links [6]. While MATSim used Dijkstra's shortest path algorithm to define the vehicles paths. The Dijkstra's algorithm is used to find the shortest distance paths between nodes in the network [59]. Also, in MATSim a trip starts and ends at links. On the other hand, in INTEGRATION a trip starts and ends at nodes, so we expect more accurate values from INTEGRATION.

3.6.2. Scaled Demand

After analyzing the base scenarios, the team decided to scale the demand up for all scenarios to test the effect of congestion in both models. The scale factor was equal to 1.5 times the base demand. The scenarios for the 1.5 scaling demand factor were evaluated based on the average trip duration and the average trip distance values.

3.6.2.1. Average Trip Duration

Table 8 depicts the average trip duration for both models and also includes the percentage difference between them. The results show that both models generated different travel times for all scenarios. However, the travel time in INTEGRATION was much higher than in MATSim. This indicates that INTEGRATION captured the fluctuating congestion on the network, while MATSim was less sensitive to congestion. This finding is against the previous studies that showed the MATSim is realistic with capturing congestion in the network [18, 19]. Scenario 10 had the longest evaluation time since it assumed a peak number of construction workforce on-site, resulting in the increase of evacuees' number. On the other hand, the average trip duration for

Scenario 10 in MATSim had the lowest value. Therefore, INTEGRATION was more realistic in depicting actual scenarios than MATSim.

3.6.2.2. Average Trip Distance

Table 9 shows the output of both models in terms of increasing the demand for all scenarios by 1.5 times the base demand. The average trip distance for the two models was obviously increased. Although INTEGRATION generated much higher average trip distance values than MATSim, INTEGRATION was able to capture fluctuating congestion on the network, as the vehicles on the network avoided using congested roads and took longer routes to arrive at their destinations. Both models have different trip definitions. In MATSim, a trip starts and ends at links. On the other hand, in INTEGRATION a trip starts and ends at nodes, so we expect more distance from INTEGRATION. The range of the percentage differences between both models was between 19% and 24% depending on the type of the scenario.

3.6.3. Statistical Analysis

Statistical analysis was performed to determine if there was any difference between the models. The analysis was done using different random seeds. The test was done by taking 20 different random seeds in INTEGRATION, and then constructing a MATSim input file (Demand file) based on the INTEGRATION output files. The new demand files had different information, such as the starting trip time for each vehicle.

Since both models' samples were completely independent, the statistical hypothesis test that was used was the pooled t-test. It was assumed that both variances were equal, but they were not known. The null hypothesis was $H_0: \mu_{INTEGRATION} - \mu_{MATSim} = 0$, where $\mu_{INTEGRATION}$ is the mean for total travel time in INTEGRATION, and μ_{MATSim} is the mean for total travel time in MATSim. The alternative hypothesis was $H_a: \mu_{INTEGRATION} - \mu_{MATSim} \neq 0$. The results show that there is a sufficient evidence to conclude that the results from the two models were statistically different (p-value < 0.0001).

3.7. Conclusions and Future Work

This paper compared INTEGRATION and MATSim for modeling different evacuation scenarios. Eleven different scenarios were modeled to reflect the effects of seasonal variations, day-of-the-week variations, weather impacts, special events, roadway impacts, and the peak construction workforce. The total area covered was approximately 814 km^2. The models were compared based on the estimated evacuation time, average trip duration, and average trip distance.

The estimated evacuation times of both INTEGRATION and MATSim were close to each other. The percentage differences between INTEGRATION and MATSim values were very small, less than 3%. The cause of the close values from INTEGRATION and MATSim was that the O-D input file has a long tail for trips. Moreover, the demand of all scenarios was less than the capacity of the network. Scenario 10 had the longest estimated evacuation time in both models. Scenario 10 assumes a peak number of construction workers on-site, and therefore the number of evacuees are bigger.

In the case of the average trip duration for the base demand and the scaled demand scenarios, the differences were considerably large reaching a 49% difference. Furthermore, MATSim appeared to produce some unrealistic behavior. Intuition would assume that the average trip duration would increase with increasing traffic demand levels and decreasing roadway capacities. The INTEGRATION results were consistent with intuition. On the other hand, the average trip duration using MATSim decreased with increasing roadway capacities and increasing traffic demands. The percentage differences values between the two models increased significantly as demand increased, demonstrating that INTEGRATION was more capable of capturing the congestion effects at higher demand levels.

The evaluation also showed a difference between the two models in the average trip distance. Although INTEGRATION produced higher values than MATSim, INTEGRATION was more realistic since INTEGRATION trip distance values were more consistent with average trip duration values. For example, in the scaled demand scenarios, in INTEGRATION, Scenario 6 had the largest value for the average trip duration and average trip distance. But in MATSim, Scenario 6 had the largest value for average trip duration only.

In conclusion, if the final evacuation time is the objective of the study and the demand is low and follows a long-tail distribution the use of MATSim could be adequate for evacuation purposes. However, if these conditions are not satisfied then the use of INTEGRATION tool is highly warranted even though the model calibration and execution is more challenging.

Among future considerations is to study the effect of extreme events on the evacuation process, such as traffic signal failures and vehicles running out of fuel. Traffic signal failures will definitely reduce the intersection capacity and increase the total travel time, as well as increase the chances of vehicle crashes at intersections. Such extreme events may produce congestion issues on the network, such as lane closures, and impede the movements of the vehicles.

Table 2. Fundamental Input Data Files [5]

File Name	Description
Master File	Master control file which specifies the global simulation parameters, and the location as well as the names of any input and output files
File 1	Node coordinates, characteristics, and attributes
File 2	Link structure, characteristics, and signal phasing discharge
File 3	Traffic signal timing plans
File 4	Origin-destination traffic demands (output of QUEENSOD software)
File 5	Incident descriptions

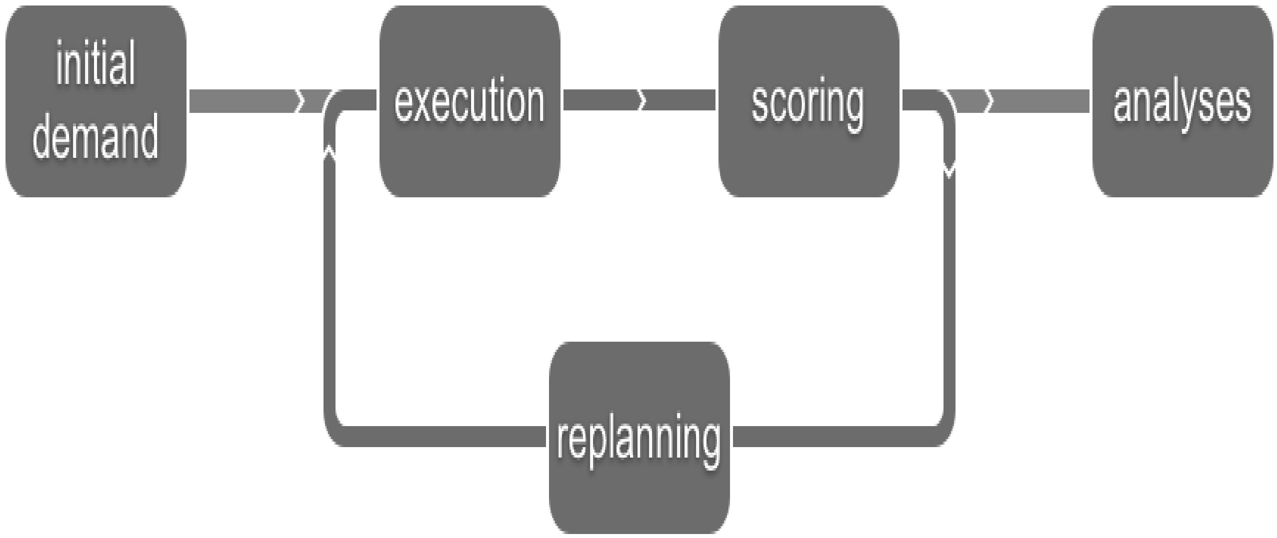

Figure 2. Stages of a MATSim Simulation [53]

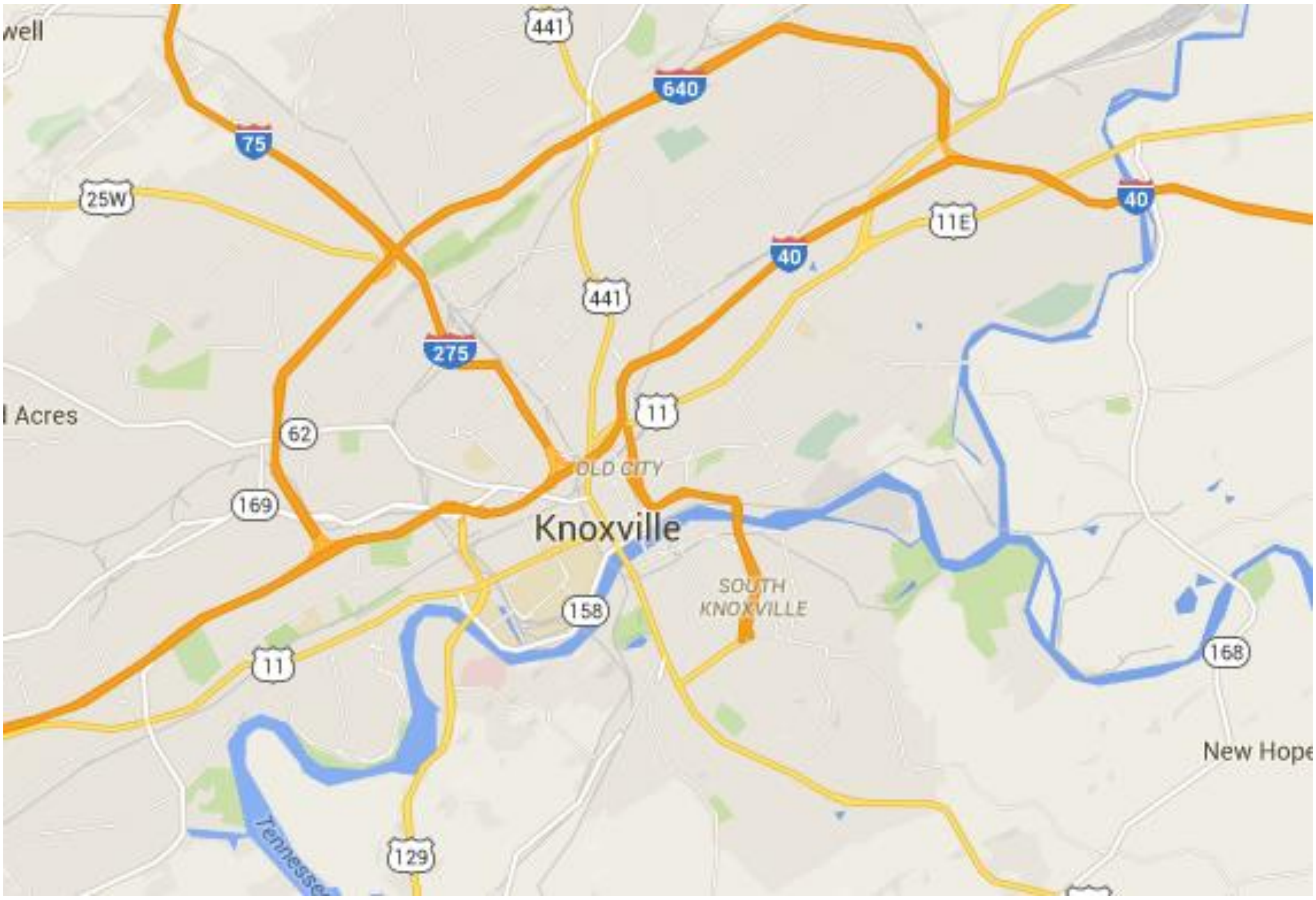

Figure 3. Knoxville, TN (Source: Google Maps)

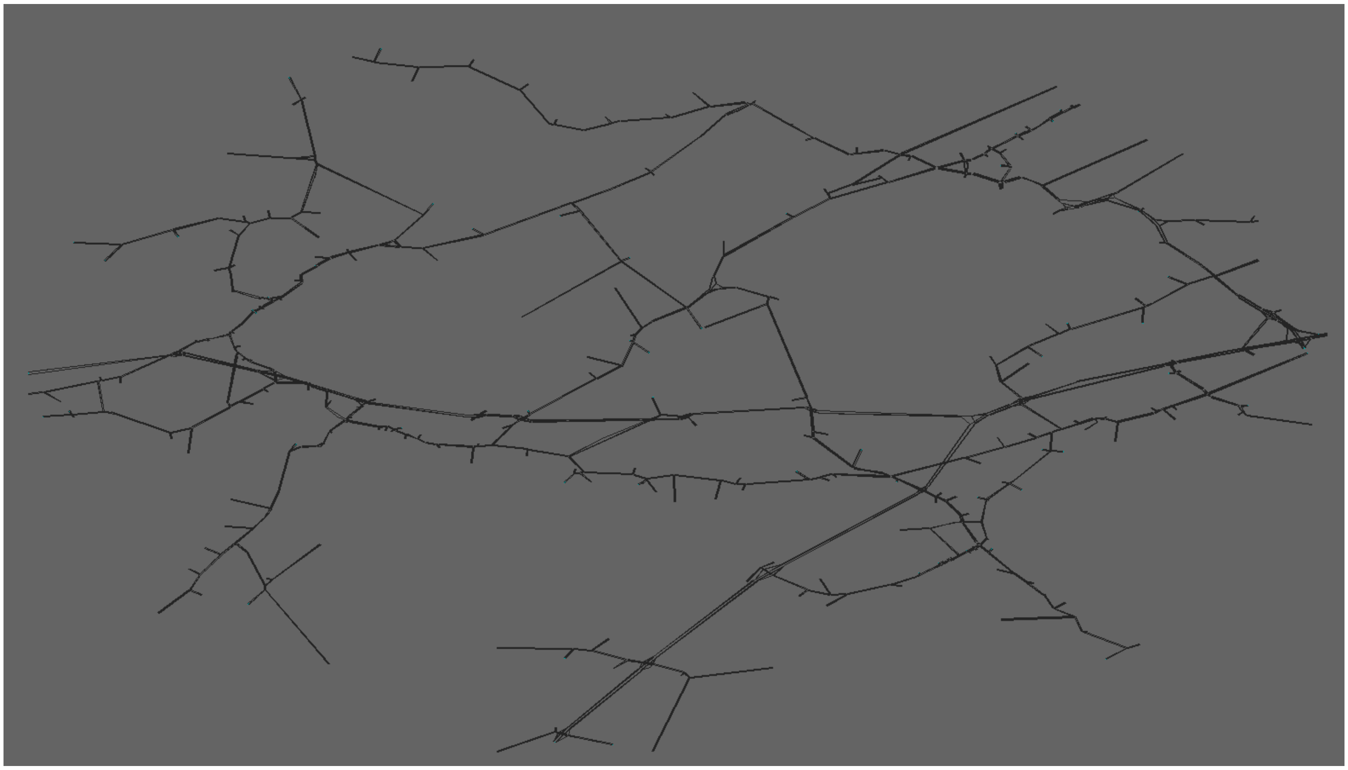

Figure 4. INTEGRATION Network of the Study Area

Table 3. Definitions of the 11 Scenarios

Scenario	Description
1	Typical normal weather, midweek daytime period in summer
2	Adverse weather, daytime midweek period in summer
3	Typical normal weather, weekend daytime period in summer
4	Typical normal weather, midweek and weekend evening period in summer
5	Typical normal weather, midweek daytime period in winter
6	Adverse weather, midweek daytime period in winter
7	Typical normal weather, weekend daytime period in winter
8	Typical normal weather, midweek and weekend evening period in winter
9	Different conditions that may impact a roadway segment such as vehicle accidents, typical normal weather, midweek daytime period in summer
10	Typical normal weather, midweek daytime period in summer; assumes that roads have the peak number of construction workers on-site
11	Typical normal weather, midweek daytime period in summer; this scenario predicts the future demand

Table 4. Weather Capacity Factors [55]

Weather Condition	Season	Roadway Capacity	Speed
Normal	Summer/Winter	100%	100%
Adverse - Heavy Rain	Summer	90%	85%
Adverse – Heavy Snow	Winter	85%	65%
Adverse - Fog	Winter	75%	85%

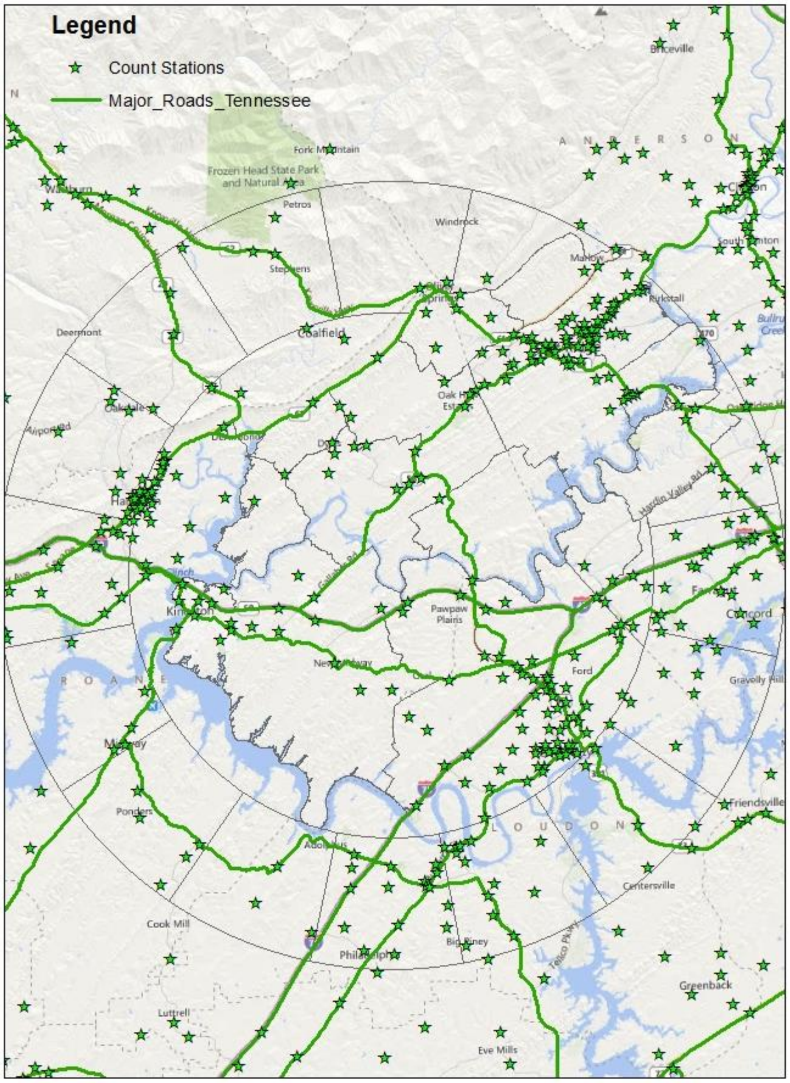

Figure 5. Count Stations and Roadway Network in Knoxville, TN, Area

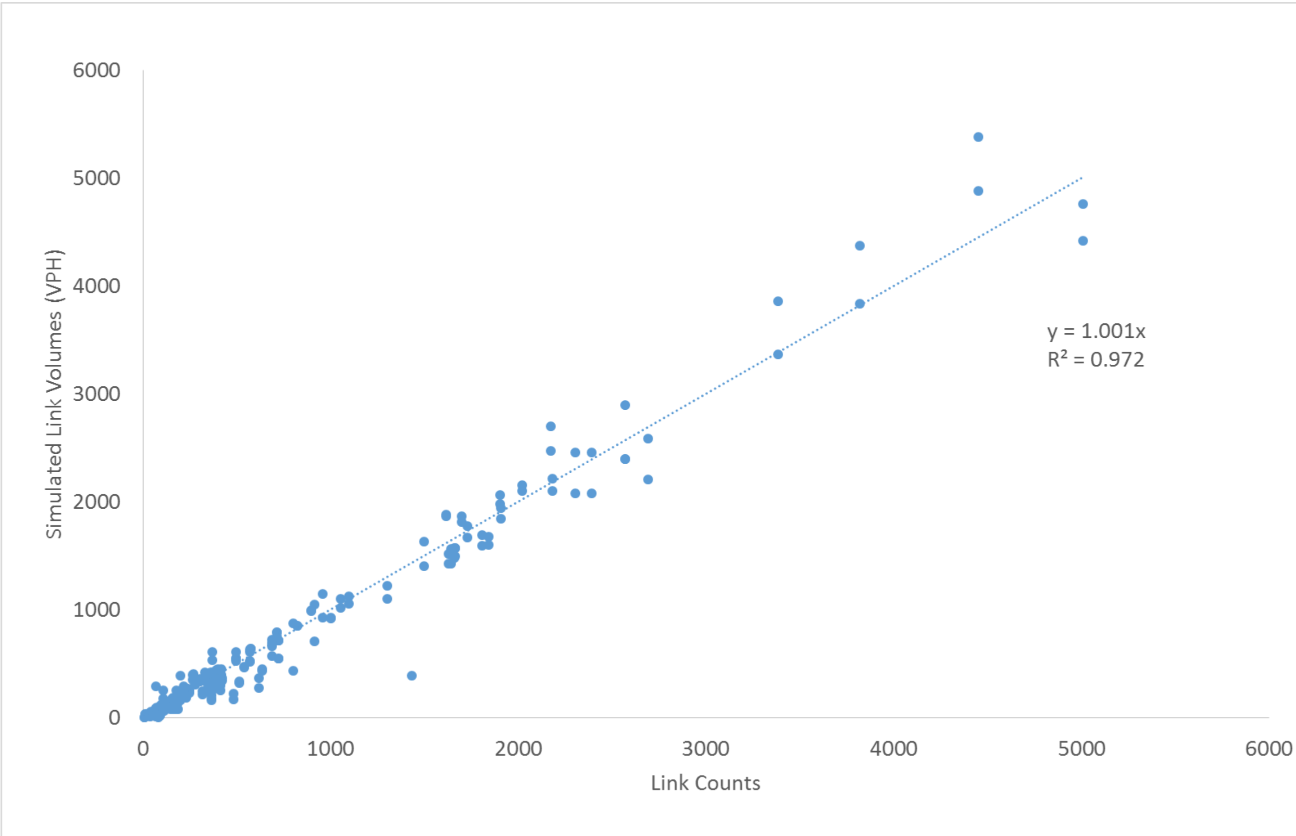

Figure 6. Relationship between Observed Link Volumes and Simulated Volumes

Table 5. Estimated Evacuation Time of the 11 Scenarios in Both Models

Scenario	INTEGRATION (h:min:s)	MATSim (h:min:s)	Difference (%)
1	4:59:00	4:56:00	0.83
2	4:53:00	4:49:00	1.3
3	4:06:00	4:02:00	1.69
4	4:11:00	4:08:00	0.90
5	4:55:00	4:53:00	0.67
6	4:57:00	4:52:00	1.75
7	4:09:00	4:02:00	2.68
8	4:08:00	4:07:00	0.54
9	4:11:00	4:07:00	1.50
10	5:57:00	5:47:00	3.03
11	4:49:00	4:47:00	0.61

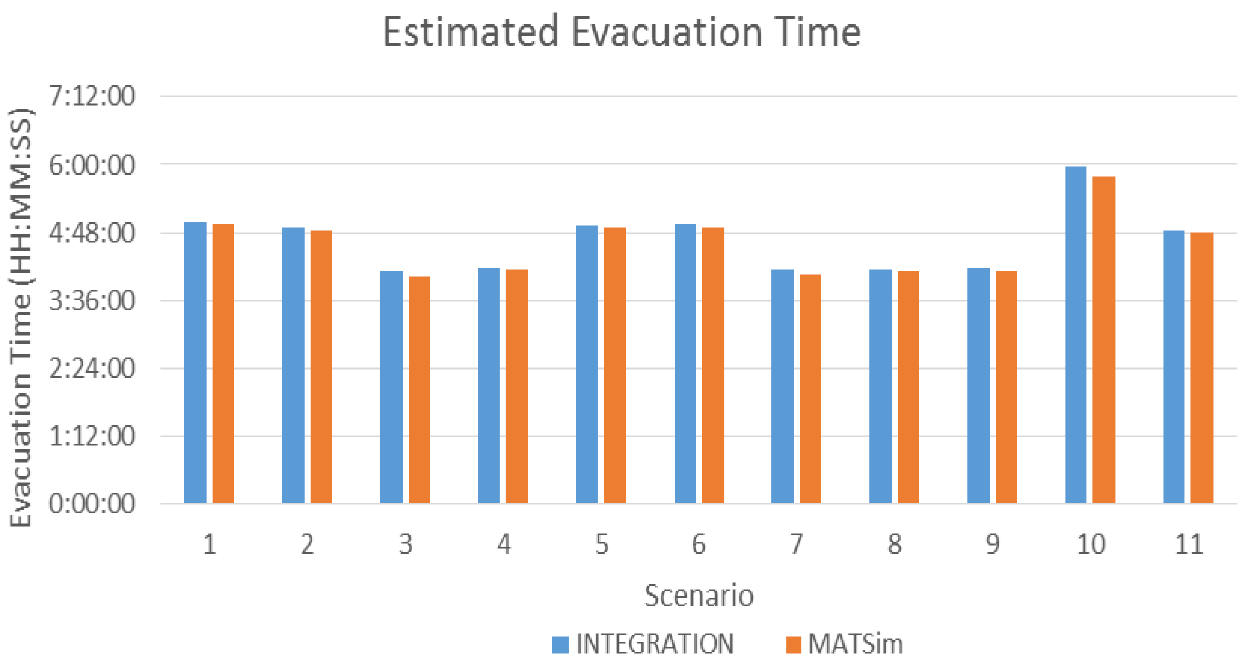

Figure 7. Estimated Evacuation Time of the 11 Scenarios for Both Models

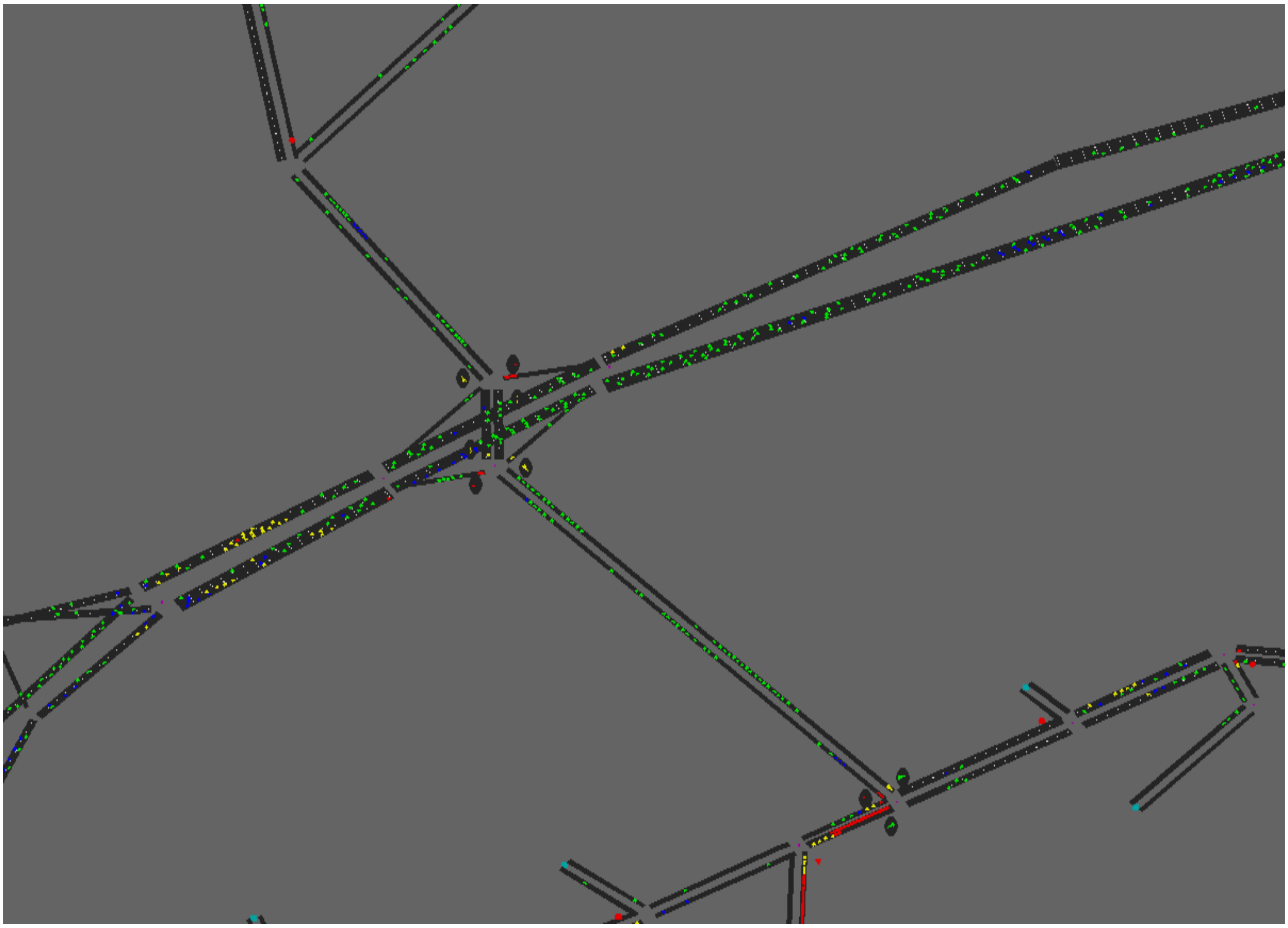

Figure 8. Screenshot of INTEGRATION Software Interface for Scenario 10

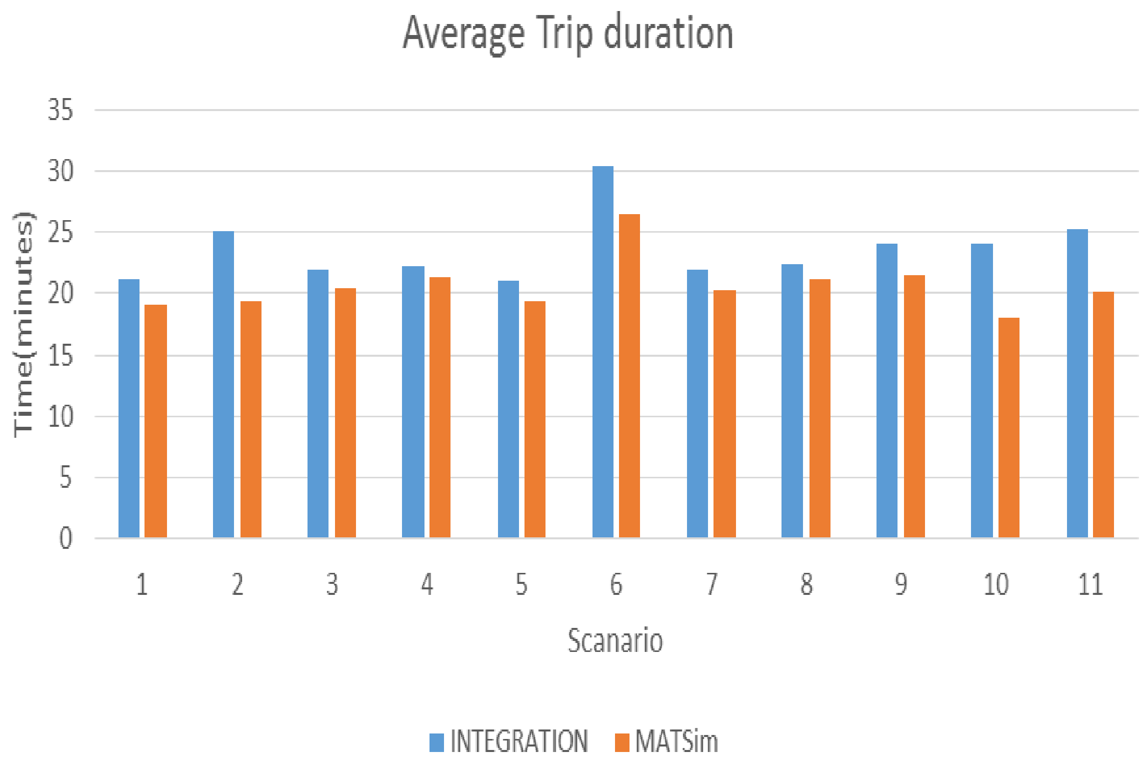

Figure 9. Average Trip Duration for the 11 Scenarios

Table 6. Average Trip Duration for the Base Scenarios

Scenario	INTEGRATION Model (vehicle-min)	MATSim Model (vehicle-min)	% Difference
1	21.26	19.04	10
2	25.11	19.40	23
3	21.94	20.43	07
4	22.27	21.31	04
5	20.99	19.32	08
6	30.38	26.45	13
7	21.99	20.36	07
8	22.43	21.27	05
9	24.06	21.51	11
10	24.08	18.06	25
11	25.32	20.10	21

Table 7. Average Trip Distance for Base Scenarios

Scenario	INTEGRATION Model (vehicle-km)	MATSim Model (vehicle-km)	% Difference
1	15.41	12.8	17
2	15.65	12.77	18
3	15.55	12.52	19
4	15.09	11.78	22
5	15.53	12.79	18
6	15.7	12.78	19
7	15.53	12.53	19
8	15.12	11.8	22
9	15.55	12.52	19
10	15.5	12.78	18
11	15.9	12.97	18

Table 8. Average Trip Duration for 1.5 Times Demand Scale Factor Scenarios

Scenario	INTEGRATION Model (vehicle-min)	MATSim Model (vehicle-min)	% Difference
1	52	34	36
2	58	34	41
3	44	33	25
4	40	33	19
5	53	33	36
6	63	44	30
7	42	33	23
8	40	32	19
9	46	35	24
10	57	31	49
11	61	35	43

Table 9. Average Trip Distance for 1.5 Times Demand Scale Factor Scenarios

Scenario	INTEGRATION Model (vehicle-km)	MATSim Model (vehicle-km)	% Difference
1	16.49	13.29	19
2	16.60	13.21	20
3	16.03	12.61	21
4	15.72	11.98	24
5	16.48	13.22	20
6	16.62	13.22	20
7	16.07	12.63	21
8	15.71	12.00	24
9	16.26	12.62	22
10	16.48	13.21	20
11	16.49	13.29	19

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CHAPTER 4: Conclusions and Recommendations

4.1. Conclusions

This thesis compared the INTEGRATION and MATSim tools for the modeling of evacuation scenarios. Specifically, eleven different scenarios were modeled to reflect the effects of seasonal variations, day-of-the-week variations, adverse weather impacts, special events, roadway impacts, and the peak construction workforce. The total area covered was approximately 814 km^2. The models were compared based on the estimated evacuation time, average trip duration, and average trip distance.

The estimated evacuation times generated by both INTEGRATION and MATSim were similar, with differences within 3%. However, a closer analysis of the results revealed that these minor differences were caused by the fact that the O-D input file had a long tail distribution. In other words the bulk of the evacuation time was related to the evacuee departure times as opposed to the actual evacuation travel times because the demand of all scenarios was less than the capacity of the network. Scenario 10 had the longest estimated evacuation time in both models. Scenario 10 assumes that roads have the peak number of construction workers on-site, and therefore the number of evacuees are bigger.

In the case of the average trip duration for the base demand and the scaled demand scenarios, the differences were considerably large reaching a 49% difference. Furthermore, MATSim appeared to produce some unrealistic behavior. Intuition would assume that the average trip duration would increase with increasing traffic demand levels and decreasing roadway capacities. The INTEGRATION results were consistent with intuition. On the other hand, the average trip duration using MATSim decreased with increasing roadway capacities and increasing traffic demands. The percentage differences values between the two models increased significantly as demand increased, demonstrating that INTEGRATION was more capable of capturing the congestion effects at higher demand levels.

The evaluation also showed a difference between the two models in the average trip distance. Although INTEGRATION produced higher values than MATSim, INTEGRATION was more realistic since INTEGRATION values were more consistent with average trip duration values. For example, Scenario 6 had the largest value for the average trip duration and average trip distance. But in MATSim, Scenario 6 had the largest value for average trip duration only.

In conclusion, if the final evacuation time is the objective of the study and the demand is low and follows a long-tail distribution the use of MATSim could be adequate for evacuation purposes. However, if these conditions are not satisfied then the use of the INTEGRATION tool is highly warranted even though the model calibration and execution is more challenging.

4.2. Recommendations for Future Research

Among future considerations is to study the effect of extreme events on the evacuation process, such as traffic signal failures and vehicles running out of fuel. Traffic signal failures will definitely reduce the intersection capacity and increase the total travel time, as well as increase the chances of vehicle crashes at intersections. Such extreme events may produce congestion issues on the network, such as lane closures, and impede the movements of the vehicles.

Appendices

Appendix A: Node Input File for all Scenarios

Node ID	X-Coordinate	Y-Coordinate	Node Category	Node Attribute
1	258.974	440.166	1	-1
2	542.092	814.136	1	-2
3	341.448	425.844	1	-3
4	292.598	396.098	1	-4
5	831.764	679.382	1	-5
6	914.534	669.396	1	-6
7	876.718	659.092	1	-7
8	843.838	636.46	1	-8
9	850.588	593.752	1	-9
10	759.188	534.61	1	-10
11	755.91	494.312	1	-11
12	853.242	489.2	1	-12
13	746.054	485.212	1	-13
14	780.418	413.794	1	-14
17	826.09	566.908	1	-17
18	831.314	536.264	1	-18
19	788.626	402.648	1	-19
20	650.234	277.188	1	-20
21	951.792	504.76	3	-21
22	392.168	12.69	2	-22
23	784.026	809.096	1	-23
24	435.666	8.708	1	-24
25	34.044	636.448	1	-25
26	301.656	684.97	1	-26
27	97.12	173.212	1	-27
28	330.572	414.444	1	-28
29	495.802	824.166	1	-29
30	744.112	781.538	1	-30
31	579.996	764.622	1	-31
32	736.772	772.682	1	-32
33	766.842	831.782	1	-33
34	715.69	757.056	1	-34
35	729.158	753.014	1	-35
36	656.882	739.322	1	-36
37	460.74	729.484	1	-37

38	466.594	721.168	1	-38
39	725.662	732.798	1	-39
40	634.272	719.574	1	-40
41	593.988	703.696	1	-41
42	150.498	651.946	1	-42
43	331.66	653.348	1	-43
44	152.416	575	1	-44
45	178.482	567.76	1	-45
46	172.916	565.748	1	-46
47	188.518	565.158	1	-47
48	175.28	553.598	1	-48
49	157.824	507.246	1	-49
50	166.316	489.706	1	-50
51	443.61	482.21	1	-51
52	208.592	452	1	-52
53	178.782	450.12	1	-53
54	225.672	438.928	1	-54
55	245.662	430.796	1	-55
56	241.076	417.544	1	-56
57	372.786	425.896	1	-57
58	226.022	398.964	1	-58
59	497.87	407.986	1	-59
60	270.474	400.506	1	-60
61	281.4	391.308	1	-61
62	306.414	380.11	1	-62
63	335.43	384.626	1	-63
64	756.718	377.788	1	-64
65	452.112	354.472	1	-65
66	621.34	377.388	1	-66
67	602.376	343.348	1	-67
68	531.004	341.69	1	-68
69	468.174	324.954	1	-69
70	533	327.23	1	-70
71	726.534	337.052	1	-71
72	715.854	265.13	1	-72
73	704.518	255.984	1	-73
74	702.518	248.448	1	-74
75	177.828	215.82	1	-75
76	685.784	240.784	1	-76
77	681.468	237.29	1	-77
78	556	236	1	-78
79	681.402	232.872	1	-79
80	664.596	222.988	1	-80

81	749.864	210.878	1	-81
82	758.788	195.504	1	-82
83	773.316	186.02	1	-83
84	764.034	788.378	1	-84
85	778	808	1	-85
86	701.564	297.034	1	-86
87	238	628	1	-87
88	214.28	607.798	1	-88
89	30.444	425.702	1	-89
90	33.762	418.402	1	-90
91	61.89	424.28	1	-91
92	368.454	543.442	1	-92
93	770	802	1	-93
94	578.688	394.962	1	-94
95	647.886	337.834	1	-95
96	595.726	182.222	1	-96
97	486.904	95.144	1	-97
98	804.214	116.036	1	-98
99	164.27	184.796	1	-99
100	590.92	215.74	1	-100
101	131.662	254.312	1	-101
102	146.614	281.45	1	-102
103	151.146	315.116	1	-103
104	482.162	312.978	1	-104
105	512.596	316.346	1	-105
106	597.082	339.106	1	-106
107	771.694	375.018	1	-107
108	723.012	392.362	1	-108
109	119.112	373.104	1	-109
110	167.6	434.464	1	-110
111	418.666	473.704	1	-111
112	53.122	468.364	1	-112
113	416.968	493.806	1	-113
114	502.05	529.382	1	-114
115	504.556	531.068	1	-115
116	198.83	588.902	1	-116
117	204.644	589.834	1	-117
118	138.904	601.066	1	-118
119	57.074	613.936	1	-119
120	244.292	614.512	1	-120
121	304.97	614.624	1	-121
122	216.47	643.364	1	-122
123	565.704	672.338	1	-123

124	396.978	670.18	1	-124
125	148.426	747.702	1	-125
126	197.444	809.194	1	-126
127	285.966	838.706	1	-127
128	262.866	878.608	1	-128
129	465.672	0.232	1	-129
130	170.818	475.836	4	0
131	0.032	471.812	3	-131
132	0.032	474.332	2	-132
133	152.968	523.22	1	-133
134	11.176	418.908	1	-134
135	330.9	361.34	1	-135
136	278.106	404.618	1	-136
137	266.518	401.622	1	-137
138	617.936	755.462	1	-138
139	917.306	614.662	1	-139
140	555.072	105.172	1	-140
141	217.724	258.76	1	-141
142	573.052	350.346	1	-142
143	746.158	397.304	1	-143
144	438.014	579.57	1	-144
145	372.874	834.412	1	-145
146	710.034	360.282	1	-146
147	828.864	133.49	1	-147
148	448.386	617.27	1	-148
149	106.484	391.852	1	-149
150	407.706	352.708	1	-150
151	400.12	336.762	1	-151
152	455.206	334.306	1	-152
153	458.244	335.288	1	-153
154	120.002	228	1	-154
155	332.19	864.906	1	-155
156	475.382	797.04	1	-156
157	394.204	790.012	1	-157
158	111.536	644.432	1	-158
159	217.568	673.362	1	-159
160	178.994	676.624	1	-160
161	153.654	607.874	1	-161
162	199.702	742.67	1	-162
163	206.784	817.412	1	-163
164	569.784	439.264	1	-164
165	430.572	793.796	1	-165
166	194.656	842.642	1	-166

167	241.76	868.544	1	-167
168	160.342	669.468	1	-168
169	159.644	490.318	1	-169
170	419.662	337.456	1	-170
171	372.128	370	1	-171
172	353.612	404.774	1	-172
173	199.434	384.206	1	-173
174	224	110	1	-174
175	128.932	195.818	1	-175
176	187.304	569.178	1	-176
177	220.656	384.612	1	-177
178	63.646	421.576	1	-178
179	23.992	437.64	1	-179
180	0.002	447.226	1	-180
181	214.114	618.848	1	-181
182	68.544	461.24	1	-182
183	125.122	513.958	1	-183
184	518.696	638.002	1	-184
185	449.636	520.038	1	-185
186	448.782	513.766	1	-186
187	559.632	565.75	1	-187
188	462.908	498.928	1	-188
189	718.646	253.484	1	-189
190	789.78	150	1	-190
191	726.034	165.044	1	-191
192	740.742	327.786	1	-192
193	596.342	396.864	1	-193
194	651.384	207.066	1	-194
195	575.4	194.636	1	-195
196	536.122	212.634	1	-196
197	349.712	0.008	1	-197
198	393.476	29.332	1	-198
199	700.052	734.094	4	0
200	741.52	765.376	1	-200
201	834.174	765.232	1	-201
202	695.284	748.218	1	-202
203	698.278	718.304	1	-203
205	715.412	744.312	1	-205
206	764.892	672.232	1	-206
207	948.15	525.196	1	-207
208	962.086	521.96	2	-208
209	953.732	498.012	1	-209
210	902.73	420.906	1	-210

211	436.83	104.044	1	-211
212	261.608	402.566	1	-212
213	392.96	11.792	1	-213
214	432.756	141.018	1	-214
215	861.01	747.466	1	-215
216	917.306	663.034	1	-216
217	909.43	432.506	1	-217
218	775.088	534.876	1	-218
219	934.528	552.102	1	-219
220	400.228	117.3	1	-220
221	349.712	130	1	-221
222	692.184	318.33	1	-222
223	957.382	409.142	1	-223
224	914.276	495.942	1	-224
225	951.522	504.71	2	-225
226	465.896	442.518	1	-226
227	968.668	520.976	2	-227
228	569.776	784.532	1	-228
229	828.422	675.836	1	-229
230	717.382	494.086	1	-230
231	722.64	227.368	1	-231
232	239.332	414.678	1	-232
233	237.48	411.72	1	-233
234	855.054	415.348	1	-234
235	856.104	427.798	1	-235
236	838.22	429.75	1	-236
237	851.196	473.004	1	-237
238	859.234	475.794	1	-238
239	810.562	387.76	1	-239
240	803.618	418.548	1	-240
241	134.592	514	1	-241
242	172.474	556.708	1	-242
243	167.058	551.856	1	-243
244	169.902	548.724	1	-244
245	708.3	317.706	1	-245
246	716.36	314.72	1	-246
247	707.27	252.638	1	-247
248	700.3	251.094	1	-248
249	687.994	242.576	1	-249
250	690.248	239.796	1	-250
251	679.276	235.498	1	-251
252	677.038	311.138	1	-252
253	680.724	323.498	1	-253

254	725.662	704	1	-254
274	968.856	521.512	1	-274
275	678.978	730.768	4	0
276	676.49	730.746	4	0
278	498.548	564.1	4	0
279	502.372	569.668	4	0
281	149.958	522.842	4	0
282	106.95	494.676	4	0
283	105.77	496.456	4	0
287	184.178	464.936	4	0
290	184.182	461.076	4	0
291	185.74	462.008	4	0
292	253.24	438.346	4	0
293	252.214	439.396	4	0
295	583.784	426.542	4	0
297	56.138	424.932	4	0
299	339.28	421.26	4	0
300	336.764	421.598	4	0
301	488.492	419.476	4	0
303	705.988	410.9	4	0
304	703.104	418.728	4	0
309	643.802	344.044	4	0
310	458.442	111.388	4	0
311	446.542	114.432	4	0
312	852.818	486.816	4	0
313	857.09	487.208	4	0
314	847.028	483.49	4	0
315	852.22	484.008	4	0
316	867.33	462.986	4	0
317	540.352	810.422	4	0
318	528.318	801.54	4	0
319	537.218	809.192	4	0
320	650.352	746.688	4	0
321	639.478	751.958	4	0
323	810.528	691.464	4	0
324	801.408	688.166	4	0
325	802.066	691.596	4	0
327	405.252	686.256	4	0
329	294.578	671.522	4	0
330	517.602	579.444	4	0
331	527.68	580.146	4	0
332	512.34	585.482	4	0
333	508.322	577.58	4	0

334	514.092	578.986	4	0
335	506.848	575.002	4	0
336	491.098	555.166	4	0
337	149.792	523.128	4	0
338	113.942	499.348	4	0
339	112.586	500.794	4	0
340	118.506	497.174	4	0
341	112.806	496.78	4	0
342	107.214	493.902	4	0
343	109.138	497.016	4	0
344	115.034	496.324	4	0
345	183.884	475.836	4	0
346	191.73	468.312	4	0
347	191.864	467.914	4	0
348	52.114	463.024	4	0
349	184.214	462.586	4	0
350	175.212	453.442	4	0
352	244.598	441.322	4	0
353	249.502	433.608	4	0
354	250.786	437.112	4	0
355	250.376	436.638	4	0
356	243.988	441.092	4	0
358	732.536	432.504	4	0
359	740.938	434.296	4	0
361	584.104	428.878	4	0
362	579.56	430.51	4	0
363	588.148	425.906	4	0
364	578.17	430.486	4	0
365	590.658	423.752	4	0
367	342.284	420.886	4	0
368	329.006	419.9	4	0
369	495.58	422.346	4	0
370	484.208	415.344	4	0
371	492.4	418.032	4	0
372	715.106	422.382	4	0
373	369.914	417.906	4	0
375	365.226	419.606	4	0
376	485.614	415.5	4	0
377	366.856	414.882	4	0
378	360.41	419.242	4	0
379	374.276	414.002	4	0
380	375.234	412.798	4	0
383	703.032	408.516	4	0

384	696.074	419.912	4	0
385	290.272	391.112	4	0
386	644.504	344.212	4	0
387	636	343.968	4	0
389	665.194	327.884	4	0
390	670.122	331.322	4	0
392	662.588	322.912	4	0
393	668.252	325.586	4	0
394	663.242	322.678	4	0
395	670.51	330.796	4	0
397	541.814	213.972	4	0
398	562.796	233.968	4	0
399	542.746	213.344	4	0
400	563.13	232.398	4	0
401	555.338	220.504	4	0
402	548.582	227.558	4	0
403	466.868	118.472	4	0
404	455.584	102.53	4	0
405	465.368	109.548	4	0
406	456.488	101.502	4	0
407	467.81	117.312	4	0
408	463.724	106.036	4	0
409	393.316	14.46	4	0
410	401.782	28.444	4	0
411	920.878	535.152	4	0
413	395.528	23.262	4	0
414	203.622	815.478	4	0
417	170.02	551.722	4	0
418	171.748	553.236	4	0
419	692.964	243.662	4	0
420	694.656	245.134	4	0
421	780.714	168.382	4	0
423	819.84	129.284	4	0
426	402.234	20.574	4	0
428	394.34	23.998	4	0
430	769.464	689.18	4	0
431	756.452	707.498	4	0
432	247.094	429.242	4	0
436	829.552	677.078	4	0
442	837.378	665.57	4	0
445	870.484	664.436	4	0
446	850.788	663.334	4	0
447	839.686	664.682	4	0

448	911.668	662.594	4	0
451	843.48	657.628	4	0
452	849.764	663.094	4	0
455	848.542	636.748	4	0
459	884.804	594.77	4	0
463	864.85	583.83	4	0
467	902.284	570.42	4	0
468	903.712	568.36	4	0
470	768.976	522.514	4	0
473	745.378	506.618	4	0
474	905.278	503.782	4	0
475	916.122	506.098	4	0
476	907.374	501.892	4	0
477	918.016	506.244	4	0
479	847.506	484.032	4	0
480	857.062	486.784	4	0
481	725.81	462.122	4	0
482	721.964	483.226	4	0
483	876.666	452.484	4	0
485	871.06	442.236	4	0
488	855.588	433.202	4	0
489	839.772	423.076	4	0
490	841.728	424.734	4	0
491	797.412	412.108	4	0
492	795.194	416.816	4	0
493	812.58	412.476	4	0
494	803.396	415.88	4	0
495	783.948	410.486	4	0
498	943.936	513.286	4	0
501	846.464	428.372	4	0
502	850.524	430.556	4	0
503	853.494	432.076	4	0
506	907.566	422.13	4	0
507	906.358	424.88	4	0
508	904.208	429.656	4	0
509	903.804	431.934	4	0
511	833.8	557.04	4	0
512	831.75	555.626	4	0
513	770.838	403.168	4	0
515	740.84	441.818	4	0
518	879.654	447.258	4	0
520	896.268	499.972	4	0
521	881.8	443.614	4	0

522	949.66	510.4	4	0
523	948.244	514.568	4	0
524	950.604	514.8	4	0
526	946.046	515.302	4	0
527	947.362	517.302	4	0
529	956.584	517.48	4	0
530	932.59	510.872	4	0
536	732.668	433.15	4	0
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547	709.174	257.422	4	0
548	709.774	258.254	4	0
550	277.906	630.96	4	0
555	951.274	506.302	4	0
564	749.444	443.438	4	0
565	748.292	442.264	4	0
574	842.16	657.758	4	0
579	496.698	422.41	4	0
582	341.158	420.224	4	0
584	326.652	419.176	4	0
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594	939.204	513.374	4	0
596	168.452	550.302	4	0
597	167.106	548.662	4	0
598	707.606	261.234	4	0
601	935.9	511.446	4	0
602	919.042	552.938	4	0
606	925.09	542.466	4	0
607	932.002	539.736	4	0
610	919.434	553.124	4	0
611	926.742	545.716	4	0
612	928.632	548.904	4	0
613	932.32	540.096	4	0
617	716.166	421.646	4	0
620	612.99	746.77	4	0
625	618.162	747.99	4	0
628	654.774	745.344	4	0
629	658.49	745.322	4	0
639	718.43	754.064	4	0
640	723.8	758.48	4	0
642	769.752	798.116	4	0
643	771.456	799.544	4	0

644	779.638	805.598	4	0
645	434.776	785.786	4	0
646	441.472	788.558	4	0
650	507.968	806.902	4	0
657	414.182	777.394	4	0
662	392.208	784.098	4	0
665	527.338	800.836	4	0
673	433.746	702.986	4	0
675	598.284	691.962	4	0
676	641.226	711.684	4	0
683	493.354	92.434	4	0
684	489.428	98.938	4	0
690	697.788	283.674	4	0
691	696.998	287.388	4	0
694	580.736	443.114	4	0
696	582.846	339.884	4	0
697	590.454	342.988	4	0
698	599.93	346.856	4	0
700	615.426	354.714	4	0
701	635.89	350.032	4	0
708	728.244	380.692	4	0
710	752.202	392.754	4	0
721	610.578	196.814	4	0
722	665.53	221.274	4	0
729	677.474	231.07	4	0
730	680.754	233.748	4	0
731	682.928	235.54	4	0
732	685.068	237.286	4	0
733	687.278	239.078	4	0
734	689.398	240.846	4	0
735	691.146	242.254	4	0
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740	701.04	250.242	4	0
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742	704.39	252.986	4	0
743	705.94	254.234	4	0
747	711.068	287.172	4	0
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751	715.068	315.252	4	0
752	716.5	318.052	4	0
755	713.174	263.286	4	0
757	714.794	266.776	4	0
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767	648.966	340.162	4	0
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772	757.714	195.796	4	0
779	257.784	862.24	4	0
780	291.278	856.388	4	0
782	366.51	827.786	4	0
786	69.35	633.818	4	0
793	142.174	667.382	4	0
798	165.698	660.96	4	0
800	195.96	667.378	4	0
802	203.554	674.594	4	0
805	151.246	596.232	4	0
809	149.79	603.156	4	0
810	149.404	604.882	4	0
816	215.272	734.892	4	0
817	213.808	739.864	4	0
823	143.894	246.19	4	0
824	154.602	260.572	4	0
827	215.302	381.426	4	0
828	186.796	325.318	4	0
834	224.486	400.16	4	0
837	235.364	413.064	4	0
838	236.71	414.794	4	0
839	232	418	4	0
841	239.072	418.69	4	0
848	222.056	430.728	4	0
853	222.692	449.69	4	0
854	238.68	413.602	4	0
855	239.7	413.018	4	0
860	261.718	406.052	4	0
863	272.152	402.906	4	0
864	267.686	406.766	4	0
865	272.776	402.338	4	0
866	281.896	396.642	4	0
870	335.336	381.494	4	0
873	372.738	377.892	4	0
877	461.378	341.442	4	0
880	535.316	334.55	4	0
881	527.832	334.69	4	0
885	360.554	407.904	4	0
888	333.216	417.526	4	0
889	334.578	418.212	4	0
900	361.308	419.544	4	0

914	457.728	529.626	4	0
915	465.36	537.584	4	0
916	570.48	668.314	4	0
917	571.492	669.22	4	0
919	442.204	613.594	4	0
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942	180.244	565.812	4	0
944	169.55	567.606	4	0
945	173.05	567.68	4	0
948	175.898	557.026	4	0
949	173.886	555.176	4	0
956	147.412	520.498	4	0
957	117.96	506.086	4	0
960	114.332	502.416	4	0
962	155.076	493.978	4	0
963	156.026	499.342	4	0
967	155.372	500.818	4	0
970	153.4	506.116	4	0
977	213.598	455.146	4	0
982	105.97	398.612	4	0
984	122.222	405.216	4	0
993	32.55	421.026	4	0
995	55.818	427.19	4	0
1001	50.748	462.582	4	0
1013	237.38	415.868	4	0
1017	585.882	767.208	4	0
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1031	652.628	749.458	4	0
1032	724.702	748.162	4	0
1033	464.51	725.062	4	0
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1042	597.202	696.204	4	0
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1045	339.98	646.22	4	0
1047	238.788	624.148	4	0
1048	152.416	576.718	4	0

1049	177.378	566.768	4	0
1050	187.83	567.81	4	0
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1052	449.586	513.158	4	0
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1062	305.762	383.674	4	0
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1064	451.32	346.47	4	0
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1066	461.15	339.93	4	0
1067	731.974	335.04	4	0
1068	177.312	294.574	4	0
1069	180.994	303.438	4	0
1070	690.1	287.022	4	0
1077	708.57	287.26	4	0
1080	672.482	279.364	4	0
1089	693.288	246.886	4	0
1090	182.068	215.218	4	0
1092	176.668	207.436	4	0
1093	745.174	211.26	4	0
1094	738.012	769.952	4	0
1095	748.166	776.706	4	0
1096	761.67	791.554	4	0
1097	695.362	295.104	4	0
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1101	63.078	423.41	4	0
1102	413.168	349.068	4	0
1103	414.448	349.266	4	0
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1116	225.142	617.35	4	0
1121	662.93	218.986	4	0
1124	176.432	202.596	4	0
1125	598.506	196.296	4	0
1126	168.084	279.346	4	0
1127	481.462	345.436	4	0
1128	516.662	339.14	4	0
1129	372.128	374.11	4	0
1130	162.64	436.434	4	0

1131	156.998	437.016	4	0
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1134	551.39	560.128	4	0
1136	294.416	628.464	4	0
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1145	510.912	594.224	4	0
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1147	808.962	697.094	4	0
1150	719.6	753.176	4	0
1152	786.388	149.976	4	0
1154	735.014	223.128	4	0
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1172	161.782	662.3	4	0
1181	388.218	785.588	4	0
1186	479.22	792.752	4	0
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1210	716.618	248.632	4	0
1216	731.066	334.204	4	0
1217	735.172	338.094	4	0
1220	762.11	398.326	4	0
1221	698.348	367.154	4	0
1225	170.276	475.782	4	0
1231	54.596	463.836	4	0
1232	151.692	525.31	4	0
1234	159.294	534.964	4	0
1236	274.226	640.292	4	0
1238	261.524	633.35	4	0
1239	203.94	586.25	4	0
1241	182.648	563.14	4	0
1242	203.69	596.876	4	0
1244	270.692	637.84	4	0
1245	272.692	639.136	4	0
1250	520.446	796.902	4	0
1251	501.066	768.992	4	0
1263	203.562	381.248	4	0
1266	128.146	221.284	4	0
1267	162.808	249.73	4	0
1278	403.144	368.924	4	0
1293	304.014	383.424	4	0

1302	295.998	386.584	4	0
1303	178.782	479.586	4	0
1322	518.696	619.678	4	0
1325	770.042	677.228	4	0
1326	775.932	678.644	4	0
1327	784.444	680.774	4	0
1328	788.25	683.686	4	0
1331	791.918	687.282	4	0
1332	773.96	679.984	4	0
1333	775.448	680.478	4	0
1334	771.414	686.108	4	0
1339	796.56	689.942	4	0
1350	619.42	748.19	4	0
1352	638.284	752.092	4	0
1356	730.886	713.096	4	0
1357	740.782	718.312	4	0
1359	813.438	699.884	4	0
1360	732.526	729.216	4	0
1361	732.362	732.254	4	0
1362	726.546	744.822	4	0
1364	784.46	681.84	4	0
1366	872.852	610.458	4	0
1372	844.074	426.774	4	0
1374	109.886	498.868	4	0
1389	407.33	347.954	4	0
1390	411.62	348.622	4	0
1391	459.15	337.344	4	0
1394	328.55	856.946	4	0
1399	107.504	652.564	4	0
1402	180.184	666.922	4	0
1406	214.134	744.574	4	0
1422	429.984	391.796	4	0
1459	174.082	567.474	4	0
1461	189.396	569.21	4	0
1465	162.536	491.336	4	0
1466	148.514	521.646	4	0
1471	195.038	376.106	4	0
1481	471.542	420.972	4	0
1486	120.382	201.82	4	0
1490	125.792	512.57	4	0
1492	129.254	514.04	4	0
1493	132.504	515.352	4	0
1498	137.434	516.402	4	0

1499	181.822	564.06	4	0
1503	147.662	428.29	4	0
1514	149.904	430.61	4	0
1515	151.186	431.782	4	0
1516	148.34	436.268	4	0
1519	154.216	434.49	4	0
1525	219.994	385.312	4	0
1530	258.436	406.846	4	0
1539	64.384	423.028	4	0
1555	248.358	431.636	4	0
1556	248.318	434.278	4	0
1566	68.544	468.338	4	0
1579	453.19	522.382	4	0
1584	552.348	568.6	4	0
1589	217.912	382.13	4	0
1598	763.56	399.106	4	0
1603	696.172	246.36	4	0
1617	677.174	318.774	4	0
1618	674.812	320.574	4	0
1620	684.446	313.288	4	0
1624	642.55	208.488	4	0
1628	581.26	202.148	4	0
1631	546.19	230.048	4	0
1633	393.28	24.602	4	0
1635	696.348	290.44	4	0
1658	734.544	767.316	4	0
1661	738.566	769.186	4	0
1663	698.752	739.242	4	0
1664	698.988	721.934	4	0
1665	699.186	722.936	4	0
1666	699.438	724.052	4	0
1667	697.926	739.05	4	0
1668	698.084	723.118	4	0
1670	713.396	747.116	4	0
1671	936.18	535.554	4	0
1673	740.4	771.6	4	0
1676	744.348	774.462	4	0
1677	753.432	780.64	4	0
1683	727.486	711.57	4	0
1687	783.93	683.162	4	0
1688	799.346	691.412	4	0
1690	704	722.898	4	0
1692	704	740	4	0

1707	569.1	782.946	4	0
1716	753.218	711.766	4	0
1723	730.948	735.712	4	0
1727	930.02	549.908	4	0
1733	783.016	461.56	4	0
1734	866.512	490.246	4	0
1735	865.552	489.54	4	0
1737	940.202	529.106	4	0
1738	934.914	537.55	4	0
1741	942.286	528.68	4	0
1742	942.968	528.004	4	0
1743	936.462	535.892	4	0
1744	909.014	420.114	4	0
1753	898.036	500.138	4	0
1754	932.594	540.902	4	0
1778	680.508	316.28	4	0
1780	420.47	126.548	4	0
1792	777.576	528.13	4	0
1799	780.666	682.214	4	0
1800	773.73	681.756	4	0
1812	840.07	561.484	4	0
1824	834.822	669.14	4	0
1829	943.768	526.732	4	0
1833	950.446	508.018	4	0
1835	813.626	412.672	4	0
1838	677.512	729.966	4	0
1839	961.252	519.766	4	0
1840	856.384	473.722	4	0

Appendix B: Link File for Normal Scenarios for Scenario 1

Link ID	From	To	Length (KM)	Speed Limit (KM/Hr)	Capacity	Number of Lanes	Density (V/KM/Lane)	Signal	First Phase Releasing	First Releasing Direction	Second Phase	Second Releasing Direction
2	1838	629	1.297	70	1900	2	150	0	0	0	0	0
3	1665	1838	1.15	70	1900	-4	150	-10	3	100	4	11
4	279	278	0.338	90	1900	2	150	0	0	0	0	0
6	282	283	0.107	70	1900	1	150	10001	0	0	0	0
10	290	1058	1.29	90	1900	2	150	0	0	0	0	0
11	292	1	0.302	70	1900	1	150	0	0	0	0	0
12	293	292	0.074	70	1900	2	150	10001	0	0	0	0
15	297	993	1.247	90	1900	1	150	0	0	0	0	0
16	299	300	0.127	70	1900	1	150	10001	0	0	0	0
17	301	1481	1.013	70	1900	1	150	0	0	0	0	0
18	303	304	0.499	90	1900	1	150	0	0	0	0	0
21	766	309	0.085	90	1900	-3	150	-31	1	100	2	11
22	310	311	0.614	90	1900	2	150	0	0	0	0	0
23	313	312	0.215	70	1900	3	150	-1	3	111	0	0
24	314	315	0.261	70	1900	3	150	10002	0	0	0	0
25	1840	315	0.6	70	2000	2	150	0	0	0	0	0
26	317	2	0.233	70	1900	1	150	0	0	0	0	0
27	318	319	0.589	70	1900	2	150	-13	2	110	0	0
28	320	1352	0.672	70	1900	1	150	0	0	0	0	0
30	324	325	0.315	30	1900	1	150	0	0	0	0	0
31	1138	327	0.68	100	1900	1	150	10001	0	0	0	0
33	331	330	0.506	90	1900	2	150	0	0	0	0	0
34	330	332	0.448	90	1900	1	150	0	0	0	0	0
35	330	279	1.109	70	1900	1	150	0	0	0	0	0
36	333	334	0.917	50	1900	1	150	0	0	0	0	0
37	335	334	0.427	70	1900	1	150	0	0	0	0	0
38	336	278	0.583	90	1900	2	150	0	0	0	0	0
39	281	337	0.1	70	1900	-3	150	-21	1	101	0	0
40	339	338	0.1	90	1900	1	150	0	0	0	0	0
41	340	339	0.362	50	1900	1	150	-22	2	101	0	0
42	338	341	0.189	70	1900	1	150	0	0	0	0	0
43	283	342	0.152	90	1900	2	150	0	0	0	0	0
44	343	282	0.313	50	1900	1	150	0	0	0	0	0
45	342	344	0.432	70	1900	1	150	0	0	0	0	0
46	346	345	0.394	70	1900	1	150	10002	0	0	0	0
47	345	1303	1.046	70	1900	2	150	0	0	0	0	0
48	287	345	0.2	70	1900	2	150	0	0	0	0	0
49	287	347	0.415	70	1900	1	150	0	0	0	0	0
50	297	348	1.92	70	1900	1	150	-24	1	101	0	0

51	349	287	0.118	70	1900	2	150	0	0	0	0	0
52	290	349	0.076	70	1900	1	150	0	0	0	0	0
53	350	290	0.59	90	1900	-2	150	-26	2	110	0	0
55	292	352	0.488	70	1900	1	150	0	0	0	0	0
56	353	292	0.303	70	1900	2	150	0	0	0	0	0
57	354	293	0.276	50	1900	1	150	0	0	0	0	0
58	354	352	0.374	130	2000	2	150	0	0	0	0	0
59	356	355	0.389	130	2000	2	150	0	0	0	0	0
61	353	355	0.311	70	1900	1	150	0	0	0	0	0
62	358	359	0.436	50	1900	1	150	-48	3	111	0	0
63	358	565	0.927	130	2000	3	150	0	0	0	0	0
64	361	362	0.243	70	1900	1	150	0	0	0	0	0
65	295	361	0.118	90	1900	2	150	0	0	0	0	0
66	363	362	0.487	130	2000	2	150	0	0	0	0	0
67	364	295	0.354	70	1900	1	150	10002	0	0	0	0
68	363	361	0.264	70	1900	2	150	10002	0	0	0	0
69	295	365	0.373	70	1900	1	150	0	0	0	0	0
70	300	3	0.325	70	1900	1	150	0	0	0	0	0
71	300	368	0.398	70	1900	1	150	0	0	0	0	0
72	367	299	0.151	90	1900	1	150	0	0	0	0	0
74	369	301	0.382	90	1900	1	150	-67	2	111	0	0
75	301	370	0.298	70	1900	1	150	0	0	0	0	0
76	371	301	0.212	70	1900	1	150	-67	1	111	0	0
77	372	304	0.637	130	2000	2	150	0	0	0	0	0
78	373	1059	0.295	90	1900	2	150	0	0	0	0	0
79	373	375	0.282	90	1900	1	150	0	0	0	0	0
80	376	371	0.363	90	1900	1	150	-68	2	111	0	0
81	378	377	0.407	90	1900	1	150	10001	0	0	0	0
82	379	373	0.297	90	1900	1	150	10001	0	0	0	0
83	377	380	0.441	70	1900	1	150	0	0	0	0	0
85	384	383	0.705	100	1900	1	150	0	0	0	0	0
86	385	4	0.276	70	1900	1	150	0	0	0	0	0
87	309	1221	2.967	90	1900	1	150	0	0	0	0	0
88	387	309	0.1	90	1900	-3	150	-31	3	111	0	0
90	390	389	0.301	90	1900	1	150	-32	3	111	0	0
92	390	392	0.566	130	2000	2	150	0	0	0	0	0
93	393	389	0.191	90	1900	-2	150	-32	1	100	2	11
94	394	395	0.545	130	2000	2	150	0	0	0	0	0
95	393	395	0.286	70	1900	1	150	0	0	0	0	0
96	394	393	0.3	90	1900	1	150	10001	0	0	0	0
97	389	392	0.32	46	1615	1	150	0	0	0	0	0
99	398	397	1.454	130	2000	2	150	0	0	0	0	0
100	399	400	1.403	130	2000	2	150	0	0	0	0	0

101	401	400	0.747	70	1900	1	150	0	0	0	0	0
102	402	397	0.783	70	1900	1	150	0	0	0	0	0
103	399	401	0.761	90	1900	1	150	10001	0	0	0	0
104	403	310	0.571	90	1900	1	150	10002	0	0	0	0
105	310	404	0.467	90	1900	1	150	0	0	0	0	0
106	405	310	0.358	90	1900	2	150	0	0	0	0	0
107	406	407	0.972	130	2000	2	150	0	0	0	0	0
108	405	407	0.408	70	1900	1	150	0	0	0	0	0
109	406	408	0.434	90	1900	1	150	0	0	0	0	0
110	410	409	0.817	130	2000	2	150	0	0	0	0	0
112	413	409	0.461	70	1900	1	150	0	0	0	0	0
113	414	166	1.43	100	1900	1	150	0	0	0	0	0
116	403	404	0.977	130	2000	2	150	0	0	0	0	0
117	408	405	0.196	70	1900	1	150	10002	0	0	0	0
118	419	420	0.112	70	1900	2	150	-37	2	110	0	0
119	421	770	0.958	90	1900	1	150	0	0	0	0	0
120	423	1152	2.073	90	1900	1	150	0	0	0	0	0
122	213	426	0.65	70	1900	1	150	10001	0	0	0	0
123	410	413	0.42	90	1900	1	150	10002	0	0	0	0
124	426	413	0.362	70	1900	1	150	0	0	0	0	0
126	413	428	0.07	70	1900	1	150	0	0	0	0	0
127	398	402	0.804	90	1900	1	150	10001	0	0	0	0
128	319	1197	0.161	70	1900	1	150	0	0	0	0	0
129	430	431	1.124	90	1900	2	150	-7	2	11	0	0
130	432	1555	0.136	70	1900	2	150	0	0	0	0	0
133	436	5	0.16	50	1900	1	150	0	0	0	0	0
136	436	1824	0.473	90	1900	3	150	0	0	0	0	0
141	446	445	1.005	100	1900	1	150	0	0	0	0	0
142	446	447	0.576	90	1900	1	150	0	0	0	0	0
143	448	6	0.375	50	1900	1	150	0	0	0	0	0
145	7	445	0.423	50	1900	1	150	10001	0	0	0	0
146	451	452	0.451	100	1900	1	150	0	0	0	0	0
148	455	451	1.082	100	1900	2	150	0	0	0	0	0
150	8	455	0.242	50	1900	1	150	10001	0	0	0	0
152	459	1366	1.042	100	1900	2	150	0	0	0	0	0
154	459	468	1.657	100	1900	2	150	0	0	0	0	0
155	463	9	1.07	50	1900	1	150	0	0	0	0	0
160	470	10	0.778	50	1900	1	150	0	0	0	0	0
163	473	470	1.427	70	1900	1	150	0	0	0	0	0
164	475	474	0.556	90	1900	3	150	-2	3	111	0	0
165	476	477	0.577	100	1900	3	150	0	0	0	0	0
167	11	473	0.994	50	1900	1	150	10001	0	0	0	0
168	312	12	0.121	50	1900	1	150	0	0	0	0	0

169	312	479	0.303	70	1900	3	150	0	0	0	0	0
170	315	480	0.284	130	2000	2	150	0	0	0	0	0
171	481	13	1.545	50	1900	1	150	0	0	0	0	0
172	481	482	1.302	70	1900	1	150	0	0	0	0	0
173	483	316	0.721	70	1900	2	150	0	0	0	0	0
177	489	490	0.128	90	1900	2	150	-86	1	100	2	11
178	491	492	0.262	50	1900	1	150	10001	0	0	0	0
179	493	494	0.51	90	1900	-2	150	-98	2	11	0	0
180	495	14	0.242	50	1900	1	150	0	0	0	0	0
183	498	522	0.351	70	1900	2	150	0	0	0	0	0
186	501	502	0.231	90	1900	2	150	0	0	0	0	0
187	502	503	0.167	90	1900	2	150	-81	2	11	0	0
190	503	485	1.016	90	1900	2	150	0	0	0	0	0
191	463	459	1.374	70	1900	-2	150	10002	0	0	0	0
192	506	507	0.15	70	1900	1	150	-45	2	110	0	0
193	507	509	0.379	70	1900	2	150	0	0	0	0	0
194	509	521	1.341	70	1900	2	150	0	0	0	0	0
196	511	17	0.626	70	1900	1	150	0	0	0	0	0
197	18	512	1.247	50	1900	1	150	10001	0	0	0	0
198	482	473	1.67	70	1900	1	150	0	0	0	0	0
199	513	359	2.241	50	1900	1	150	-48	2	11	0	0
200	515	536	0.623	70	1900	1	150	0	0	0	0	0
203	485	518	0.498	90	1900	-3	150	-44	1	111	0	0
204	520	1734	1.565	100	1900	4	150	0	0	0	0	0
205	521	518	0.211	70	1900	-3	150	-44	2	100	3	11
206	19	491	0.685	50	1900	1	150	0	0	0	0	0
208	523	524	0.1	50	1900	1	150	0	0	0	0	0
209	526	527	0.555	50	1900	2	150	0	0	0	0	0
212	594	530	0.354	100	1900	2	150	0	0	0	0	0
213	474	411	2.805	70	1900	2	150	0	0	0	0	0
220	540	542	0.507	50	1900	2	150	0	0	0	0	0
223	498	523	0.225	50	1900	2	150	0	0	0	0	0
225	547	548	0.1	70	1900	-3	150	-34	3	100	4	11
227	550	1238	0.84	90	1900	2	150	0	0	0	0	0
230	21	555	0.081	100	1900	4	150	0	0	0	0	0
233	335	332	0.606	90	1900	2	150	0	0	0	0	0
235	333	279	0.495	90	1900	2	150	0	0	0	0	0
236	278	335	0.686	90	1900	2	150	0	0	0	0	0
238	334	331	0.684	90	1900	2	150	0	0	0	0	0
240	364	365	0.71	130	2000	2	150	0	0	0	0	0
241	362	369	4.525	130	2000	2	150	0	0	0	0	0
243	564	536	0.985	130	2000	3	150	0	0	0	0	0
248	325	436	1.677	90	1900	2	150	0	0	0	0	0

249	323	1339	0.727	90	1900	2	150	0	0	0	0	0
251	447	436	0.806	90	1900	2	150	0	0	0	0	0
252	442	574	0.46	90	1900	2	150	0	0	0	0	0
253	574	455	1.101	100	1900	2	150	0	0	0	0	0
254	341	132	6.132	130	2000	2	150	0	0	0	0	0
256	344	1225	3.141	130	2000	2	150	0	0	0	0	0
257	369	370	0.668	130	2000	2	150	0	0	0	0	0
259	376	579	0.653	130	2000	2	150	0	0	0	0	0
262	582	378	0.969	130	2000	2	150	0	0	0	0	0
263	367	368	0.666	130	2000	2	150	0	0	0	0	0
264	584	582	0.728	130	2000	2	150	0	0	0	0	0
265	368	354	4.273	130	2000	2	150	0	0	0	0	0
266	304	363	5.91	130	2000	2	150	0	0	0	0	0
270	213	590	1.025	130	2000	2	150	0	0	0	0	0
271	409	22	0.106	130	2000	2	150	0	0	0	0	0
275	544	540	0.231	100	1900	4	150	0	0	0	0	0
277	596	418	0.221	70	1900	2	150	0	0	0	0	0
278	597	596	0.106	70	1900	2	150	-89	1	100	2	11
279	598	690	1.246	90	1900	2	150	0	0	0	0	0
280	530	475	0.858	100	1900	4	150	0	0	0	0	0
281	477	601	0.931	100	1900	4	150	0	0	0	0	0
283	527	522	0.364	100	1900	3	150	0	0	0	0	0
286	606	611	0.182	50	1900	1	150	0	0	0	0	0
287	606	607	0.38	70	1900	2	150	0	0	0	0	0
288	602	607	0.926	100	2000	3	150	0	0	0	0	0
290	610	467	1.218	100	1900	3	150	0	0	0	0	0
291	602	606	0.643	70	1900	3	150	-4	3	111	0	0
292	611	612	0.188	50	1900	-3	150	-5	1	110	0	0
293	612	610	0.528	70	1900	2	150	0	0	0	0	0
294	613	612	0.493	70	1900	2	150	-5	2	111	0	0
297	384	617	1.099	130	2000	2	150	0	0	0	0	0
299	620	1017	1.724	70	1900	1	150	0	0	0	0	0
302	620	625	0.267	70	1900	2	150	-12	2	110	0	0
304	628	320	0.236	70	1900	2	150	-11	3	111	0	0
305	629	628	0.186	70	1900	2	150	0	0	0	0	0
315	1838	1668	1.094	70	1900	2	150	0	0	0	0	0
316	639	1658	1.063	70	1900	2	150	0	0	0	0	0
318	642	643	0.111	70	1900	2	150	-56	2	111	0	0
319	643	644	0.509	70	1900	2	150	0	0	0	0	0
320	645	646	0.362	90	1900	1	150	0	0	0	0	0
321	646	1186	1.923	100	1900	1	150	0	0	0	0	0
325	657	645	1.12	90	1900	1	150	0	0	0	0	0
334	665	318	0.06	70	1900	2	150	0	0	0	0	0

341	675	676	2.491	90	1900	1	150	-49	2	110	0	0
343	644	23	0.281	70	1900	2	150	0	0	0	0	0
347	24	426	1.848	70	1900	1	150	0	0	0	0	0
349	683	684	0.38	70	1900	1	150	0	0	0	0	0
350	389	767	1.017	90	1900	2	150	0	0	0	0	0
354	690	691	0.19	90	1900	-3	150	-33	2	111	0	0
356	694	1134	7.041	90	1900	1	150	0	0	0	0	0
357	696	697	0.411	90	1900	1	150	0	0	0	0	0
358	697	698	0.512	90	1900	1	150	0	0	0	0	0
361	309	700	1.581	90	1900	2	150	0	0	0	0	0
366	708	710	1.343	90	1900	1	150	0	0	0	0	0
374	722	729	0.773	70	1900	1	150	0	0	0	0	0
381	729	730	0.212	70	1900	-2	150	-40	2	111	0	0
382	730	731	0.141	70	1900	2	150	-39	2	110	0	0
383	731	732	0.138	70	1900	2	150	0	0	0	0	0
384	732	733	0.142	70	1900	2	150	-38	2	110	0	0
385	733	734	0.138	70	1900	2	150	-85	2	111	0	0
386	734	419	0.227	70	1900	2	150	0	0	0	0	0
391	739	740	0.107	70	1900	2	150	-36	2	111	0	0
392	740	742	0.217	70	1900	2	150	0	0	0	0	0
394	742	743	0.1	70	1900	2	150	-35	2	111	0	0
395	743	547	0.2	70	1900	2	150	0	0	0	0	0
398	747	750	1.285	90	1900	1	150	0	0	0	0	0
400	750	751	0.205	90	1900	1	150	-90	2	111	0	0
401	751	1216	1.288	90	1900	1	150	0	0	0	0	0
404	755	757	0.196	90	1900	1	150	0	0	0	0	0
406	757	747	1.053	90	1900	1	150	0	0	0	0	0
409	395	303	4.461	130	2000	2	150	0	0	0	0	0
414	401	402	0.488	70	1900	1	150	0	0	0	0	0
416	767	766	0.239	90	1900	2	150	0	0	0	0	0
419	770	772	0.926	90	1900	1	150	0	0	0	0	0
421	772	1093	1.064	90	1900	1	150	0	0	0	0	0
426	780	779	1.707	100	1900	1	150	0	0	0	0	0
427	782	1394	2.48	100	1900	1	150	0	0	0	0	0
430	786	1399	2.198	100	1900	1	150	0	0	0	0	0
437	798	1172	0.22	70	1900	1	150	0	0	0	0	0
438	800	802	0.538	70	1900	1	150	0	0	0	0	0
439	802	1194	2.729	70	1900	1	150	0	0	0	0	0
442	1044	798	1	70	1900	1	150	10001	0	0	0	0
443	809	810	0.088	70	1900	1	150	0	0	0	0	0
445	810	1044	2.062	70	1900	1	150	0	0	0	0	0
450	816	817	0.26	100	1900	1	150	0	0	0	0	0
455	329	26	0.809	70	1900	1	150	0	0	0	0	0

456	823	824	0.898	90	1900	1	150	0	0	0	0	0
457	27	1486	1.847	90	1900	1	150	0	0	0	0	0
459	828	1471	2.624	90	1900	1	150	0	0	0	0	0
464	837	838	0.111	70	1900	-3	150	-27	2	111	0	0
465	838	848	1.146	70	1900	1	150	0	0	0	0	0
467	841	432	0.67	70	1900	2	150	0	0	0	0	0
475	854	838	0.115	70	1900	-2	150	-27	1	111	0	0
476	855	854	0.059	70	1900	1	150	-91	2	111	0	0
481	860	864	0.341	70	1900	1	150	0	0	0	0	0
483	863	864	0.295	70	1900	1	150	0	0	0	0	0
484	865	863	0.05	70	1900	1	150	0	0	0	0	0
485	866	865	0.541	70	1900	1	150	0	0	0	0	0
487	385	866	0.503	70	1900	1	150	0	0	0	0	0
488	870	1144	0.65	90	1900	1	150	0	0	0	0	0
494	880	881	0.376	90	1900	1	150	0	0	0	0	0
499	888	889	0.077	70	1900	1	150	0	0	0	0	0
500	28	888	0.206	70	1900	1	150	0	0	0	0	0
501	584	888	0.345	90	1900	1	150	0	0	0	0	0
502	889	582	0.348	70	1900	1	150	0	0	0	0	0
508	579	364	4.385	130	2000	2	150	0	0	0	0	0
511	375	900	0.2	70	1900	1	150	0	0	0	0	0
519	914	915	0.561	90	1900	1	150	0	0	0	0	0
520	916	917	0.068	90	1900	2	150	0	0	0	0	0
536	938	939	0.093	100	1900	2	150	0	0	0	0	0
537	1239	941	0.167	70	1900	2	150	-15	2	111	0	0
538	942	1049	0.154	70	1900	1	150	0	0	0	0	0
539	944	945	0.183	70	1900	1	150	-18	2	11	0	0
542	418	949	0.144	70	1900	2	150	-20	2	111	0	0
550	957	1490	0.512	70	1900	1	150	0	0	0	0	0
552	339	957	0.378	70	1900	2	150	0	0	0	0	0
554	962	963	0.276	70	1900	1	150	-29	1	111	0	0
558	963	970	0.363	70	1900	1	150	0	0	0	0	0
562	970	281	0.8	70	1900	1	150	0	0	0	0	0
566	853	977	0.553	90	1900	1	150	0	0	0	0	0
570	982	984	0.908	90	1900	1	150	0	0	0	0	0
571	984	1503	1.717	90	1900	1	150	0	0	0	0	0
577	993	297	1.142	90	1900	1	150	0	0	0	0	0
583	1001	348	0.072	70	1900	1	150	-24	2	11	0	0
592	838	841	0.228	70	1900	2	150	0	0	0	0	0
594	650	29	1.161	50	1900	1	150	0	0	0	0	0
598	31	1017	0.322	50	1900	1	150	10001	0	0	0	0
611	639	34	0.212	50	1900	1	150	0	0	0	0	0
612	320	33	8.013	50	1900	1	150	0	0	0	0	0

613	1032	35	0.334	50	1900	1	150	0	0	0	0	0
614	36	629	0.312	50	1900	1	150	10001	0	0	0	0
615	1033	37	0.299	50	1900	1	150	0	0	0	0	0
616	38	1033	0.221	50	1900	1	150	10001	0	0	0	0
617	1361	39	0.34	50	1900	1	150	0	0	0	0	0
619	1036	40	0.177	50	1900	1	150	0	0	0	0	0
621	676	1036	0.354	50	1900	1	150	0	0	0	0	0
622	1038	1360	0.977	90	1900	2	150	0	0	0	0	0
624	1041	41	0.274	50	1900	1	150	0	0	0	0	0
627	675	1041	0.355	50	1900	1	150	0	0	0	0	0
628	1044	42	0.577	50	1900	1	150	0	0	0	0	0
629	1045	43	0.642	50	1900	1	150	0	0	0	0	0
630	120	1047	0.983	50	1900	1	150	10001	0	0	0	0
631	44	1048	0.1	50	1900	1	150	10001	0	0	0	0
632	1049	45	0.074	50	1900	1	150	0	0	0	0	0
633	46	945	0.1	50	1900	1	150	-18	1	101	0	0
634	47	1050	0.142	50	1900	1	150	-16	1	101	0	0
635	48	949	0.105	50	1900	1	150	-20	1	111	0	0
636	970	49	0.228	50	1900	1	150	0	0	0	0	0
637	1051	186	0.147	50	1900	1	150	0	0	0	0	0
638	1053	50	0.102	50	1900	1	150	0	0	0	0	0
639	51	1054	0.051	50	1900	1	150	10001	0	0	0	0
640	1054	113	1.603	50	1900	1	150	0	0	0	0	0
641	179	1057	1	50	1900	1	150	10001	0	0	0	0
642	52	1058	0.949	50	1900	1	150	10001	0	0	0	0
643	53	350	0.245	50	1900	1	150	10001	0	0	0	0
644	848	54	0.449	50	1900	1	150	0	0	0	0	0
645	432	55	0.106	50	1900	1	150	0	0	0	0	0
646	56	841	0.116	50	1900	1	150	10001	0	0	0	0
647	1059	57	0.244	50	1900	1	150	0	0	0	0	0
649	58	834	0.097	50	1900	1	150	10001	0	0	0	0
650	59	371	0.58	50	1900	1	150	-68	1	111	0	0
651	60	865	0.147	50	1900	1	150	10001	0	0	0	0
652	61	866	0.276	50	1900	1	150	10001	0	0	0	0
653	62	1062	0.208	50	1900	1	150	10001	0	0	0	0
654	870	63	0.158	50	1900	1	150	0	0	0	0	0
655	1063	64	0.316	50	1900	1	150	0	0	0	0	0
656	1064	65	0.402	50	1900	1	150	0	0	0	0	0
658	700	66	1.249	50	1900	1	150	0	0	0	0	0
659	1066	877	0.077	50	1900	1	150	10001	0	0	0	0
660	67	698	0.218	50	1900	1	150	10001	0	0	0	0
661	881	68	0.389	50	1900	1	150	0	0	0	0	0
662	69	1066	0.886	50	1900	1	150	10001	0	0	0	0

663	70	880	0.416	50	1900	1	150	10001	0	0	0	0
664	1067	71	0.29	50	1900	1	150	0	0	0	0	0
665	1068	1069	0.48	100	1900	1	150	0	0	0	0	0
672	747	1098	0.584	50	1900	1	150	0	0	0	0	0
675	1080	1070	0.972	50	1900	1	150	0	0	0	0	0
677	72	757	0.098	50	1900	1	150	10001	0	0	0	0
681	743	73	0.113	50	1900	1	150	0	0	0	0	0
685	74	740	0.116	50	1900	1	150	-36	1	111	0	0
687	420	1080	2.095	50	1900	1	150	0	0	0	0	0
688	1090	75	0.224	50	1900	1	150	0	0	0	0	0
689	733	76	0.113	50	1900	1	150	0	0	0	0	0
690	731	77	0.114	50	1900	1	150	0	0	0	0	0
691	1631	78	0.67	50	1900	1	150	0	0	0	0	0
692	1092	1090	0.474	50	1900	1	150	0	0	0	0	0
693	79	730	0.055	50	1900	1	150	-40	1	111	0	0
694	722	80	0.098	50	1900	1	150	0	0	0	0	0
695	81	1093	0.247	50	1900	1	150	0	0	0	0	0
696	82	772	0.057	50	1900	1	150	10001	0	0	0	0
697	770	83	0.571	50	1900	1	150	0	0	0	0	0
698	1094	32	0.157	50	1900	1	150	0	0	0	0	0
699	1095	30	0.319	50	1900	1	150	0	0	0	0	0
700	84	1096	0.198	50	1900	1	150	10001	0	0	0	0
701	644	85	0.12	50	1900	1	150	0	0	0	0	0
702	1097	86	0.342	50	1900	1	150	0	0	0	0	0
703	691	1098	0.121	50	1900	1	150	0	0	0	0	0
704	1070	691	0.469	50	1900	1	150	-33	1	111	0	0
705	1047	87	0.05	50	1900	1	150	0	0	0	0	0
706	938	88	0.071	50	1900	1	150	0	0	0	0	0
707	88	938	0.071	50	1900	1	150	0	0	0	0	0
708	941	117	0.054	50	1900	1	150	0	0	0	0	0
709	993	89	0.256	50	1900	1	150	0	0	0	0	0
710	90	993	0.144	50	1900	1	150	10001	0	0	0	0
711	1101	91	0.077	50	1900	1	150	0	0	0	0	0
712	1102	1103	0.065	50	1900	1	150	10001	0	0	0	0
713	92	919	5.5	50	1900	1	150	10001	0	0	0	0
714	643	93	0.12	50	1900	1	150	0	0	0	0	0
716	404	410	4.602	130	2000	2	150	0	0	0	0	0
718	407	399	6.122	130	2000	2	150	0	0	0	0	0
720	380	376	6.027	130	2000	2	150	0	0	0	0	0
723	1113	1114	0.403	90	1900	2	150	0	0	0	0	0
724	95	767	0.23	50	1900	1	150	10001	0	0	0	0
726	1116	181	0.642	50	1900	1	150	0	0	0	0	0
729	392	398	6.699	130	2000	2	150	0	0	0	0	0

730	1121	722	0.173	70	1900	1	150	0	0	0	0	0
731	96	721	1.074	90	1900	1	150	0	0	0	0	0
738	97	684	0.303	50	1900	1	150	10001	0	0	0	0
739	98	423	1.077	50	1900	1	150	10001	0	0	0	0
740	99	1124	1.09	50	1900	1	150	10001	0	0	0	0
741	1125	100	1.101	50	1900	1	150	0	0	0	0	0
742	823	101	0.746	50	1900	1	150	0	0	0	0	0
743	1126	102	1.118	50	1900	1	150	0	0	0	0	0
744	1069	103	1.873	50	1900	1	150	0	0	0	0	0
745	104	1127	1.757	50	1900	1	150	10001	0	0	0	0
746	105	1128	1.17	50	1900	1	150	10001	0	0	0	0
747	106	697	0.448	50	1900	1	150	10001	0	0	0	0
748	107	1063	0.498	50	1900	1	150	10001	0	0	0	0
749	708	108	0.695	50	1900	1	150	0	0	0	0	0
750	1129	873	0.207	50	1900	1	150	10001	0	0	0	0
751	109	984	1.782	50	1900	1	150	10001	0	0	0	0
752	110	1130	0.298	50	1900	1	150	0	0	0	0	0
753	1131	110	0.593	50	1900	1	150	0	0	0	0	0
755	1133	111	0.45	50	1900	1	150	0	0	0	0	0
758	114	336	1.447	50	1900	1	150	-14	1	111	0	0
759	115	1134	2.799	50	1900	1	150	10001	0	0	0	0
762	118	810	0.579	50	1900	1	150	10001	0	0	0	0
763	119	786	1.554	50	1900	1	150	0	0	0	0	0
765	121	1136	0.92	50	1900	1	150	0	0	0	0	0
766	1136	1137	0.068	50	1900	1	150	10001	0	0	0	0
767	122	800	2.174	50	1900	1	150	0	0	0	0	0
768	916	123	0.314	50	1900	1	150	0	0	0	0	0
769	1138	124	0.556	50	1900	1	150	0	0	0	0	0
770	817	125	3.776	50	1900	1	150	0	0	0	0	0
772	126	414	0.486	50	1900	1	150	0	0	0	0	0
773	127	780	1.05	50	1900	1	150	10001	0	0	0	0
774	779	128	0.894	50	1900	1	150	0	0	0	0	0
781	332	1145	0.443	90	1900	2	150	0	0	0	0	0
782	1146	1147	0.402	70	1900	1	150	0	0	0	0	0
784	1150	639	0.077	90	1900	-3	150	-53	3	100	4	11
786	676	1838	2.037	70	1900	-2	150	-10	1	100	2	11
787	1152	421	0.975	90	1900	1	150	0	0	0	0	0
788	1093	1154	0.842	90	1900	1	150	0	0	0	0	0
795	1164	870	0.172	90	1900	1	150	0	0	0	0	0
796	1144	885	1.53	100	1900	1	150	0	0	0	0	0
799	1133	1054	1.257	90	1900	1	150	0	0	0	0	0
800	673	1033	1.896	100	1900	1	150	0	0	0	0	0
802	1033	1251	2.885	100	1900	1	150	0	0	0	0	0

806	650	1197	1.463	100	1900	1	150	0	0	0	0	0
808	798	1402	0.939	70	1900	1	150	0	0	0	0	0
811	982	1539	2.445	90	1900	1	150	0	0	0	0	0
813	1128	1127	2.104	90	1900	1	150	0	0	0	0	0
815	1181	782	2.504	100	1900	1	150	0	0	0	0	0
828	1194	816	0.927	70	1900	1	150	10001	0	0	0	0
833	1197	650	1.463	100	1900	1	150	0	0	0	0	0
835	129	683	7.041	70	1900	1	150	0	0	0	0	0
837	1201	221	5.5	90	1900	1	150	0	0	0	0	0
840	721	1624	1.76	90	1900	1	150	0	0	0	0	0
846	1210	548	0.591	70	1900	-2	150	-34	1	100	2	11
858	1216	1067	0.062	90	1900	1	150	-41	2	111	0	0
859	1067	1063	2.663	90	1900	1	150	0	0	0	0	0
864	1221	708	1.641	90	1900	1	150	0	0	0	0	0
866	698	387	2	90	1900	1	150	0	0	0	0	0
868	1097	1620	1.086	90	1900	2	150	0	0	0	0	0
869	361	694	0.746	90	1900	1	150	0	0	0	0	0
870	1225	347	1.298	130	2000	2	150	0	0	0	0	0
871	346	130	1.1	130	2000	2	150	0	0	0	0	0
872	1225	287	0.951	70	1900	1	150	10001	0	0	0	0
873	345	130	0.818	70	1900	1	150	0	0	0	0	0
874	371	579	0.313	70	1900	1	150	0	0	0	0	0
878	130	340	3.1	130	2000	2	150	0	0	0	0	0
879	131	343	5.942	130	2000	2	150	0	0	0	0	0
881	1057	1001	2.09	70	1900	1	150	0	0	0	0	0
885	1231	1566	0.733	70	1900	1	150	0	0	0	0	0
886	1231	112	0.239	50	1900	1	150	0	0	0	0	0
887	337	1232	0.145	70	1900	1	150	0	0	0	0	0
888	1232	1234	0.616	70	1900	1	150	0	0	0	0	0
889	133	1232	0.124	50	1900	1	150	0	0	0	0	0
891	1234	597	0.793	70	1900	-2	150	0	0	0	0	0
895	116	941	0.248	50	1900	1	150	-15	1	111	0	0
898	1241	1050	0.349	70	1900	2	150	-16	2	11	0	0
899	941	1242	0.384	70	1900	2	150	0	0	0	0	0
900	1242	938	0.81	100	1900	2	150	0	0	0	0	0
903	1238	1244	0.518	90	1900	2	150	0	0	0	0	0
904	1244	1245	0.119	90	1900	2	150	0	0	0	0	0
908	1250	665	0.397	70	1900	2	150	0	0	0	0	0
911	1251	1250	1.731	70	1900	1	150	0	0	0	0	0
914	1045	327	3.969	90	1900	1	150	0	0	0	0	0
916	1137	1045	2.558	90	1900	1	150	0	0	0	0	0
918	319	317	0.169	70	1900	2	150	0	0	0	0	0
920	327	673	1.653	90	1900	1	150	0	0	0	0	0

923	1048	805	1.024	70	1900	1	150	0	0	0	0	0
926	1049	1459	0.169	70	1900	1	150	0	0	0	0	0
928	834	837	0.85	70	1900	1	150	0	0	0	0	0
930	824	1126	1.163	90	1900	1	150	0	0	0	0	0
931	1263	827	0.587	50	1900	1	150	0	0	0	0	0
935	1267	824	0.757	90	1900	1	150	10001	0	0	0	0
936	1092	1267	2.314	90	1900	1	150	0	0	0	0	0
942	297	1101	0.356	90	1900	1	150	0	0	0	0	0
944	1101	297	0.392	90	1900	1	150	0	0	0	0	0
946	134	993	1.074	90	1900	1	150	0	0	0	0	0
949	881	1128	0.612	90	1900	1	150	0	0	0	0	0
950	877	1064	0.607	90	1900	1	150	0	0	0	0	0
951	1278	873	1.629	90	1900	1	150	0	0	0	0	0
956	135	1164	1.082	50	1900	1	150	10001	0	0	0	0
957	1164	1062	1.378	90	1900	1	150	0	0	0	0	0
958	1062	1164	1.378	90	1900	1	150	0	0	0	0	0
961	863	136	0.318	50	1900	1	150	0	0	0	0	0
962	137	864	0.309	50	1900	1	150	10001	0	0	0	0
965	848	853	1.075	70	1900	1	150	0	0	0	0	0
976	1293	1302	0.453	50	1900	1	150	0	0	0	0	0
977	1293	1062	0.088	90	1900	1	150	0	0	0	0	0
978	1127	1128	2.104	90	1900	1	150	0	0	0	0	0
984	1103	1278	1.215	90	1900	1	150	0	0	0	0	0
990	1303	1053	0.532	70	1900	1	150	0	0	0	0	0
997	1145	333	0.892	90	1900	2	150	0	0	0	0	0
1001	885	377	0.471	100	1900	1	150	0	0	0	0	0
1009	1322	916	3.626	90	1900	2	150	0	0	0	0	0
1011	1325	1326	0.308	50	1900	1	150	0	0	0	0	0
1012	1326	1327	0.445	50	1900	1	150	0	0	0	0	0
1013	1327	1328	0.24	90	1900	2	150	0	0	0	0	0
1015	1331	430	1.442	90	1900	2	150	0	0	0	0	0
1016	1332	1325	0.242	50	1900	1	150	0	0	0	0	0
1017	1333	1326	0.164	50	1900	1	150	0	0	0	0	0
1023	1334	1327	0.786	90	1900	2	150	0	0	0	0	0
1025	336	919	4.866	100	1900	1	150	0	0	0	0	0
1026	1339	1331	0.269	90	1900	2	150	0	0	0	0	0
1027	1328	325	0.807	90	1900	2	150	0	0	0	0	0
1029	324	1146	0.198	30	1900	1	150	0	0	0	0	0
1038	625	138	0.374	100	1900	1	150	0	0	0	0	0
1039	625	1352	1.034	70	1900	2	150	0	0	0	0	0
1044	1683	1356	0.196	70	1900	3	150	0	0	0	0	0
1046	1356	1357	0.559	70	1900	3	150	0	0	0	0	0
1047	431	1334	1.307	90	1900	2	150	0	0	0	0	0

1048	1147	1359	0.264	70	1900	1	150	0	0	0	0	0
1049	1360	1361	0.153	90	1900	-3	150	-57	2	110	0	0
1050	1361	1362	0.693	90	1900	2	150	0	0	0	0	0
1051	1362	1032	0.191	90	1900	2	150	-58	2	11	0	0
1052	1032	1150	0.358	90	1900	2	150	0	0	0	0	0
1053	917	675	1.822	90	1900	1	150	-50	2	110	0	0
1055	1331	1364	0.462	90	1900	1	150	0	0	0	0	0
1056	1328	324	0.714	70	1900	1	150	0	0	0	0	0
1062	1145	1322	1.412	90	1900	1	150	0	0	0	0	0
1063	915	336	1.599	90	1900	-2	150	-14	2	111	0	0
1069	1372	501	0.144	90	1900	2	150	-82	2	11	0	0
1070	490	1372	0.156	90	1900	2	150	0	0	0	0	0
1071	524	544	0.477	50	1900	2	150	0	0	0	0	0
1072	683	140	3.17	50	1900	1	150	0	0	0	0	0
1073	1090	141	2.89	50	1900	1	150	0	0	0	0	0
1074	696	142	1.01	50	1900	1	150	0	0	0	0	0
1075	710	143	0.409	50	1900	1	150	0	0	0	0	0
1076	914	144	3.402	50	1900	1	150	0	0	0	0	0
1077	782	145	0.494	50	1900	1	150	0	0	0	0	0
1079	1374	339	0.166	70	1900	2	150	-22	1	11	0	0
1080	536	372	1.03	130	2000	3	150	0	0	0	0	0
1084	146	1221	0.789	50	1900	1	150	10001	0	0	0	0
1090	423	147	0.57	50	1900	1	150	0	0	0	0	0
1093	889	300	0.204	70	1900	1	150	0	0	0	0	0
1095	919	148	0.362	50	1900	1	150	0	0	0	0	0
1096	149	982	0.349	50	1900	1	150	10001	0	0	0	0
1101	1389	150	0.255	50	1900	1	150	0	0	0	0	0
1102	151	1389	0.68	50	1900	1	150	0	0	0	0	0
1103	1389	1390	0.217	50	1900	1	150	0	0	0	0	0
1104	152	1391	0.249	50	1900	1	150	0	0	0	0	0
1105	1391	1066	0.164	50	1900	1	150	0	0	0	0	0
1106	153	1391	0.117	50	1900	1	150	10001	0	0	0	0
1109	1266	154	0.551	50	1900	1	150	0	0	0	0	0
1110	1394	155	0.447	70	1900	1	150	0	0	0	0	0
1111	1186	156	0.323	50	1900	1	150	0	0	0	0	0
1112	662	157	0.314	50	1900	1	150	0	0	0	0	0
1117	1399	793	2.5	100	1900	1	150	0	0	0	0	0
1119	158	1399	0.498	50	1900	1	150	10001	0	0	0	0
1120	159	802	0.753	50	1900	1	150	0	0	0	0	0
1121	800	1402	1.007	70	1900	1	150	0	0	0	0	0
1124	1402	160	0.633	50	1900	1	150	0	0	0	0	0
1125	810	161	0.238	50	1900	1	150	0	0	0	0	0
1129	162	1406	0.963	50	1900	1	150	0	0	0	0	0

1130	414	163	0.185	50	1900	1	150	0	0	0	0	0
1136	303	617	0.744	130	2000	2	150	0	0	0	0	0
1138	372	383	0.987	130	2000	2	150	0	0	0	0	0
1139	617	358	0.983	130	2000	4	150	0	0	0	0	0
1142	347	356	2.966	130	2000	2	150	0	0	0	0	0
1148	900	367	0.959	130	2000	2	150	0	0	0	0	0
1149	378	380	0.812	130	2000	2	150	0	0	0	0	0
1153	379	900	0.707	130	2000	2	150	0	0	0	0	0
1155	377	373	0.215	70	1900	-2	150	0	0	0	0	0
1159	1278	1481	4.399	70	1900	2	150	0	0	0	0	0
1160	164	694	0.595	70	1900	1	150	10001	0	0	0	0
1163	397	403	6.093	130	2000	2	150	0	0	0	0	0
1170	662	1181	0.213	70	1900	1	150	0	0	0	0	0
1172	645	165	0.496	50	1900	1	150	0	0	0	0	0
1173	1186	650	1.604	100	1900	1	150	0	0	0	0	0
1180	779	167	0.862	100	1900	1	150	0	0	0	0	0
1186	1394	780	1.88	100	1900	1	150	0	0	0	0	0
1194	780	1394	1.88	100	1900	1	150	0	0	0	0	0
1197	817	1406	0.236	100	1900	1	150	0	0	0	0	0
1198	1406	414	3.851	100	1900	1	150	0	0	0	0	0
1202	329	816	5.269	90	1900	1	150	0	0	0	0	0
1211	1402	800	1.007	70	1900	1	150	0	0	0	0	0
1212	1172	793	1.12	70	1900	1	150	0	0	0	0	0
1218	805	809	0.354	50	1900	1	150	0	0	0	0	0
1223	1172	168	0.366	50	1900	1	150	0	0	0	0	0
1227	1459	945	0.053	70	1900	1	150	-18	2	110	0	0
1229	949	1241	0.6	70	1900	2	150	-17	2	110	0	0
1232	1050	1239	1.241	70	1900	2	150	0	0	0	0	0
1237	1053	1465	0.191	70	1900	1	150	0	0	0	0	0
1238	1465	963	0.519	70	1900	1	150	-29	2	110	0	0
1239	169	1465	0.156	50	1900	1	150	0	0	0	0	0
1240	956	1466	0.08	70	1900	-3	150	0	0	0	0	0
1241	1466	337	0.098	70	1900	3	150	-21	2	11	0	0
1244	1064	1103	2.267	90	1900	1	150	0	0	0	0	0
1247	1390	1102	0.081	50	1900	1	150	0	0	0	0	0
1248	170	1390	1.501	50	1900	1	150	10001	0	0	0	0
1250	172	885	0.396	50	1900	1	150	10001	0	0	0	0
1251	1471	173	0.508	30	1900	1	150	0	0	0	0	0
1258	1126	1068	0.902	90	1900	1	150	0	0	0	0	0
1260	1069	828	1.135	100	1900	1	150	0	0	0	0	0
1266	1059	1133	3.315	90	1900	1	150	0	0	0	0	0
1268	174	1124	5.5	90	1900	1	150	0	0	0	0	0
1270	1124	1092	0.242	90	1900	1	150	0	0	0	0	0

1271	1266	823	1.48	90	1900	1	150	0	0	0	0	0
1275	175	1486	0.523	50	1900	1	150	10001	0	0	0	0
1277	1486	1266	1.054	90	1900	1	150	0	0	0	0	0
1283	1490	1492	0.188	70	1900	1	150	0	0	0	0	0
1285	1492	1493	0.175	70	1900	1	150	-92	2	11	0	0
1291	1493	956	0.804	70	1900	1	150	0	0	0	0	0
1292	1241	942	0.18	70	1900	1	150	0	0	0	0	0
1296	942	176	0.435	50	1900	1	150	0	0	0	0	0
1299	1245	329	2.241	90	1900	1	150	0	0	0	0	0
1302	1503	1514	0.162	90	1900	-3	150	0	0	0	0	0
1314	1514	1515	0.087	90	1900	-3	150	-25	1	100	2	111
1315	1516	962	3.34	70	1900	2	150	0	0	0	0	0
1318	1131	350	1.253	90	1900	2	150	0	0	0	0	0
1320	1515	1131	0.391	90	1900	2	150	0	0	0	0	0
1329	1054	1051	1.574	90	1900	1	150	0	0	0	0	0
1334	177	1525	0.05	50	1900	1	150	10001	0	0	0	0
1335	1525	834	0.812	70	1900	1	150	0	0	0	0	0
1341	860	855	1.194	70	1900	1	150	0	0	0	0	0
1345	1302	385	0.365	70	1900	1	150	0	0	0	0	0
1352	977	1058	0.413	90	1900	2	150	0	0	0	0	0
1353	1058	291	1.199	90	1900	2	150	0	0	0	0	0
1354	1539	1101	0.068	90	1900	1	150	0	0	0	0	0
1356	178	1539	0.082	50	1900	1	150	0	0	0	0	0
1365	1057	180	0.6	70	1900	1	150	0	0	0	0	0
1377	1555	353	0.114	70	1900	2	150	-28	1	110	0	0
1379	1556	353	0.068	90	1900	-2	150	-28	2	101	0	0
1380	356	1556	0.409	90	1900	1	150	0	0	0	0	0
1385	939	1116	0.59	90	1900	2	150	0	0	0	0	0
1394	1566	283	2.387	70	1900	1	150	0	0	0	0	0
1397	182	1566	0.618	50	1900	1	150	10001	0	0	0	0
1401	1490	183	0.077	50	1900	1	150	0	0	0	0	0
1408	919	1138	3.749	100	1900	1	150	0	0	0	0	0
1417	1322	184	1.235	50	1900	1	150	0	0	0	0	0
1419	185	1579	0.223	50	1900	1	150	10001	0	0	0	0
1422	1579	914	0.429	90	1900	1	150	0	0	0	0	0
1424	1051	1579	0.532	90	1900	1	150	0	0	0	0	0
1425	188	1051	0.9	50	1900	1	150	10001	0	0	0	0
1428	187	1584	0.403	50	1900	1	150	10001	0	0	0	0
1429	1134	1584	0.43	90	1900	1	150	0	0	0	0	0
1430	1584	331	1.576	90	1900	1	150	0	0	0	0	0
1436	1471	1263	0.515	90	1900	1	150	0	0	0	0	0
1440	827	1589	0.137	70	1900	1	150	0	0	0	0	0
1441	1589	1525	0.198	70	1900	1	150	0	0	0	0	0

1444	1047	1238	1.231	90	1900	2	150	0	0	0	0	0
1446	1116	1047	0.764	90	1900	2	150	0	0	0	0	0
1456	1598	1220	0.083	90	1900	1	150	0	0	0	0	0
1457	1063	1598	1.189	90	1900	1	150	10002	0	0	0	0
1459	348	1231	0.131	70	1900	1	150	0	0	0	0	0
1460	283	1374	0.239	70	1900	2	150	0	0	0	0	0
1462	1598	513	0.417	90	1900	-2	150	-43	2	110	0	0
1465	1210	189	0.305	50	1900	1	150	0	0	0	0	0
1467	190	1152	0.187	50	1900	1	150	10001	0	0	0	0
1468	191	421	3.862	50	1900	1	150	10001	0	0	0	0
1469	1154	1210	2.435	90	1900	1	150	0	0	0	0	0
1470	192	1067	0.593	50	1900	1	150	-41	1	111	0	0
1471	548	598	0.196	70	1900	2	150	0	0	0	0	0
1473	420	739	0.315	70	1900	2	150	0	0	0	0	0
1482	193	1114	0.609	50	1900	1	150	10001	0	0	0	0
1495	1617	393	0.562	90	1900	2	150	0	0	0	0	0
1506	194	1624	0.469	50	1900	1	150	10001	0	0	0	0
1508	1125	721	0.669	70	1900	1	150	0	0	0	0	0
1509	1125	1628	0.983	70	1900	1	150	0	0	0	0	0
1510	1628	401	1.593	70	1900	1	150	0	0	0	0	0
1511	195	1628	0.476	50	1900	1	150	0	0	0	0	0
1514	402	1631	0.173	70	1900	1	150	0	0	0	0	0
1517	196	1631	1.1	70	1900	1	150	10001	0	0	0	0
1519	197	1633	2.63	50	1900	1	150	0	0	0	0	0
1520	1633	198	0.264	50	1900	1	150	0	0	0	0	0
1521	147	423	0.57	90	1900	1	150	10001	0	0	0	0
1523	691	1097	0.395	90	1900	2	150	0	0	0	0	0
1538	684	405	1.343	90	1900	2	150	0	0	0	0	0
1539	323	1147	0.384	70	1900	1	150	0	0	0	0	0
1540	428	1633	0.061	50	1900	1	150	0	0	0	0	0
1541	1114	295	1.309	90	1900	2	150	0	0	0	0	0
1549	700	1113	2.75	90	1900	2	150	0	0	0	0	0
1555	1359	215	3.398	100	1900	1	150	0	0	0	0	0
1562	1658	1094	0.218	70	1900	-3	150	-54	2	111	0	0
1565	1661	1094	0.05	50	1900	-3	150	-54	1	111	0	0
1567	199	1663	0.266	50	1900	3	150	-51	3	100	4	11
1568	1664	1665	0.051	50	1900	-3	150	-9	3	100	4	11
1570	1667	1663	0.05	70	1900	-3	150	-51	1	100	2	11
1572	205	1670	0.181	50	1900	-2	150	-52	1	101	0	0
1574	542	526	0.239	50	1900	3	150	0	0	0	0	0
1575	601	498	0.413	50	1900	2	150	0	0	0	0	0
1576	555	529	0.657	70	1900	2	150	0	0	0	0	0
1577	452	446	0.053	100	1900	1	150	0	0	0	0	0

1578	200	1661	0.241	50	1900	1	150	0	0	0	0	0
1579	1094	1676	0.389	70	1900	2	150	0	0	0	0	0
1582	1676	1095	0.221	70	1900	2	150	-55	2	110	0	0
1583	1095	1096	1.022	70	1900	2	150	0	0	0	0	0
1585	1096	642	0.521	70	1900	2	150	0	0	0	0	0
1589	1357	1716	0.74	70	1900	2	150	0	0	0	0	0
1590	431	201	4.917	50	1900	2	150	0	0	0	0	0
1591	1683	1038	0.111	70	1900	3	150	-8	1	100	2	11
1592	1038	254	0.1	70	1900	3	150	0	0	0	0	0
1597	1687	1688	1.009	50	1900	1	150	0	0	0	0	0
1598	1688	1339	0.158	70	1900	1	150	0	0	0	0	0
1599	1364	1687	0.071	50	1900	1	150	0	0	0	0	0
1602	1038	1690	1	70	1900	3	150	0	0	0	0	0
1604	1838	1667	1.125	70	1900	2	150	0	0	0	0	0
1605	1663	1692	0.15	70	1900	2	150	0	0	0	0	0
1606	1690	1665	0.45	70	1900	3	150	-9	1	100	2	11
1607	1663	202	0.115	50	1900	1	150	0	0	0	0	0
1608	203	1664	0.185	50	1900	1	150	0	0	0	0	0
1616	1017	1707	1.155	70	1900	1	150	0	0	0	0	0
1625	1707	317	2.117	70	1900	1	150	0	0	0	0	0
1629	1670	639	0.429	70	1900	2	150	-53	1	100	2	11
1630	1692	1670	0.75	70	1900	2	150	-52	2	11	0	0
1641	1716	431	0.266	70	1900	-3	150	-7	1	110	2	10
1642	431	1357	1	90	1900	2	150	0	0	0	0	0
1645	1147	1688	0.558	70	1900	1	150	0	0	0	0	0
1655	206	1325	0.362	50	1900	1	150	0	0	0	0	0
1657	455	1366	1.795	100	1900	2	150	0	0	0	0	0
1658	612	219	0.337	50	1900	1	150	0	0	0	0	0
1659	479	1733	3.426	130	2000	4	150	0	0	0	0	0
1661	565	314	5.371	130	2000	4	150	0	0	0	0	0
1662	1733	564	1.91	130	2000	3	150	0	0	0	0	0
1664	1734	313	0.495	130	2000	4	150	0	0	0	0	0
1665	1735	1753	1.709	100	1900	4	150	0	0	0	0	0
1666	1737	594	0.891	70	2000	3	150	0	0	0	0	0
1667	207	1754	1.106	70	1900	2	150	0	0	0	0	0
1668	1738	613	0.182	100	1900	4	150	0	0	0	0	0
1669	1671	1737	0.385	70	2000	3	150	0	0	0	0	0
1671	1671	1741	0.461	100	1900	3	150	0	0	0	0	0
1673	1742	1743	0.513	100	1900	3	150	0	0	0	0	0
1674	1743	1738	0.113	100	1900	3	150	0	0	0	0	0
1675	607	1671	0.296	100	2000	3	150	0	0	0	0	0
1676	1741	527	0.625	100	1900	3	150	0	0	0	0	0
1677	1744	506	0.124	70	1900	1	150	0	0	0	0	0

1679	442	452	0.709	100	1900	1	150	0	0	0	0	0
1681	613	610	0.916	100	1900	3	150	0	0	0	0	0
1682	1737	208	1.387	100	1900	3	150	0	0	0	0	0
1683	526	594	0.356	100	1900	2	150	0	0	0	0	0
1684	601	529	1.077	100	1900	5	150	0	0	0	0	0
1685	315	312	0.144	70	1900	2	150	-1	1	100	2	110
1686	359	515	0.376	50	1900	-2	150	-47	1	100	2	10
1688	476	474	0.141	70	1900	4	150	-2	1	100	2	110
1689	314	480	0.535	130	2000	4	150	0	0	0	0	0
1690	1366	459	0.984	100	1900	2	150	0	0	0	0	0
1692	359	565	0.578	130	2000	1	150	0	0	0	0	0
1693	468	602	1.1	100	1900	4	150	0	0	0	0	0
1694	515	481	1.474	50	1900	1	150	0	0	0	0	0
1695	494	492	0.451	90	1900	2	150	0	0	0	0	0
1696	518	209	4.57	90	1900	2	150	0	0	0	0	0
1697	210	507	0.304	50	1900	1	150	-45	1	101	0	0
1703	313	479	0.505	130	2000	4	150	0	0	0	0	0
1704	480	1735	0.446	130	2000	4	150	0	0	0	0	0
1705	426	590	0.451	70	1900	1	150	0	0	0	0	0
1706	211	311	0.737	70	1900	1	150	10001	0	0	0	0
1707	212	860	0.175	50	1900	1	150	-30	1	101	0	0
1709	555	544	0.355	100	1900	3	150	0	0	0	0	0
1717	467	459	1.478	100	1900	2	150	0	0	0	0	0
1723	411	606	0.425	50	1900	2	150	-4	1	1	2	11
1734	1238	550	0.84	90	1900	2	150	0	0	0	0	0
1740	590	406	4.498	130	2000	2	150	0	0	0	0	0
1742	400	394	6.767	130	2000	2	150	0	0	0	0	0
1743	383	390	4.291	130	2000	2	150	0	0	0	0	0
1745	1620	1778	0.254	90	1900	2	150	0	0	0	0	0
1748	1778	1617	0.208	90	1900	2	150	-94	2	111	0	0
1750	311	1780	1.44	90	1900	1	150	0	0	0	0	0
1751	1780	214	0.97	30	1900	1	150	0	0	0	0	0
1752	1780	1201	0.735	90	1900	1	150	0	0	0	0	0
1763	343	344	0.298	130	2000	2	150	0	0	0	0	0
1765	340	341	0.286	130	2000	2	150	0	0	0	0	0
1770	548	755	0.304	70	1900	2	150	0	0	0	0	0
1771	448	216	0.283	100	1900	1	150	0	0	0	0	0
1774	509	217	0.283	50	1900	1	150	0	0	0	0	0
1775	470	1792	0.514	70	1900	1	150	0	0	0	0	0
1777	1792	218	0.366	50	1900	1	150	0	0	0	0	0
1780	220	1201	0.708	70	1900	1	150	10001	0	0	0	0
1781	221	1201	5.5	90	1900	1	150	0	0	0	0	0
1783	1754	612	0.467	70	1900	1	150	10002	0	0	0	0

1785	1620	222	0.469	50	1900	1	150	0	0	0	0	0
1790	1333	1332	0.078	90	1900	1	150	0	0	0	0	0
1791	1799	1333	0.271	90	1900	1	150	0	0	0	0	0
1792	1364	1799	0.19	90	1900	1	150	0	0	0	0	0
1794	1799	1687	0.17	50	1900	1	150	0	0	0	0	0
1795	1800	1799	0.376	50	1900	1	150	0	0	0	0	0
1796	1800	1332	0.096	50	1900	1	150	10001	0	0	0	0
1797	1334	1800	0.248	50	1900	1	150	0	0	0	0	0
1804	365	384	5.398	130	2000	2	150	0	0	0	0	0
1805	352	346	3.002	130	2000	2	150	0	0	0	0	0
1811	370	379	6.004	130	2000	2	150	0	0	0	0	0
1813	1753	477	1.044	100	1900	4	150	0	0	0	0	0
1815	475	520	1.039	100	1900	4	150	0	0	0	0	0
1823	355	584	4.173	130	2000	2	150	0	0	0	0	0
1824	511	463	2.075	70	1900	1	150	0	0	0	0	0
1827	512	511	0.12	70	1900	-2	150	-6	1	100	2	11
1839	436	323	1.257	90	1900	2	150	0	0	0	0	0
1841	1824	442	0.233	90	1900	3	150	0	0	0	0	0
1845	451	447	0.43	100	1900	2	150	0	0	0	0	0
1849	1366	455	1.786	100	1900	2	150	0	0	0	0	0
1851	223	1744	3.12	50	1900	1	150	0	0	0	0	0
1852	540	1829	0.504	100	1900	3	150	0	0	0	0	0
1853	1829	1742	0.075	100	1900	3	150	0	0	0	0	0
1857	1833	225	0.174	130	2000	4	150	0	0	0	0	0
1858	522	1833	0.125	100	1900	4	150	0	0	0	0	0
1859	495	492	0.645	90	1900	2	150	0	0	0	0	0
1861	493	489	1.5	90	1900	2	150	0	0	0	0	0
1863	564	515	0.445	90	1900	1	150	-47	3	111	0	0
1864	513	495	0.751	90	1900	2	150	0	0	0	0	0
1865	518	483	0.301	70	1900	2	150	0	0	0	0	0
1867	224	476	0.456	70	1900	-4	150	-3	1	1	2	11
1868	1753	476	0.479	90	1900	3	150	-3	3	111	0	0
1869	474	520	0.491	130	2000	2	150	0	0	0	0	0
1872	721	1125	0.669	70	1900	1	150	0	0	0	0	0
1874	1113	94	0.42	50	1900	1	150	0	0	0	0	0
1875	1481	226	1.273	50	1900	1	150	0	0	0	0	0
1876	274	530	1.89	100	1900	4	150	0	0	0	0	0
1877	529	227	0.629	100	1900	4	150	0	0	0	0	0
1878	39	1361	0.34	50	1900	-2	150	-57	1	101	0	0
1880	274	1839	0.391	50	1900	3	150	0	0	0	0	0
1881	1839	542	0.554	50	1900	2	150	0	0	0	0	0
1882	1707	228	0.086	50	1900	1	150	0	0	0	0	0
1883	229	436	0.068	50	1900	1	150	10001	0	0	0	0

1884	482	230	0.643	50	1900	1	150	0	0	0	0	0
1885	1154	231	0.673	70	1900	1	150	0	0	0	0	0
1886	550	1245	0.689	70	1900	2	150	0	0	0	0	0
1890	854	232	0.063	50	1900	1	150	0	0	0	0	0
1891	233	854	0.112	50	1900	1	150	-91	1	111	0	0
1892	234	501	0.78	50	1900	1	150	-82	3	111	0	0
1893	235	503	0.251	50	1900	1	150	-81	3	111	0	0
1894	490	236	0.306	50	1900	1	150	0	0	0	0	0
1895	237	1840	0.264	70	1900	1	150	-87	3	100	4	11
1896	1840	238	0.181	70	1900	2	150	0	0	0	0	0
1898	239	493	1.238	70	1900	1	150	-97	3	101	0	0
1899	494	240	0.135	50	1900	1	150	0	0	0	0	0
1901	241	1493	0.117	50	1900	1	150	-92	1	101	0	0
1902	949	242	0.104	50	1900	1	150	0	0	0	0	0
1903	596	243	0.104	50	1900	1	150	0	0	0	0	0
1904	244	596	0.107	50	1900	1	150	-89	3	111	0	0
1905	751	245	0.363	50	1900	1	150	0	0	0	0	0
1906	246	751	0.07	50	1900	1	150	-90	1	111	0	0
1907	247	743	0.104	50	1900	1	150	-35	1	111	0	0
1908	740	248	0.056	50	1900	1	150	0	0	0	0	0
1909	734	249	0.111	50	1900	1	150	0	0	0	0	0
1910	250	734	0.068	50	1900	2	150	-85	1	111	0	0
1911	730	251	0.114	50	1900	1	150	0	0	0	0	0
1912	252	1617	0.4	50	1900	1	150	-94	1	111	0	0
1914	1617	253	0.297	50	1900	1	150	0	0	0	0	0
1915	275	1838	0.084	70	1900	-3	150	-10	1	100	2	11
1916	276	1838	0.064	70	1900	-4	150	-10	3	100	4	11
1920	287	349	0.118	70	1900	2	150	0	0	0	0	0
1922	291	290	0.091	90	1900	-3	150	-26	2	11	0	0
1923	1	292	0.302	70	1900	1	150	0	0	0	0	0
1924	295	1114	1.309	90	1900	2	150	0	0	0	0	0
1925	1481	301	1.013	70	1900	1	150	-67	1	111	0	0
1926	309	767	0.323	90	1900	2	150	0	0	0	0	0
1927	311	310	0.614	90	1900	2	150	0	0	0	0	0
1928	315	1840	0.6	70	2000	3	150	-87	1	100	2	11
1929	2	317	0.233	70	1900	1	150	10001	0	0	0	0
1930	319	1250	1.046	70	1900	2	150	0	0	0	0	0
1931	321	320	0.612	70	1900	1	150	-11	3	111	0	0
1932	327	1138	0.582	100	1900	1	150	0	0	0	0	0
1933	329	1236	2.145	90	1900	1	150	0	0	0	0	0
1934	278	336	0.583	90	1900	2	150	-14	2	111	0	0
1935	337	970	0.879	70	1900	1	150	0	0	0	0	0
1937	345	287	0.2	70	1900	2	150	0	0	0	0	0

1938	348	995	1.8	70	1900	1	150	0	0	0	0	0
1940	349	290	0.076	70	1900	-3	150	-26	1	101	0	0
1941	290	350	0.59	90	1900	2	150	0	0	0	0	0
1942	292	353	0.303	70	1900	-2	150	-28	1	11	0	0
1943	361	295	0.118	90	1900	2	150	0	0	0	0	0
1944	3	300	0.325	70	1900	1	150	0	0	0	0	0
1945	301	371	0.212	70	1900	1	150	-68	1	111	0	0
1946	1059	373	0.295	90	1900	2	150	0	0	0	0	0
1948	4	385	0.276	70	1900	1	150	10001	0	0	0	0
1949	1221	309	0.1	90	1900	-2	150	-31	3	111	0	0
1951	309	698	2.3	90	1900	1	150	0	0	0	0	0
1952	389	393	0.191	90	1900	2	150	0	0	0	0	0
1953	310	405	0.358	90	1900	2	150	0	0	0	0	0
1955	418	417	0.115	70	1900	2	150	0	0	0	0	0
1956	420	419	0.112	70	1900	2	150	0	0	0	0	0
1959	426	24	1.848	70	1900	1	150	0	0	0	0	0
1960	413	426	0.362	70	1900	1	150	0	0	0	0	0
1961	428	413	0.07	70	1900	1	150	0	0	0	0	0
1962	1197	319	0.16	70	1900	1	150	-13	1	101	0	0
1965	5	436	0.16	50	1900	1	150	10001	0	0	0	0
1967	445	446	1.005	100	1900	1	150	0	0	0	0	0
1969	6	448	0.375	50	1900	1	150	10001	0	0	0	0
1971	445	7	0.423	50	1900	1	150	0	0	0	0	0
1972	455	8	0.242	50	1900	1	150	0	0	0	0	0
1973	9	463	1.07	50	1900	1	150	10001	0	0	0	0
1974	10	470	0.778	50	1900	1	150	10001	0	0	0	0
1975	470	473	1.427	70	1900	1	150	0	0	0	0	0
1978	473	482	1.67	70	1900	1	150	0	0	0	0	0
1979	473	11	0.994	50	1900	1	150	0	0	0	0	0
1980	12	312	0.121	50	1900	1	150	-1	1	1	2	11
1981	13	481	1.545	50	1900	1	150	10001	0	0	0	0
1982	482	481	1.302	70	1900	2	150	0	0	0	0	0
1984	485	488	0.897	90	1900	2	150	0	0	0	0	0
1987	490	489	0.128	90	1900	2	150	0	0	0	0	0
1988	492	491	0.262	50	1900	1	150	0	0	0	0	0
1989	494	493	0.51	90	1900	2	150	-97	2	10	0	0
1990	14	495	0.242	50	1900	1	150	10001	0	0	0	0
1991	491	19	0.685	50	1900	1	150	0	0	0	0	0
1995	502	501	0.231	90	1900	2	150	-82	1	100	2	11
1996	503	502	0.167	90	1900	2	150	0	0	0	0	0
1998	463	1812	1.691	70	1900	1	150	0	0	0	0	0
1999	488	503	0.119	90	1900	2	150	-81	1	100	2	11
2000	459	463	1.374	70	1900	2	150	0	0	0	0	0

2001	507	1744	0.274	70	1900	1	150	0	0	0	0	0
2002	508	507	0.263	70	1900	2	150	-45	2	11	0	0
2004	509	508	0.116	70	1900	2	150	0	0	0	0	0
2005	17	511	0.626	70	1900	1	150	-6	3	111	0	0
2006	512	18	1.247	50	1900	1	150	0	0	0	0	0
2008	359	513	2.241	50	1900	1	150	-43	1	101	0	0
2011	518	485	0.498	90	1900	2	150	0	0	0	0	0
2012	518	521	0.211	70	1900	2	150	0	0	0	0	0
2014	411	474	2.805	70	1900	2	150	-2	2	111	0	0
2023	417	596	0.106	70	1900	2	150	-89	1	100	2	11
2024	596	1234	0.899	70	1900	2	150	0	0	0	0	0
2027	611	606	0.18	50	1900	1	150	-4	1	100	2	10
2028	612	611	0.188	50	1900	1	150	0	0	0	0	0
2034	625	620	0.267	70	1900	2	150	0	0	0	0	0
2036	320	629	0.422	70	1900	2	150	0	0	0	0	0
2038	629	276	1.233	70	1900	2	150	0	0	0	0	0
2048	640	639	0.2	70	1900	-3	150	-53	1	100	2	11
2050	643	1096	0.632	70	1900	2	150	0	0	0	0	0
2051	644	643	0.509	70	1900	2	150	-56	2	111	0	0
2052	646	645	0.362	90	1900	1	150	0	0	0	0	0
2055	650	1186	1.604	100	1900	1	150	0	0	0	0	0
2057	645	657	1.112	90	1900	1	150	0	0	0	0	0
2060	657	662	1.161	70	1900	1	150	0	0	0	0	0
2064	662	657	1.161	70	1900	1	150	0	0	0	0	0
2071	673	327	1.653	90	1900	1	150	0	0	0	0	0
2073	676	675	2.491	90	1900	1	150	-50	2	11	0	0
2074	1663	275	1.083	70	1900	2	150	0	0	0	0	0
2075	23	644	0.281	70	1900	2	150	0	0	0	0	0
2080	683	129	7.041	70	1900	1	150	0	0	0	0	0
2081	684	683	0.38	70	1900	1	150	0	0	0	0	0
2082	767	389	1	77	1710	2	150	-32	1	1	2	11
2086	691	598	1.436	90	1900	2	150	0	0	0	0	0
2089	697	696	0.411	90	1900	1	150	0	0	0	0	0
2090	698	697	0.512	90	1900	1	150	0	0	0	0	0
2091	700	701	1.085	90	1900	2	150	0	0	0	0	0
2093	701	309	0.496	90	1900	-3	150	-31	1	100	2	11
2099	710	708	1.343	90	1900	1	150	0	0	0	0	0
2104	721	96	1.074	90	1900	1	150	0	0	0	0	0
2112	730	722	0.985	70	1900	2	150	0	0	0	0	0
2113	731	730	0.141	70	1900	2	150	-40	2	111	0	0
2114	732	731	0.138	70	1900	2	150	-39	2	11	0	0
2115	733	732	0.142	70	1900	2	150	0	0	0	0	0
2116	734	733	0.138	70	1900	2	150	-38	2	11	0	0

2117	735	734	0.112	70	1900	2	150	-85	2	111	0	0
2118	419	735	0.115	70	1900	2	150	0	0	0	0	0
2121	739	1603	0.218	70	1900	2	150	0	0	0	0	0
2122	740	739	0.107	70	1900	2	150	0	0	0	0	0
2123	741	740	0.137	70	1900	2	150	-36	2	111	0	0
2124	742	741	0.08	70	1900	2	150	0	0	0	0	0
2125	743	742	0.1	70	1900	2	150	0	0	0	0	0
2126	548	743	0.3	70	1900	2	150	-35	2	111	0	0
2128	747	757	1.053	90	1900	1	150	0	0	0	0	0
2131	751	747	1.49	90	1900	1	150	0	0	0	0	0
2132	752	751	0.158	90	1900	1	150	-90	2	111	0	0
2136	757	755	0.196	90	1900	1	150	0	0	0	0	0
2142	401	1628	1.593	70	1900	1	150	0	0	0	0	0
2143	402	401	0.488	70	1900	1	150	0	0	0	0	0
2147	770	421	0.958	90	1900	1	150	0	0	0	0	0
2149	772	770	0.926	90	1900	1	150	0	0	0	0	0
2154	779	780	1.707	100	1900	1	150	0	0	0	0	0
2157	25	786	1.866	100	1900	1	150	0	0	0	0	0
2164	793	1172	1.12	70	1900	1	150	0	0	0	0	0
2169	805	1048	1.024	70	1900	1	150	0	0	0	0	0
2172	810	809	0.088	70	1900	1	150	0	0	0	0	0
2176	802	800	0.538	70	1900	1	150	0	0	0	0	0
2179	817	816	0.26	100	1900	1	150	0	0	0	0	0
2184	26	329	0.809	70	1900	1	150	10001	0	0	0	0
2185	824	823	0.898	90	1900	1	150	0	0	0	0	0
2187	827	1263	0.587	50	1900	1	150	0	0	0	0	0
2191	834	1525	0.812	70	1900	1	150	0	0	0	0	0
2193	838	837	0.111	70	1900	2	150	0	0	0	0	0
2194	839	838	0.35	70	1900	-2	150	-27	1	111	0	0
2195	841	1013	0.165	70	1900	2	150	0	0	0	0	0
2200	848	839	0.8	70	1900	1	150	0	0	0	0	0
2203	853	848	1.075	70	1900	1	150	0	0	0	0	0
2204	838	854	0.115	70	1900	1	150	-91	2	111	0	0
2205	854	855	0.059	70	1900	1	150	0	0	0	0	0
2206	855	1530	1.018	70	1900	1	150	0	0	0	0	0
2210	864	860	0.35	70	1900	1	150	-30	2	110	0	0
2212	864	863	0.295	70	1900	1	150	0	0	0	0	0
2213	863	865	0.05	70	1900	1	150	0	0	0	0	0
2215	866	385	0.503	70	1900	1	150	0	0	0	0	0
2218	873	1278	1.629	90	1900	1	150	0	0	0	0	0
2221	877	1127	1.103	90	1900	1	150	0	0	0	0	0
2223	881	880	0.376	90	1900	1	150	0	0	0	0	0
2227	889	888	0.077	70	1900	1	150	0	0	0	0	0

2228	888	28	0.206	70	1900	1	150	0	0	0	0	0
2232	915	914	0.561	90	1900	1	150	0	0	0	0	0
2233	917	916	0.068	90	1900	2	150	0	0	0	0	0
2249	939	938	0.093	100	1900	2	150	0	0	0	0	0
2250	941	1239	0.167	70	1900	2	150	0	0	0	0	0
2252	945	1048	1.742	70	1900	1	150	0	0	0	0	0
2255	949	418	0.144	70	1900	2	150	0	0	0	0	0
2256	948	949	0.137	70	1900	2	150	-20	2	111	0	0
2262	956	1498	0.551	70	1900	1	150	0	0	0	0	0
2265	960	339	0.119	70	1900	-2	150	-22	1	110	0	0
2266	962	1516	3.34	70	1900	1	150	0	0	0	0	0
2267	963	962	0.276	70	1900	1	150	0	0	0	0	0
2271	967	963	0.081	70	1900	1	150	-29	2	11	0	0
2274	970	967	0.282	70	1900	1	150	0	0	0	0	0
2280	977	853	0.553	90	1900	1	150	0	0	0	0	0
2291	993	134	1.074	90	1900	1	150	0	0	0	0	0
2296	348	1001	0.072	70	1900	1	150	0	0	0	0	0
2298	1001	1057	2.09	70	1900	1	150	0	0	0	0	0
2303	1013	838	0.063	70	1900	-3	150	-27	2	111	0	0
2305	29	650	1.161	50	1900	1	150	10001	0	0	0	0
2309	1017	31	0.322	50	1900	1	150	0	0	0	0	0
2310	32	1094	0.16	50	1900	1	150	-54	1	111	0	0
2311	33	1031	7.834	50	1900	1	150	0	0	0	0	0
2319	34	1028	0.097	50	1900	1	150	0	0	0	0	0
2322	1028	639	0.115	50	1900	-3	150	-53	3	100	4	11
2323	1031	320	0.179	50	1900	1	150	-11	2	111	0	0
2324	35	1032	0.334	50	1900	1	150	-58	1	101	0	0
2325	629	36	0.312	50	1900	1	150	0	0	0	0	0
2326	37	1033	0.299	50	1900	1	150	10001	0	0	0	0
2327	1033	38	0.221	50	1900	1	150	0	0	0	0	0
2330	40	1036	0.177	50	1900	1	150	0	0	0	0	0
2331	1036	1037	0.246	50	1900	1	150	0	0	0	0	0
2332	1037	676	0.108	50	1900	1	150	-49	1	101	0	0
2333	1039	1038	0.116	90	1900	-4	150	-8	3	100	4	11
2334	41	1041	0.274	50	1900	1	150	0	0	0	0	0
2336	1041	1042	0.134	50	1900	1	150	0	0	0	0	0
2338	1042	675	0.221	50	1900	1	150	-50	1	101	0	0
2339	42	1044	0.577	50	1900	1	150	10001	0	0	0	0
2340	43	1045	0.642	50	1900	1	150	0	0	0	0	0
2341	1047	120	0.983	50	1900	1	150	0	0	0	0	0
2342	1048	44	0.07	50	1900	1	150	0	0	0	0	0
2343	45	1049	0.074	50	1900	1	150	10001	0	0	0	0
2344	945	46	0.097	50	1900	1	150	0	0	0	0	0

2345	1050	47	0.142	50	1900	1	150	0	0	0	0	0
2346	949	48	0.105	50	1900	1	150	0	0	0	0	0
2347	49	970	0.228	50	1900	1	150	10001	0	0	0	0
2348	1052	1051	0.097	50	1900	1	150	10001	0	0	0	0
2349	50	1053	0.102	50	1900	1	150	10001	0	0	0	0
2350	1054	51	0.051	50	1900	1	150	0	0	0	0	0
2351	113	1054	1.6	50	1900	1	150	10001	0	0	0	0
2352	1057	179	0.998	50	1900	1	150	0	0	0	0	0
2353	1058	52	0.949	50	1900	1	150	0	0	0	0	0
2354	350	53	0.245	50	1900	1	150	0	0	0	0	0
2355	54	848	0.449	50	1900	1	150	10001	0	0	0	0
2356	55	432	0.106	50	1900	1	150	10001	0	0	0	0
2357	841	56	0.116	50	1900	1	150	0	0	0	0	0
2358	57	1059	0.244	50	1900	1	150	10001	0	0	0	0
2360	834	58	0.097	50	1900	1	150	0	0	0	0	0
2361	371	59	0.58	50	1900	1	150	0	0	0	0	0
2362	865	60	0.147	50	1900	1	150	0	0	0	0	0
2363	866	61	0.276	50	1900	1	150	0	0	0	0	0
2364	1062	62	0.208	50	1900	1	150	0	0	0	0	0
2365	63	870	0.158	50	1900	1	150	10001	0	0	0	0
2366	64	1063	0.316	50	1900	1	150	10001	0	0	0	0
2367	65	1064	0.402	50	1900	1	150	0	0	0	0	0
2368	66	1065	1.192	50	1900	1	150	0	0	0	0	0
2369	1065	700	0.057	50	1900	1	150	10001	0	0	0	0
2370	877	1066	0.077	50	1900	1	150	0	0	0	0	0
2371	698	67	0.218	50	1900	1	150	0	0	0	0	0
2372	68	881	0.389	50	1900	1	150	10001	0	0	0	0
2373	1066	69	0.886	50	1900	1	150	0	0	0	0	0
2374	880	70	0.416	50	1900	1	150	0	0	0	0	0
2375	71	1067	0.29	50	1900	1	150	-41	1	111	0	0
2376	1069	1068	0.48	100	1900	1	150	0	0	0	0	0
2383	1077	747	0.125	50	1900	1	150	10001	0	0	0	0
2388	757	72	0.098	50	1900	1	150	0	0	0	0	0
2392	73	743	0.113	50	1900	1	150	-35	1	111	0	0
2396	740	74	0.116	50	1900	1	150	0	0	0	0	0
2398	1089	420	0.111	50	1900	1	150	-37	1	101	0	0
2399	75	1090	0.224	50	1900	1	150	0	0	0	0	0
2400	76	733	0.113	50	1900	1	150	-38	1	101	0	0
2401	77	731	0.114	50	1900	1	150	-39	1	101	0	0
2403	1090	1092	0.474	50	1900	1	150	10001	0	0	0	0
2404	730	79	0.055	50	1900	1	150	0	0	0	0	0
2405	80	722	0.098	50	1900	1	150	10001	0	0	0	0
2406	1093	81	0.247	50	1900	1	150	0	0	0	0	0

2407	772	82	0.057	50	1900	1	150	0	0	0	0	0
2408	83	770	0.571	50	1900	1	150	10001	0	0	0	0
2410	30	1095	0.32	50	1900	1	150	-55	1	111	0	0
2411	1096	84	0.198	50	1900	1	150	0	0	0	0	0
2412	85	644	0.12	50	1900	1	150	10001	0	0	0	0
2413	86	1097	0.342	50	1900	1	150	0	0	0	0	0
2414	1098	691	0.121	50	1900	1	150	-33	1	111	0	0
2415	691	1080	1.441	50	1900	1	150	0	0	0	0	0
2416	87	1047	0.05	50	1900	1	150	10001	0	0	0	0
2419	117	941	0.054	50	1900	1	150	-15	1	111	0	0
2420	89	993	0.256	50	1900	1	150	0	0	0	0	0
2421	993	90	0.144	50	1900	1	150	0	0	0	0	0
2422	91	1101	0.077	50	1900	1	150	10001	0	0	0	0
2423	1103	1390	0.146	50	1900	1	150	0	0	0	0	0
2424	919	92	5.5	50	1900	1	150	0	0	0	0	0
2425	93	643	0.12	50	1900	1	150	-56	1	111	0	0
2428	1114	1113	0.403	90	1900	2	150	0	0	0	0	0
2430	767	95	0.129	50	1900	1	150	0	0	0	0	0
2433	722	1121	0.173	70	1900	1	150	0	0	0	0	0
2437	684	97	0.303	50	1900	1	150	0	0	0	0	0
2438	423	98	1.077	50	1900	1	150	0	0	0	0	0
2439	1124	99	1.09	50	1900	1	150	0	0	0	0	0
2440	100	1125	1.101	50	1900	1	150	0	0	0	0	0
2441	101	823	0.746	50	1900	1	150	10001	0	0	0	0
2442	102	1126	1.118	50	1900	1	150	10001	0	0	0	0
2443	103	1069	1.873	50	1900	1	150	10001	0	0	0	0
2444	1127	104	1.757	50	1900	1	150	0	0	0	0	0
2445	1128	105	1.17	50	1900	1	150	0	0	0	0	0
2446	697	106	0.448	50	1900	1	150	0	0	0	0	0
2447	1063	107	0.498	50	1900	1	150	0	0	0	0	0
2448	108	708	0.695	50	1900	1	150	10001	0	0	0	0
2449	873	171	0.535	50	1900	1	150	0	0	0	0	0
2450	984	109	1.782	50	1900	1	150	0	0	0	0	0
2452	1130	1131	0.295	50	1900	1	150	10001	0	0	0	0
2454	111	1133	0.45	50	1900	1	150	10001	0	0	0	0
2455	112	1231	0.239	50	1900	1	150	0	0	0	0	0
2457	336	114	1.447	50	1900	1	150	0	0	0	0	0
2458	1134	115	2.799	50	1900	1	150	0	0	0	0	0
2461	810	118	0.579	50	1900	1	150	0	0	0	0	0
2462	786	119	1.554	50	1900	1	150	0	0	0	0	0
2465	1137	121	0.988	50	1900	1	150	0	0	0	0	0
2466	800	122	2.174	50	1900	1	150	0	0	0	0	0
2467	123	916	0.314	50	1900	1	150	10001	0	0	0	0

2468	124	1138	0.556	50	1900	1	150	0	0	0	0	0
2469	125	817	3.776	50	1900	1	150	0	0	0	0	0
2471	414	126	0.486	50	1900	1	150	0	0	0	0	0
2472	780	127	1.05	50	1900	1	150	0	0	0	0	0
2473	128	779	0.894	50	1900	1	150	10001	0	0	0	0
2479	885	1144	1.53	100	1900	1	150	10001	0	0	0	0
2480	1147	1146	0.402	70	1900	1	150	0	0	0	0	0
2483	1838	676	2.037	70	1900	2	150	-49	2	11	0	0
2485	1154	1093	0.842	90	1900	1	150	0	0	0	0	0
2488	708	1221	1.641	90	1900	1	150	0	0	0	0	0
2492	870	1164	0.172	90	1900	1	150	0	0	0	0	0
2498	1033	673	1.896	100	1900	1	150	0	0	0	0	0
2500	995	297	0.114	70	1900	1	150	10001	0	0	0	0
2504	1172	798	0.22	70	1900	1	150	0	0	0	0	0
2506	1137	550	0.81	90	1900	1	150	0	0	0	0	0
2515	782	1181	2.504	100	1900	1	150	0	0	0	0	0
2516	1186	646	1.923	100	1900	1	150	0	0	0	0	0
2520	414	1406	3.851	100	1900	1	150	0	0	0	0	0
2525	816	802	3.656	70	1900	1	150	0	0	0	0	0
2543	548	1210	0.591	70	1900	2	150	0	0	0	0	0
2545	1080	1089	1.984	50	1900	1	150	0	0	0	0	0
2547	1093	772	1.064	90	1900	1	150	0	0	0	0	0
2549	421	1152	0.975	90	1900	1	150	0	0	0	0	0
2554	1216	752	1.13	90	1900	1	150	0	0	0	0	0
2555	1067	1216	0.062	90	1900	1	150	0	0	0	0	0
2556	1217	1067	0.221	90	1900	1	150	-41	2	111	0	0
2558	1063	1217	2.442	90	1900	1	150	0	0	0	0	0
2559	1220	710	0.568	90	1900	1	150	0	0	0	0	0
2566	694	361	0.746	90	1900	1	150	0	0	0	0	0
2567	579	371	0.313	70	1900	1	150	0	0	0	0	0
2576	1232	337	0.145	70	1900	-3	150	-21	2	110	0	0
2579	1232	133	0.124	50	1900	1	150	0	0	0	0	0
2583	1238	1047	1.231	90	1900	2	150	0	0	0	0	0
2584	941	116	0.248	50	1900	1	150	0	0	0	0	0
2586	1239	1461	1.136	70	1900	2	150	0	0	0	0	0
2587	1050	1241	0.349	70	1900	-2	150	-17	2	11	0	0
2588	1242	941	0.384	70	1900	2	150	-15	2	111	0	0
2589	938	1242	0.81	100	1900	2	150	0	0	0	0	0
2592	1244	1238	0.518	90	1900	2	150	0	0	0	0	0
2593	1245	1244	0.119	90	1900	2	150	0	0	0	0	0
2598	1250	1251	1.731	70	1900	1	150	0	0	0	0	0
2599	1251	1033	2.885	100	1900	1	150	0	0	0	0	0
2602	327	1045	3.969	90	1900	1	150	0	0	0	0	0

2607	317	319	0.169	70	1900	2	150	-13	2	11	0	0
2613	1048	944	1.559	70	1900	1	150	0	0	0	0	0
2619	1126	824	1.163	90	1900	1	150	0	0	0	0	0
2622	1266	1486	1.054	90	1900	1	150	0	0	0	0	0
2623	837	834	0.85	70	1900	1	150	0	0	0	0	0
2624	824	1267	0.757	90	1900	1	150	0	0	0	0	0
2628	1267	1092	2.314	90	1900	1	150	0	0	0	0	0
2637	880	696	2.487	90	1900	1	150	0	0	0	0	0
2638	1128	881	0.612	90	1900	1	150	0	0	0	0	0
2639	1064	877	0.607	90	1900	1	150	0	0	0	0	0
2641	873	1144	1.57	90	1900	1	150	0	0	0	0	0
2643	1144	870	0.65	90	1900	1	150	0	0	0	0	0
2645	1164	135	1.082	50	1900	1	150	0	0	0	0	0
2649	865	866	0.541	70	1900	1	150	0	0	0	0	0
2650	136	863	0.318	50	1900	1	150	10001	0	0	0	0
2651	864	137	0.309	50	1900	1	150	0	0	0	0	0
2666	1062	1293	0.088	90	1900	1	150	0	0	0	0	0
2671	1127	877	1.103	90	1900	1	150	0	0	0	0	0
2672	1103	1064	2.267	90	1900	1	150	0	0	0	0	0
2675	1144	873	1.57	90	1900	1	150	0	0	0	0	0
2677	1302	1293	0.453	50	1900	1	150	0	0	0	0	0
2678	1303	345	1.046	70	1900	2	150	0	0	0	0	0
2687	377	885	0.471	100	1900	1	150	0	0	0	0	0
2694	1134	694	7.041	90	1900	1	150	0	0	0	0	0
2695	916	1322	3.626	90	1900	2	150	0	0	0	0	0
2699	1138	919	3.749	100	1900	1	150	0	0	0	0	0
2700	919	336	4.87	100	1900	1	150	-14	1	111	0	0
2701	1146	324	0.198	30	1900	1	150	0	0	0	0	0
2702	317	1707	2.117	70	1900	1	150	0	0	0	0	0
2710	138	625	0.374	100	1900	1	150	-12	1	101	0	0
2711	1350	625	0.064	70	1900	2	150	-12	2	11	0	0
2713	1352	321	0.06	70	1900	1	150	0	0	0	0	0
2714	1352	1350	0.97	70	1900	2	150	0	0	0	0	0
2718	1357	1683	0.755	70	1900	3	150	0	0	0	0	0
2719	1359	1147	0.264	70	1900	1	150	10002	0	0	0	0
2720	1361	1360	0.153	90	1900	2	150	0	0	0	0	0
2722	1032	1723	0.697	90	1900	2	150	0	0	0	0	0
2723	639	1032	0.44	90	1900	2	150	-58	2	110	0	0
2724	675	917	1.822	90	1900	1	150	0	0	0	0	0
2729	1278	1103	1.215	90	1900	1	150	0	0	0	0	0
2731	336	915	1.599	90	1900	2	150	0	0	0	0	0
2736	489	1835	1.447	90	1900	2	150	0	0	0	0	0
2737	501	1372	0.144	90	1900	2	150	0	0	0	0	0

2738	1372	490	0.156	90	1900	2	150	-86	2	11	0	0
2739	140	683	3.17	50	1900	1	150	10001	0	0	0	0
2740	141	1090	2.89	50	1900	1	150	0	0	0	0	0
2741	142	696	1.01	50	1900	1	150	0	0	0	0	0
2742	143	710	0.409	50	1900	1	150	10001	0	0	0	0
2743	144	914	3.402	50	1900	1	150	10001	0	0	0	0
2744	145	782	0.494	50	1900	1	150	0	0	0	0	0
2745	283	1566	2.387	70	1900	1	150	0	0	0	0	0
2746	339	283	0.405	70	1900	2	150	0	0	0	0	0
2750	1221	146	0.789	50	1900	1	150	0	0	0	0	0
2755	1121	1624	1.196	90	1900	1	150	0	0	0	0	0
2759	300	889	0.204	70	1900	1	150	0	0	0	0	0
2760	148	919	0.362	50	1900	1	150	10001	0	0	0	0
2761	982	149	0.349	50	1900	1	150	0	0	0	0	0
2766	150	1389	0.255	50	1900	1	150	10001	0	0	0	0
2767	1389	151	0.68	50	1900	1	150	0	0	0	0	0
2768	1390	1389	0.217	50	1900	1	150	0	0	0	0	0
2769	1391	152	0.249	50	1900	1	150	0	0	0	0	0
2770	1066	1391	0.164	50	1900	1	150	0	0	0	0	0
2771	1391	153	0.117	50	1900	1	150	0	0	0	0	0
2774	154	1266	0.551	50	1900	1	150	10001	0	0	0	0
2775	155	1394	0.447	70	1900	1	150	10001	0	0	0	0
2776	156	1186	0.323	50	1900	1	150	0	0	0	0	0
2777	157	662	0.3	50	1900	1	150	10001	0	0	0	0
2781	786	25	1.866	100	1900	1	150	0	0	0	0	0
2782	793	1399	2.5	100	1900	1	150	0	0	0	0	0
2783	1399	786	2.198	100	1900	1	150	0	0	0	0	0
2784	1399	158	0.498	50	1900	1	150	0	0	0	0	0
2785	802	159	0.753	50	1900	1	150	0	0	0	0	0
2788	798	1044	1	70	1900	1	150	0	0	0	0	0
2789	160	1402	0.633	50	1900	1	150	0	0	0	0	0
2790	161	810	0.238	50	1900	1	150	10001	0	0	0	0
2794	1406	162	0.963	50	1900	1	150	0	0	0	0	0
2795	163	414	0.185	50	1900	1	150	0	0	0	0	0
2801	373	377	0.215	70	1900	2	150	0	0	0	0	0
2802	1422	1278	1.789	70	1900	1	150	10001	0	0	0	0
2803	694	164	0.595	70	1900	1	150	0	0	0	0	0
2805	1221	386	2.86	90	1900	1	150	0	0	0	0	0
2811	1181	662	0.213	70	1900	1	150	0	0	0	0	0
2812	165	645	0.496	50	1900	1	150	10001	0	0	0	0
2819	166	414	1.43	100	1900	1	150	0	0	0	0	0
2821	167	779	0.862	100	1900	1	150	0	0	0	0	0
2827	1394	782	2.48	100	1900	1	150	0	0	0	0	0

2837	1406	817	0.236	100	1900	1	150	0	0	0	0	0
2839	816	329	5.269	90	1900	1	150	0	0	0	0	0
2850	1402	798	0.939	70	1900	1	150	0	0	0	0	0
2854	1044	810	2.062	70	1900	1	150	0	0	0	0	0
2857	809	805	0.354	50	1900	1	150	0	0	0	0	0
2863	168	1172	0.366	50	1900	1	150	10001	0	0	0	0
2866	1241	948	0.45	70	1900	2	150	0	0	0	0	0
2867	945	1459	0.053	70	1900	1	150	0	0	0	0	0
2868	1459	1049	0.169	70	1900	1	150	0	0	0	0	0
2870	942	1499	0.118	70	1900	1	150	0	0	0	0	0
2872	1461	1050	0.105	70	1900	2	150	-16	2	110	0	0
2873	1053	1303	0.532	70	1900	1	150	0	0	0	0	0
2877	1465	1053	0.191	70	1900	1	150	0	0	0	0	0
2878	963	1465	0.519	70	1900	1	150	0	0	0	0	0
2879	1465	169	0.156	50	1900	1	150	0	0	0	0	0
2881	337	956	0.178	70	1900	1	150	0	0	0	0	0
2888	1390	170	1.501	50	1900	1	150	0	0	0	0	0
2889	171	1129	0.328	50	1900	1	150	0	0	0	0	0
2890	885	172	0.396	50	1900	1	150	0	0	0	0	0
2891	173	1471	0.508	30	1900	1	150	10001	0	0	0	0
2899	1068	1126	0.902	90	1900	1	150	0	0	0	0	0
2902	828	1069	1.135	100	1900	1	150	0	0	0	0	0
2905	1481	1422	2.61	70	1900	1	150	0	0	0	0	0
2909	1124	174	5.5	90	1900	1	150	0	0	0	0	0
2910	1092	1124	0.242	90	1900	1	150	0	0	0	0	0
2912	823	1266	1.48	90	1900	1	150	0	0	0	0	0
2915	1486	175	0.523	50	1900	1	150	0	0	0	0	0
2916	1486	27	1.847	90	1900	1	150	0	0	0	0	0
2918	957	960	0.259	70	1900	-2	150	0	0	0	0	0
2922	1490	957	0.512	70	1900	1	150	0	0	0	0	0
2925	1493	1490	0.363	70	1900	1	150	0	0	0	0	0
2931	1498	1493	0.253	70	1900	1	150	-92	2	110	0	0
2932	1499	1241	0.062	70	1900	1	150	-17	1	101	0	0
2935	1049	942	0.154	70	1900	1	150	0	0	0	0	0
2936	176	942	0.435	50	1900	1	150	10001	0	0	0	0
2939	550	1137	0.81	90	1900	1	150	0	0	0	0	0
2946	984	982	0.908	90	1900	1	150	0	0	0	0	0
2953	1515	1503	0.249	90	1900	2	150	0	0	0	0	0
2954	1516	1515	0.266	70	1900	1	150	-25	3	101	0	0
2955	1515	1516	0.266	70	1900	1	150	0	0	0	0	0
2959	1519	1515	0.203	90	1900	2	150	-25	2	11	0	0
2960	1131	1519	0.188	90	1900	2	150	0	0	0	0	0
2967	1054	1133	1.257	90	1900	1	150	0	0	0	0	0

2972	1133	1059	3.315	90	1900	1	150	0	0	0	0	0
2973	1525	177	0.05	50	1900	1	150	0	0	0	0	0
2980	1530	860	0.176	70	1900	1	150	-30	2	11	0	0
2984	385	1302	0.365	70	1900	1	150	0	0	0	0	0
2991	1058	977	0.413	90	1900	2	150	0	0	0	0	0
2993	1101	1539	0.068	90	1900	1	150	0	0	0	0	0
2994	1539	982	2.445	90	1900	1	150	0	0	0	0	0
2995	1539	178	0.082	50	1900	1	150	0	0	0	0	0
3012	1503	984	1.717	90	1900	2	150	0	0	0	0	0
3013	432	841	0.67	70	1900	2	150	0	0	0	0	0
3014	353	1555	0.114	70	1900	2	150	0	0	0	0	0
3015	1555	432	0.136	70	1900	2	150	0	0	0	0	0
3017	1047	1116	0.764	90	1900	2	150	0	0	0	0	0
3021	1116	939	0.59	90	1900	2	150	0	0	0	0	0
3022	181	1116	0.642	50	1900	1	150	0	0	0	0	0
3032	1566	182	0.618	50	1900	1	150	0	0	0	0	0
3035	1566	1231	0.733	70	1900	1	150	0	0	0	0	0
3036	183	1490	0.077	50	1900	1	150	10001	0	0	0	0
3044	1045	1137	2.558	90	1900	1	150	0	0	0	0	0
3050	184	1322	1.235	50	1900	1	150	10001	0	0	0	0
3051	1322	1145	1.412	90	1900	1	150	0	0	0	0	0
3052	1579	185	0.223	50	1900	1	150	0	0	0	0	0
3053	186	1052	0.05	50	1900	1	150	0	0	0	0	0
3054	1579	1051	0.532	90	1900	1	150	0	0	0	0	0
3055	914	1579	0.429	90	1900	1	150	0	0	0	0	0
3058	1051	188	0.89	50	1900	1	150	0	0	0	0	0
3060	1051	1054	1.574	90	1900	1	150	0	0	0	0	0
3061	1584	187	0.403	50	1900	1	150	0	0	0	0	0
3062	1584	1134	0.43	90	1900	1	150	0	0	0	0	0
3063	331	1584	1.576	90	1900	1	150	0	0	0	0	0
3070	1263	1471	0.515	90	1900	1	150	0	0	0	0	0
3072	1471	828	2.624	90	1900	1	150	0	0	0	0	0
3074	1525	827	0.335	70	1900	1	150	0	0	0	0	0
3081	1234	1232	0.616	70	1900	1	150	0	0	0	0	0
3088	350	1131	1.253	90	1900	2	150	0	0	0	0	0
3089	1598	1063	1.189	90	1900	1	150	0	0	0	0	0
3090	1231	348	0.131	70	1900	-3	150	-24	2	110	0	0
3093	513	1598	0.417	90	1900	1	150	0	0	0	0	0
3096	189	1210	0.305	50	1900	1	150	10001	0	0	0	0
3097	1210	1154	2.435	90	1900	1	150	0	0	0	0	0
3098	1152	190	0.187	50	1900	1	150	0	0	0	0	0
3099	421	191	3.862	50	1900	1	150	0	0	0	0	0
3101	1067	192	0.593	50	1900	1	150	0	0	0	0	0

3102	598	548	0.2	70	1900	-3	150	-34	1	100	2	11
3104	1603	420	0.097	70	1900	2	150	-37	2	11	0	0
3108	1114	193	0.609	50	1900	1	150	0	0	0	0	0
3110	696	880	2.487	90	1900	1	150	0	0	0	0	0
3120	393	1618	0.413	90	1900	2	150	0	0	0	0	0
3121	1618	1617	0.149	90	1900	2	150	-94	2	111	0	0
3124	1620	1097	1.086	90	1900	2	150	0	0	0	0	0
3130	1624	721	1.76	90	1900	1	150	0	0	0	0	0
3131	1624	1121	1.196	90	1900	1	150	0	0	0	0	0
3132	1624	194	0.469	50	1900	1	150	0	0	0	0	0
3135	1628	1125	0.983	70	1900	1	150	0	0	0	0	0
3137	1628	195	0.476	50	1900	1	150	0	0	0	0	0
3141	78	1631	0.67	70	1900	1	150	10001	0	0	0	0
3142	1631	402	0.173	70	1900	1	150	0	0	0	0	0
3143	1631	196	1.092	70	1900	1	150	0	0	0	0	0
3145	1633	197	2.63	50	1900	1	150	0	0	0	0	0
3146	198	1633	0.264	50	1900	1	150	10001	0	0	0	0
3148	1097	1635	0.239	90	1900	2	150	0	0	0	0	0
3149	1635	691	0.156	90	1900	-3	150	-33	2	111	0	0
3152	1098	1077	0.459	50	1900	1	150	0	0	0	0	0
3160	405	684	1.343	90	1900	2	150	0	0	0	0	0
3161	1633	428	0.061	50	1900	1	150	0	0	0	0	0
3167	1113	700	2.75	90	1900	2	150	0	0	0	0	0
3183	1094	1658	0.218	70	1900	2	150	0	0	0	0	0
3185	1658	640	0.993	70	1900	2	150	0	0	0	0	0
3186	1094	200	0.288	50	1900	1	150	0	0	0	0	0
3188	1663	1666	0.764	50	1900	3	150	0	0	0	0	0
3189	1665	203	0.236	50	1900	1	150	0	0	0	0	0
3190	1666	1665	0.057	50	1900	3	150	-9	3	100	4	11
3192	1668	1665	0.056	70	1900	2	150	-9	1	100	2	11
3193	1670	205	0.181	50	1900	1	150	0	0	0	0	0
3195	1673	1094	0.1	70	1900	-3	150	-54	2	111	0	0
3198	1095	1676	0.221	70	1900	2	150	0	0	0	0	0
3199	1677	1095	0.329	70	1900	2	150	-55	2	11	0	0
3206	201	431	4.917	50	1900	1	150	-7	3	111	0	0
3207	1038	1683	0.111	70	1900	3	150	0	0	0	0	0
3208	254	1038	0.1	70	1900	4	150	-8	3	100	4	11
3211	1688	1687	1.009	50	1900	1	150	0	0	0	0	0
3212	1687	1364	0.071	50	1900	1	150	0	0	0	0	0
3213	1690	1038	1	70	1900	3	150	-8	1	100	2	11
3216	1692	1663	0.15	70	1900	-4	150	-51	1	100	2	11
3217	1665	1690	0.45	70	1900	2	150	0	0	0	0	0
3218	202	1663	0.115	50	1900	2	150	-51	3	100	4	11

3238	1096	1677	0.693	70	1900	2	150	0	0	0	0	0
3240	639	1670	0.429	70	1900	2	150	-52	2	110	0	0
3241	1670	1692	0.75	70	1900	2	150	0	0	0	0	0
3245	1707	1017	1.155	70	1900	1	150	0	0	0	0	0
3246	1017	620	1.724	70	1900	1	150	0	0	0	0	0
3257	1723	1361	0.187	90	1900	2	150	-57	2	11	0	0
3260	1360	1039	0.861	90	1900	2	150	0	0	0	0	0
3261	1325	206	0.362	50	1900	1	150	0	0	0	0	0
3262	1727	612	0.086	50	1900	1	150	-5	1	111	0	0
3266	312	315	0.144	70	1900	2	150	0	0	0	0	0
3267	515	359	0.376	50	1900	2	150	-48	1	100	2	10
3268	474	476	0.141	70	1900	3	150	-3	1	100	2	10
3269	481	515	1.474	50	1900	1	150	-47	2	11	0	0
3270	492	494	0.451	90	1900	-2	150	-98	1	100	2	10
3271	209	518	4.57	90	1900	-3	150	-44	1	111	0	0
3272	507	210	0.304	50	1900	1	150	0	0	0	0	0
3273	445	448	2.082	100	1900	1	150	0	0	0	0	0
3274	311	211	0.737	70	1900	1	150	0	0	0	0	0
3275	860	212	0.175	50	1900	1	150	0	0	0	0	0
3280	606	411	0.425	50	1900	2	150	0	0	0	0	0
3292	1617	1620	0.462	90	1900	2	150	0	0	0	0	0
3294	1780	311	1.44	90	1900	1	150	0	0	0	0	0
3295	214	1780	0.97	30	1900	1	150	10001	0	0	0	0
3297	1201	1780	0.735	90	1900	1	150	0	0	0	0	0
3300	215	1359	3.398	100	1900	1	150	0	0	0	0	0
3304	521	509	1.341	70	1900	2	150	0	0	0	0	0
3307	1676	1673	0.3	70	1900	2	150	0	0	0	0	0
3310	755	548	0.35	70	1900	-3	150	-34	3	100	4	11
3311	216	448	0.283	100	1900	1	150	0	0	0	0	0
3313	1152	423	2.073	90	1900	1	150	0	0	0	0	0
3314	217	509	0.283	50	1900	1	150	10001	0	0	0	0
3316	1792	470	0.514	70	1900	1	150	0	0	0	0	0
3317	218	1792	0.366	50	1900	1	150	10001	0	0	0	0
3318	219	1727	0.251	50	1900	1	150	0	0	0	0	0
3319	1201	220	0.708	70	1900	1	150	0	0	0	0	0
3322	612	207	1.575	70	1900	1	150	0	0	0	0	0
3323	1792	512	3.253	70	1900	1	150	0	0	0	0	0
3324	222	1620	0.469	50	1900	1	150	10001	0	0	0	0
3328	1812	511	0.384	70	1900	1	150	-6	2	111	0	0
3331	511	512	0.124	70	1900	1	150	0	0	0	0	0
3334	512	1792	3.253	70	1900	1	150	0	0	0	0	0
3337	1744	223	3.12	50	1900	1	150	0	0	0	0	0
3338	448	445	2.082	100	1900	1	150	0	0	0	0	0

3342	492	495	0.645	90	1900	2	150	0	0	0	0	0
3343	1835	493	0.053	90	1900	2	150	-97	1	100	2	10
3345	495	513	0.751	90	1900	2	150	-43	2	11	0	0
3346	483	518	0.3	70	1900	-3	150	-44	2	100	3	11
3348	476	224	0.456	70	1900	2	150	0	0	0	0	0
3352	94	1113	0.42	50	1900	1	150	10001	0	0	0	0
3353	226	1481	1.273	50	1900	1	150	0	0	0	0	0
3356	228	1707	0.086	50	1900	1	150	10001	0	0	0	0
3357	436	229	0.068	50	1900	1	150	0	0	0	0	0
3358	230	482	0.643	50	1900	1	150	10001	0	0	0	0
3359	231	1154	0.673	70	1900	1	150	10002	0	0	0	0
3360	1245	550	0.689	70	1900	2	150	0	0	0	0	0
3364	232	854	0.063	50	1900	1	150	-91	1	111	0	0
3365	854	233	0.112	50	1900	1	150	0	0	0	0	0
3366	501	234	0.78	50	1900	1	150	0	0	0	0	0
3367	503	235	0.251	50	1900	1	150	0	0	0	0	0
3368	236	490	0.306	50	1900	1	150	-86	3	101	0	0
3369	1840	237	0.264	70	1900	1	150	0	0	0	0	0
3370	238	1840	0.18	70	1900	2	150	-87	3	100	4	11
3372	493	239	1.238	70	1900	1	150	0	0	0	0	0
3373	240	494	0.135	50	1900	1	150	-98	3	101	0	0
3375	1493	241	0.117	50	1900	1	150	0	0	0	0	0
3376	242	949	0.104	50	1900	1	150	-20	1	111	0	0
3377	243	596	0.104	50	1900	1	150	-89	3	111	0	0
3378	596	244	0.107	50	1900	1	150	0	0	0	0	0
3379	245	751	0.363	50	1900	1	150	-90	1	111	0	0
3380	751	246	0.07	50	1900	1	150	0	0	0	0	0
3381	743	247	0.104	50	1900	1	150	0	0	0	0	0
3382	248	740	0.056	50	1900	1	150	-36	1	111	0	0
3383	249	734	0.111	50	1900	1	150	-85	1	111	0	0
3384	734	250	0.068	50	1900	2	150	0	0	0	0	0
3385	251	730	0.114	50	1900	1	150	-40	1	111	0	0
3386	1617	252	0.405	50	1900	1	150	0	0	0	0	0
3388	253	1617	0.297	50	1900	1	150	-94	1	111	0	0
3389	316	1840	0.764	70	1900	-3	150	-87	1	100	2	11
3390	1840	483	1.485	70	1900	2	150	0	0	0	0	0
3391	710	1598	0.65	90	1900	1	150	0	0	0	0	0
3394	1236	1245	0.096	90	1900	-2	150	0	0	0	0	0
3400	20	1080	0.8	50	1900	1	150	0	0	0	0	0
3401	1080	20	0.8	50	1900	1	150	0	0	0	0	0
3411	1665	199	0.555	50	1900	3	150	0	0	0	0	0
3420	180	1057	0.6	70	1900	1	150	0	0	0	0	0
3430	139	459	2.18	70	1900	-2	150	10002	0	0	0	0

3431	459	139	2.18	70	1900	2	150	0	0	0	0	0
3450	1043	1036	1.13	50	1900	1	150	10002	0	0	0	0
3451	1036	1043	1.13	50	1900	1	150	0	0	0	0	0
3452	1043	1041	1.13	50	1900	1	150	10002	0	0	0	0
3453	1041	1043	1.13	50	1900	1	150	0	0	0	0	0
3454	1043	320	3.5	50	1900	1	150	-11	1	100	2	111
3455	320	1043	3.5	50	1900	1	150	10002	0	0	0	0

Appendix C: Signal Input File for all Scenarios

1	75	65	85	0	3	12	3	17	3	37	3	300	0	0	0	0	0
2	75	65	85	-3	3	6	3	18	3	42	3	300	0	0	0	0	0
3	85	75	95	0	3	6	3	35	3	35	3	300	0	0	0	0	0
4	75	65	85	0	3	8	4	17	6	34.5	5.5	300	0	0	0	0	0
5	70	65	85	-4	2	35	4	26	5	300	0	0	0	0	0	0	0
6	85	75	95	0	3	9	6	39	6	19	6	300	0	0	0	0	0
7	85	70	90	0	3	11	3	50	3	15	3	300	0	0	0	0	0
8	90	80	120	0	4	15	5	22	5	15	5	18	5	300	0	0	0
9	90	80	120	-10	4	7	4	37	4	15	4	15	4	300	0	0	0
10	100	90	120	0	4	8	5	42	5	15	5	15	5	300	0	0	0
11	100	90	120	0	3	15	5	30	5	40	5	300	0	0	0	0	0
12	80	70	90	0	2	25	5	45	5	300	0	0	0	0	0	0	0
13	80	70	90	0	2	25	5	45	5	300	0	0	0	0	0	0	0
14	80	70	90	0	2	25	5	45	5	300	0	0	0	0	0	0	0
15	80	70	90	0	2	25	5	45	5	300	0	0	0	0	0	0	0
16	80	70	90	0	2	25	5	45	5	300	0	0	0	0	0	0	0
17	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
18	60	60	60	0	2	16	4	36	4	300	0	0	0	0	0	0	0
20	80	70	90	0	2	25	5	45	5	300	0	0	0	0	0	0	0
21	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
22	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
24	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
25	85	75	95	0	3	20	3	30	3	26	3	300	0	0	0	0	0
26	85	75	95	-25	2	30	5	45	5	300	0	0	0	0	0	0	0
27	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
28	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
29	85	75	95	0	2	36	4	41	4	300	0	0	0	0	0	0	0
30	60	50	70	0	2	16	4	36	4	300	0	0	0	0	0	0	0
31	75	70	90	0	3	12	3	30	3	24	3	300	0	0	0	0	0
32	75	70	90	0	3	10	5	25	5	24	6	300	0	0	0	0	0
33	85	75	95	-34	2	30	5	45	5	300	0	0	0	0	0	0	0
34	85	80	110	0	4	7	3	41	3	7	3	18	3	300	0	0	0
35	85	75	95	-34	2	30	5	45	5	300	0	0	0	0	0	0	0
36	60	50	70	-34	2	16	4	36	4	300	0	0	0	0	0	0	0
37	85	75	95	-34	2	30	5	45	5	300	0	0	0	0	0	0	0
38	60	50	70	-34	2	16	4	36	4	300	0	0	0	0	0	0	0
39	60	50	70	-34	2	16	4	36	4	300	0	0	0	0	0	0	0
40	60	50	70	-34	2	16	4	36	4	300	0	0	0	0	0	0	0
41	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
43	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0

44	85	80	100	0	3	30	3	10	3	36	3	300	0	0	0	0	0
45	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
47	85	75	95	0	3	24	6	22	6	21	6	300	0	0	0	0	0
48	85	75	95	-47	3	16	6	34	6	17	6	300	0	0	0	0	0
49	85	75	95	-10	2	30	5	45	5	300	0	0	0	0	0	0	0
50	85	75	95	-10	2	30	5	45	5	300	0	0	0	0	0	0	0
51	85	80	100	0	4	12	3	41	3	8	3	12	3	300	0	0	0
52	85	75	95	-53	2	30	5	45	5	300	0	0	0	0	0	0	0
53	85	80	100	0	4	7	3	41	3	10	3	15	3	300	0	0	0
54	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
55	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
56	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
57	85	75	95	-53	2	30	5	45	5	300	0	0	0	0	0	0	0
58	85	75	95	-53	2	30	5	45	5	300	0	0	0	0	0	0	0
67	85	75	95	-68	2	45	5	30	5	300	0	0	0	0	0	0	0
68	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
81	60	60	80	-44	3	8	5	21	6	14	6	300	0	0	0	0	0
82	60	60	80	-44	3	9	5	22	6	12	6	300	0	0	0	0	0
85	85	75	95	-34	2	30	5	45	5	300	0	0	0	0	0	0	0
86	70	60	80	-44	3	15	5	25	5	15	5	300	0	0	0	0	0
87	90	80	100	-44	4	8	3	35	3	9	3	26	3	300	0	0	0
89	60	50	70	0	3	9	5	21	6	13	6	300	0	0	0	0	0
90	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
91	60	50	70	0	2	16	4	36	4	300	0	0	0	0	0	0	0
92	85	75	95	0	2	25	5	50	5	300	0	0	0	0	0	0	0
94	85	75	95	0	2	30	5	45	5	300	0	0	0	0	0	0	0
97	110	100	120	0	3	24	6	55	5	16	4	300	0	0	0	0	0
98	95	85	105	0	3	9	6	55	5	16	4	300	0	0	0	0	0

Notice: The demand files are very large, so it is hard to copy them here.