



**South Kesteven  
Local Development Framework**

**Traffic Modelling**

**Lincolnshire County Council  
South Kesteven District Council**





**July 2009**






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**1.1 Purpose of Report**

Jacobs were commissioned by Lincolnshire County Council (LCC) in June 2009 to produce forecasts of traffic volumes for Grantham to support and inform the South Kesteven Local Development Framework (LDF) submission. The commission includes the requirement to model a number of different traffic scenarios which are based on different assumptions regarding the location of new land use and road infrastructure development.

A Lincolnshire County Council transport model provides the basis for forecasting future traffic volumes in Grantham. The model is used to assess the impact of new transportation infrastructure, housing and employment development in the town.

The purpose of this report is to provide a non-technical description of the transport model and how it was used to forecast traffic volumes and produce road network performance data. This report presents the results of the traffic modelling and describes the forecast traffic volumes within Grantham.

**1.2 Overview**

Jacobs work in partnership with LCC to provide technical and management support to the Council's service delivery. Jacobs manage and develop transport models on behalf of the County and District Councils. These models provide a common traffic forecasting tool and are used to support service delivery in transport planning, traffic engineering, development control and related areas.

The Grantham transport model was originally developed jointly by Lincolnshire County Council and JMP. The model was updated in 2000 and most recently by Jacobs to establish a 2006 'base' traffic model for the purposes of the Grantham Transport Study. The base model serves the purpose of describing the existing (base) traffic conditions within the town and provides a suitable basis for producing forecasts of future traffic volumes. Full details of how the model was developed are provided in the report *Grantham Transport Study Technical Note 7: Traffic Modelling, July 2007*.

LCC commissioned Jacobs to provide traffic volume data for a number of development allocation scenarios to inform the LDF for the forecast years of 2014 and 2029. These forecast years correspond to the opening and design years of the Grantham Southern Relief Road and were agreed as suitable forecast scenarios for the purposes of the LDF.

Following the Introduction, the policy background and development scenarios are described in **Section 2**. An overview of the traffic forecasting methodology is provided in **Section 3**, with a more detailed description in *Traffic Forecasting Assumptions Report, June 2009* (see Appendix A). **Section 4** describes the results of the traffic modelling in terms of traffic volume and road network performance. **Section 5** summarise the results and provides conclusions.

**2.1 South Kesteven District Council Local Development Framework**

South Kesteven District Council (SKDC) is in the process of developing its Local Development Framework to replace the 1995 South Kesteven Local Plan.

The Core Strategy January 2009 sets out the strategic plan for South Kesteven. The document describes how the district’s housing allocation of 16,800 dwellings, to be delivered in the period 2001 - 2026, will be distributed throughout the district. The housing allocation figures are consistent with those presented in the East Midlands Regional Plan 2009.

The Core Strategy concentrates over half of the housing allocation to Grantham. These 8,568 proposed houses include the additional housing allocated to Grantham as a result of its Growth Point status (see Section 2.2).

**2.2 Grantham Growth Point Status**

Grantham was designated as a New Growth Point in 2007 and is required to deliver increased sustainable growth by identifying key development sites in and around the town for housing, commercial, employment and retail development.

Of the 8,568 proposed houses in the Core Strategy, 1,567 had been built by 2008; therefore an annual build rate of 389 is required for the remainder of the plan period. According to the Core Strategy a further 1,133 houses are committed. Although it is considered that there is capacity in the town centre for a further 2,000 homes, Urban Extensions will be required to provide at least 3,868 houses to meet the housing allocation for Grantham.

The Core Strategy identifies two Urban Extensions for Grantham. These are Poplar Farm to the north-west and the Southern Quadrant to the south-east. It is anticipated that the Urban Extensions could yield up to 7,500 houses. An alternative site adjacent to the Manthorpe Estate was considered in the preferred options version of the Core Strategy. Should this site be allocated it could accommodate an additional 1,530 new dwellings.

**2.3 Grantham Development Allocations**

The Housing and Economic Development Plan Document (DPD) Preferred Options Consultation Report 2006 sets out site-based housing, employment and retail allocations. This document provides detailed site-based policies and includes information which is used to inform the development of the traffic forecast scenarios. A number of preferred options are described, including details of the Urban Extensions in Grantham at Poplar Farm and the Southern Quadrant. A number of town centre sites suitable for housing development are also presented.

The DPD describes “opportunity areas” within Grantham. Opportunity areas are sites which could provide significant regeneration for areas of the town centre, such as the Canal Basin. It is expected that opportunity areas would facilitate mixed-use developments. Employment-related site allocations are then described. The DPD highlights the significant new land allocations for employment purposes and these

include areas of land south of Barrowby Road/east of the A1, north of Harlaxton Road/west of the A1 and the Old Quarry at Spittlegate.

The Core Strategy and DPD Preferred Options report provides data related to the location of development allocations in Grantham. This information is used to develop reliable traffic forecasts.

## **2.4 Development Scenarios**

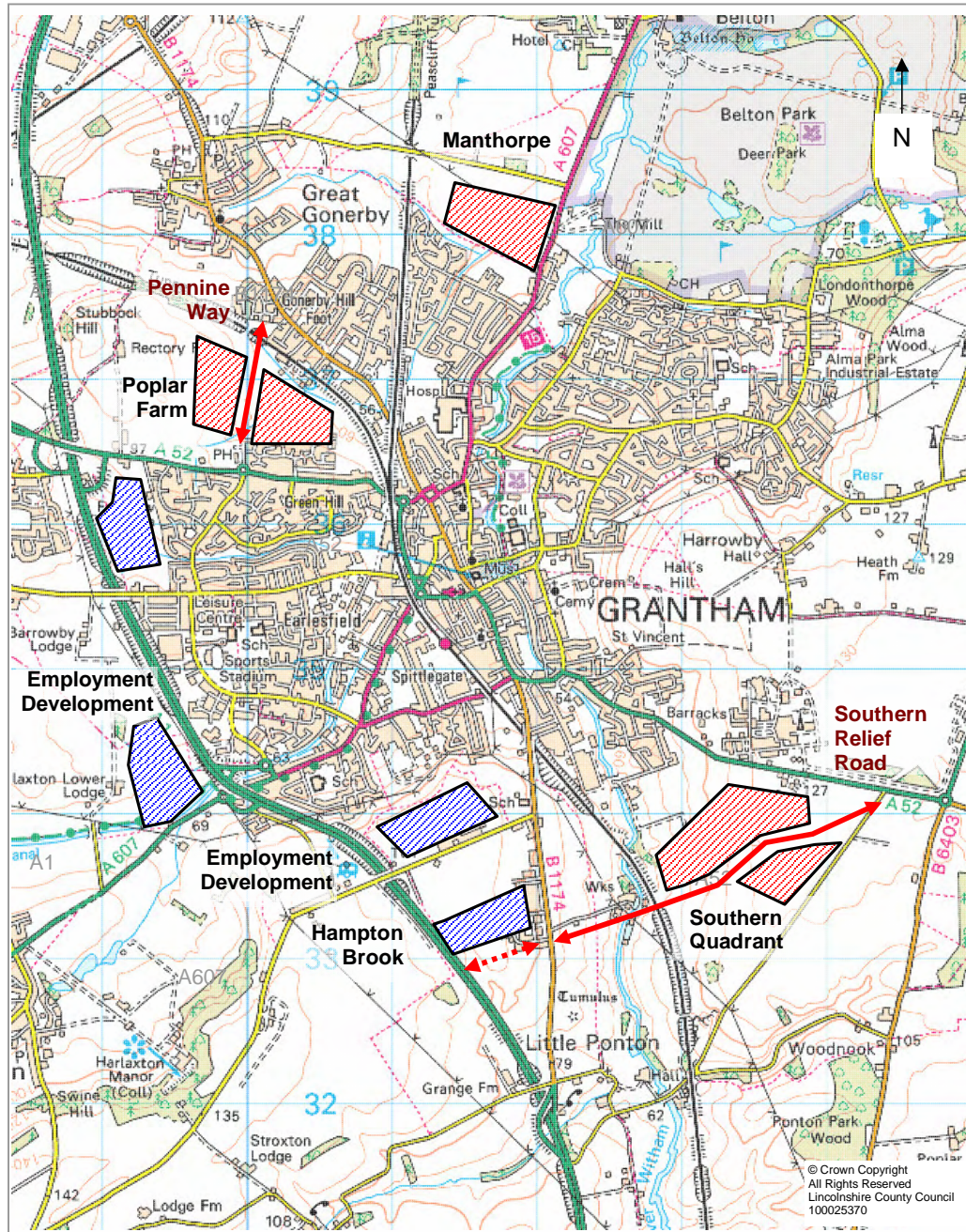
The 2006 Grantham transport model is used as a base from which to test the traffic impact of the future developments. The forecast years of 2014 and 2029 are used as a basis for the assessments. These years correspond to the opening and design year for the Southern Relief Road. The design year is defined as the opening year + 15 years, as advised by the IHT guidance *Guidelines for Traffic Impact Assessment* when the construction of new infrastructure is involved. Table 2-A presents the forecast year scenarios (for both AM and PM peak periods) and lists the road infrastructure provision and allocation of housing for each scenario. Figure 2-A presents the location of the potential road infrastructure and major housing and employment developments. For the individual forecast scenarios of 2014 and 2029 the total allocation of housing is the same for all development scenarios. This provides a consistent basis for assessing the forecast traffic volumes.

According to the annual build rate required for the remainder of the plan period, 2,334 houses will have been built by 2014. Assuming all the currently committed developments will have been completed by this point, a further 1,201 houses are required. As the committed developments are in the town centre, the Reference Case scenario (2) assumes the remaining 1,201 houses are provided by the Poplar Farm development. A list of the committed developments can be found in the *Traffic Forecasting Assumptions Report, June 2009*, in Appendix A.

As 2014 is the opening year of the Southern Relief Road, it is assumed only 500 houses will have been completed and occupied for the Southern Quadrant development. Therefore the remaining 701 houses required are either allocated to the Poplar Farm development (scenario 3a) or the town centre (scenario 3b).

In the 2029 scenarios the total housing allocation for Grantham of 8,568 houses is provided. Of these, 2,700 have either been built or are committed, and the remaining 5,868 houses are allocated to specific developments depending on the scenario under consideration.





**Figure 2-A** Location of potential development areas in Grantham



Scenario		Road Infrastructure			Housing Development Allocations*					
		Committed Highway Improvements	Southern Relief Road	Pennine Way	Committed Development	Southern Quadrant (Capacity 4000)	Poplar Farm (Capacity 3500)	Manthorpe (Capacity 1530)	Town Centre (Capacity 2000)	
2006 Base	1									
2014 Reference Case	2	✓		✓	✓		1201			+1201 Dwellings
2014 Southern Quadrant	3a	✓	✓	✓	✓	500	701			
	3b	✓	✓		✓	500			701	
	3c	✓		✓	✓	500	701			
2014 No Pennine Way	4a	✓	✓		✓	500	701			
	4b	✓			✓		1201			
	4c	✓			✓			1201		
2029 Reference Case	5	✓		✓	✓		3500	368	2000	+5868 Dwellings
2029 Southern Quadrant	6a	✓	✓	✓	✓	4000	1868			
	6b	✓	✓		✓	4000			1868	
	6c	✓		✓	✓	4000	1868			
2029 No Pennine Way	7a	✓	✓		✓	4000	1868			
	7b	✓			✓		3500	368	2000	
2029 Southern Quadrant + Manthorpe	8a	✓	✓	✓	✓	4000	338	1530		
	8b	✓	✓		✓	4000		1530	338	

**Table 2-A Forecast Development Scenarios**

\* no. of dwellings

## 3 Traffic Forecasting Methodology

### 3.1 Introduction

This chapter provides a summary of the methodology used to forecast the volume of traffic that will travel on the Grantham road network in 2014 and 2029. Full details of the methodology are provided in the *Traffic Forecasting Assumptions Report, June 2009* (see Appendix A).

### 3.2 Summary of Methodology

The 2014 and 2029 forecast traffic volumes are derived by applying growth factors obtained from Department for Transport (DfT) software to the 2006 base traffic volumes. The traffic volume forecast to be generated by the new committed developments and Urban Extensions are added to the transport model. For each of the various forecast scenarios the full level of housing and employment allocation for 2014 and 2029 is included in the transport model.

The transport model is able to simulate the “strategic” journeys traffic will make on the Grantham road network from a point of origin (e.g. home) to a destination (e.g. work). The model predicts the routes vehicles will take to travel along the road network depending upon the journey times of the available routes. The “strategic” nature of the transport model means that it is suitable for assessing the broad traffic volumes on main roads and the road network performance for the whole town.

The transport model simulates the traffic conditions during the typical weekday peak periods in the AM (8:00 – 9:00) and PM (17:00 – 18:00) time periods. This methodology provides a ‘worst case’ assessment as the impact of modal shift or peak spreading is not considered. Modal shift is where a person may choose to undertake their journey by a different mode of transport e.g. bus. Peak spreading is where a person may choose to change when they travel to a quieter time outside of the peak traffic hour.

### 3.3 Forecast Traffic Volume

Table 3-A presents the total trips for each scenario. The figures have been rounded to the nearest 50 vehicles.

Scenario		AM (08:00 – 09:00)		PM (17:00 – 18:00)	
		Total Trips	% Growth	Total Trips	% Growth
2006 Base	1	7450		8050	
2014 Forecast	2,3a,3b,3c,4a,4b,4c	9300	24.8%	10050	24.8%
2029 Forecast	5,6a,6b,6c,7a,7b,8a,8b	11350	52.3%	12350	53.4%

**Table 3-A Total trips for all scenarios**

# 4 Modelling Results

## 4.1 Introduction

This section presents the results of the transport modelling in terms of road network performance in Grantham for each scenario. This section also assesses the impact of the Urban Extensions and associated road infrastructure to help inform and develop the emerging LDF for South Kesteven. The various development scenarios have been assessed in terms of total road network performance, changes in the volume of traffic and the level of congestion that is likely to occur at a number of key junctions on the strategic road network.

## 4.2 Road Network Performance

Tables 4-A and 4-B present the total road network performance for Grantham in the AM and PM peak hours in terms of total travel time on the road network, average speed and total delay for all vehicles. Definitions of these measures of road network performance are provided below.

Scenario		Total Travel Time (Vehicle hours)	Average Speed (Kph)	Total Delay (Vehicle hours)	Performance compared to Reference Case
2006 Base	1	927	41	244	-
2014 Reference Case	2	1283	38	408	-
2014 Southern Quadrant	3a	1204	40	347	Positive
	3b	1225	40	368	Positive
	3c	1278	38	408	Neutral
2014 No Pennine Way	4a	1232	40	370	Positive
	4b	1333	37	455	Negative
	4c	1462	34	579	Negative
2029 Do Minimum	5	2236	27	1145	-
2029 Southern Quadrant	6a	2114	29	1027	Positive
	6b	2175	28	1097	Neutral
	6c	2605	24	1494	Negative
2029 No Pennine Way	7a	2243	27	1149	Neutral
	7b	2604	23	1505	Negative
2029 Southern Quadrant + Manthorpe	8a	2463	25	1376	Negative
	8b	2505	24	1415	Negative

**Table 4-A Road Network Performance in AM Peak Hour**

- *Total Travel Time (Vehicle Hours) - the cumulative travel time for all journeys undertaken within and around Grantham in the peak hour.*
- *Average Speed (Kph) - the average vehicle speed on the road network within and around Grantham for all journeys undertaken in the peak hour.*



- *Total Delay (Vehicle Hours) - the cumulative total additional time that vehicles are delayed as a result of congestion within and around Grantham for all journeys undertaken in the peak hour.*
- *Performance compared to Reference Case – a greater than 5% reduction in Total Delay is considered as a Positive impact, a greater than 5% increase in Total Delay is considered as a Negative impact, otherwise a Neutral impact.*

Scenario		Total Travel Time (Vehicle hours)	Average Speed (Kph)	Total Delay (Vehicle hours)	Performance compared to Reference Case
2006 Base	1	929	43	253	-
2014 Reference Case	2	1433	36	560	-
2014 Southern Quadrant	3a	1275	40	415	Positive
	3b	1283	40	421	Positive
	3c	1450	35	577	Negative
2014 No Pennine Way	4a	1296	40	431	Positive
	4b	1480	35	600	Negative
	4c	1377	38	498	Positive
2029 Reference Case	5	2406	26	1319	-
2029 Southern Quadrant	6a	2431	26	1329	Neutral
	6b	2554	25	1463	Negative
	6c	2644	25	1505	Negative
2029 No Pennine Way	7a	2632	25	1526	Negative
	7b	2718	24	1608	Negative
2029 Southern Quadrant + Manthorpe	8a	2451	26	1352	Neutral
	8b	2536	26	1435	Negative

**Table 4-B Road Network Performance in PM Peak Hour**

The modelling results indicate a significant increase in the level of delay for all scenarios in 2014 and 2029 when compared to the existing (base) situation in Grantham, particularly in the PM peak hour. This is a result of the significant increases in traffic volumes associated with the new development allocations.

In order to consider the relative road network performance in Grantham in the future years, the various scenarios are compared to a “Reference Case” scenario. The column in tables 4-A and 4-B labelled “Performance compared to Reference Case” provides a useful guide to understand the impact of the various infrastructure and housing allocation options and hence which options provide improvements in road network performance over and above the “Reference Case” scenario.

In 2014, scenario 3a, where development is located in the Southern Quadrant and Poplar Farm Urban Extensions with both the Southern Relief Road and Pennine Way Link Road, this scenario results in the best overall road network performance in both the AM and PM peaks. The scenarios where the development is located in the Town Centre as opposed to Poplar Farm (scenario 3b) or where the development allocation is the same as scenario 3a but Pennine Way is not constructed (scenario

4a), also perform well. The results indicate there would be the worst overall road network performance in the AM peak when there is no additional infrastructure provided and the housing development is allocated to Manthorpe (scenario 4c), and the worst network performance in the PM peak when the housing development is allocated to Poplar Farm (scenario 4b).

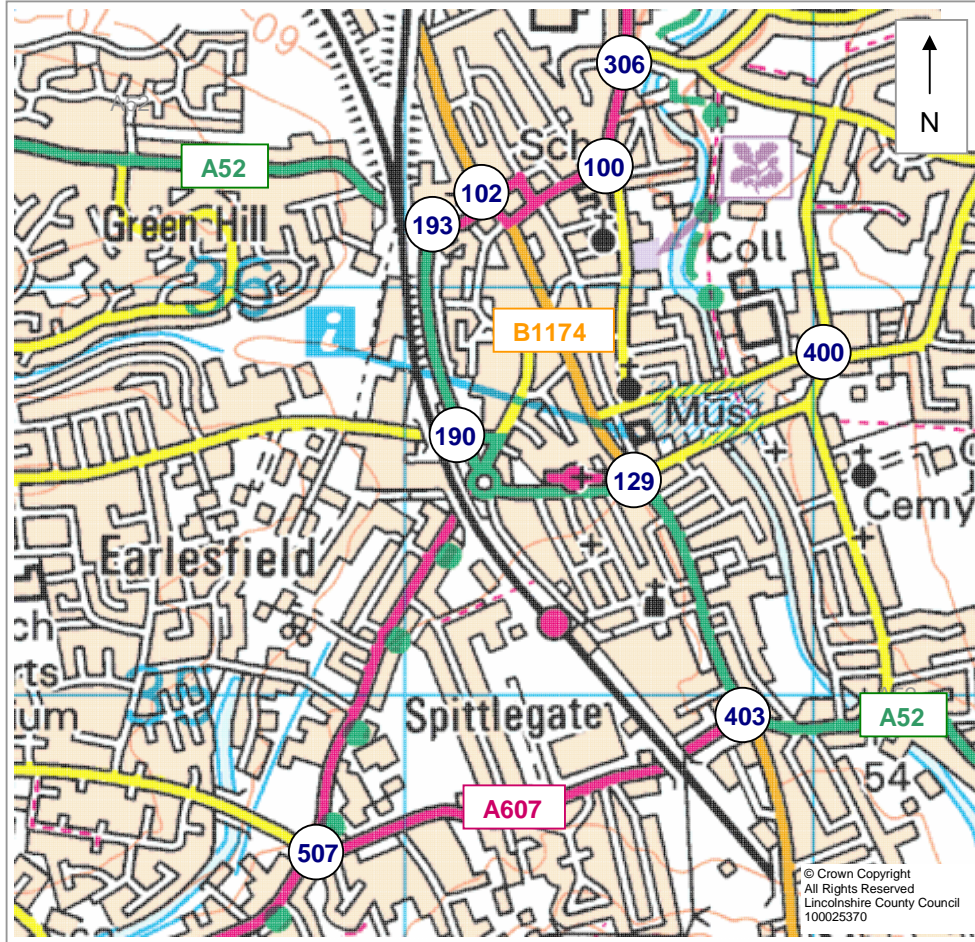
In the AM peak in 2029, the results suggest scenario 6a (the comparable scenario to 3a), would produce the best road network performance. Scenario 7b, where development is predominately located within Poplar Farm and the Town Centre but Pennine Way is not provided, scenario 6c where the Southern Relief Road is not provided, and the scenarios where development is allocated to Manthorpe (scenarios 8a and 8b) would result in the worst overall road network performance, with 7b and 6c performing particularly poorly.

In the PM peak in 2029, the results suggest scenarios 6a, 8a and the Reference case (5) would all perform similarly in terms of overall road network performance. The scenarios where development is allocated to Poplar Farm but Pennine Way is not provided (scenarios 7a and 7b) result in the worst overall road network performance.

### **4.3 Junction Performance**

The transport model used for the purposes of this assessment is a strategic model (see Section 3.2) and is suitable for assessing the broad impacts of the development of the new road infrastructure and Urban Extensions. The model can also be used to identify, in broad terms, the junctions that are forecast to experience capacity issues.

An assessment of selected key junctions in the town centre has been undertaken (see Appendix D) and Figure 4-A presents the junctions that are forecast to operate significantly over capacity in all 2014 and 2029 forecast scenarios. The level of junction performance depends upon the location of future land-use development and infrastructure improvement. It will be necessary to study the potential for junction capacity improvement measures at these and other key junctions. It will also be necessary to consider other ways to manage the growth in the volume of traffic.



**Figure 4-A Key junctions forecast to operate over capacity in 2014 and 2029**

- Junction No. 193: Barrowby Road/St Augustin Roundabout
- Junction No. 129: London Road/Wharf Road
- Junction No. 403: London Road/South Parade/Springfield Road
- Junction No. 507: Harlaxton Road/Trent Road/Springfield Road
- Junction No. 102: North Street/Barrowby Road/North Parade
- Junction No. 100: Brook Street/Castle Gate
- Junction No. 190: Dysart Road/St Augustin Way
- Junction No. 306: Manthorpe Road/Belton Lane
- Junction No. 400: Stonebridge Rd/Sandon Rd/Beacon Ln/Harrowby Rd

#### 4.4 Urban Extensions

Figures 4-B and 4-C present the two-way AM and PM peak hour flows on the key routes within Grantham for 2014 scenarios where the housing development is allocated in the different Urban Extensions:

- *Poplar Farm (Scenario 2)*
- *Southern Quadrant and Poplar Farm (Scenario 3a)*
- *Southern Quadrant and Town Centre (Scenario 3b)*
- *Manthorpe (Scenario 4c)*

Further information on forecast traffic volumes on all routes for all scenarios is presented in Appendix B.

The results suggest that when housing is allocated in the Southern Quadrant (3a and 3b) there are the lowest traffic volumes on the A52 Somerby Hill and A607 Harlaxton Road, as traffic diverts to use the new relief roads. In the AM peak there are minimal differences in town centre traffic volumes when the remainder of the allocation is either in Poplar Farm or Town Centre locations. However, in the PM peak, locating development in the Town Centre (3b) would result in higher volumes on the northern A607 and B1174 routes than locating the remaining development within Poplar Farm (3a).

In scenario 2 where all the housing development is allocated within Poplar Farm there are slightly higher volumes near the development on the A52 Barrowby Road and B1174 Gonerby Road. In the PM there is also a particularly high volume on the A52 St Augustin Way.

When all the housing is allocated to the Manthorpe development (4c) there are significantly higher traffic volumes on the A607 Manthorpe Road in both the AM and PM peak.



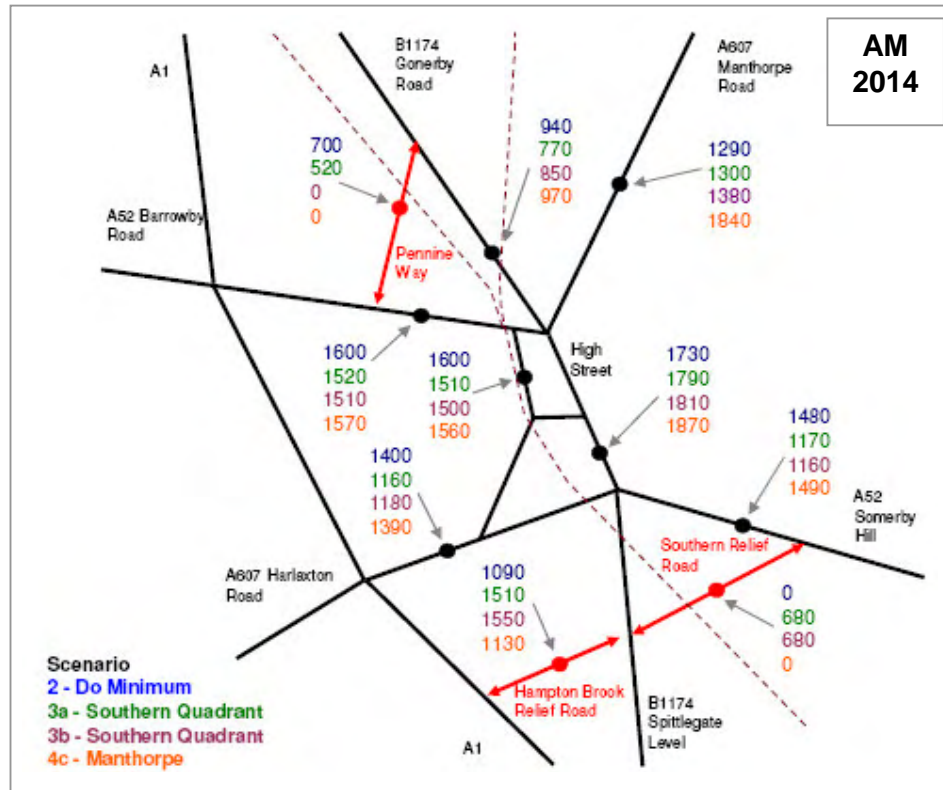


Figure 4-B 2014 AM peak hour two-way traffic volumes

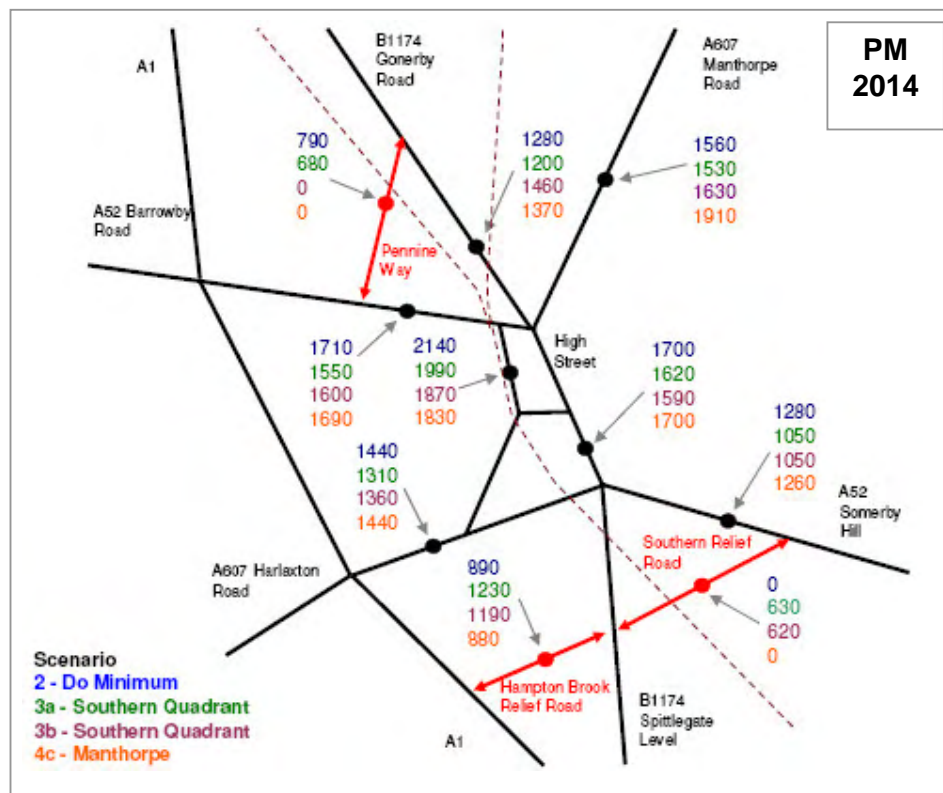


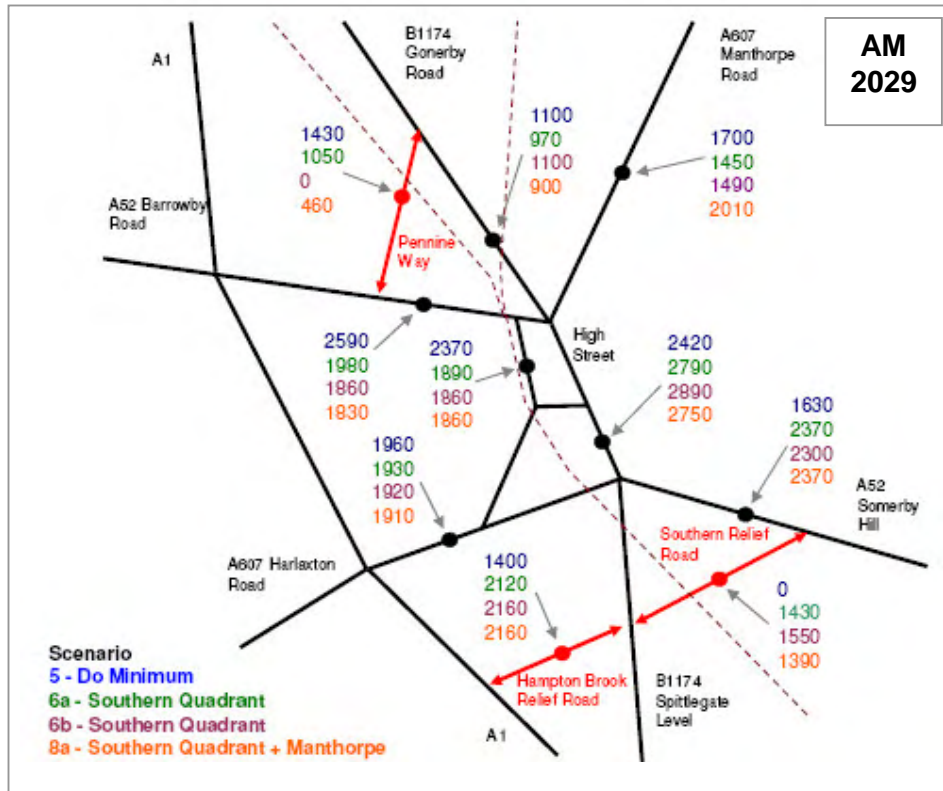
Figure 4-C 2014 PM peak hour two-way traffic volumes

Figures 4-D and 4-E present the two-way AM and PM peak hour volumes on the key routes within Grantham for 2029 scenarios where the housing development is allocated in the different Urban Extensions:

- *Poplar Farm and Town Centre (Scenario 5)*
- *Southern Quadrant and Poplar Farm (Scenario 6a)*
- *Southern Quadrant and Town Centre (Scenario 6b)*
- *Southern Quadrant and Manthorpe (Scenario 8a)*

The results suggest that when housing is allocated in the Southern Quadrant (6a, 6b and 8a) there would be significantly higher traffic volumes on the A52 Somerby Hill and A52 London Road in both the AM and PM peak hours. The key differences in traffic volumes for the alternative locations is that there are higher volumes on the A52 Barrowby Road when housing is located in Poplar Farm; higher volumes on the B1174 Gonerby Road and A52 London Road when housing is located in the Town Centre; and higher volumes on the A607 Manthorpe Road when housing is located in Manthorpe.

In scenario 5 where the housing development is predominately located within Poplar Farm and the Town Centre, there would be higher traffic volumes on the A52 Barrowby Road and A52 St Augustin Way, particularly in the AM peak.



**Figure 4-D 2029 AM peak hour two-way traffic volumes**

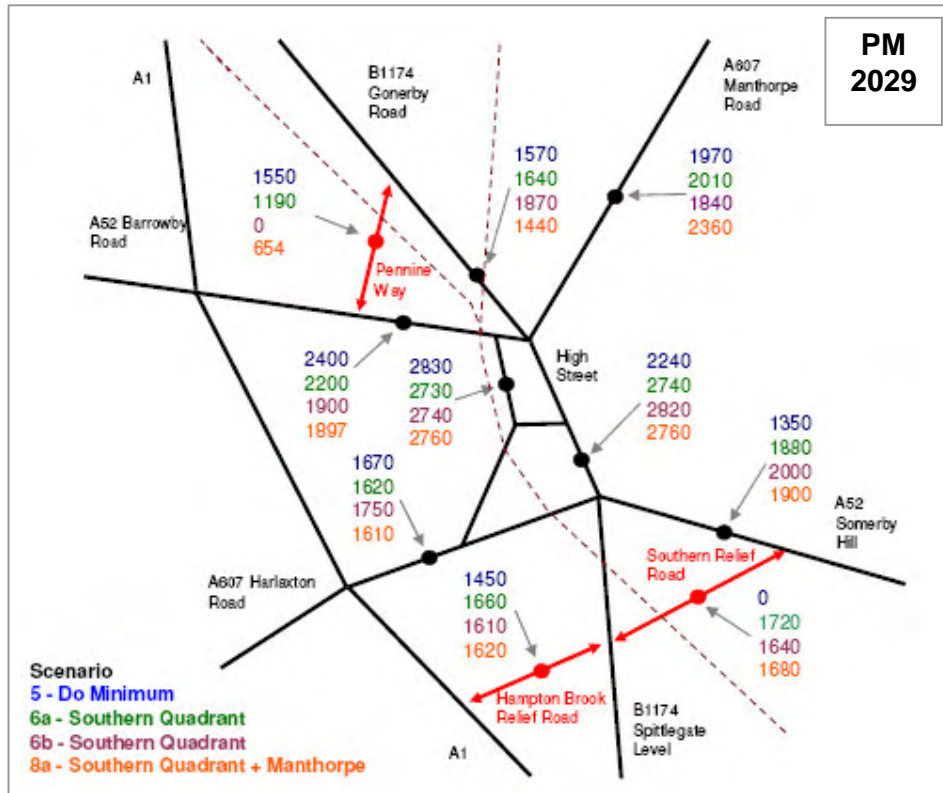


Figure 4-E 2029 PM peak hour two-way traffic volumes

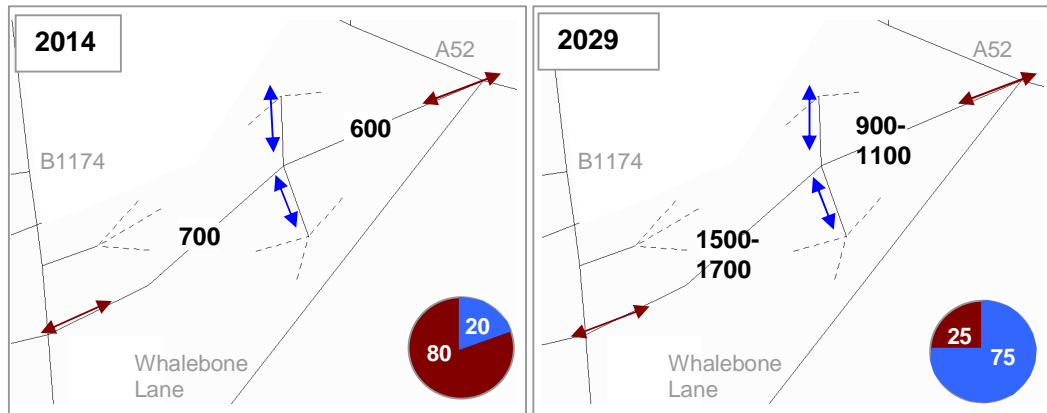
#### 4.5 Southern Relief Road and Southern Quadrant Development

The Southern Relief Road is developer funded and hence the impact of the new infrastructure must be considered in combination with the traffic generated by the Southern Quadrant Urban Extension. It is unrealistic to consider the road network improvement benefits of the Southern Relief Road without the associated traffic generated by the Urban Extension. The results presented in Tables 4-A and 4-B suggest the provision of the Southern Relief Road and the associated Southern Quadrant has a neutral or positive impact on the overall performance of the Grantham road network, when compared with the Reference Case scenarios where the Southern Relief Road infrastructure is not constructed. In general, the road network performs better for the scenarios where the Southern Relief Road is developed as opposed to scenarios without the new road.

If the Southern Quadrant development were to be built without the provision of the Southern Relief Road, it is assumed that there would not be a bridge provided over the railway lane. This would mean that the traffic associated with the western section of the Southern Quadrant development would only be able to access the main road network via the B1174 and traffic from the eastern section would only have access to the A52 Somerby Hill. In 2014 there would be around a 20% increase in total network delay in the AM peak and a 40% increase in the PM peak (comparing scenarios 3a and 3c). In 2029 there would be a 45% increase in the AM peak and a 15% increase in the PM peak (comparing scenarios 6a and 6c). There would also be an increase in the volume of traffic on the A52 Somerby Hill route as traffic would no longer be able to divert via the Southern Relief Road.

In the 2014 scenarios where the Southern Relief Road infrastructure is provided and the Southern Quadrant development is only partially complete, the average two-way traffic volume on the new road is typically around 700 vehicles per hour in both the AM and PM peak periods, as shown in Figure 4-B. With limited development in the Southern Quadrant, the traffic using the route is characterised by a significant proportion of longer distance through-trips. Around 80% of traffic on the Southern Relief Road travels to or from the A52 to the East of Grantham in 2014. There is an accompanying reduction of traffic volume on the A52 Somerby Hill into Grantham of 250 to 300 vehicles in the peak hours, as traffic is able to use the alternative and more direct east-west route along the Southern Relief Road (see Appendix C).

In 2029, the development of the Southern Quadrant Urban Extension is forecast to be complete. As a result, the average two-way traffic volumes on the Southern Relief Road increase to approximately 1,500 vehicles per hour in the AM peak and 1,700 in the PM peak, more than double the forecast traffic volume in 2014. The Southern Relief Road therefore becomes characterised by a higher proportion of local trips with around 75% of the traffic using the Southern Relief Road travelling to or from the Southern Quadrant Urban Extension. Accordingly, there is only a reduction in traffic volumes on the A52 Somerby Hill into Grantham. The completion of the Southern Quadrant development contributes to a subsequent increase of traffic volume on the A52 Somerby Hill in 2029 of 700 vehicles per hour in the AM peak and 500 in the PM peak when comparing scenarios 6a and 5 (Reference Case), see Appendix C for further details. Further detail on forecast traffic volumes throughout the network can be found in Appendix B.



Red: through-traffic  
Blue: local traffic

Figure 4-F Traffic volume on the Southern Relief Road

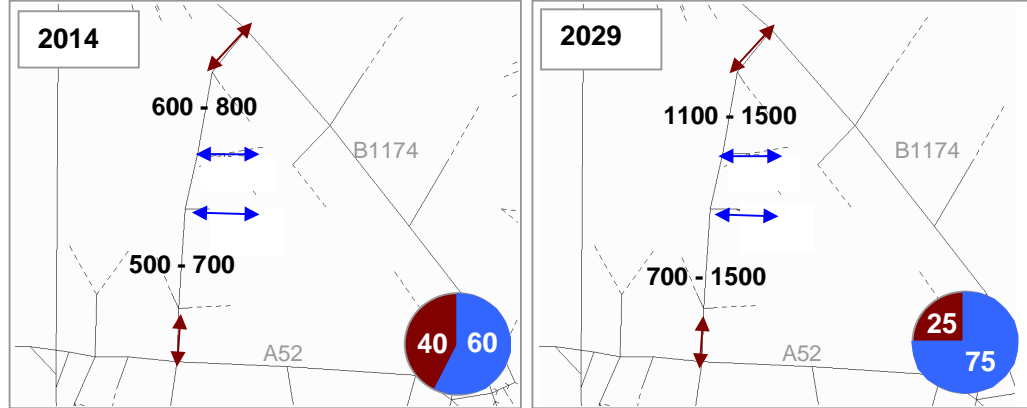
As part of the Southern Relief Road infrastructure development, two key junctions will be constructed, connecting the new road with the B1174 at its Western extent, and with the A52 to the East. The modelling results suggest these junctions will operate within capacity in 2014 if the junctions are developed as simple unsignalised roundabouts with one lane on each approach arm. However, this level of junction capacity is insufficient to accommodate the forecast traffic volumes in 2029. The traffic volume data derived from these assessments will be used to inform the detailed design of these junctions such that they will have the capacity to accommodate the forecast traffic volumes.

#### 4.6 Pennine Way Link Road and Poplar Farm Development

The construction of the Pennine Way Link Road is subject to developer funding associated with the Poplar Farm Urban Extension. The Pennine Way Link Road would provide a connection between A52 Barrowby Road and B1174 Gonerby Road, including a bridge over the railway line. It has been assumed as part of the Reference Case scenario that the Poplar Farm development will go ahead, and hence the Pennine Way Link Road will be constructed.

A number of forecast scenarios have been prepared which exclude the Pennine Way Link Road, and this enables direct assessment of the provision (or otherwise) of the Pennine Way Link Road. The modelling results suggest there is an improvement in the overall road network performance in Grantham in both the AM and PM peaks in 2014 and 2029 when the Pennine Way Link Road is built. Appendix C presents the differences in volume in the area of Poplar Farm when comparing scenarios 2 and 4b for 2014 and scenarios 5 and 7b in 2029.

In 2014 with the Pennine Way Link Road open, typically around 60% of the traffic using this new road is associated with the Poplar Farm development. The remainder is longer distance through-traffic mostly travelling to or from the A1 and A52. However, in the 2029 scenarios, around 75% of the traffic using Pennine Way is associated with Poplar Farm. In 2029, the housing development for the Poplar Farm Urban Extension will have been completed, therefore the volume of local traffic using Pennine Way will increase. The forecast traffic volumes for the new road are presented in Figure 4-C and in Appendix B.



Red: through-traffic

Blue: local traffic

Figure 4-G Traffic volumes on Pennine Way

In the forecast scenarios where housing development is completed at Poplar Farm but the Pennine Way Link Road is not provided (4a, 4b, 7a, 7b) the current junction with the A52 Barrowby Road and Pennine Way would operate significantly over capacity in 2029 and require significant junction capacity improvements to accommodate the traffic volumes.

Comparing the scenarios (3a & 3b, 6a & 6b) where additional housing is provided in Poplar Farm as part of an Urban Extension as opposed to the town centre, there is minimal difference in overall network performance in 2014. However, in 2029 when there are a larger number of houses, the Grantham road network performs better



with the Poplar Farm development and the associated Pennine Way Link in place than allocating the houses to town centre sites.

#### **4.7 Manthorpe Development**

The Manthorpe development is the third potential site for an Urban Extension. Development on this site is not dependent upon any significant new infrastructure provision.

In 2014, when all the housing development is allocated to the Manthorpe Urban Extension (scenario 4c), the AM peak results indicate that the overall road network performance in Grantham will be the worst of all the scenarios. However, the overall road network performance improves in the PM peak compared to locating all the development in Poplar Farm (scenarios 2 and 4b).

In 2029, for a forecast scenario where the road infrastructure provision in Grantham is the same (scenarios 6a and 8a), the AM peak results indicate that the overall road network performance in Grantham is better if the Urban Extension is located in the Poplar Farm development, rather than at Manthorpe. Similarly, the overall road network performance in Grantham is better if the additional housing is located within the general town centre area, rather than at Manthorpe. The PM peak results show little difference between the options in terms of overall road network performance.

Appendix C presents the differences in traffic volumes in the Manthorpe area when comparing scenarios with and without housing allocated to Manthorpe.

The modelling results suggest that the new roundabout near the junction of the A607 with Belton Lane which will provide access to the Manthorpe development from the A607 will operate within capacity in both the AM and PM peak hours. This is based on the design of the junction proposed by the consultants working on behalf of the developers.

#### **4.8 Hampton Brook Relief Road**

The Hampton Brook Relief Road (see Figure 2a) is included in all forecast scenarios. The modelling results suggest that in 2014 the two-way volume will be in the region of 1100 - 1550 vehicles per hour in the AM peak and 900 – 1250 per hour in the PM peak. In 2029 this will increase to 1400 – 2200 vehicles in the AM peak and 1450 – 1650 in the PM peak hour.

This infrastructure improvement combined with the closure of the Little Ponton A1 junction means that the route between the A52 and A1 via Whalebone lane, through Little Ponton to the B1174 Spittlegate Level and the Hampton Brook Relief Road may become attractive. The provision of the Southern Relief Road will provide a more direct route between the A52 and the A1. However, when the Southern Relief Road is not constructed, the potential two-way traffic volume using this route could be in the region of 150 vehicles in the AM and PM peak hours in 2014, increasing to 200 – 400 vehicles in 2029. The scenario where this route is likely to be most used is when housing is allocated to the Southern Quadrant but the Southern Relief Road is not provided (scenarios 3c and 6c). It may be necessary to consider if this level of traffic is acceptable or if traffic management measures may be required. Limiting the traffic using this route would have the effect of increasing traffic volumes on the A52 Somerby Hill.

**5.1 Summary**

Jacobs were commissioned by SKDC in June 2009 to produce forecasts of traffic volumes for Grantham to support and inform South Kesteven’s LDF submission. An LCC transport model provides the basis for forecasting future traffic volumes in Grantham. The model is used to assess the impact of new transportation infrastructure, housing and employment development in the town.

SKDC is in the process of developing its LDF to replace the 1995 South Kesteven Local Plan. The Core Strategy January 2009 sets out the strategic plan for South Kesteven which concentrates over half of the housing allocation to Grantham, including those allocated as part of Grantham gaining Growth Point status. In total, 8,568 houses have been proposed for development over the period 2001 – 2026.

The transport model is used to assess road network performance in Grantham for various development scenarios and includes the assessment of the Urban Extensions and associated road infrastructure. The various development scenarios have been assessed in terms of total road network performance, changes in the volume of traffic and the level of congestion that is likely at a number of key junctions on the strategic road network.

**5.2 Conclusions**

Grantham is forecast to experience traffic growth in the future as a result of a significant expansion in housing and employment related development and general background traffic growth related to socio-economic factors. It is forecast that the level of traffic will increase by around 25% by 2014, and 50% by 2029. A number of junctions in Grantham are already operating close to or over capacity and the significant growth in traffic volumes will present challenges in terms of managing traffic flow.

A range of traffic scenarios have been investigated using the Grantham transport model. The traffic assessments reveal the likely total travel times and delays in the town. Of the scenarios considered in this report, the best option to minimise the increase in road network delay is to locate development (4,000 houses) in the Southern Quadrant Urban Extension with the provision of the associated Southern Relief Road infrastructure. In this scenario (6a), the remainder of the housing allocation (1,868 houses) would be located in the Poplar Farm development, with the provision of the Pennine Way Link Road.

The Southern Relief Road and Pennine Way Link Road open up key strategic routes within Grantham which enables drivers to take more direct journeys along the road network. The Southern Relief Road allows traffic to travel directly between the A52 to the south-east of the town towards the A1 in the south-west, avoiding the route via Somerby Hill and Springfield Road. The Pennine Way Link provides the opportunity to travel directly from the A52 Barrowby Road to the B1174 Gonerby Road which allows traffic to avoid travelling towards central Grantham.

The assessment indicates the use of the Manthorpe site to accommodate additional housing does not perform as well in traffic terms, particularly in the AM peak. This is perhaps as a result of the peripheral nature of the site and that no new road

infrastructure is provided as part of the development, other than that required to access the site.

The potential for increasing the housing provision by up to 2000 dwellings in the town centre is considered. The assessment shows that the road network performance in Grantham is better in the AM peak if houses are allocated in the town centre sites rather than at Manthorpe. Also, allocating the housing to the Poplar Farm Urban Extension is preferable in traffic terms to allocating the additional housing in the town centre sites. However, the allocation of houses in the town centre would provide the best opportunity for the implementation of sustainable travel strategies, with closer proximity to Grantham railway and bus stations.

### **5.3 Recommendations**

The information presented in this report provides a strategic overview of the likely traffic conditions in Grantham in the future. This information will help to guide and inform SKDC's emerging LDF. With the selection of a preferred option, the transport model can be interrogated to provide more detail of the impact of the traffic growth upon the local road network.

Following the selection of a preferred development scenario, further detailed phases of study are recommended and these may include some or all of the following:

- *Detailed junction modelling in order to develop a traffic impact mitigation strategy for the preferred option, which may include the study of junction capacity improvement options. The VISSIM micro-simulation model of the town centre developed as part of the Grantham Transport Study could be used as a base for the assessment.*
- *Quantitative assessment of sustainable transport options developed during the Grantham Transport Study to assess their potential to manage the growth in traffic volumes and support local, regional and national transport objectives, including the transport goals set out in the DfT document *Delivering a Sustainable Transport System* November 2008.*



**Appendix A Traffic Forecasting Assumptions Report**



## **Grantham Traffic Modelling**





## **Traffic Forecasting Assumptions Report**





**Lincolnshire County Council  
South Kesteven District Council**





**June 2009**

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### 1.1 Purpose of Report

Jacobs have been commissioned to produce forecasts of traffic flows for Grantham to support and inform the assessment of the Grantham Southern Relief Road and the South Kesteven Local Development Framework (LDF) submission. The commissions include the requirement to model a number of different traffic scenarios which are based on different assumptions regarding the location of new land use and road infrastructure development.

The purpose of this report is to detail the trip forecasting methodology and development assumptions used to produce the forecasts of traffic volumes in Grantham.

### 1.2 Overview

The Grantham SATURN model was originally developed jointly by Lincolnshire County Council and JMP. The model was updated in 2000 and most recently by Jacobs to establish a 2006 base traffic model for the purposes of the Grantham Transport Study.

After a review of the relevant regional and local planning documents a number of development scenarios have been identified for the forecast years of 2014 and 2029. These scenarios correspond to the opening and design years of the Grantham Southern Relief Road. The design year is opening year + 15 years. The development scenarios are described in **Section 2**.

Details of the traffic forecasting methodology are provided in **Section 3**. TEMPRO provides the basis of the growth factors to apply to the 2006 Base matrix to produce the 2014 and 2029 future year matrices. TEMPRO is used to provide factors of the growth in background traffic and additional development generation across urban areas. However, the geographical zones within TEMPRO are large and it is therefore considered to be inappropriate to assess accurately the impact on the local road network of growth from specific committed developments.

This report describes the future housing and employment forecasts, along with details of how they were applied with TEMPRO to obtain growth factors and how they are applied to produce future year matrices.

The technique used to add specific committed development trips to the network is given. This includes details of trip generation, trip distribution and network loading point selection.

Finally, **Section 4** lists committed highway improvement schemes in Grantham. These schemes will be included as part of the 'do-minimum' road network and will be used as a base for the future year traffic assignments.

**2.1 South Kesteven District Council Local Development Framework**

South Kesteven District Council is in the process of developing its Local Development Framework to replace the 1995 South Kesteven Local Plan.

The Core Strategy January 2009 sets out the strategic plan for South Kesteven. The document describes how the district’s housing allocation of 16,800 dwellings, to be delivered in the period 2001-2026, will be distributed throughout the district. The housing allocation figures are consistent with those presented in the East Midlands Regional Plan 2009.

The Core Strategy concentrates over half of the housing allocation to Grantham. These 8,568 proposed houses include the additional housing allocated to Grantham as a result of its Growth Point status (see Section 2.2).

**2.2 Grantham Growth Point Status**

Grantham was designated as a New Growth Point in 2007 and is required to deliver increased sustainable growth by identifying key development sites in and around the town for housing, commercial, employment and retail development.

Of the 8,568 proposed houses in the Core Strategy, 1,567 had been built by 2008; therefore an annual build rate of 389 is required for the remainder of the plan period. According to the Core Strategy a further 1,133 houses are committed. Although it is thought that there is capacity in the town centre for a further 2,000 homes, to meet the housing allocation for Grantham, Urban Extensions will be required to provide at least 3,868 houses.

The Core Strategy identifies two Urban Extensions for Grantham. These are Poplar Farm to the north-west and the Southern Quadrant to the south-east. It is anticipated that the Urban Extensions could yield up to 7,500 houses. An alternative site adjacent to the Manthorpe Estate was considered in the preferred options version of the Core Strategy, should this site be allocated it could yield an additional 1,530 new dwellings.

**2.3 Development Scenarios**

The 2006 Grantham SATURN model is to be used as a base from which to test future developments. All future scenario matrices are to be growthed from the 2006 base trip matrices.

The future years of 2014 and 2029 correspond to the opening and design year for the Southern Relief Road. Table 2-A presents the future year scenarios (AM and PM peaks) to be modelled, and lists the infrastructure provision and allocation of housing for each scenario. In both future years the total allocation of housing is the same for all development scenarios.

According to the annual build rate required for the remainder of the plan period, 2,334 houses will have been built by 2014. Assuming all the currently committed developments will have been completed by this point, a further 1,201 houses are required. As the committed developments are in the town centre, in the Reference

Case scenario it is assumed the additional houses are provided by the Poplar Farm development. An alternative scenario assumes all the additional housing is allocated to the Manthorpe development.

As 2014 is the opening year for the Southern Quadrant development it is assumed only 500 houses will have been completed. Therefore the remaining 701 required are either allocated to the town centre or Poplar Farm development depending on the scenario.

In all the 2029 scenarios the total housing allocation for Grantham of 8,568 houses is provided; of these 2,700 have either been built or are committed, and the remaining 5,868 houses are allocated to specific developments depending on the scenario under consideration.



Scenario		Road Infrastructure			Housing Development Allocations*					
		Committed Highway Improvements	Southern Relief Road	Pennine Way	Committed Development	Southern Quadrant (Capacity 4000)	Poplar Farm (Capacity 3500)	Manthorpe (Capacity 1530)	Town Centre (Capacity 2000)	
2006 Base	1									
2014 Reference Case	2	✓		✓	✓		1201			+1201 Dwellings
2014 Southern Quadrant	3a	✓	✓	✓	✓	500	701			
	3b	✓	✓		✓	500			701	
	3c	✓		✓	✓	500	701			
2014 No Pennine Way	4a	✓	✓		✓	500	701			
	4b	✓			✓		1201			
	4c	✓			✓			1201		
2029 Reference Case	5	✓		✓	✓		3500	368	2000	+5868 Dwellings
2029 Southern Quadrant	6a	✓	✓	✓	✓	4000	1868			
	6b	✓	✓		✓	4000			1868	
	6c	✓		✓	✓	4000	1868			
2029 No Pennine Way	7a	✓	✓		✓	4000	1868			
	7b	✓			✓		3500	368	2000	
2029 Southern Quadrant + Manthorpe	8a	✓	✓	✓	✓	4000	338	1530		
	8b	✓	✓		✓	4000		1530	338	

**Table 2-A Forecast Development Scenarios**

\* no. of dwelling

The 2014 and 2029 base matrices will be derived by applying growth factors to the 2006 base model and adding trips from the committed developments, which have been excluded from the TEMPRO growth, at specific loading points on the network. Trips generated from the additional developments required in the Reference Case scenario will then also be added to create the Reference Case matrices.

Modelling will be carried out for AM (8:00 – 9:00) and PM (17:00 – 18:00) time periods. The 2014 and 2029 Reference Case scenarios will then be used to test the impact of the Southern Relief Road and the various development scenarios. This provides a 'worst case' assessment as the impact of mode shift or peak spreading is not considered.

In summary, the following processes create the 2014 and 2029 traffic forecast scenarios:

- *The total additional residential and employment development assumed within TEMPRO for Grantham is reviewed*
- *Some committed developments are removed from the total residential and employment development assumed in TEMPRO (see Section 3)*
- *The resulting growth factors are applied to the 2006 Base matrix*
- *Trip generation and distribution is performed for the committed and additional developments required for each development scenario, and these trips are added to the base matrix to provide the future year Reference Case and development scenarios.*

## **2.4 Sensitivity Testing**

A review of current guidance in WebTAG suggests sensitivity testing should be carried out to reflect the uncertainty surrounding background trends affecting highway models such as future GDP growth and fuel costs. As specified in the guidance, a range of +/- 7.1% will be applied to the Reference Case matrix for 2014 and +/- 12.0% will be applied to 2029 Reference Case matrix.

The DfT have recently released a new TEMPRO dataset version 6.0. However, employment forecasts resulting from the updated dataset are reported to differ significantly from that in version 5.4. Current DfT guidance is to continue using version 5.4 until 31st March 2010. However, to demonstrate the scheme is robust to alternative assumptions, DfT recommends conducting a sensitivity test using the version 6.0 dataset.

The following list summarises the sensitivity tests that will be performed as part of the approach to modelling the Southern Relief Road:

- *Core Scenario*
- *Low Growth (-7.1% for 2014 and -12.0% for 2029)*
- *High Growth (+7.1% for 2014 and +12.0% for 2029)*
- *TEMPRO Dataset Version 6.0 Growth*

**3.1 TEMPRO**

TEMPRO is a software package created by the Department for Transport (DfT) which provides forecast data on trips for transport planning purposes. The current version of the software (Version 6.1) provides multi-modal trip data for the years 1991 to 2041. Outputs are given in terms of growth factors between the selected base and forecast years or as raw trip end data.

The base travel data used within TEMPRO is the 2001 census output. A combination of forecast data and trends is used to predict population, households and employment changes from the 2001 census base data in individual spatial units. The smallest spatial unit or zone in TEMPRO is defined as a National Trip End Model (NTEM) zone. There are 2,496 NTEM zones in Great Britain and these can be aggregated to Local Authority level.

This version of TEMPRO (Dataset version 5.4) includes policy-based forecasts of dwellings in future years. This policy-based data is given at Local Authority level and is combined with the trend-based population data to estimate the number of households in future years. This version of TEMPRO (Dataset version 5.4) gives a greater weighting to policy based forecasts than the trend based data when estimating household levels.

A key feature of TEMPRO is that it allows the user to view the planning assumptions that have been used in forecasting, and significantly, it allows the user to enter alternative planning data. Alternative levels of households and numbers of jobs can be entered for both base and future and then used to generate alternative growth factors. The number of households will predominantly affect the trip productions and the number of jobs will predominantly affect the trip attractions.

As identified previously, whilst the TEMPRO software provides factors of the background growth in traffic and additional development generation for urban areas, the zones within TEMPRO are large, hence this analysis is coarse (for example, there is one zone for the whole of the Grantham administrative area). As such, the application of an overall growth factor is considered to be inappropriate to assess accurately the impact of individual committed developments and specifically the proposed developments for Grantham associated with the Southern Relief Road.

Therefore, the forecast modelling methodology adopted in this case requires that the TEMPRO planning data for households and jobs be altered for the future years (2014 and 2029) to reflect accurately the level of trips in the 2014 and 2029 matrices. This necessitates that the development trips from the committed developments be identified and removed from the general TEMPRO model growth factors. This process is a precursor to ensuring that trips associated with each committed development are localised on the network in the appropriate area as opposed to being distributed over the entire Grantham area.

**3.2 Households**

The committed developments in Grantham are shown in Table 3-A. This excludes dwellings that were constructed by 2006, however, many of them have now been built since 2006. These are taken from the *Grantham Transport Study Technical*

*Note 7: Traffic Modelling (July 2007)* and subsequent advice from Lincolnshire County Council and South Kesteven District Council. For the future case models the trips produced by these developments will be added to specific points on the network. In order to do this the TEMPRO planning data will be adjusted to remove the households included from these developments to ensure that no double-counting occurs.

The planning data for dwellings used in the latest version of TEMPRO was taken from the draft East Midlands Regional Spatial Strategy (RSS). This is stated in the TEMPRO Planning Data Version 5.4 Guidance Note published in February 2008.

Committed Development	Number of Households built	
	2014	2029
Autumn Park, Dysart Road	107	180
D Wilson, North of Springfield	89	89
Derwent Road	25	25
Londonthorpe Lane	150	150
Springfield Road	480	600
Impress Site, Springfield Road	140	170
Station Road	100	100
Kwiksave Site	50	50
Beacons Road	43	43
St Vincent Lodge	0	72
Rycroft St	38	38
Bairds Malt	50	50
<b>Total</b>	<b>1272</b>	<b>1567</b>

**Table 3-A** Number of proposed households for committed developments

It should be noted that the TEMPRO planning data does not contain explicit assumptions that particular developments do or do not go ahead. From 2006 - 2014 and 2006 - 2029 the TEMPRO growth is based on an increase of 1,195 and 3,793 households. However, in all development scenarios for both forecast years the committed developments and the additional housing allocated to alternative developments exceed the increases in households in TEMPRO. Therefore, it is reasonable to assume that there will be no further development in Grantham over this period additional to that specifically accounted for in the development scenarios, and all households can be removed from TEMPRO for both 2014 and 2029.

The revised number of households to be used in TEMPRO for 2014 and 2029 is presented in Table 3-B.

Year	TEMPRO Households	Households to remove from TEMPRO	Adjusted Households
2006	15274	-	-
2014	16469	1195	15274
2029	19067	3793	15274

**Table 3-B** Revised number of households for 2014 and 2029 in Grantham

**3.3 Jobs**

The number of known committed employment developments is low relative to the number of known committed housing developments. The South Kesteven District Submission Core Strategy allocates up to 90 hectares in Grantham for employment development and an additional 70 hectares which could be bought forward towards the end of the plan period if there is sufficient demand.

The employment developments allocated in the South Kesteven District Housing and Economic DPD Preferred Option 2006, and the known Hampton Brook development, are presented in Table 3-C. At this stage full details of the specific type of development are not known for each site. To estimate the potential number of jobs each site is likely to yield, the TRICS database has been used to obtain typical employment number for similar types and sizes of development. For those sites that may potentially have a number of development types the average has been used. Details of the TRICS output are presented in Appendix A.

Allocated Development	Potential Types	Number of Jobs	
		2014	2019
South of Barrowby Road, east of A1	Business	0	1444
North of Harlaxton Road, west of A1	Business, General Industry, Storage and Distribution	0	2105
Old Quarry, Spittlegate Level	Business, General Industry, Storage and Distribution	0	917
Hampton Brook	Storage and Distribution	2192	2192
<b>Total</b>		<b>2192</b>	<b>6658</b>

**Table 3-C Potential number of jobs associated with allocated employment developments**

From 2006 – 2014 and 2006 – 2029 the TEMPRO growth is based on an increase of 2,002 and 5,168 jobs in Grantham respectively. However, it is thought that the employment developments identified in Table 3-C are additional to those in TEMPRO and therefore the numbers of jobs in TEMPRO will not be adjusted.

The South Kesteven District Council Employment Land Study 2005 noted that Grantham lacks deliverable employment land in accessible locations and as a result employment opportunities have been lost to competing towns. This will be considered when determining the distribution of trips from the proposed new housing developments. If the level of employment opportunities does not increase at the same rate as the growth in housing then there may be an increase in those commuting out of Grantham.

**3.4 Growth Factors**

Having established the number of households and jobs associated with the committed developments contained in TEMPRO, the growth factors for the model matrices are calculated to reflect background growth alone.

The adjusted planning data for households in 2014 and 2029 gives the growth factors from TEMPRO, shown in Table 3-D.

Year	AM Car driver		PM Car driver	
	Production	Attraction	Production	Attraction
	2006 – 2014	1.0278	1.0476	1.0525
2006 – 2029	0.9912	1.0561	1.0802	1.0981

**Table 3-D Growth factors from TEMPRO for 2014 and 2029 for Grantham using revised households planning data**

In addition to the internal Grantham zones, the model area also has 10 external zones. The growth factors given in Table 3-D will not be applied to trips produced by or attracted to these zones. These trips would naturally be longer distance trips less influenced by the proposed developments in Grantham.

An alternative growth factor obtained from TEMPRO for Lincolnshire County will be applied to these external trip ends. There will be no adjustment made to planning data for these external areas. These growth factors are given in Table 3-E.

Year	AM Car driver		PM Car driver	
	Production	Attraction	Production	Attraction
	2006 – 2014	1.1275	1.1197	1.1276
2006 – 2029	1.2990	1.2819	1.3168	1.2904

**Table 3-E Growth factors from TEMPRO for 2014 and 2029 for Lincolnshire for external trip ends**

The TEMPRO factors require further adjustment to take account of fuel price and income forecasts, the adjustment factors required for 2014 and 2029 are presented in Table 3-F.

Year	Income Adjustment Factor	Fuel Adjustment Factor	Overall Adjustment
2006 – 2014	1.022	1.078	1.102
2006 – 2029	1.070	1.091	1.167

**Table 3-F Fuel price and income forecast adjustments 2014 and 2029**

### 3.5 Committed Housing Development Trips

The trips generated from the committed developments have been calculated as part of the *Grantham Transport Study Technical Note 7: Traffic Modelling (July 2007)* and have been factored according to the extent to which they will have been completed for the future years of 2014 and 2029, as shown in Tables 3-G and 3-H along with the corresponding model zone for each development. For the committed developments listed by Lincolnshire County Council, trip rates have been obtained from the TRICS database. The TRICS output is presented in Appendix A.

Development	AM		PM	
	Extra Traffic		Extra Traffic	
	Prod	Attr	Prod	Attr
Autumn Park, Dysart Rd	83	22	32	65
D Wilson N. of Springfield	48	12	21	43
Derwent Road	14	4	6	12
Londonthorpe Lane	81	21	36	72

Springfield Road	182	46	79	174
Impress Springfield Rd	76	20	35	68
Station Road	54	14	24	48
Kwiksave Site	27	7	12	23
Beacons Road	16	7	9	15
St Vincent Lodge	0	0	0	0
Rycroft St	14	6	8	13
Bairds Malt	18	8	11	17

**Table 3-G Trip generation for committed developments in 2014**

Development	AM		PM	
	Extra Traffic		Extra Traffic	
	Prod	Attr	Prod	Attr
Autumn Park, Dysart Rd	140	37	54	109
D Wilson N. of Springfield	48	12	21	43
Derwent Road	14	4	6	12
Londonthorpe Lane	81	21	36	72
Springfield Road	227	57	99	218
Impress Springfield Rd	92	24	41	82
Station Road	54	14	24	48
Kwiksave Site	27	7	12	23
Beacons Road	16	7	9	15
St Vincent Lodge	26	12	16	25
Rycroft St	14	6	8	13
Bairds Malt	18	8	11	17

**Table 3-H Trip generation for committed developments in 2029**

For each development, the generated trips are distributed according to the current distribution for that zone. Where zones are specific to a new development, the trip distribution from an appropriate adjacent zone is used.

The trip generation and distribution data for the committed developments are added to the 2014 and 2029 matrices produced from applying the TEMPRO growth factors to the 2006 matrix, to give the 2014 and 2029 base matrices.

### 3.6 Additional Housing Development Trips

Trip rates were obtained from the TRICS database for the additional developments and are presented in Table 3-I. The TRICS output is presented in Appendix A.

Development	Scenario	Number of houses	AM		PM	
			Extra Traffic		Extra Traffic	
			Prod	Attr	Prod	Attr
Southern Quadrant	3a, 3b, 4a	500	180	69	99	139
	6a, 6b, 6c, 7a, 8a, 8b	4000	1824	468	780	1524
Poplar Farm	8a	338	122	46	67	94
	3a, 4a	701	320	82	137	267
	2, 4b	1201	548	141	234	458

	6a, 6c, 7a	1868	852	218	364	712
	5, 7b	3500	1596	410	683	1334
Manthorpe	5, 7b	368	133	50	73	103
	4c	1201	548	141	234	458
	8a, 8b	1530	698	179	298	583
Town Centre	8b	338	122	46	67	94
	3b	701	320	82	137	267
	6b	1868	852	218	364	712
	5, 7b	2000	912	234	390	762

**Table 3-I Trip generation for the additional housing developments**

The trips generated by the Southern Quadrant, Poplar Farm and Manthorpe developments will be distributed according to the trip generation from adjacent zones whilst taking into account the potential imbalance between growth in housing and employment development within Grantham town centre, to ensure that a disproportionate amount of trips are not allocated to the town centre.

The trips generated by the additional town centre development will be added to existing residential zones within the town centre.

The trips generated by the additional development will be added to the 2014 and 2029 base matrices to provide the 2014 and 2029 development scenario matrices.

### 3.7 Employment Development Trips

The TRICS database has been used to obtain typical trip rates for similar types and sizes of development. For those sites that may potentially have a number of development types the average has been used. The trips for the Hampton Brook development are those used in the Transport Assessment for the development by White Young Green. The trip rates used are presented in Table 3-J and 3-K.

Development	AM		PM	
	Prod	Attr	Prod	Attr
South of Barrowby Road, east of A1	0	0	0	0
North of Harlaxton Road, west of A1	0	0	0	0
Old Quarry, Spittlegate Level	0	0	0	0
Hampton Brook	91	171	177	129

**Table 3-J Trip generation for the employment developments in 2014**

Development	AM		PM	
	Prod	Attr	Prod	Attr
South of Barrowby Road, east of A1	64	541	405	45
North of Harlaxton Road, west of A1	122	561	445	93
Old Quarry, Spittlegate Level	53	244	194	41
Hampton Brook	91	171	177	129

**Table 3-K Trip generation for the employment developments in 2029**



**3.8 Final Forecast Matrices**

Table 3-L presents the total trips and percentage growth from the 2006 base for each scenario for the final forecast matrices. The figures have been rounded to the nearest 50 trips. It should be noted that the original 2006 base model did not include through trips on the A1. However, through trips on the A1 based on data obtained from the Highways Agency database will also be added to the model for each of the scenarios and are included in the trip totals presented in Table 3-L.

Scenario		AM		PM	
		Total Trips	% Growth	Total Trips	% Growth
2006 Base	1	7450		8050	
2014 Forecast	2,3a,3b,3c,4a,4b, 4c	9300	24.8%	10050	24.8%
2029 Forecast	5,6a,6b,6c,7a,7b,8a,8b	11350	52.3%	12350	53.4%

**Table 3-L Total trips for all scenarios**

**4 Highway Schemes**

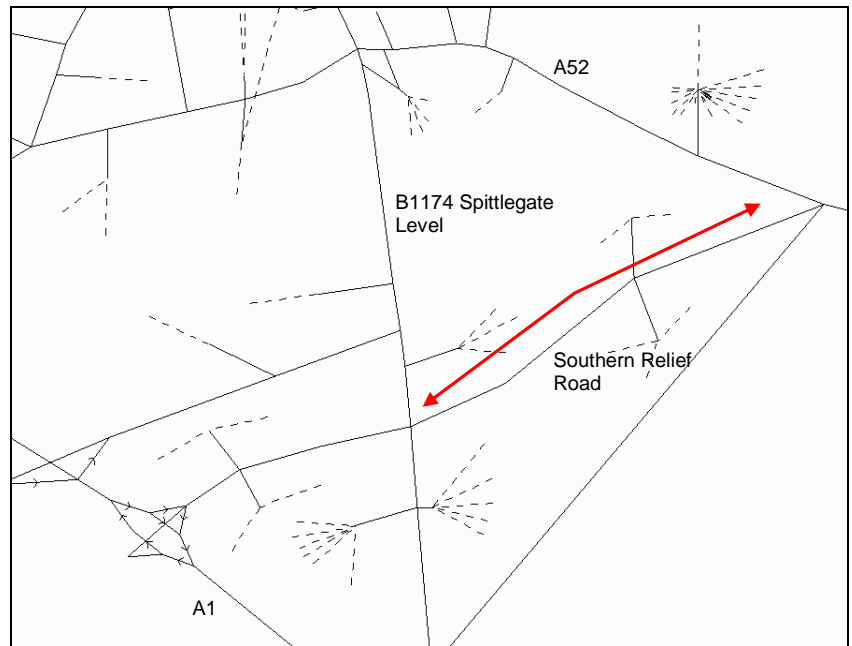
**4.1 Introduction**

A number of highway schemes were modelled as part of the original Grantham Transport Study 2006 which assessed traffic in 2016. Committed schemes will be included in all scenarios, in both 2014 and 2029. Pennine Way and the Southern Relief Road will only be included in the appropriate scenarios as shown in Table 2-A.

As a result the future year models require several changes to be incorporated into the network from the 2006 model used for calibration. The Southern Relief Road is shown in section 4.2, Pennine Way in section 4.3 and the committed schemes are shown in sections 4.4 to 4.7. Potential schemes listed in section 4.8 are not included in the model as insufficient data is available at this time, and they are not expected to have any significant impact on traffic volume and route choice.

**4.2 Southern Relief Road**

The Southern Relief Road was tested as part of the Grantham Transport Study 2006 and is intended to relieve the town centre of through traffic, especially the existing high proportion of HGVs that pass through Grantham. The location of the Southern Relief Road is shown in Figure 4-A. A number of different alignments and designs will be tested.

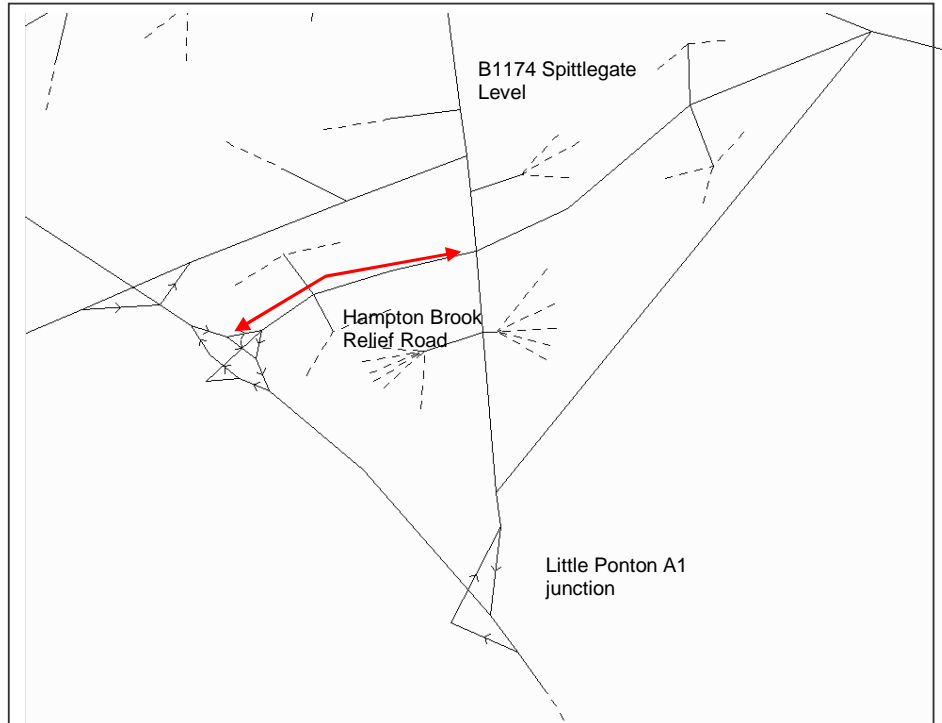


**Figure 4-A Southern Relief Road**

**4.3 Pennine Way Link Road**

Closely associated with the development of Poplar Farm is a proposed link road, commonly known as the Pennine Way link, running north to south through the site and connecting A52 Barrowby Road with the B1174 Gonerby Road. A new bridge

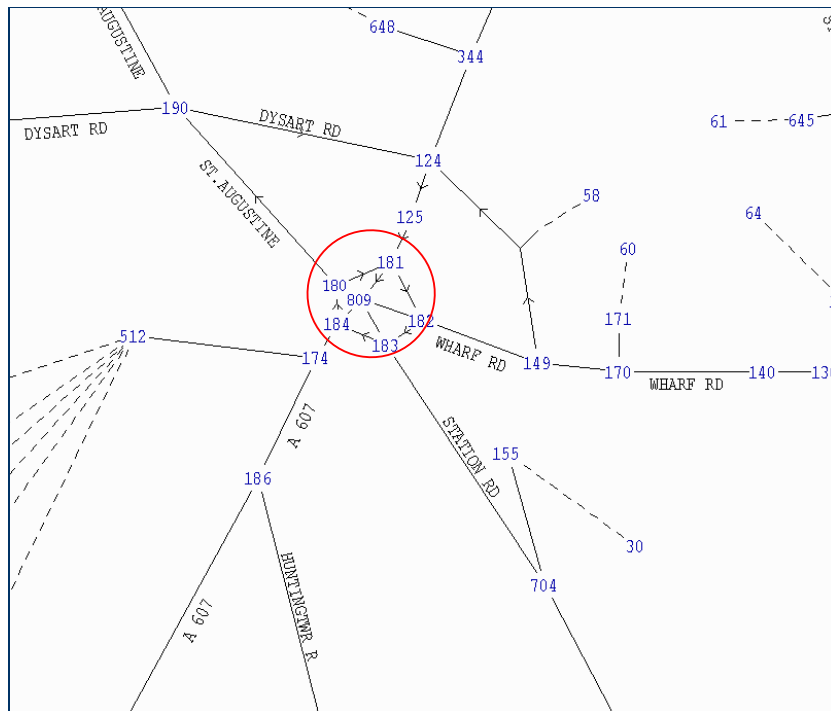




**Figure 4-C Hampton Brook Relief Road**

#### 4.5 Harlaxton Road/Wharf Road (Complete)

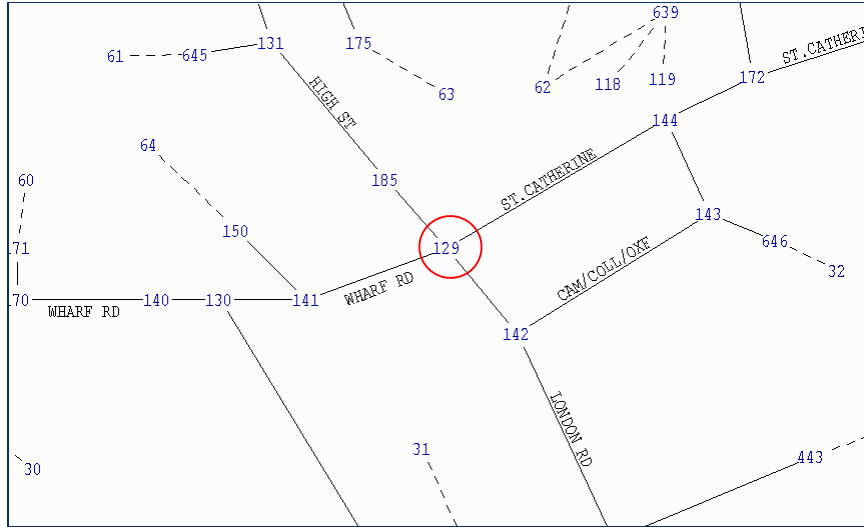
This particular junction has been signalised. An extract from the model showing the location of the scheme is shown in Figure 4-D below.



**Figure 4-D Harlaxton Road/Wharf Road Signalisation**

#### 4.6 Wharf Road/London Road junction (Complete)

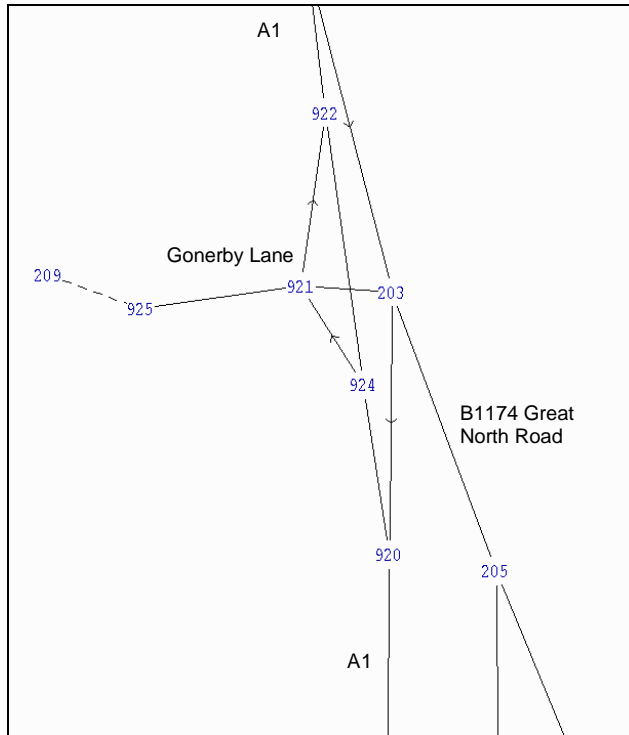
The scheme alters the layout and staging at the Wharf Road/London Road junction. A screenshot of the location is shown in Figure 4-E.



**Figure 4-E Wharf Road/London Road junction**

#### 4.7 A1 – Gonerby Moor Junction Improvement (Complete)

The existing roundabout has been replaced by a grade-separated junction. The location of the new junction within the model is shown in Figure 4-F.



**Figure 4-F Gonerby junction improvement scheme**

#### 4.8 Other Committed Schemes

There are several other schemes, listed in Table 4-A, which could potentially be included in the model. However, the details of these schemes are currently unavailable and they are not expected to have a significant impact upon traffic volume and route choice. These schemes are of relatively small size and are not incorporated in the future year models at this stage.

Scheme	Status
Springfield Rd/Trent Rd/Harlaxton Rd	<i>Currently on Hold</i>
A1(T) Southbound/A607 Slip Road	<i>Currently on Hold</i>
Butchers Row Pedestrianisation Scheme	<i>August 2009</i>
Harlaxton Road/A607 Maltings Building Ghost Island/Right Turn	<i>Currently on Hold</i>
Springfield Road/Gainsborough Corner Signals and Extra lane	<i>January 2011</i>
St Peters Hill/High Street Pedestrian/ Signal Improvements	<i>August 2009</i>
Vine St/Market Place/High St Signal Improvements	<i>Provisional August 2010</i>

**Table 4-A Other committed schemes**

**Appendix A TRICS Output**



TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT  
Category : B - BUSINESS PARK  
VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	OX OXFORDSHIRE	1 days
04	EAST ANGLIA	
	CA CAMBRIDGESHIRE	1 days
06	WEST MIDLANDS	
	WM WEST MIDLANDS	1 days
09	NORTH	
	TW TYNE & WEAR	1 days

Main parameter selection:

Parameter: Gross floor area  
Range: 30042 to 118448 (units: sqm)

Date Range: 01/01/00 to 11/12/08

Selected survey days:

Monday	1 days
Tuesday	1 days
Thursday	1 days
Friday	1 days

Selected survey types:

Manual count	4 days
Directional ATC Count	0 days

Selected Locations:

Suburban Area (PPS6 Out of Centre)	1
Edge of Town	3

Selected Location Sub Categories:

Industrial Zone	3
Commercial Zone	1

TRIP RATE for Land Use 02 - EMPLOYMENT/B - BUSINESS PARK  
VEHICLES

Calculation factor: 100 sqm

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 00:30	0	0	0.000	0	0	0.000	0	0	0.000
00:30 - 01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00 - 01:30	0	0	0.000	0	0	0.000	0	0	0.000
01:30 - 02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00 - 02:30	0	0	0.000	0	0	0.000	0	0	0.000
02:30 - 03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00 - 03:30	0	0	0.000	0	0	0.000	0	0	0.000
03:30 - 04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00 - 04:30	0	0	0.000	0	0	0.000	0	0	0.000
04:30 - 05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00 - 05:30	0	0	0.000	0	0	0.000	0	0	0.000
05:30 - 06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00 - 06:30	0	0	0.000	0	0	0.000	0	0	0.000
06:30 - 07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00 - 07:30	4	55112	0.153	4	55112	0.029	4	55112	0.182
07:30 - 08:00	4	55112	0.388	4	55112	0.055	4	55112	0.443
08:00 - 08:30	4	55112	0.634	4	55112	0.075	4	55112	0.709
08:30 - 09:00	4	55112	0.654	4	55112	0.078	4	55112	0.732
09:00 - 09:30	4	55112	0.507	4	55112	0.088	4	55112	0.595
09:30 - 10:00	4	55112	0.331	4	55112	0.103	4	55112	0.434
10:00 - 10:30	4	55112	0.159	4	55112	0.084	4	55112	0.243
10:30 - 11:00	4	55112	0.128	4	55112	0.092	4	55112	0.220
11:00 - 11:30	4	55112	0.124	4	55112	0.099	4	55112	0.223
11:30 - 12:00	4	55112	0.097	4	55112	0.118	4	55112	0.215
12:00 - 12:30	4	55112	0.131	4	55112	0.264	4	55112	0.395
12:30 - 13:00	4	55112	0.211	4	55112	0.248	4	55112	0.459
13:00 - 13:30	4	55112	0.225	4	55112	0.236	4	55112	0.461
13:30 - 14:00	4	55112	0.235	4	55112	0.154	4	55112	0.389
14:00 - 14:30	4	55112	0.139	4	55112	0.159	4	55112	0.298
14:30 - 15:00	4	55112	0.132	4	55112	0.145	4	55112	0.277
15:00 - 15:30	4	55112	0.098	4	55112	0.165	4	55112	0.263
15:30 - 16:00	4	55112	0.078	4	55112	0.243	4	55112	0.321
16:00 - 16:30	4	55112	0.068	4	55112	0.310	4	55112	0.378
16:30 - 17:00	4	55112	0.066	4	55112	0.437	4	55112	0.503
17:00 - 17:30	4	55112	0.054	4	55112	0.496	4	55112	0.550
17:30 - 18:00	4	55112	0.053	4	55112	0.469	4	55112	0.522
18:00 - 18:30	4	55112	0.036	4	55112	0.293	4	55112	0.329
18:30 - 19:00	4	55112	0.029	4	55112	0.165	4	55112	0.194
19:00 - 19:30	0	0	0.000	0	0	0.000	0	0	0.000
19:30 - 20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00 - 20:30	0	0	0.000	0	0	0.000	0	0	0.000
20:30 - 21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00 - 21:30	0	0	0.000	0	0	0.000	0	0	0.000
21:30 - 22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00 - 22:30	0	0	0.000	0	0	0.000	0	0	0.000
22:30 - 23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00 - 23:30	0	0	0.000	0	0	0.000	0	0	0.000
23:30 - 24:00	0	0	0.000	0	0	0.000	0	0	0.000
Total Rates:			4.730			4.605			9.335

#### Parameter summary

Trip rate parameter range selected:	30042 - 118448 (units: sqm)
Survey date date range:	01/01/00 - 11/12/08
Number of weekdays (Monday-Friday):	4
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	NO
Surveys manually removed from selection:	2

## TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT  
 Category : D - INDUSTRIAL ESTATE  
 VEHICLES

Selected regions and areas:

04	EAST ANGLIA	
	NF NORFOLK	1 days
	SF SUFFOLK	1 days
05	EAST MIDLANDS	
	DS DERBYSHIRE	1 days
	NT NOTTINGHAMSHIRE	1 days
06	WEST MIDLANDS	
	ST STAFFORDSHIRE	1 days
07	YORKSHIRE & NORTH LINCOLNSHIRE	
	WY WEST YORKSHIRE	1 days
08	NORTH WEST	
	CH CHESHIRE	1 days
09	NORTH	
	TW TYNE & WEAR	1 days

## Main parameter selection:

Parameter: Gross floor area  
 Range: 20484 to 167416 (units: sqm)

Date Range: 01/01/00 to 13/05/08

Selected survey days:

Monday	1 days
Tuesday	2 days
Wednesday	1 days
Thursday	1 days
Friday	3 days

Selected survey types:

Manual count	8 days
Directional ATC Count	0 days

Selected Locations:

Suburban Area (PPS6 Out of Centre)	2
Edge of Town	6

Selected Location Sub Categories:

Industrial Zone	4
Built-Up Zone	1
No Sub Category	3

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE  
VEHICLES

Calculation factor: 100 sqm

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 00:30	0	0	0.000	0	0	0.000	0	0	0.000
00:30 - 01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00 - 01:30	0	0	0.000	0	0	0.000	0	0	0.000
01:30 - 02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00 - 02:30	0	0	0.000	0	0	0.000	0	0	0.000
02:30 - 03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00 - 03:30	0	0	0.000	0	0	0.000	0	0	0.000
03:30 - 04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00 - 04:30	0	0	0.000	0	0	0.000	0	0	0.000
04:30 - 05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00 - 05:30	0	0	0.000	0	0	0.000	0	0	0.000
05:30 - 06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00 - 06:30	0	0	0.000	0	0	0.000	0	0	0.000
06:30 - 07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00 - 07:30	8	47302	0.145	8	47302	0.059	8	47302	0.204
07:30 - 08:00	8	47302	0.210	8	47302	0.078	8	47302	0.288
08:00 - 08:30	8	47302	0.203	8	47302	0.087	8	47302	0.290
08:30 - 09:00	8	47302	0.206	8	47302	0.091	8	47302	0.297
09:00 - 09:30	8	47302	0.138	8	47302	0.096	8	47302	0.234
09:30 - 10:00	8	47302	0.107	8	47302	0.113	8	47302	0.220
10:00 - 10:30	8	47302	0.115	8	47302	0.112	8	47302	0.227
10:30 - 11:00	8	47302	0.106	8	47302	0.109	8	47302	0.215
11:00 - 11:30	8	47302	0.102	8	47302	0.110	8	47302	0.212
11:30 - 12:00	8	47302	0.116	8	47302	0.128	8	47302	0.244
12:00 - 12:30	8	47302	0.112	8	47302	0.140	8	47302	0.252
12:30 - 13:00	8	47302	0.121	8	47302	0.138	8	47302	0.259
13:00 - 13:30	8	47302	0.134	8	47302	0.146	8	47302	0.280
13:30 - 14:00	8	47302	0.138	8	47302	0.118	8	47302	0.256
14:00 - 14:30	8	47302	0.109	8	47302	0.128	8	47302	0.237
14:30 - 15:00	8	47302	0.101	8	47302	0.117	8	47302	0.218
15:00 - 15:30	8	47302	0.101	8	47302	0.117	8	47302	0.218
15:30 - 16:00	8	47302	0.098	8	47302	0.145	8	47302	0.243
16:00 - 16:30	8	47302	0.095	8	47302	0.171	8	47302	0.266
16:30 - 17:00	8	47302	0.088	8	47302	0.196	8	47302	0.284
17:00 - 17:30	8	47302	0.065	8	47302	0.203	8	47302	0.268
17:30 - 18:00	8	47302	0.048	8	47302	0.147	8	47302	0.195
18:00 - 18:30	8	47302	0.044	8	47302	0.080	8	47302	0.124
18:30 - 19:00	8	47302	0.034	8	47302	0.052	8	47302	0.086
19:00 - 19:30	0	0	0.000	0	0	0.000	0	0	0.000
19:30 - 20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00 - 20:30	0	0	0.000	0	0	0.000	0	0	0.000
20:30 - 21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00 - 21:30	0	0	0.000	0	0	0.000	0	0	0.000
21:30 - 22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00 - 22:30	0	0	0.000	0	0	0.000	0	0	0.000
22:30 - 23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00 - 23:30	0	0	0.000	0	0	0.000	0	0	0.000
23:30 - 24:00	0	0	0.000	0	0	0.000	0	0	0.000
<b>Total Rates:</b>			2.736			2.881			5.617

#### Parameter summary

Trip rate parameter range selected:	20484 - 167416 (units: sqm)
Survey date date range:	01/01/00 - 13/05/08
Number of weekdays (Monday-Friday):	8
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	NO
Surveys manually removed from selection:	1

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT  
Category : F - WAREHOUSING (COMMERCIAL)  
VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	BU BUCKINGHAMSHIRE	1 days
	HF HERTFORDSHIRE	3 days
06	WEST MIDLANDS	
	WO WORCESTERSHIRE	1 days
09	NORTH	
	TV TEES VALLEY	2 days

Main parameter selection:

Parameter: Gross floor area  
Range: 15881 to 80066 (units: sqm)

Date Range: 01/01/00 to 07/10/08

Selected survey days:

Tuesday	1 days
Wednesday	1 days
Thursday	4 days
Friday	1 days

Selected survey types:

Manual count	7 days
Directional ATC Count	0 days

Selected Locations:

Suburban Area (PPS6 Out of Centre)	2
Edge of Town	5

Selected Location Sub Categories:

Industrial Zone	4
Commercial Zone	2
No Sub Category	1



TRIP RATE for Land Use 02 - EMPLOYMENT/F - WAREHOUSING (COMMERCIAL)

VEHICLES

Calculation factor: 100 sqm

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 00:30	0	0	0.000	0	0	0.000	0	0	0.000
00:30 - 01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00 - 01:30	0	0	0.000	0	0	0.000	0	0	0.000
01:30 - 02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00 - 02:30	0	0	0.000	0	0	0.000	0	0	0.000
02:30 - 03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00 - 03:30	0	0	0.000	0	0	0.000	0	0	0.000
03:30 - 04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00 - 04:30	0	0	0.000	0	0	0.000	0	0	0.000
04:30 - 05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00 - 05:30	0	0	0.000	0	0	0.000	0	0	0.000
05:30 - 06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00 - 06:30	1	30187	0.036	1	30187	0.086	1	30187	0.122
06:30 - 07:00	1	30187	0.056	1	30187	0.063	1	30187	0.119
07:00 - 07:30	7	48568	0.039	7	48568	0.044	7	48568	0.083
07:30 - 08:00	7	48568	0.069	7	48568	0.032	7	48568	0.101
08:00 - 08:30	7	48568	0.042	7	48568	0.030	7	48568	0.072
08:30 - 09:00	7	48568	0.053	7	48568	0.029	7	48568	0.082
09:00 - 09:30	7	48568	0.051	7	48568	0.032	7	48568	0.083
09:30 - 10:00	7	48568	0.057	7	48568	0.034	7	48568	0.091
10:00 - 10:30	7	48568	0.037	7	48568	0.037	7	48568	0.074
10:30 - 11:00	7	48568	0.034	7	48568	0.033	7	48568	0.067
11:00 - 11:30	7	48568	0.043	7	48568	0.032	7	48568	0.075
11:30 - 12:00	7	48568	0.044	7	48568	0.037	7	48568	0.081
12:00 - 12:30	7	48568	0.039	7	48568	0.048	7	48568	0.087
12:30 - 13:00	7	48568	0.036	7	48568	0.038	7	48568	0.074
13:00 - 13:30	7	48568	0.066	7	48568	0.054	7	48568	0.120
13:30 - 14:00	7	48568	0.132	7	48568	0.095	7	48568	0.227
14:00 - 14:30	7	48568	0.051	7	48568	0.102	7	48568	0.153
14:30 - 15:00	7	48568	0.059	7	48568	0.074	7	48568	0.133
15:00 - 15:30	7	48568	0.040	7	48568	0.061	7	48568	0.101
15:30 - 16:00	7	48568	0.049	7	48568	0.059	7	48568	0.108
16:00 - 16:30	7	48568	0.041	7	48568	0.064	7	48568	0.105
16:30 - 17:00	7	48568	0.035	7	48568	0.065	7	48568	0.100
17:00 - 17:30	7	48568	0.028	7	48568	0.054	7	48568	0.082
17:30 - 18:00	7	48568	0.050	7	48568	0.054	7	48568	0.104
18:00 - 18:30	6	51632	0.021	6	51632	0.045	6	51632	0.066
18:30 - 19:00	6	51632	0.018	6	51632	0.024	6	51632	0.042
19:00 - 19:30	0	0	0.000	0	0	0.000	0	0	0.000
19:30 - 20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00 - 20:30	0	0	0.000	0	0	0.000	0	0	0.000
20:30 - 21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00 - 21:30	0	0	0.000	0	0	0.000	0	0	0.000
21:30 - 22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00 - 22:30	0	0	0.000	0	0	0.000	0	0	0.000
22:30 - 23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00 - 23:30	0	0	0.000	0	0	0.000	0	0	0.000
23:30 - 24:00	0	0	0.000	0	0	0.000	0	0	0.000
Total Rates:			1.226			1.326			2.552

#### Parameter summary

Trip rate parameter range selected:	15881 - 80066 (units: sqm)
Survey date date range:	01/01/00 - 07/10/08
Number of weekdays (Monday-Friday):	7
Number of Saturdays:	0
Number of Sundays:	0
Optional parameters used in selection:	NO
Surveys manually removed from selection:	0

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL  
Category : A - HOUSES PRIVATELY OWNED  
VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	ES EAST SUSSEX	1 days
	SC SURREY	1 days
04	EAST ANGLIA	
	CA CAMBRIDGESHIRE	1 days
08	NORTH WEST	
	MS MERSEYSIDE	1 days

Main parameter selection:

Parameter: Number of dwellings  
Range: 254 to 585 (units: )

Date Range: 01/01/00 to 19/10/08

Selected survey days:

Tuesday	1 days
Thursday	3 days

Selected survey types:

Manual count	4 days
Directional ATC Count	0 days

Selected Locations:

Edge of Town Centre	1
Edge of Town	2
Neighbourhood Centre (PPS6 Local Centre)	1

Selected Location Sub Categories:

Residential Zone	4
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TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED  
 VEHICLES

Calculation factor: 1 DWELLS

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00 - 02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00 - 03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00 - 04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00 - 05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00 - 06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00 - 07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00 - 08:00	4	435	0.064	4	435	0.226	4	435	0.290
08:00 - 09:00	4	435	0.137	4	435	0.359	4	435	0.496
09:00 - 10:00	4	435	0.167	4	435	0.185	4	435	0.352
10:00 - 11:00	4	435	0.139	4	435	0.157	4	435	0.296
11:00 - 12:00	4	435	0.157	4	435	0.163	4	435	0.320
12:00 - 13:00	4	435	0.180	4	435	0.147	4	435	0.327
13:00 - 14:00	4	435	0.141	4	435	0.152	4	435	0.293
14:00 - 15:00	4	435	0.164	4	435	0.171	4	435	0.335
15:00 - 16:00	4	435	0.225	4	435	0.195	4	435	0.420
16:00 - 17:00	4	435	0.249	4	435	0.162	4	435	0.411
17:00 - 18:00	4	435	0.278	4	435	0.197	4	435	0.475
18:00 - 19:00	4	435	0.272	4	435	0.181	4	435	0.453
19:00 - 20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00 - 21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00 - 22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00 - 23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00 - 24:00	0	0	0.000	0	0	0.000	0	0	0.000
<b>Total Rates:</b>			<b>2.173</b>			<b>2.295</b>			<b>4.468</b>

Parameter summary

Trip rate parameter range selected: 254 - 585 (units: )  
 Survey date range: 01/01/00 - 19/10/08  
 Number of weekdays (Monday-Friday): 4  
 Number of Saturdays: 0  
 Number of Sundays: 0  
 Optional parameters used in selection: NO  
 Surveys manually removed from selection: 0

## TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL  
 Category : A - HOUSES PRIVATELY OWNED  
 VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	BD BEDFORDSHIRE	1 days
	HF HERTFORDSHIRE	1 days
	SC SURREY	1 days
03	SOUTH WEST	
	CW CORNWALL	2 days
	GS GLOUCESTERSHIRE	1 days
	WL WILTSHIRE	1 days
04	EAST ANGLIA	
	SF SUFFOLK	1 days
05	EAST MIDLANDS	
	DS DERBYSHIRE	1 days
	LE LEICESTERSHIRE	1 days
06	WEST MIDLANDS	
	WM WEST MIDLANDS	3 days
	WO WORCESTERSHIRE	2 days
07	YORKSHIRE & NORTH LINCOLNSHIRE	
	NY NORTH YORKSHIRE	1 days
08	NORTH WEST	
	LC LANCASHIRE	1 days
09	NORTH	
	CB CUMBRIA	1 days
	TW TYNE & WEAR	1 days

## Main parameter selection:

Parameter: Number of households  
 Range: 10 to 99 (units: )

Date Range: 01/01/00 to 13/05/08

Selected survey days:

Monday	3 days
Tuesday	8 days
Wednesday	3 days
Thursday	3 days
Friday	2 days

Selected survey types:

Manual count	19 days
Directional ATC Count	0 days

Selected Locations:

Edge of Town Centre	2
Suburban Area (PPS6 Out of Centre)	9
Edge of Town	7
Neighbourhood Centre (PPS6 Local Centre)	1

Selected Location Sub Categories:

Residential Zone	17
No Sub Category	2

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED  
VEHICLES

Calculation factor: 1 HHOLDS

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. HHOLDS	Trip Rate	No. Days	Ave. HHOLDS	Trip Rate	No. Days	Ave. HHOLDS	Trip Rate
00:00 - 01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00 - 02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00 - 03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00 - 04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00 - 05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00 - 06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00 - 07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00 - 08:00	19	56	0.071	19	56	0.255	19	56	0.326
08:00 - 09:00	19	56	0.169	19	56	0.368	19	56	0.537
09:00 - 10:00	19	56	0.201	19	56	0.246	19	56	0.447
10:00 - 11:00	19	56	0.179	19	56	0.211	19	56	0.390
11:00 - 12:00	19	56	0.208	19	56	0.175	19	56	0.383
12:00 - 13:00	19	56	0.249	19	56	0.191	19	56	0.440
13:00 - 14:00	19	56	0.205	19	56	0.218	19	56	0.423
14:00 - 15:00	19	56	0.206	19	56	0.213	19	56	0.419
15:00 - 16:00	19	56	0.278	19	56	0.232	19	56	0.510
16:00 - 17:00	19	56	0.338	19	56	0.216	19	56	0.554
17:00 - 18:00	19	56	0.348	19	56	0.218	19	56	0.566
18:00 - 19:00	19	56	0.293	19	56	0.213	19	56	0.506
19:00 - 20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00 - 21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00 - 22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00 - 23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00 - 24:00	0	0	0.000	0	0	0.000	0	0	0.000
<b>Total Rates:</b>			<b>2.745</b>			<b>2.756</b>			<b>5.501</b>

Parameter summary

Trip rate parameter range selected: 10 - 99 (units: )  
 Survey date date range: 01/01/00 - 13/05/08  
 Number of weekdays (Monday-Friday): 19  
 Number of Saturdays: 0  
 Number of Sundays: 0  
 Optional parameters used in selection: NO  
 Surveys manually removed from selection: 0

## TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL  
 Category : A - HOUSES PRIVATELY OWNED  
 VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	HC HAMPSHIRE	3 days
	SC SURREY	1 days
06	WEST MIDLANDS	
	ST STAFFORDSHIRE	1 days
	WO WORCESTERSHIRE	1 days

## Main parameter selection:

Parameter: Number of households  
 Range: 514 to 4334 (units: )

Date Range: 01/01/95 to 13/05/08

Selected survey days:

Tuesday	1 days
Wednesday	1 days
Thursday	1 days
Friday	3 days

Selected survey types:

Manual count	4 days
Directional ATC Count	2 days

Selected Locations:

Suburban Area (PPS6 Out of Centre)	1
Edge of Town	5

Selected Location Sub Categories:

Residential Zone	4
No Sub Category	2



LIST OF SITES relevant to selection parameters

1	HC-03-A-13 ANCELLS ROAD	MIXED HOUSES/FLATS, FLEET	HAMPSHIRE
	FLEET		
	Total Number of households:	747	
	Survey date: THURSDAY	05/03/98	Survey Type: MANUAL
2	HC-03-A-15 KNIGHTWOOD ROAD	MIXED HOUSES, EASTLEIGH	HAMPSHIRE
	BADGER'S COPSE EASTLEIGH		
	Total Number of households:	700	
	Survey date: WEDNESDAY	18/08/99	Survey Type: MANUAL
3	HC-03-A-16 RIDGEWAY/MEADOW WAY	MIXED HOUSES/FLATS, WINCHSTR	HAMPSHIRE
	BADGER FARM WINCHESTER		
	Total Number of households:	1040	
	Survey date: FRIDAY	08/12/00	Survey Type: DIRECTIONAL ATC COUNT
4	SC-03-A-02 A24	SEMI DETACHED, EPSOM	SURREY
	EPSOM		
	Total Number of households:	514	
	Survey date: TUESDAY	03/10/00	Survey Type: MANUAL
5	ST-03-A-02 A51 LICHFIELD ROAD	SEMI D./DETACHED, TAMWORTH	STAFFORDSHIRE
	TAMWORTH		
	Total Number of households:	531	
	Survey date: FRIDAY	14/07/95	Survey Type: DIRECTIONAL ATC COUNT
6	WO-03-A-04 MALVERN ROAD	MIXED HOUSES, WORCESTER	WORCESTERSHIRE
	WORCESTER		
	Total Number of households:	792	
	Survey date: FRIDAY	24/05/02	Survey Type: MANUAL

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED  
VEHICLES

Calculation factor: 1 HHOLDS

Estimated TRIP rate value per 2000 HHOLDS shown in shaded columns

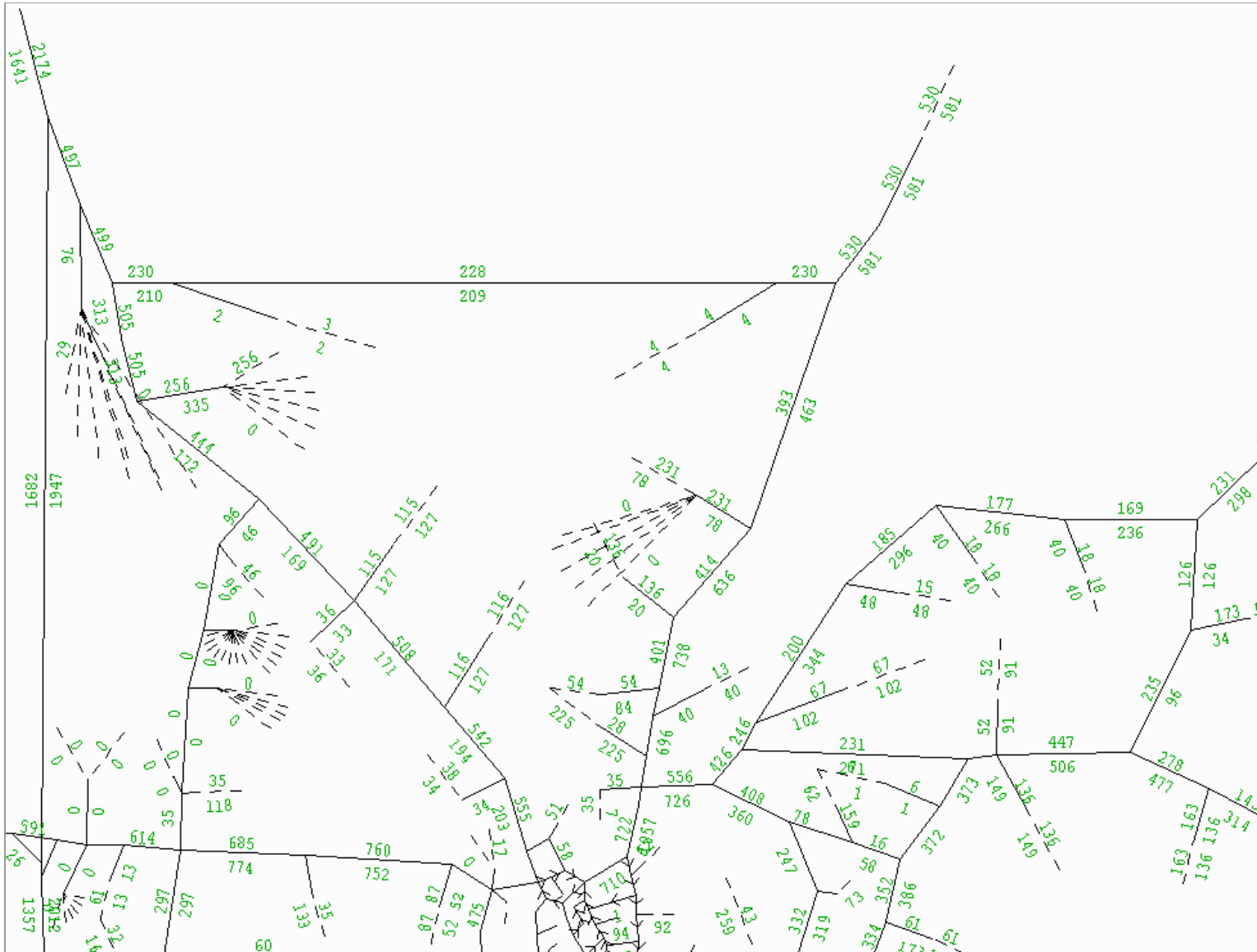
BOLD print indicates peak (busiest) period

Time Range	ARRIVALS				DEPARTURES				TOTALS			
	No. Days	Ave. HHOLDS	Trip Rate	Estimated Trip Rate	No. Days	Ave. HHOLDS	Trip Rate	Estimated Trip Rate	No. Days	Ave. HHOLDS	Trip Rate	Estimated Trip Rate
00:00 - 01:00	1	1040	0.024	48.077	1	1040	0.016	32.692	1	1040	0.040	80.769
01:00 - 02:00	1	1040	0.010	19.231	1	1040	0.005	9.615	1	1040	0.015	28.846
02:00 - 03:00	1	1040	0.010	19.231	1	1040	0.008	15.385	1	1040	0.018	34.616
03:00 - 04:00	1	1040	0.001	1.923	1	1040	0.001	1.923	1	1040	0.002	3.846
04:00 - 05:00	1	1040	0.001	1.923	1	1040	0.004	7.692	1	1040	0.005	9.615
05:00 - 06:00	1	1040	0.004	7.692	1	1040	0.023	46.154	1	1040	0.027	53.846
06:00 - 07:00	2	786	0.022	44.558	2	786	0.113	226.607	2	786	0.135	271.165
07:00 - 08:00	6	721	0.076	151.711	6	721	0.309	618.871	6	721	0.385	770.582
08:00 - 09:00	6	721	0.117	233.580	6	721	0.456	911.656	6	721	0.573	1145.236
09:00 - 10:00	6	721	0.145	290.472	6	721	0.207	414.431	6	721	0.352	704.903
10:00 - 11:00	6	721	0.133	265.032	6	721	0.154	308.973	6	721	0.287	574.005
11:00 - 12:00	6	721	0.149	297.872	6	721	0.159	317.761	6	721	0.308	615.633
12:00 - 13:00	6	721	0.198	396.855	6	721	0.162	324.699	6	721	0.360	721.554
13:00 - 14:00	6	721	0.192	383.441	6	721	0.178	355.227	6	721	0.370	738.668
14:00 - 15:00	6	721	0.185	370.028	6	721	0.169	338.113	6	721	0.354	708.141
15:00 - 16:00	6	721	0.256	511.563	6	721	0.202	404.255	6	721	0.458	915.818
16:00 - 17:00	6	721	0.290	580.944	6	721	0.177	354.302	6	721	0.467	935.246
17:00 - 18:00	6	721	0.381	762.257	6	721	0.195	389.917	6	721	0.576	1152.174
18:00 - 19:00	6	721	0.347	694.727	6	721	0.212	424.144	6	721	0.559	1118.871
19:00 - 20:00	2	786	0.260	520.687	2	786	0.219	437.938	2	786	0.479	958.625
20:00 - 21:00	2	786	0.173	345.003	2	786	0.136	272.438	2	786	0.309	617.441
21:00 - 22:00	2	786	0.126	252.069	2	786	0.074	147.677	2	786	0.200	399.746
22:00 - 23:00	1	1040	0.092	184.615	1	1040	0.051	101.923	1	1040	0.143	286.538
23:00 - 24:00	1	1040	0.090	180.769	1	1040	0.069	138.462	1	1040	0.159	319.231
<b>Total Rates:</b>			3.282	6564.260			3.299	6600.855			6.581	13165.11

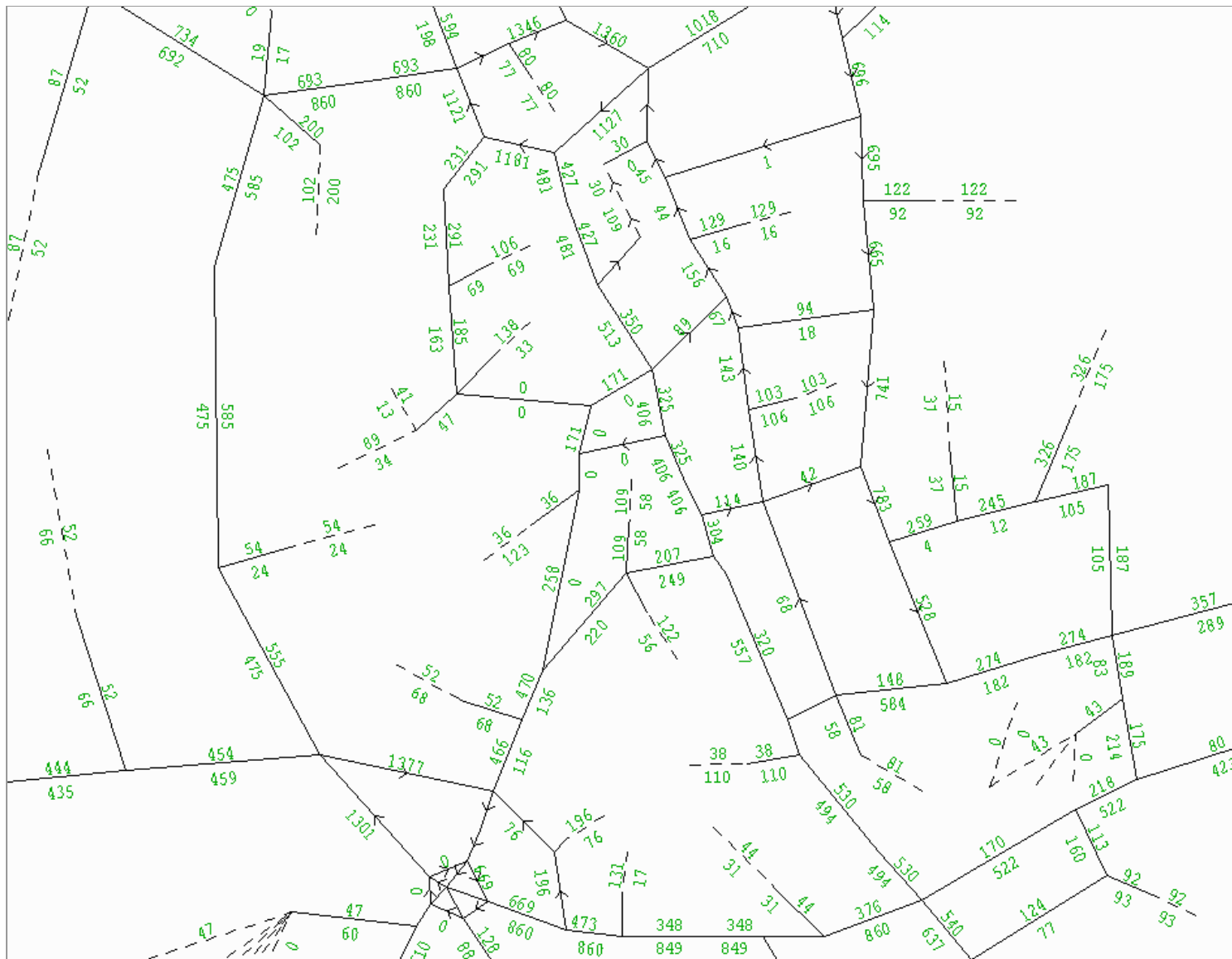
Parameter summary

Trip rate parameter range selected: 514 - 4334 (units: )  
 Survey date date range: 01/01/95 - 13/05/08  
 Number of weekdays (Monday-Friday): 17  
 Number of Saturdays: 0  
 Number of Sundays: 0  
 Optional parameters used in selection: NO  
 Surveys manually removed from selection: 1

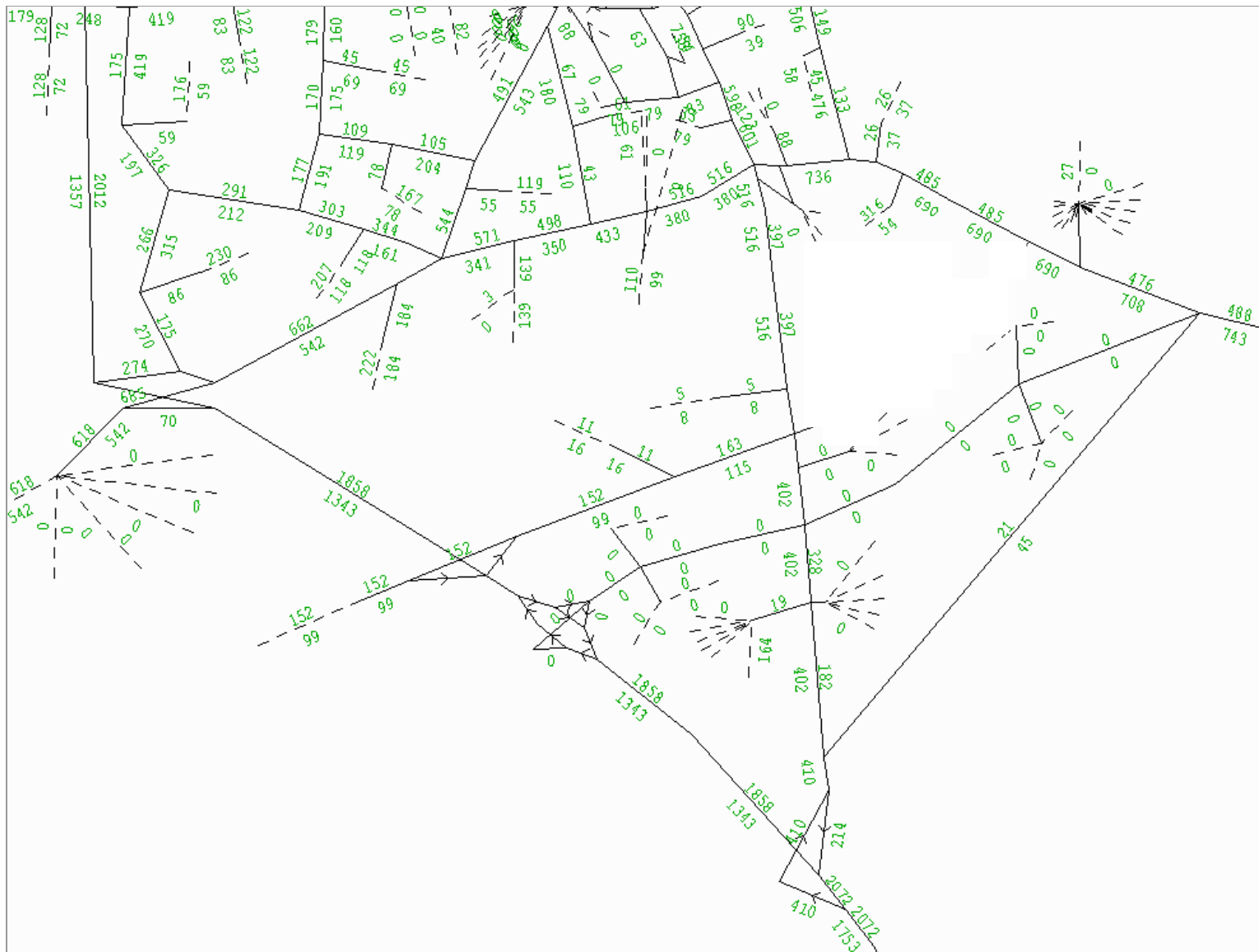
**Appendix B Traffic Volume Diagrams**



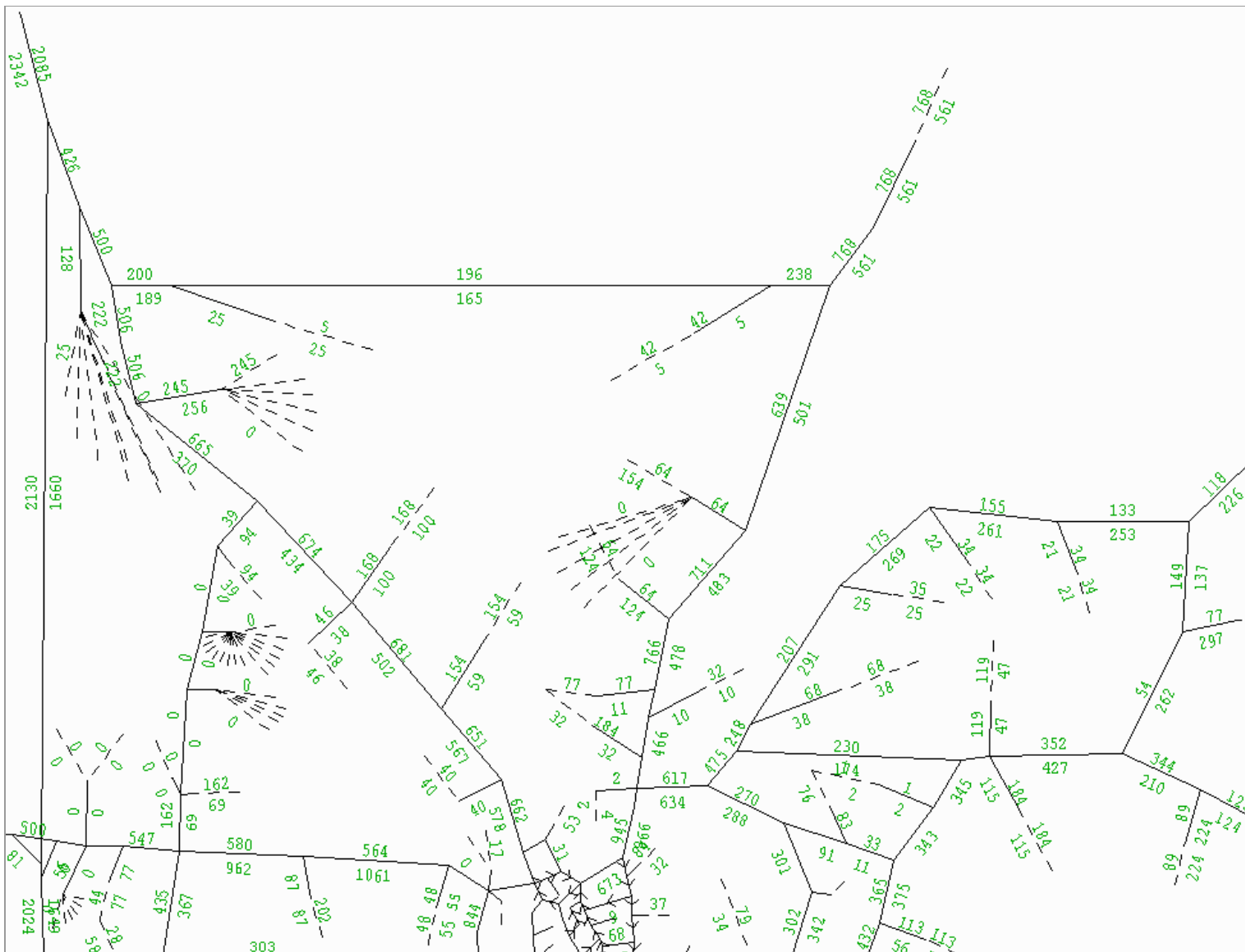
Scenario 1 2006 Base  
Demand Flow – AM (08:00 - 09:00) – Northern Section



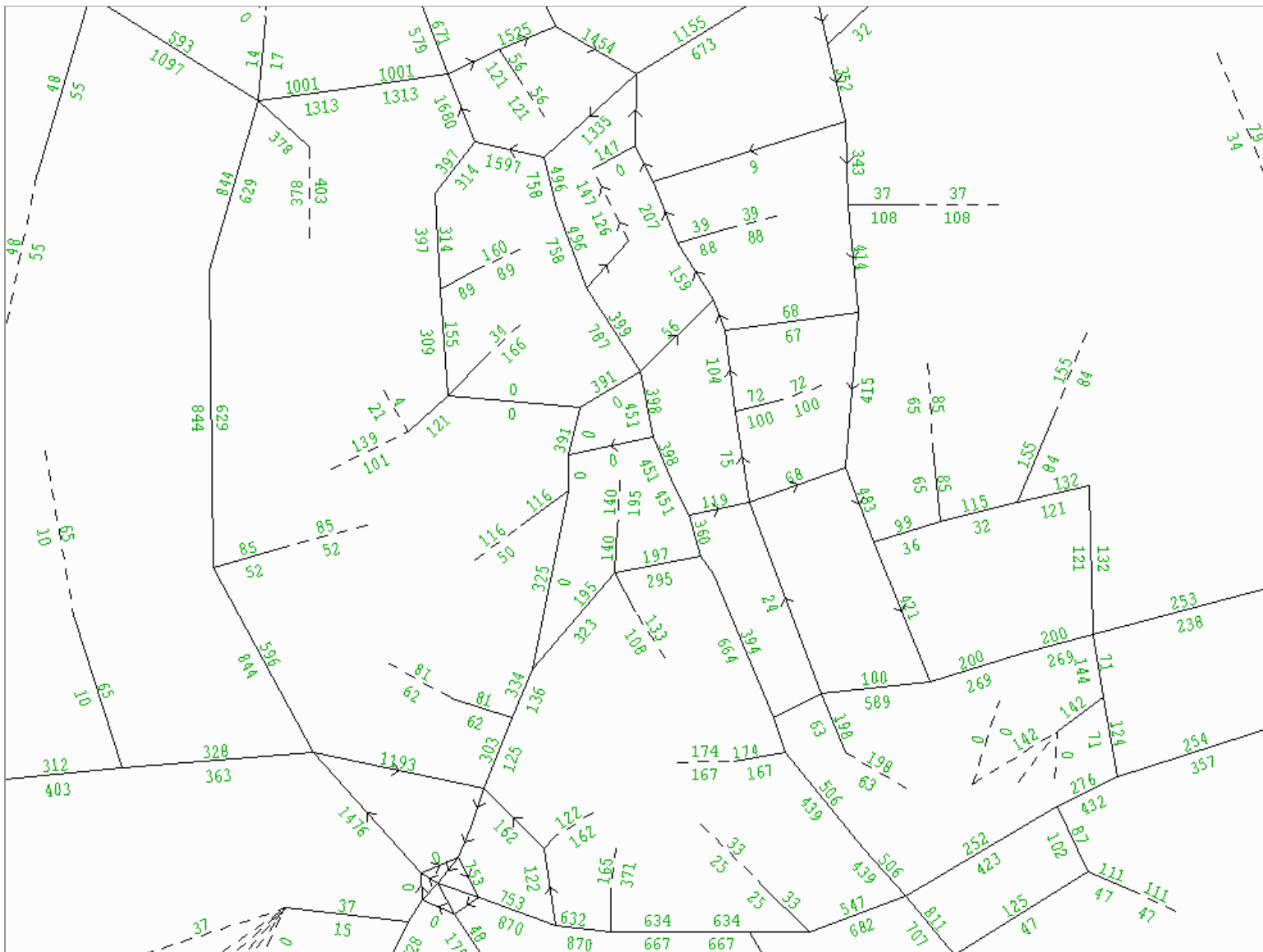
Scenario 1 2006 Base  
Demand Flow – AM (08:00 - 09:00) – Town Centre



Scenario 1 2006 Base  
Demand Flow – AM (08:00 - 09:00) – Southern Section

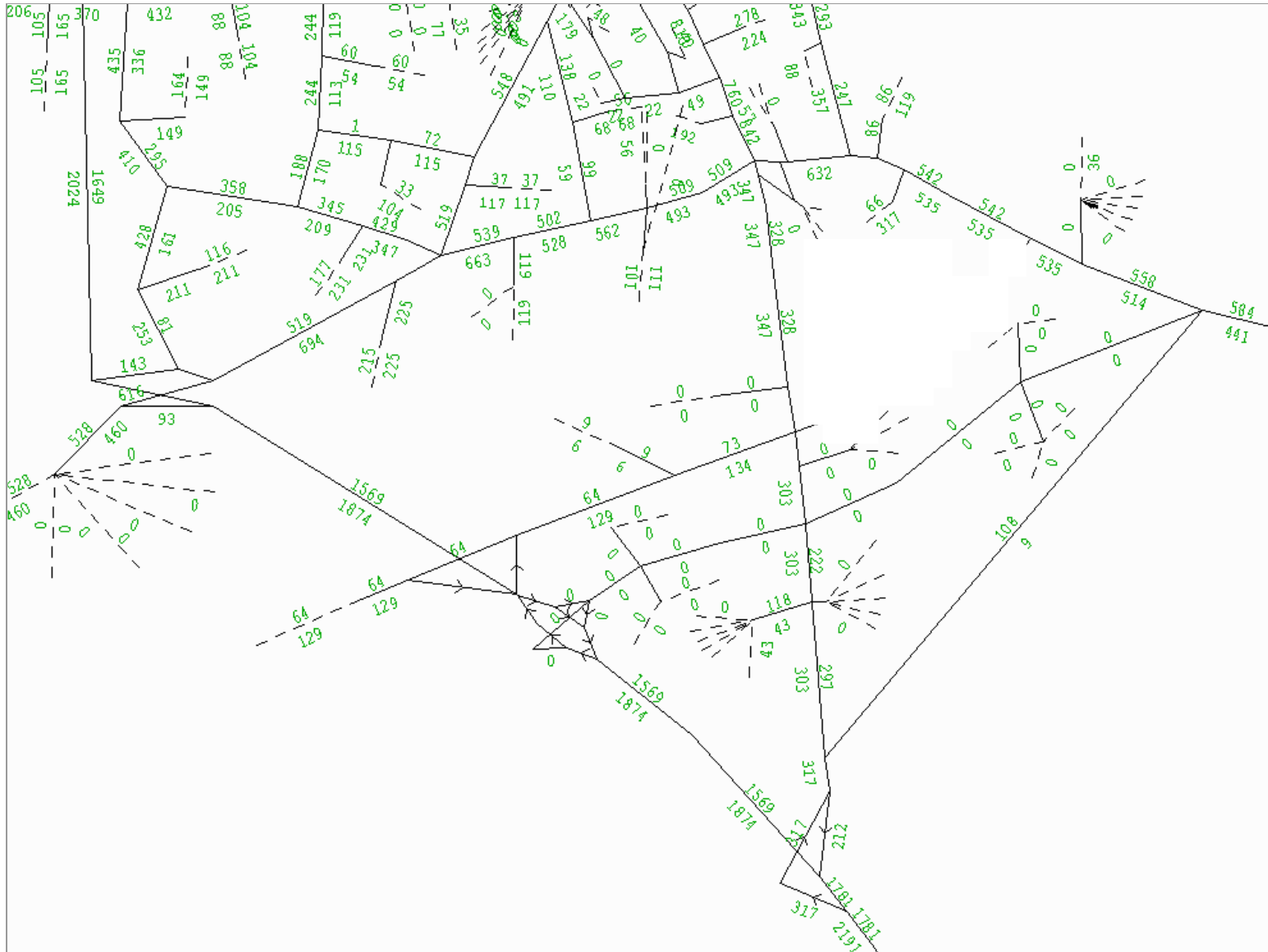


Scenario 1 2006 Base  
Demand Flow – PM (17:00 - 18:00) – Northern Section

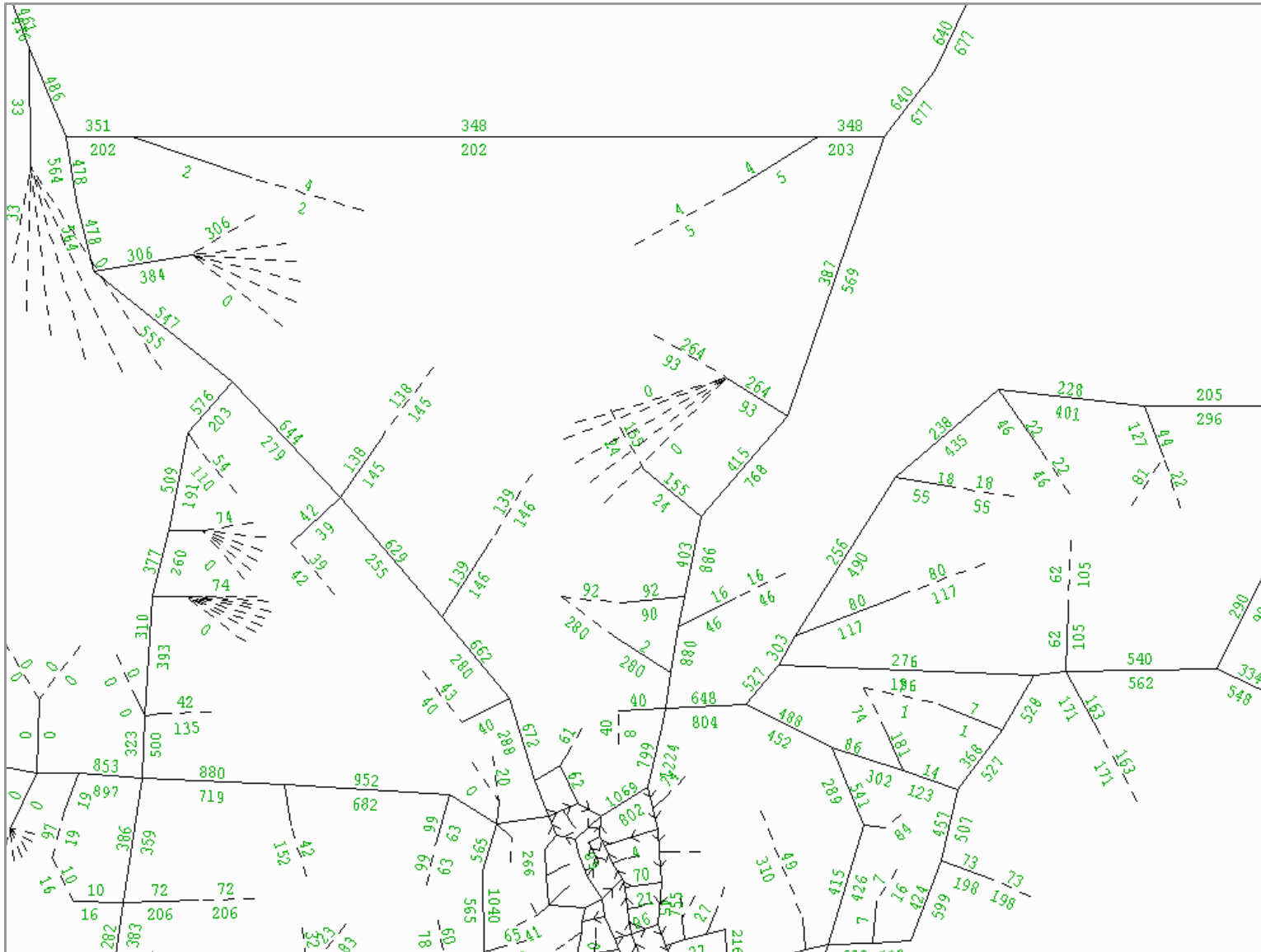


Scenario 1 2006 Base  
Demand Flow – PM (17:00 – 18:00) – Town Centre

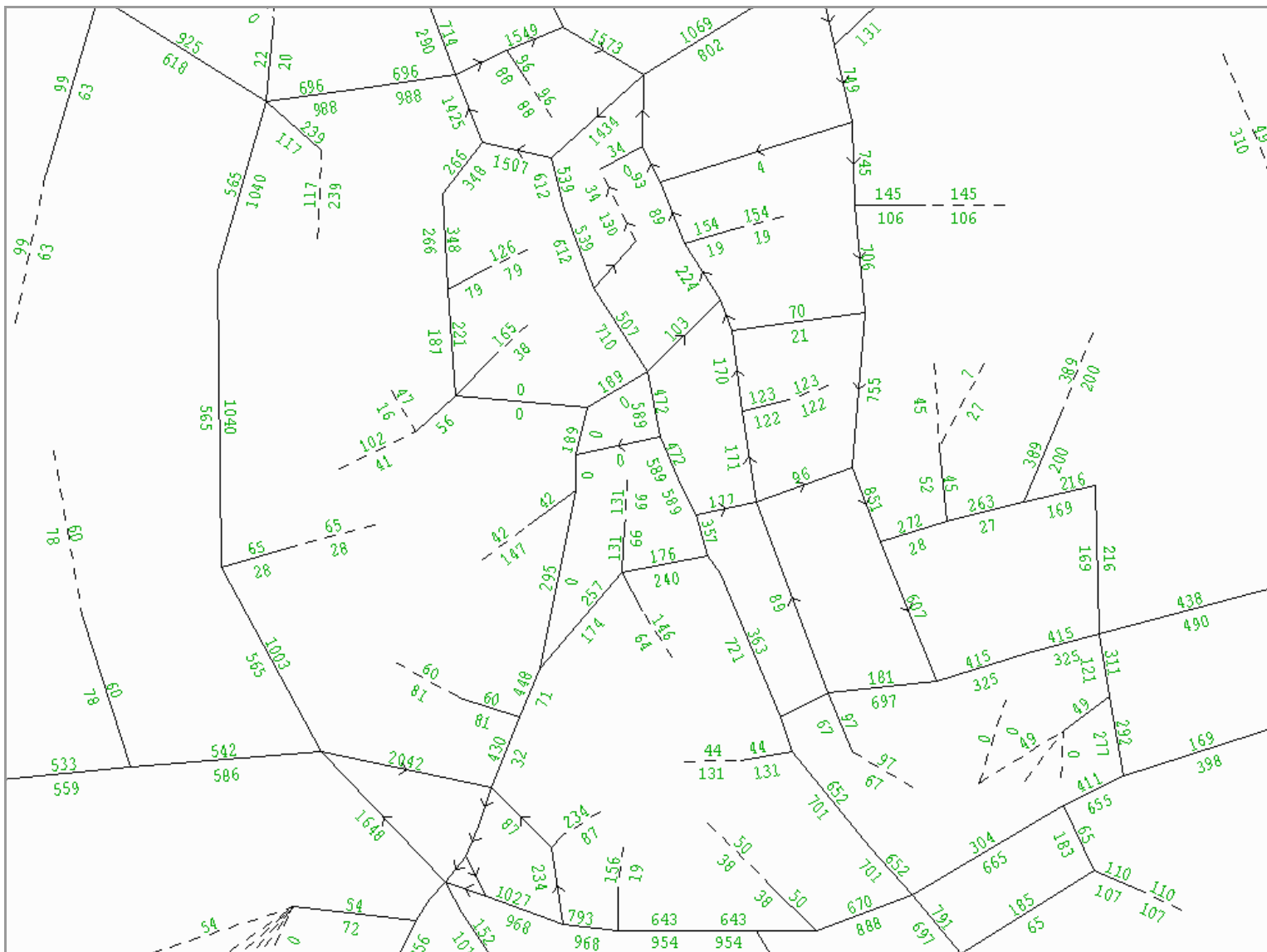




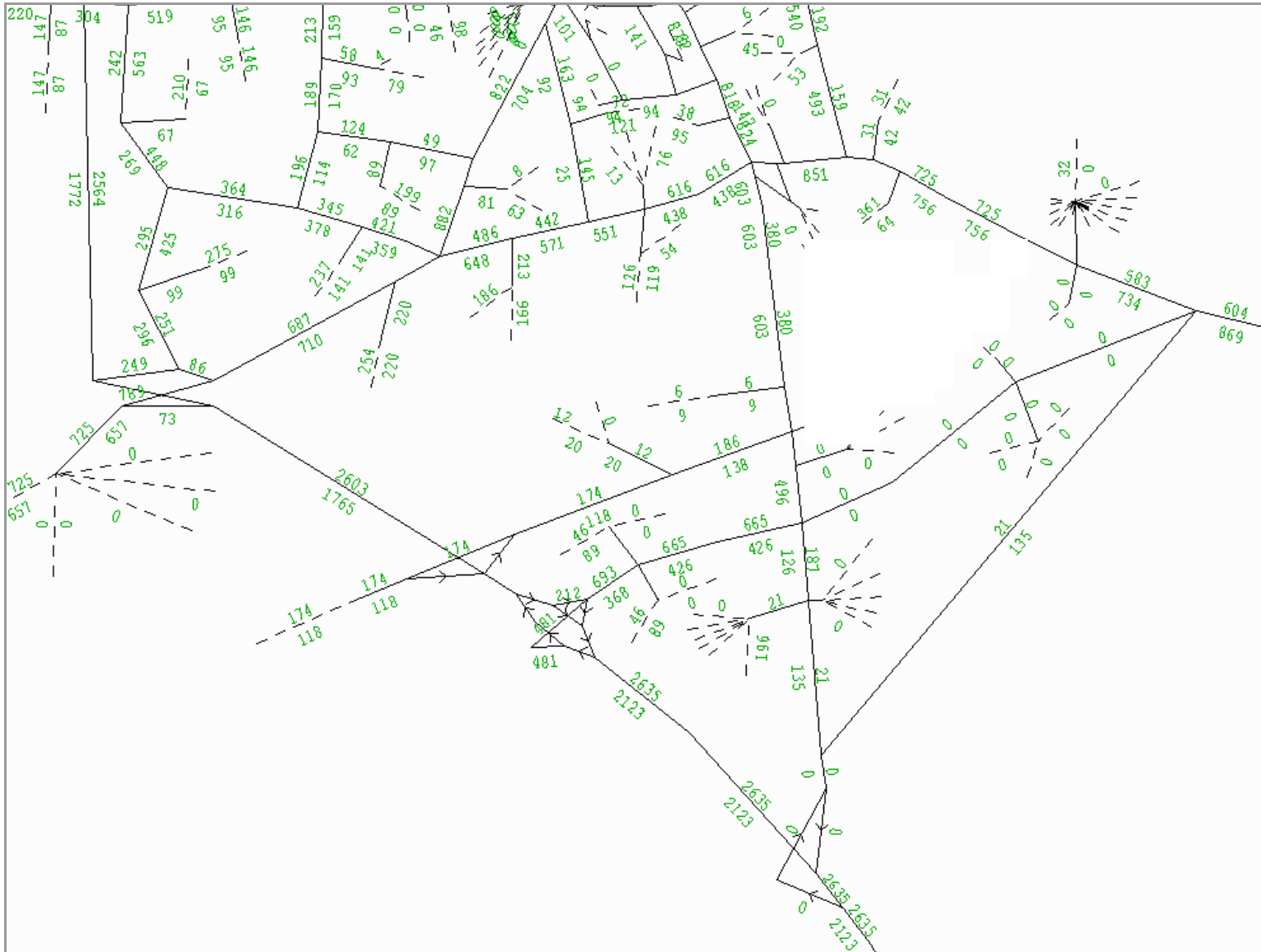
Scenario 1 2006 Base  
Demand Flow – PM (17:00 – 18:00) – Southern Section



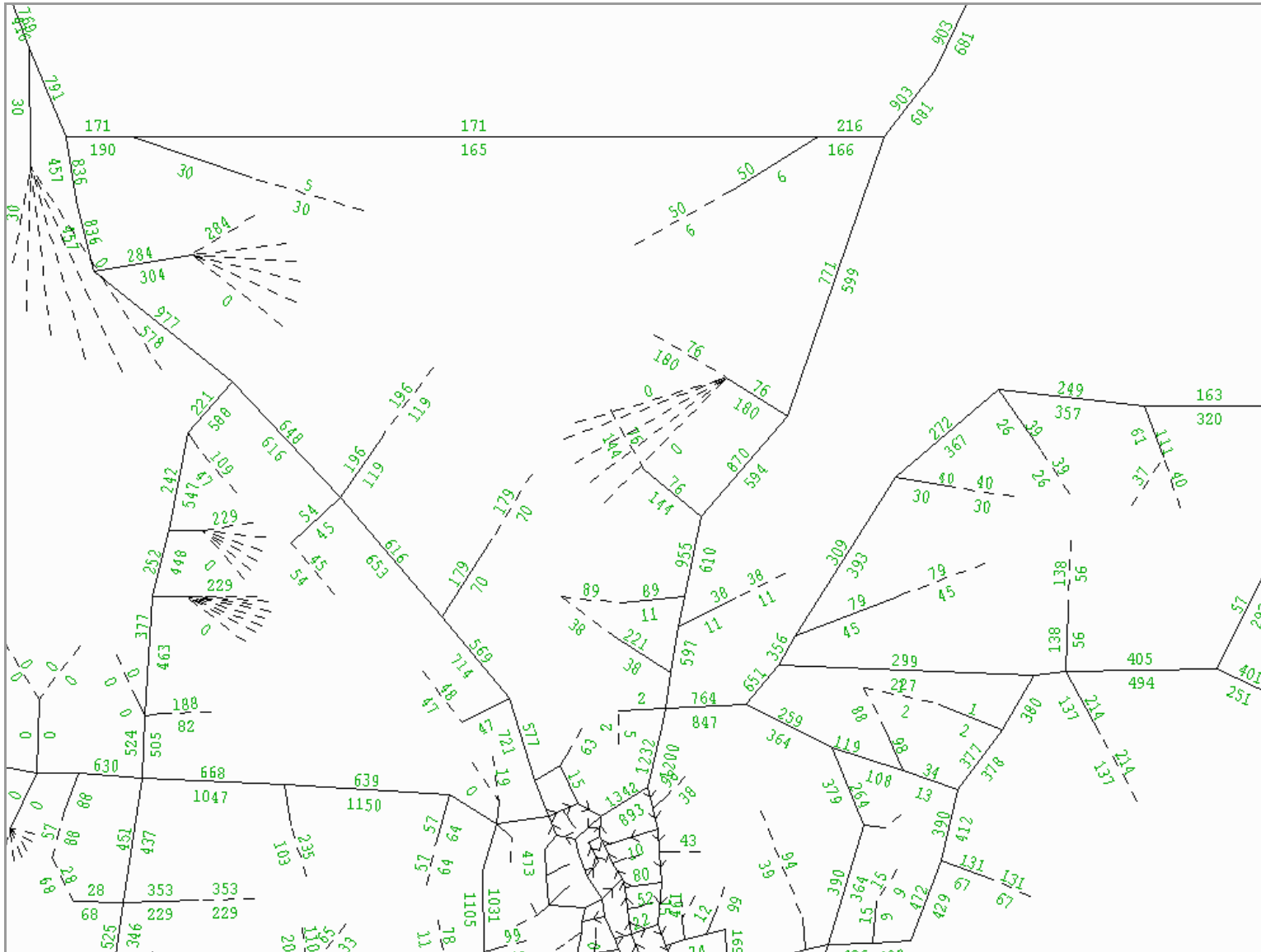
Scenario 2 2014 Reference Case  
Demand Flow – AM (08:00 - 09:00) – Northern Section



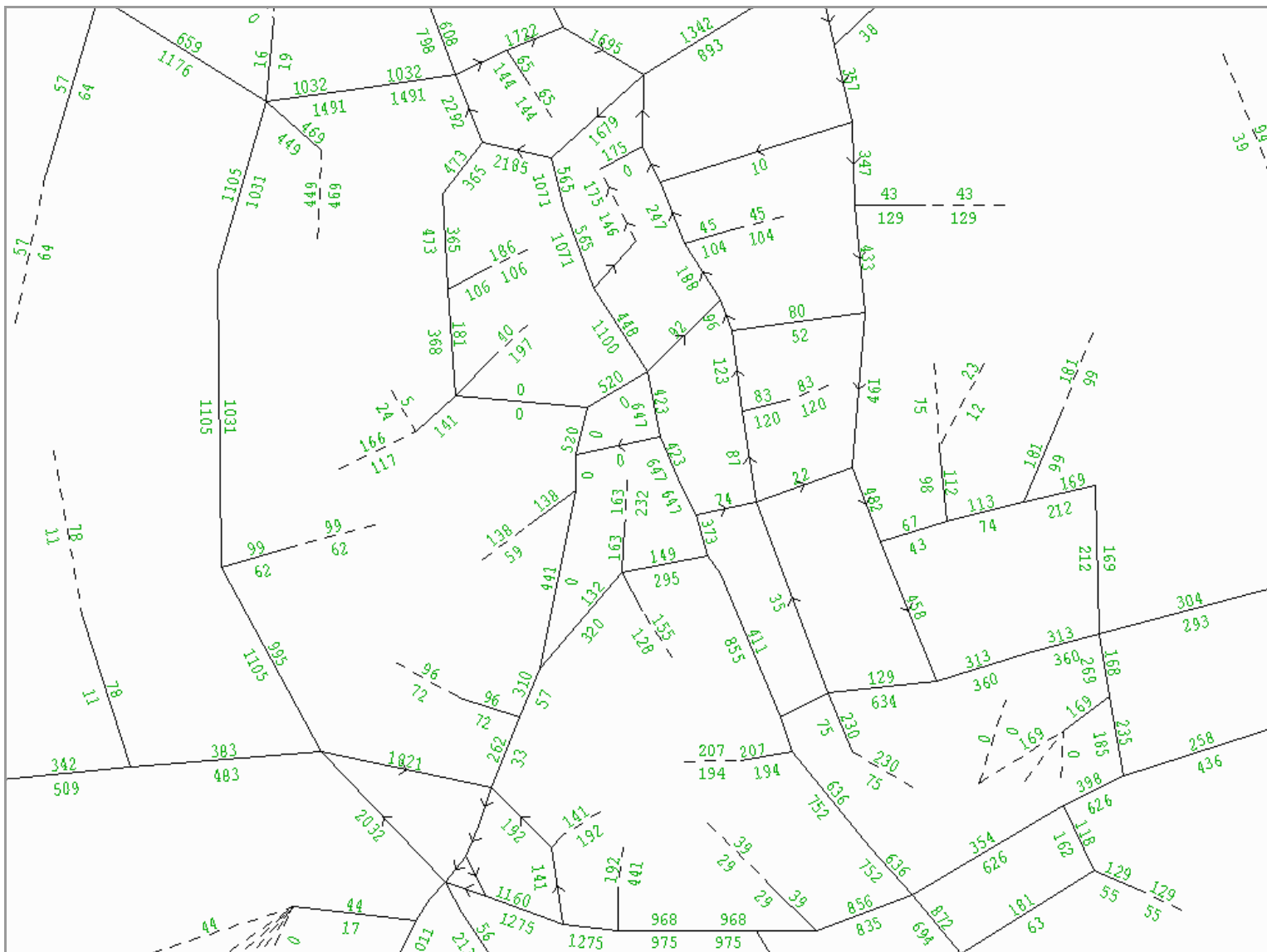
Scenario 2 2014 Reference Case  
Demand Flow – AM (08:00 - 09:00) – Town Centre



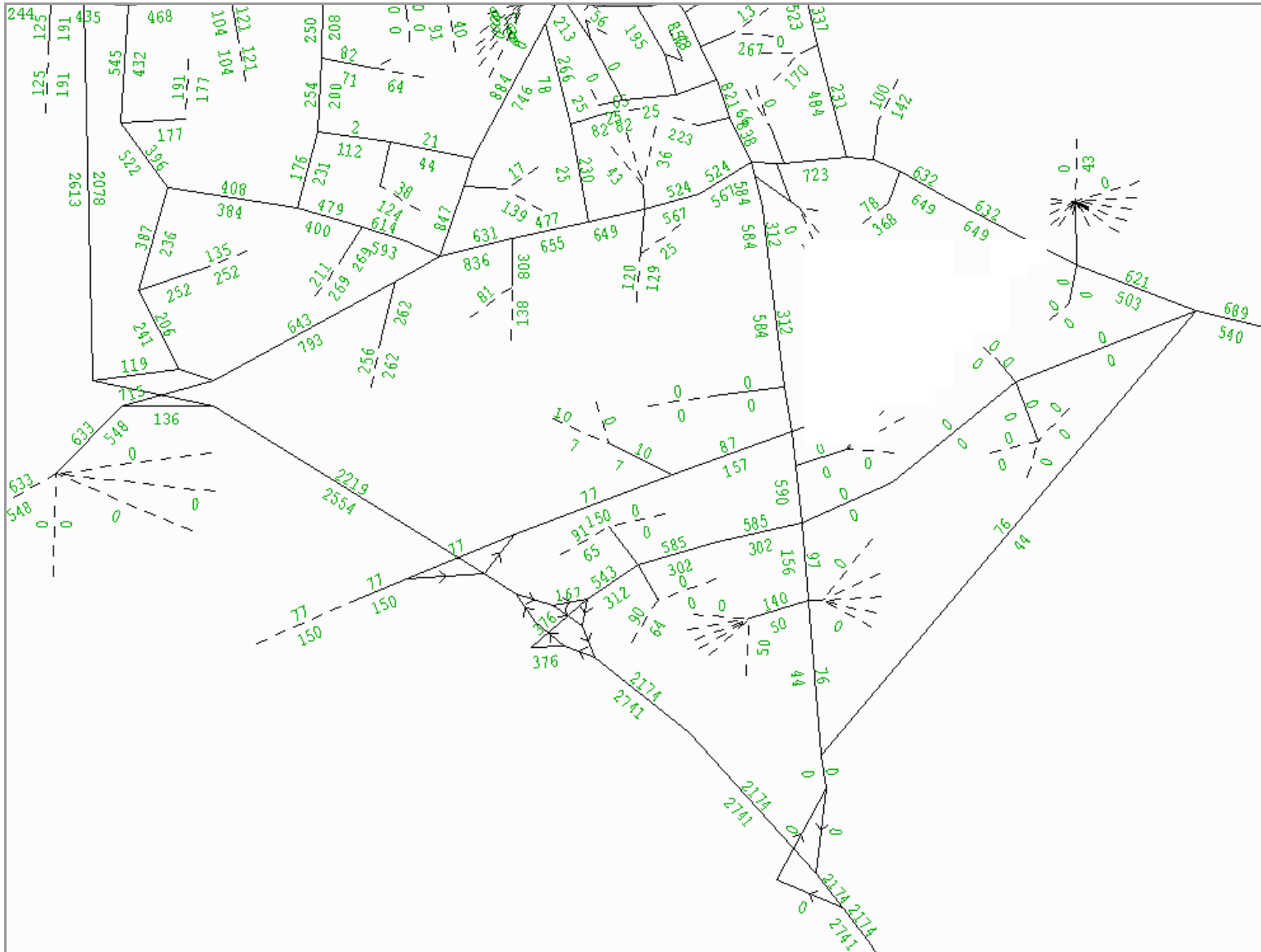
Scenario 2 2014 Reference Case  
Demand Flow – AM (08:00 - 09:00) – South Section



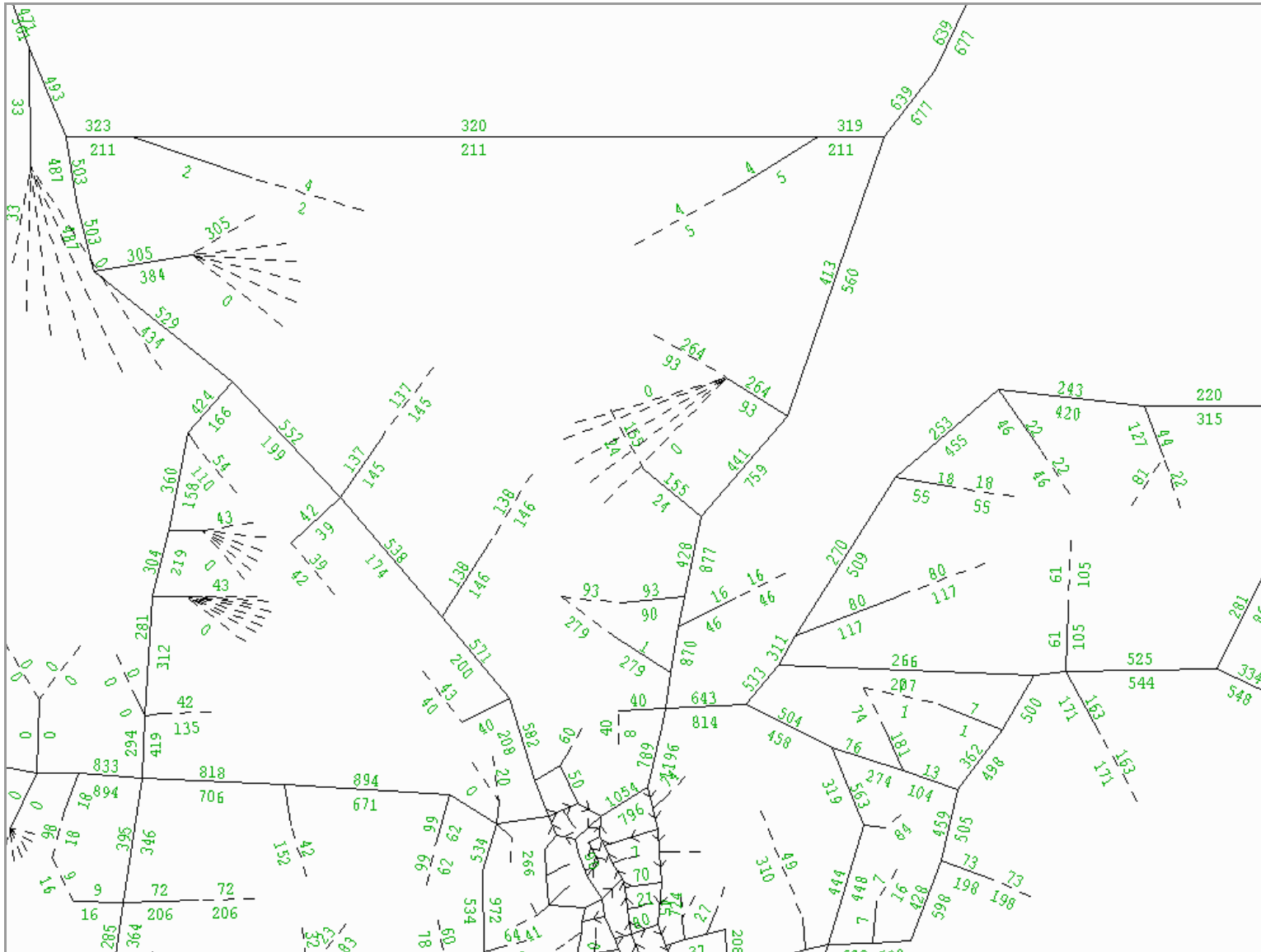
Scenario 2 2014 Reference Case  
Demand Flow – PM (17:00 - 18:00) – North Section



Scenario 2 2014 Reference Case  
Demand Flow – PM (17:00 - 18:00) – Town Centre

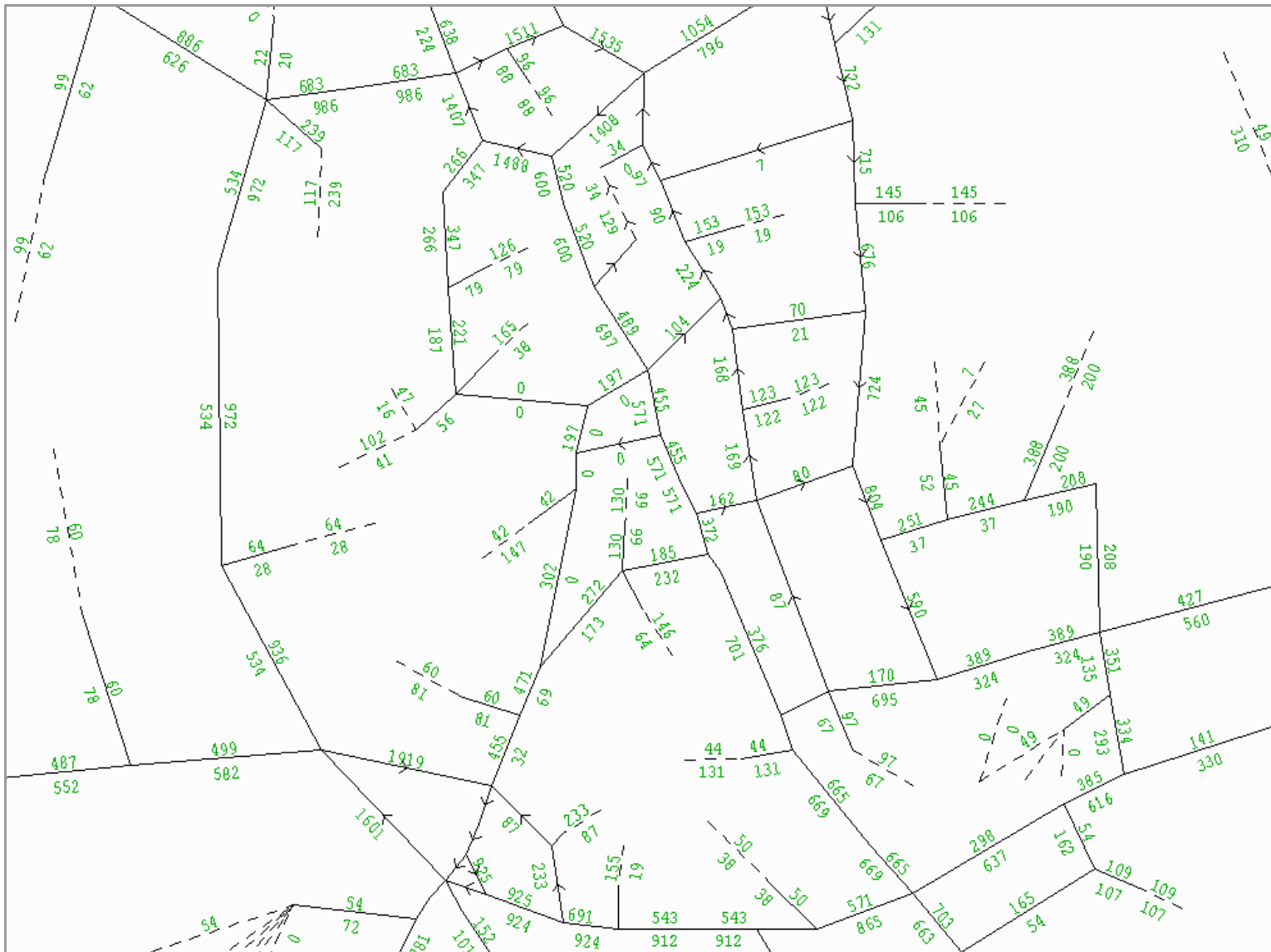


Scenario 2 2014 Reference Case  
Demand Flow – PM (17:00 - 18:00) – South Section

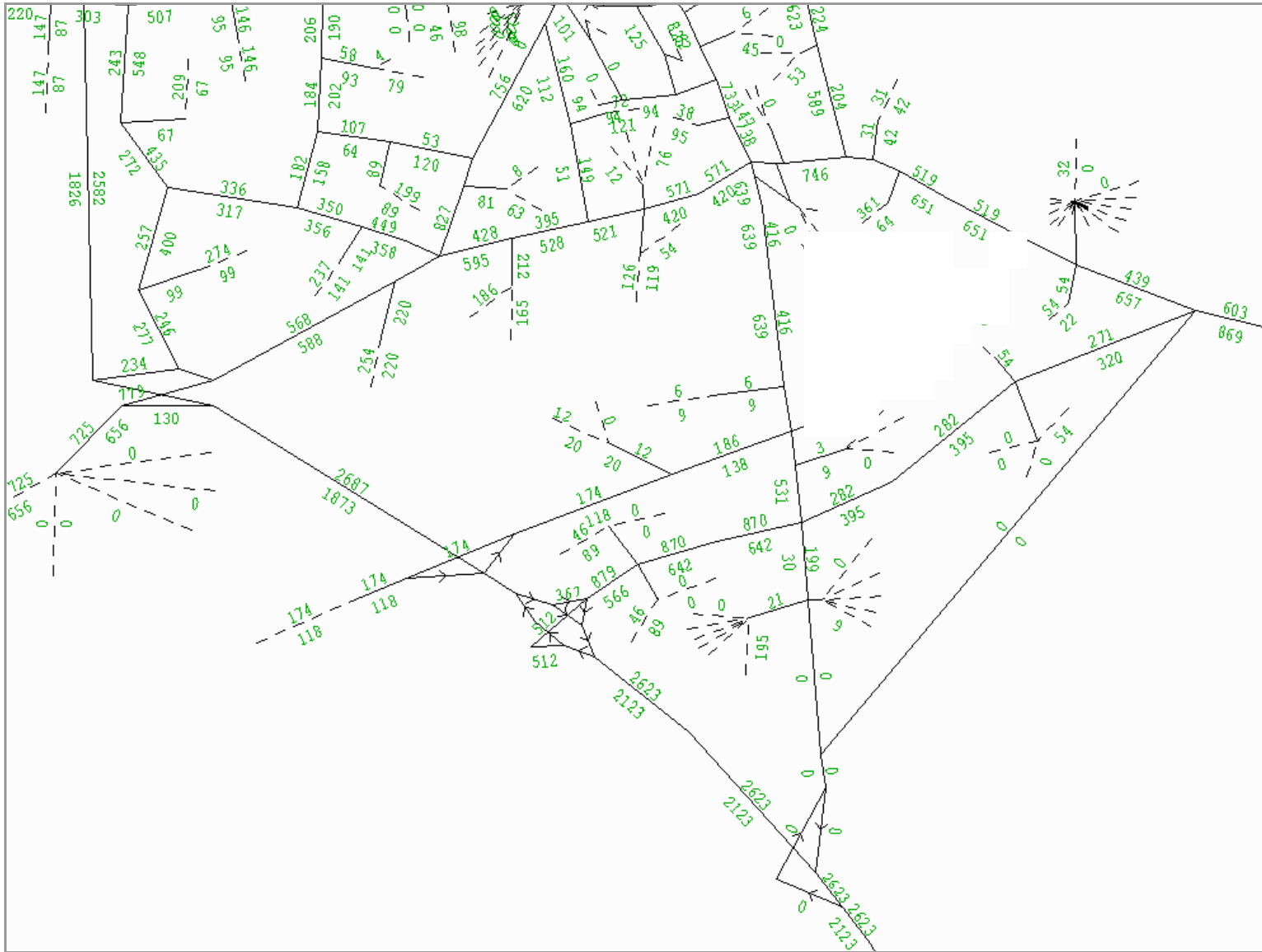


Scenario 3a 2014 Southern Quadrant  
Demand Flow – AM (8:00 - 9:00) – North Section

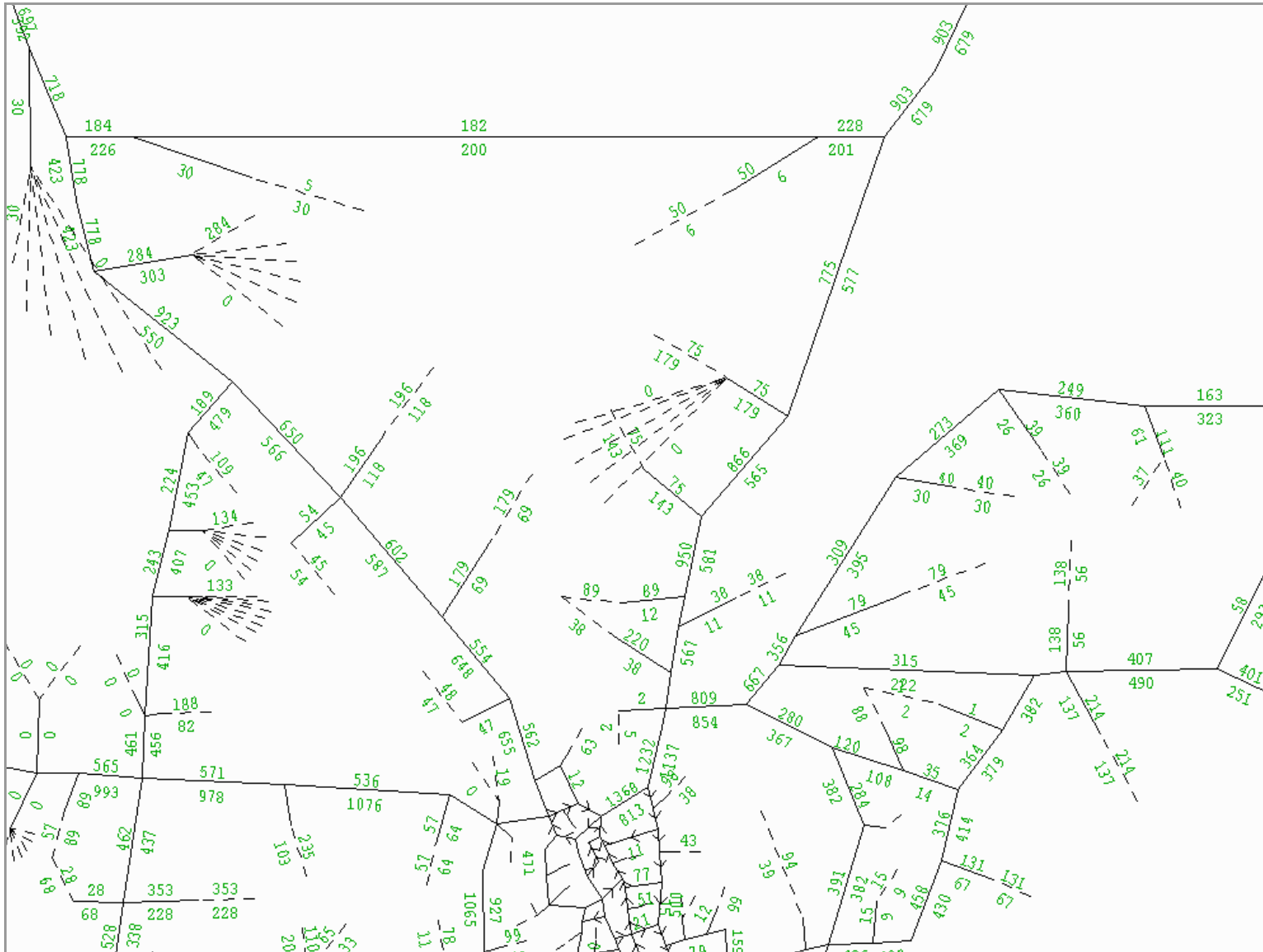




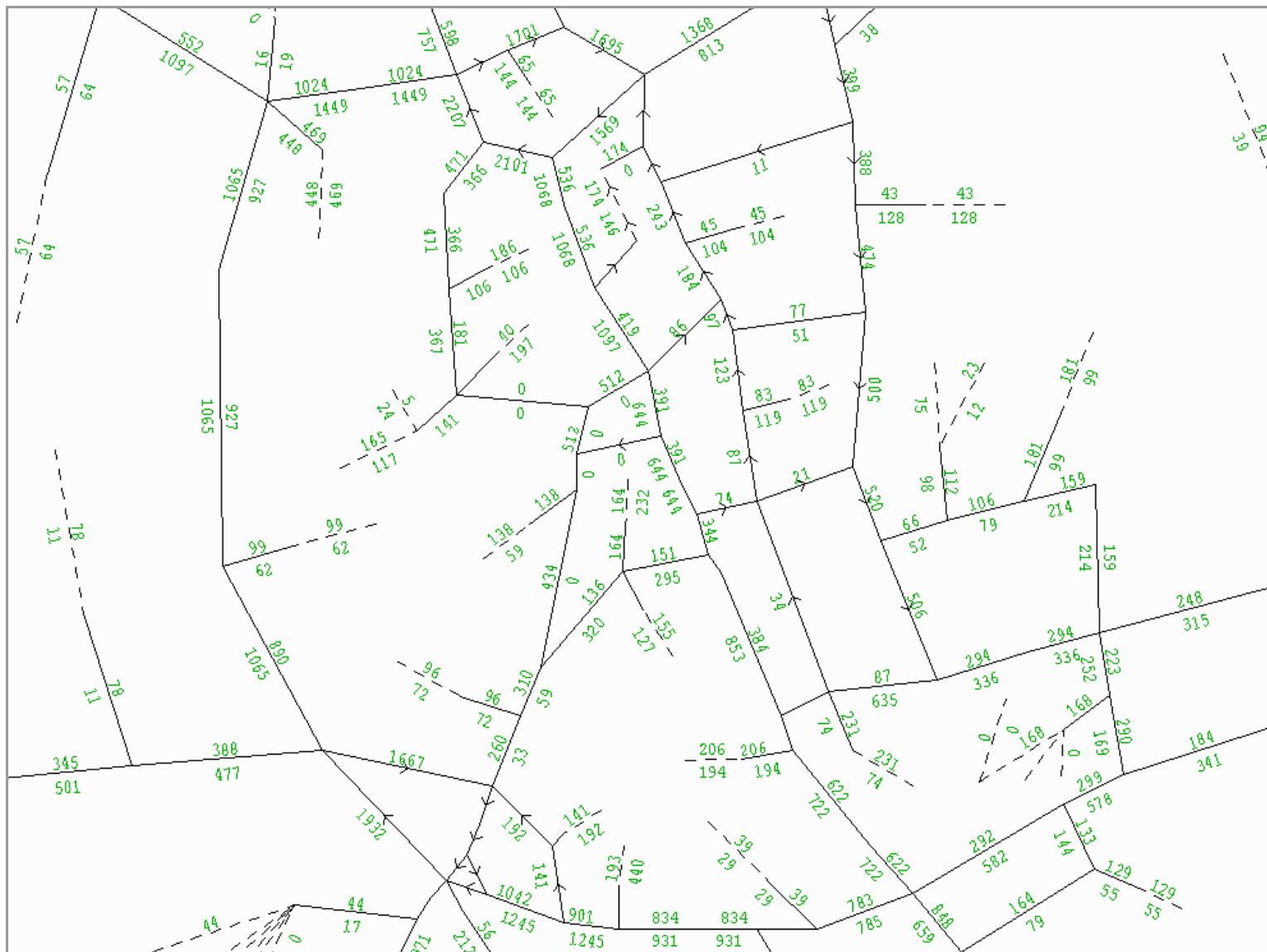
Scenario 3a 2014 Southern Quadrant  
Demand Flow – AM (8:00 - 9:00) – Town Centre



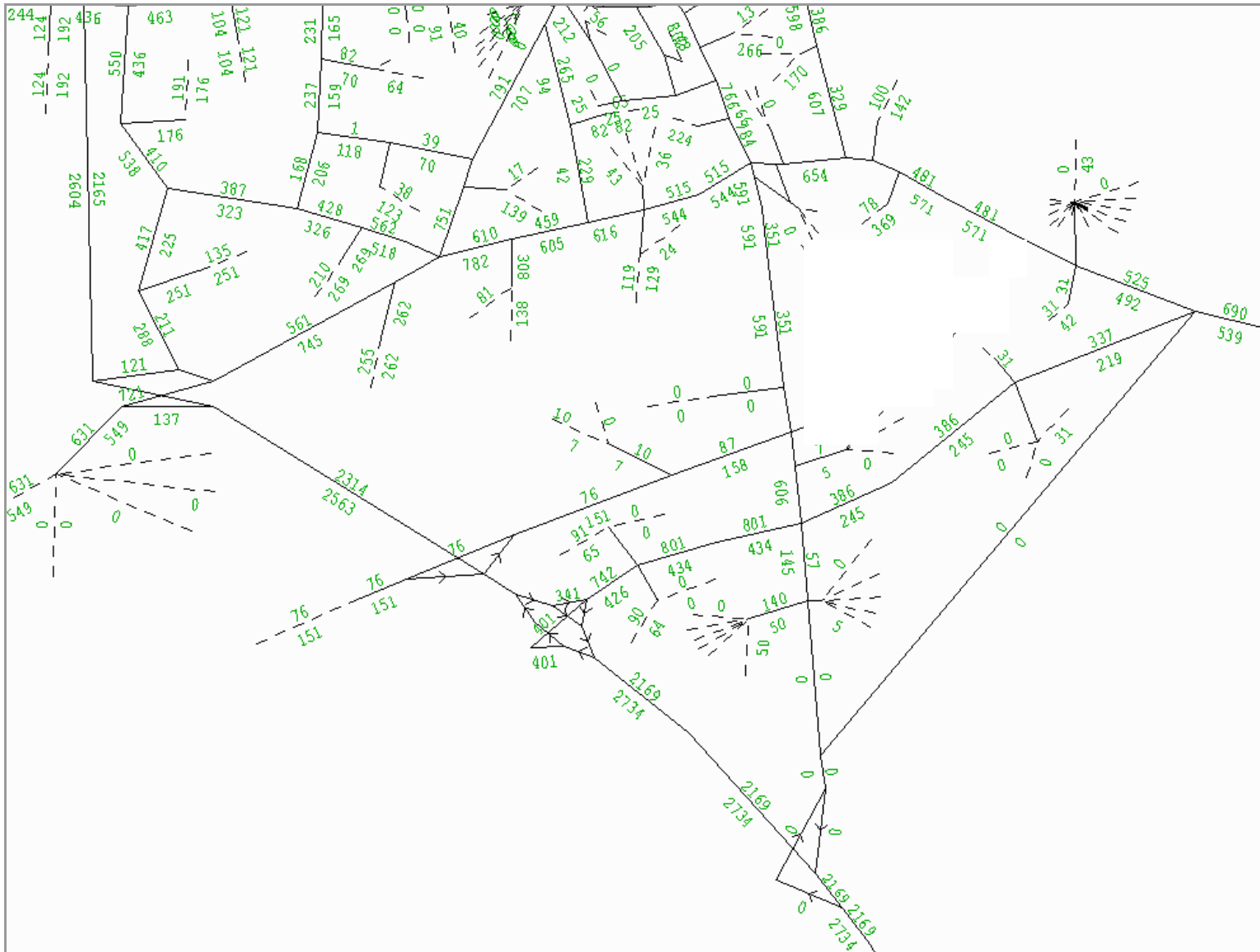
Scenario 3a 2014 Southern Quadrant  
Demand Flow – AM (8:00 - 9:00) – South Section



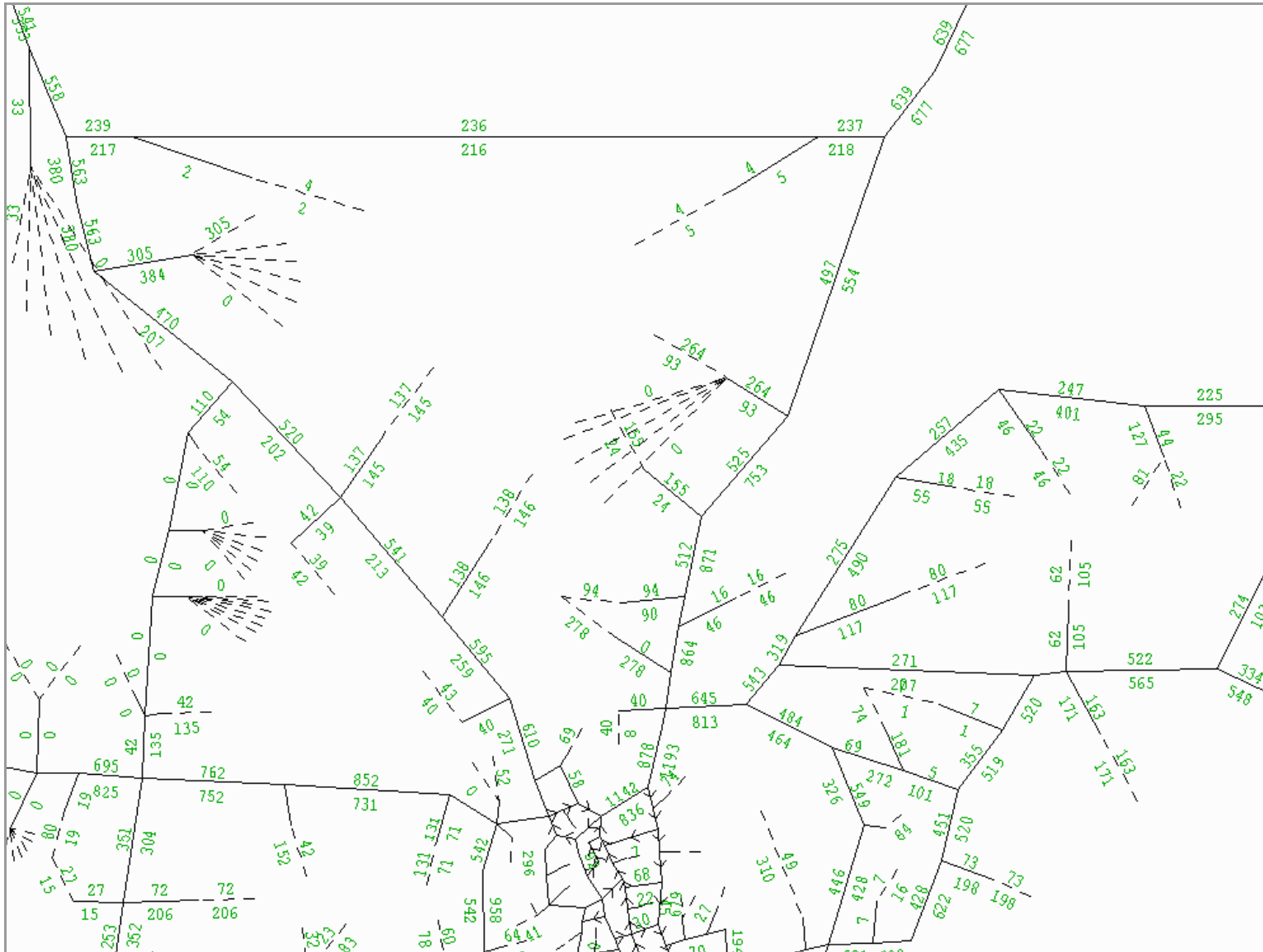
Scenario 3a 2014 Southern Quadrant Demand Flow – PM (17:00 - 18:00) – North Section



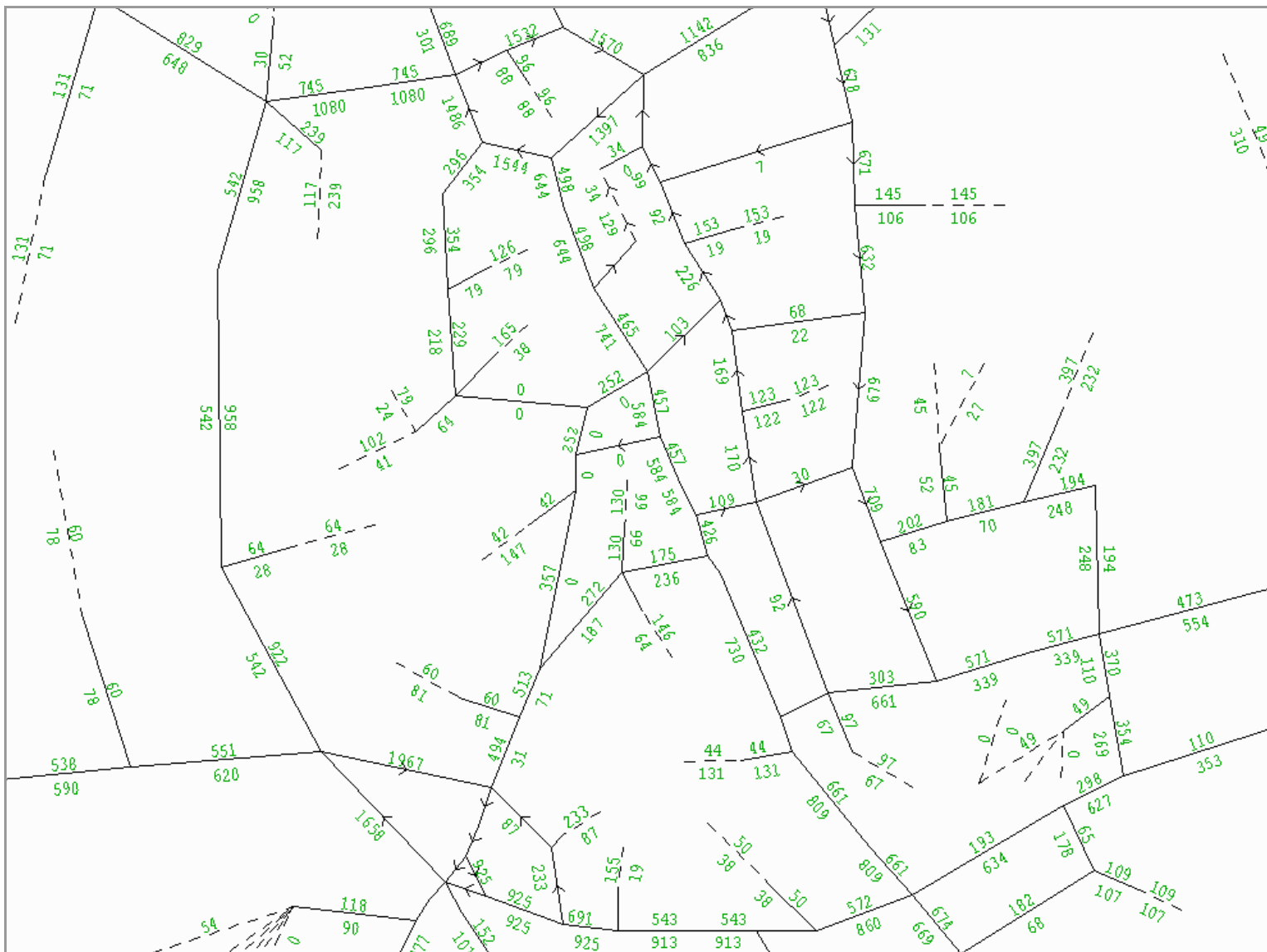
Scenario 3a 2014 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Town Centre



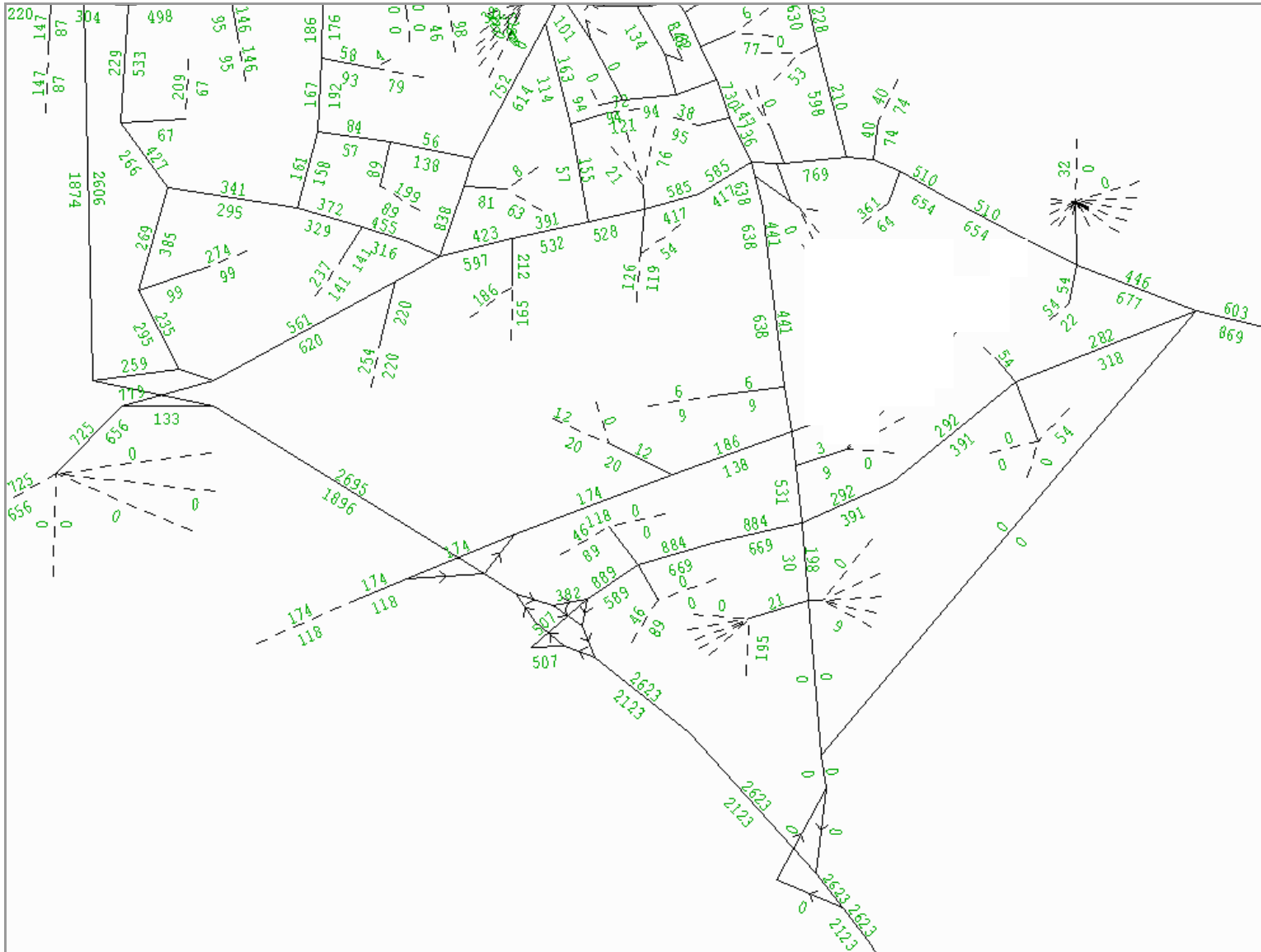
Scenario 3a 2014 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Southern Section



Scenario 3b 2014 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Northern Section

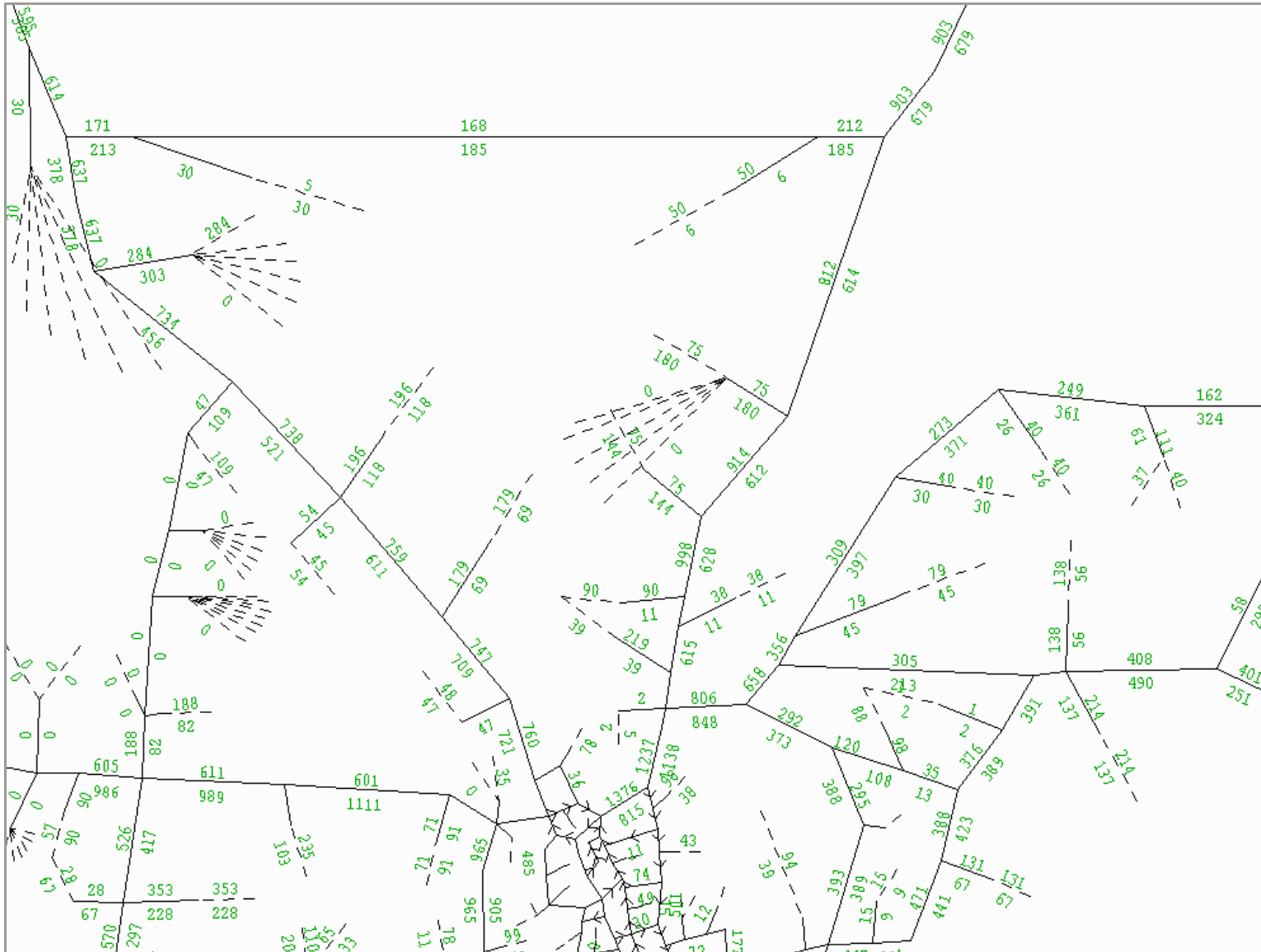


Scenario 3b 2014 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Town Centre

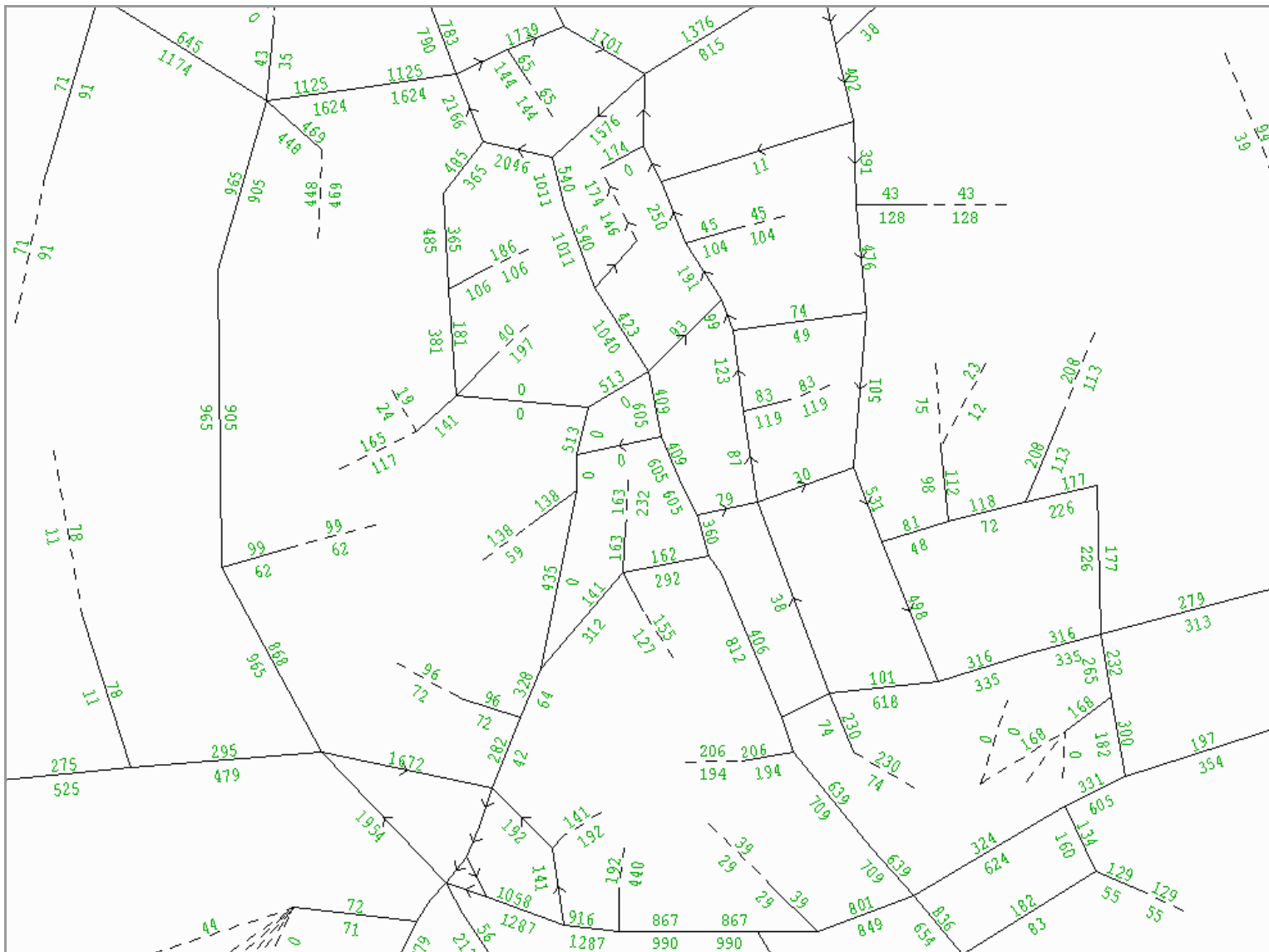


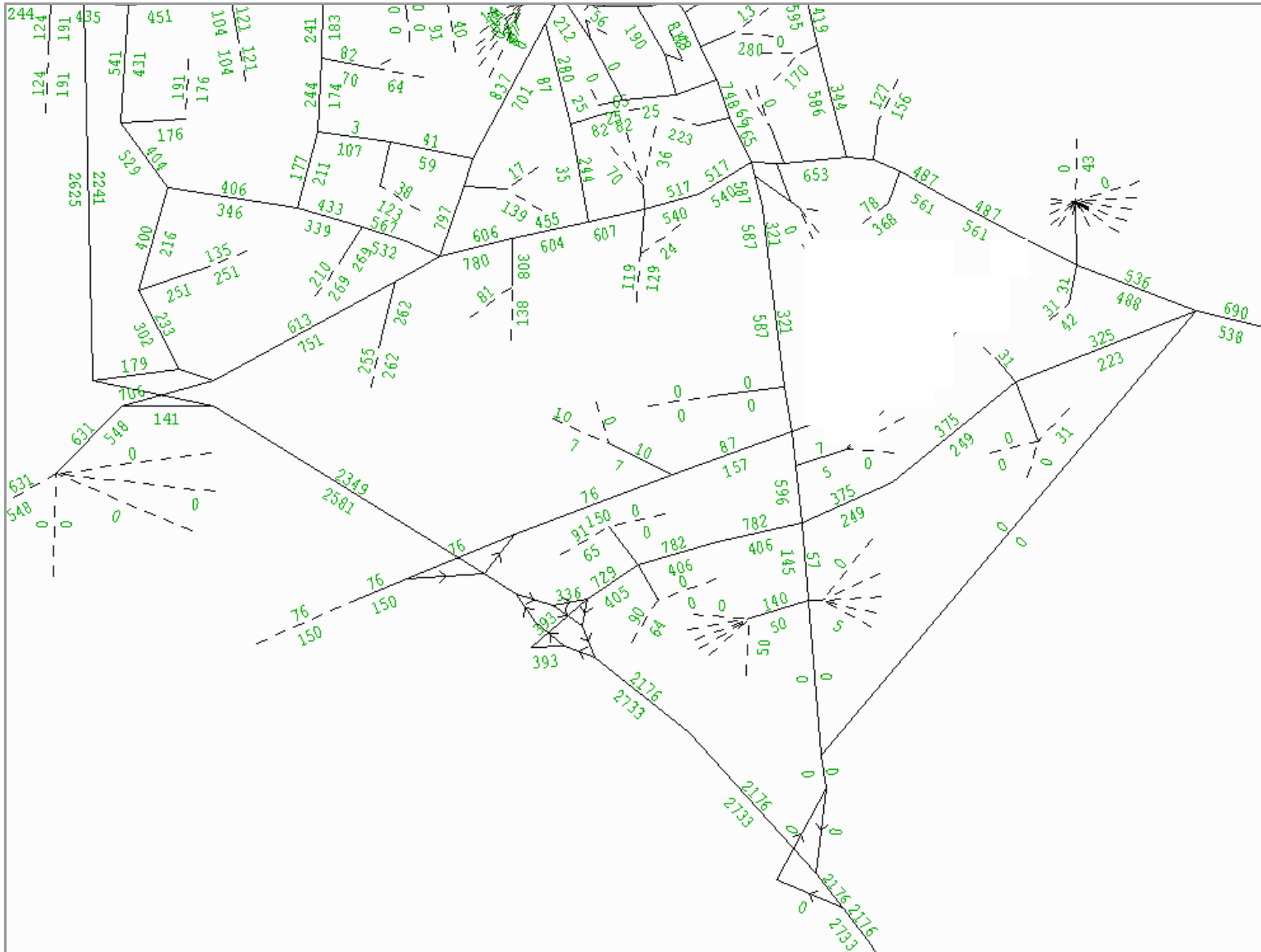
Scenario 3b 2014 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Southern Section



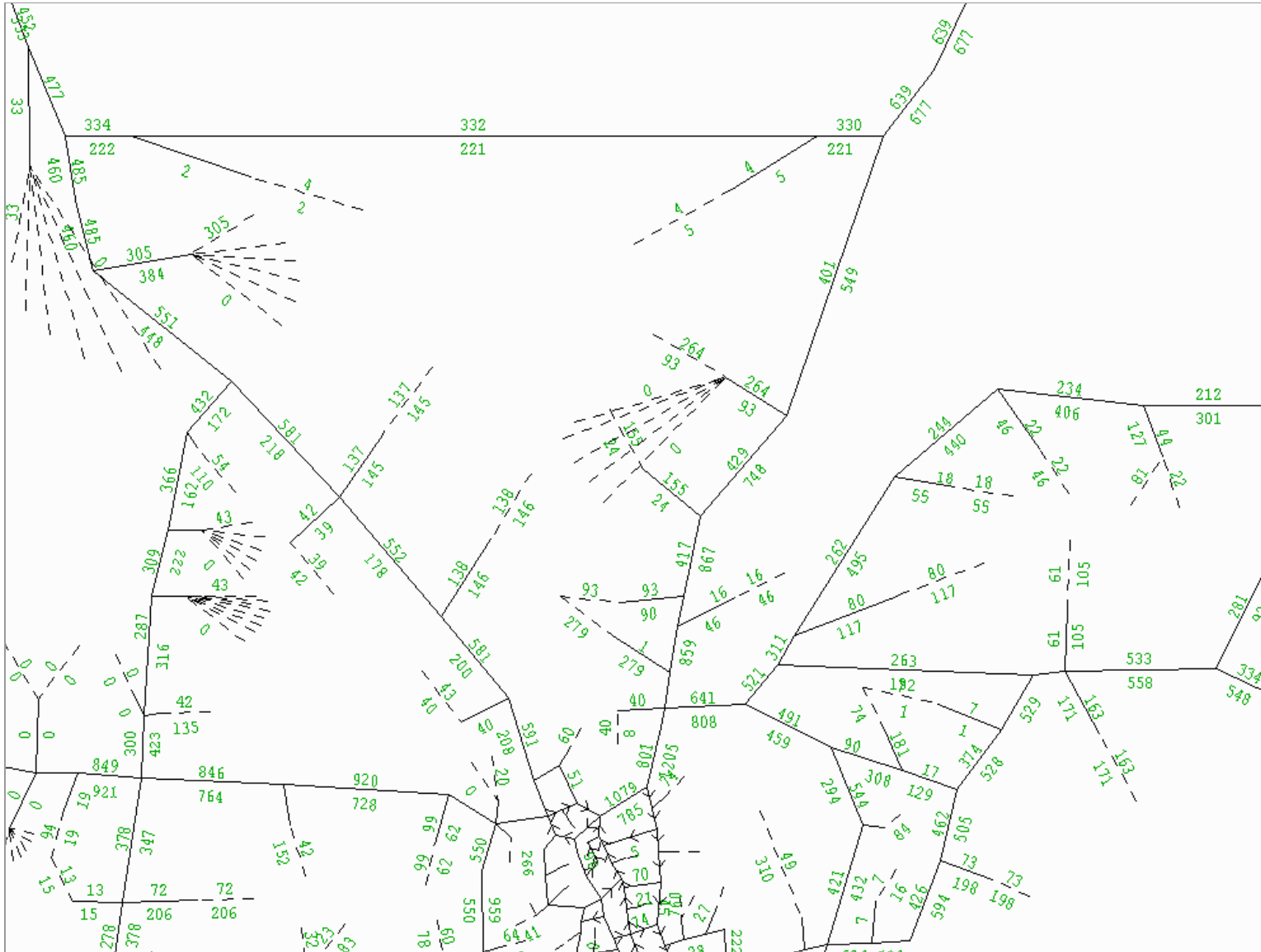


Scenario 3b 2014 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Northern Section

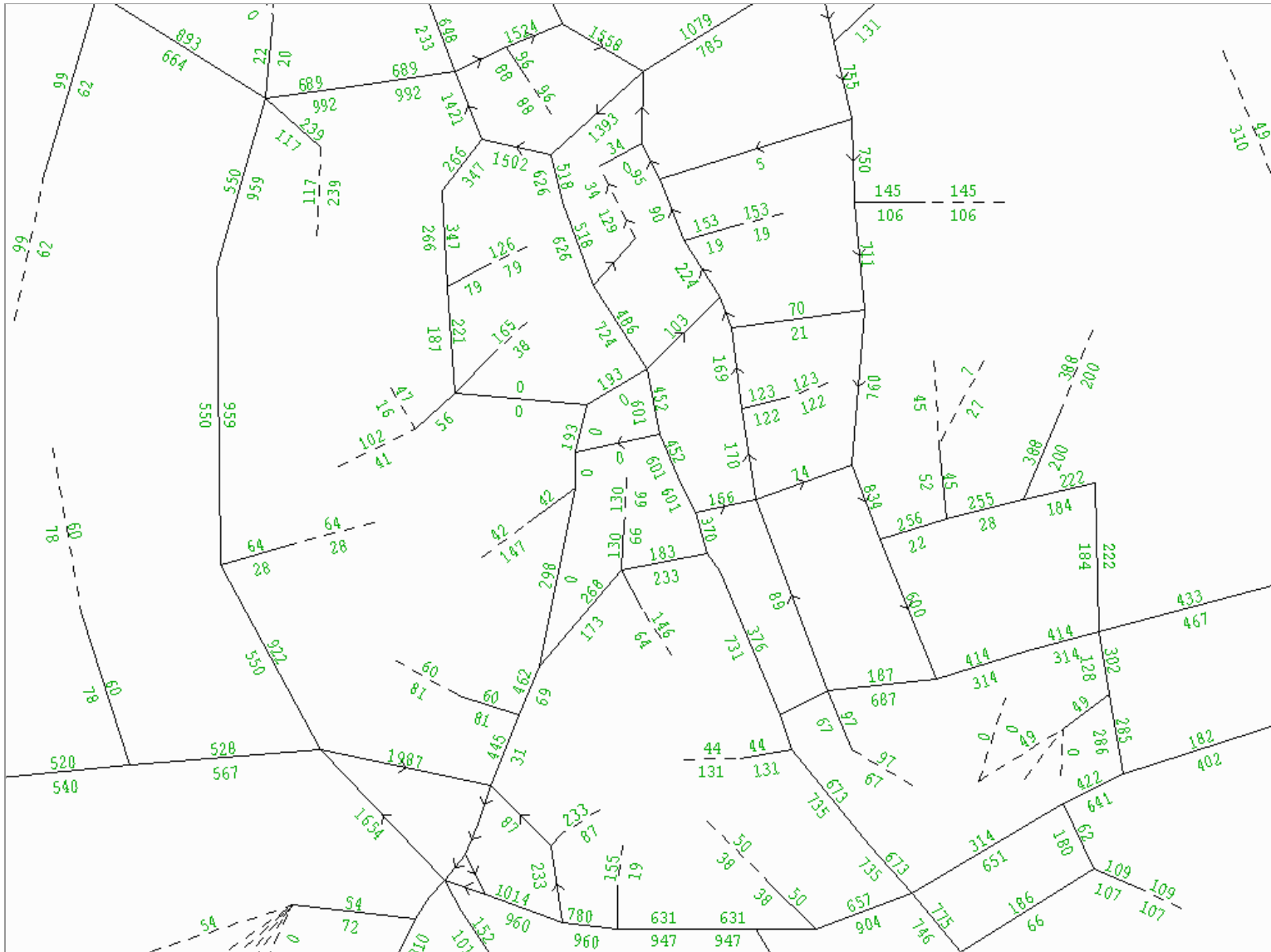




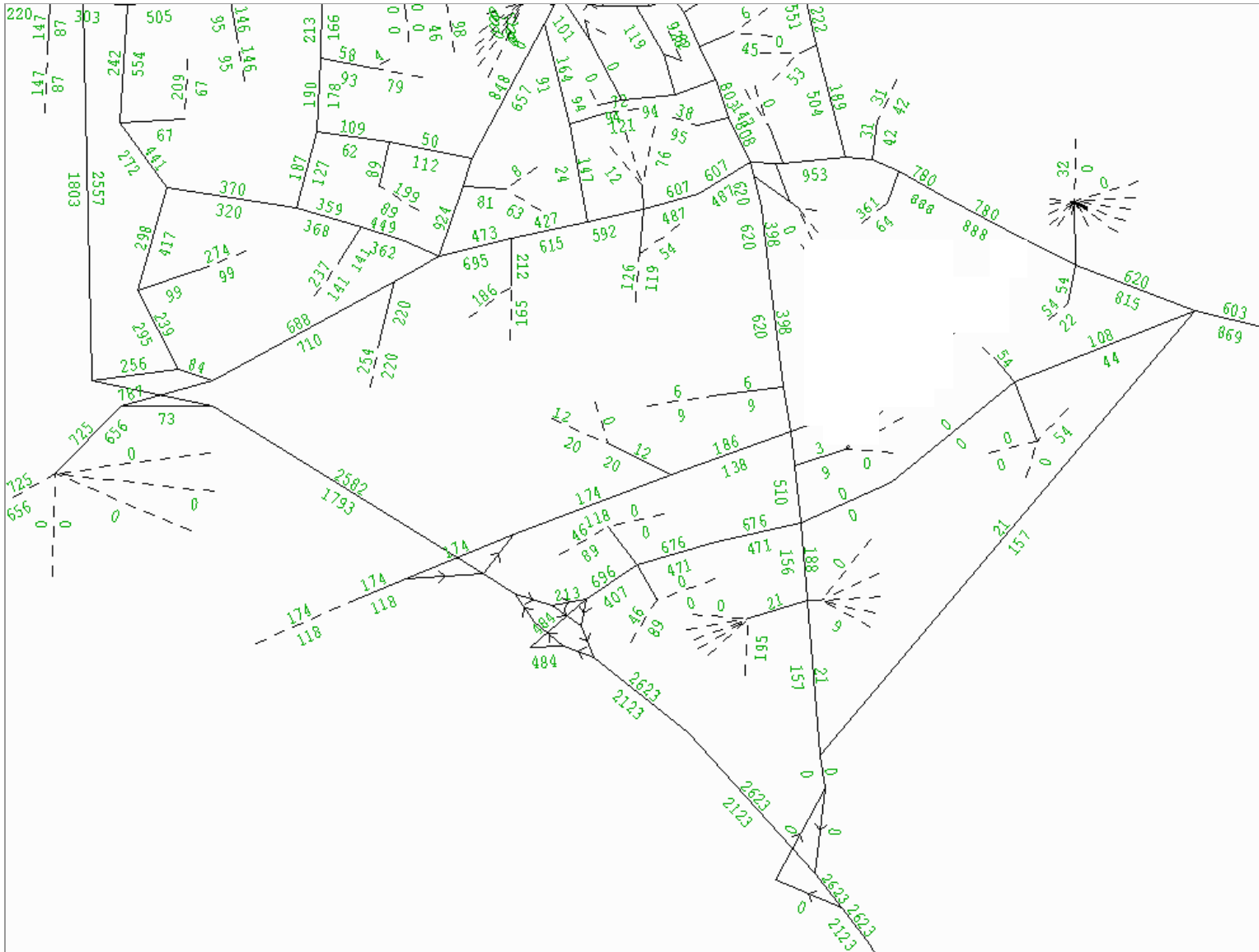
Scenario 3b 2014 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Southern Section



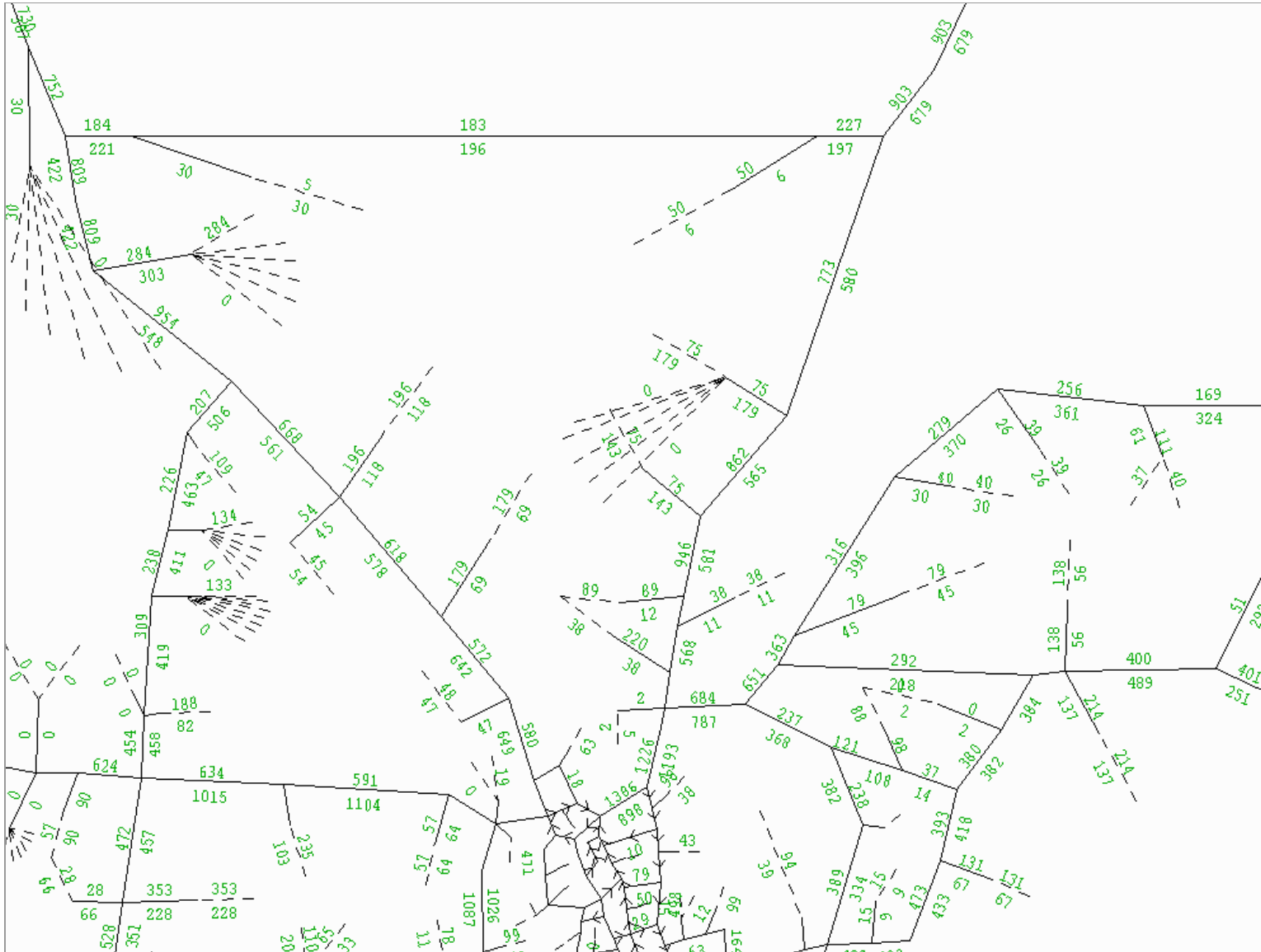
Scenario 3c 2014 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Northern Section



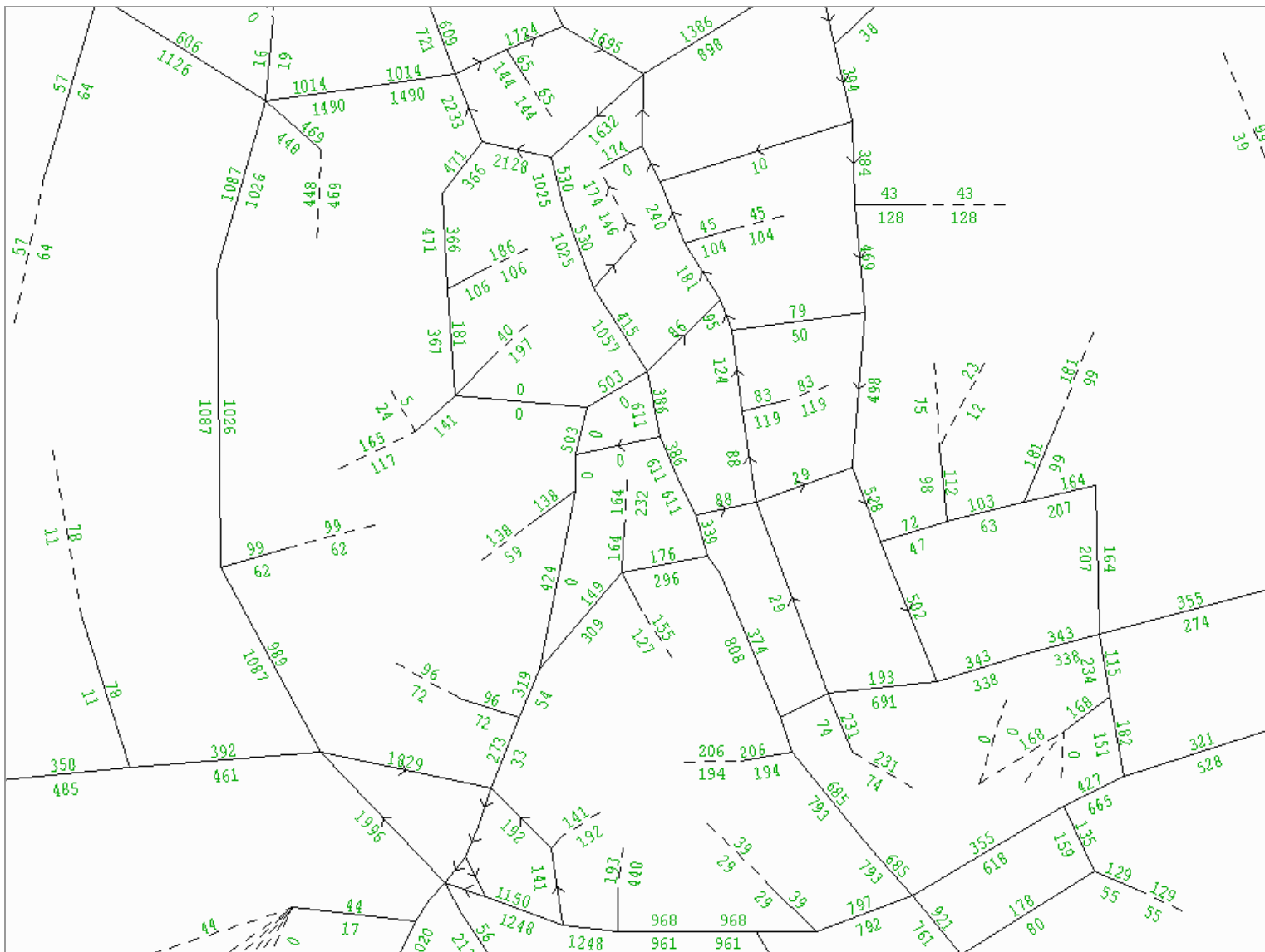
Scenario 3c 2014 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Town Centre



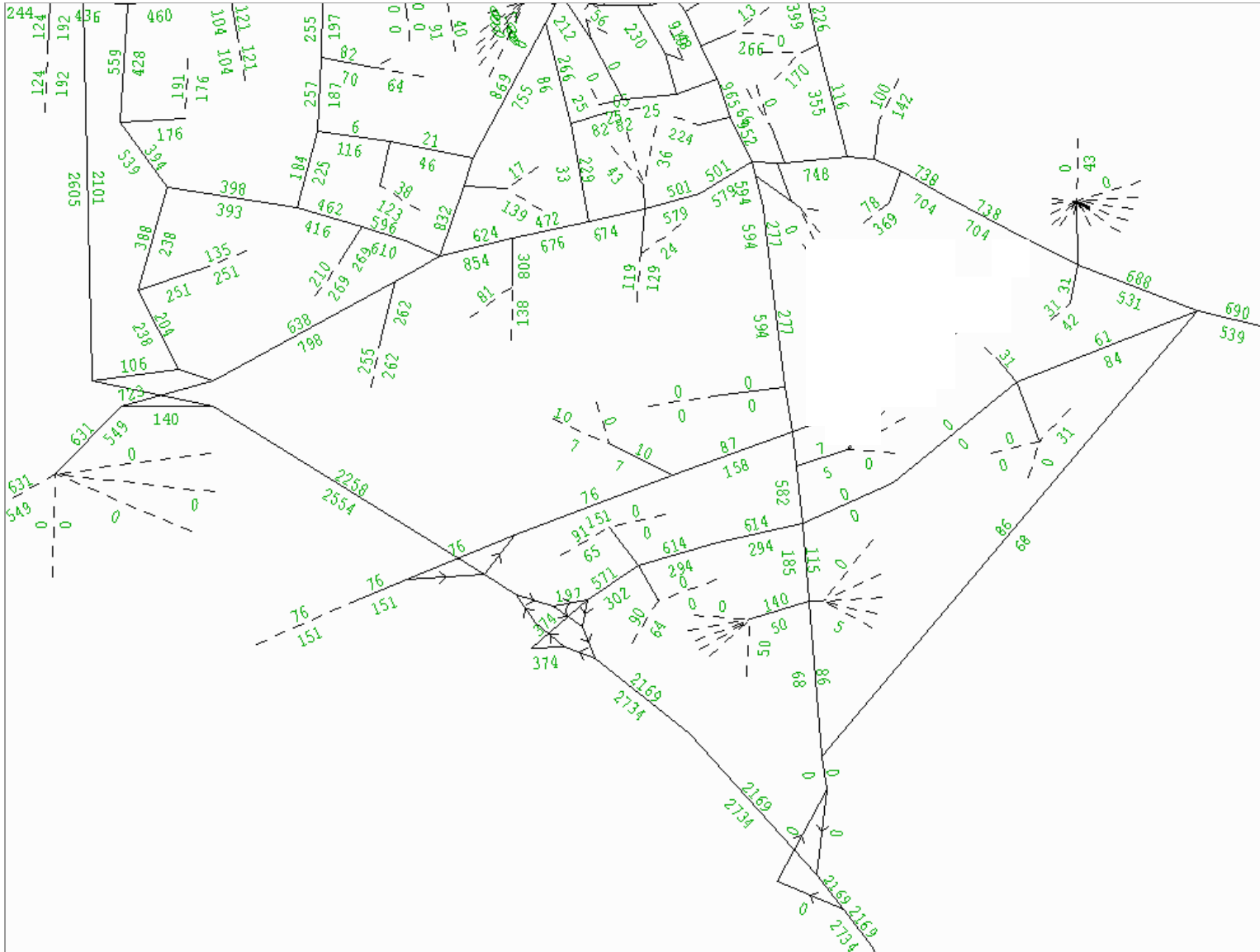
Scenario 3c 2014 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Southern Section



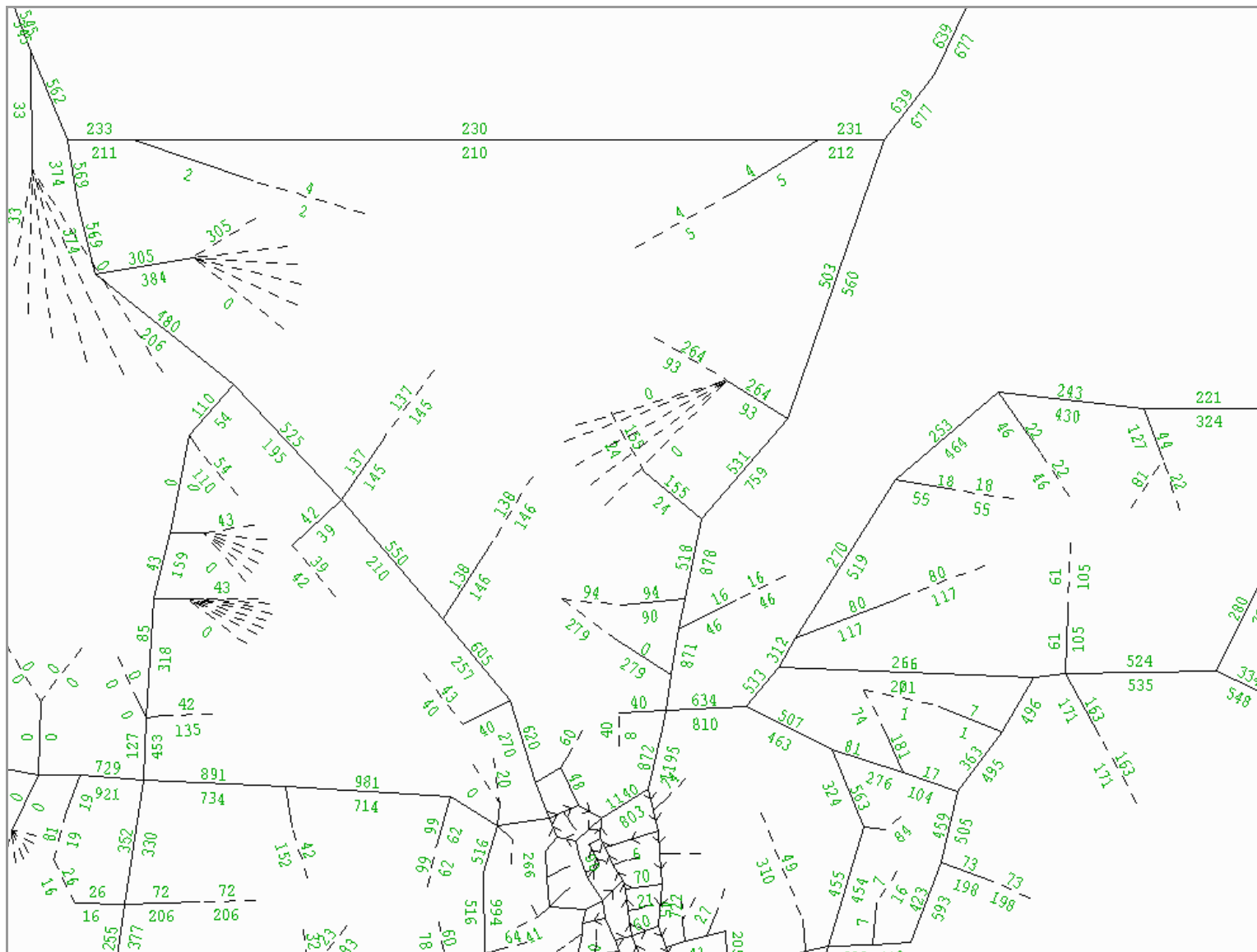
Scenario 3c 2014 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Northern Section



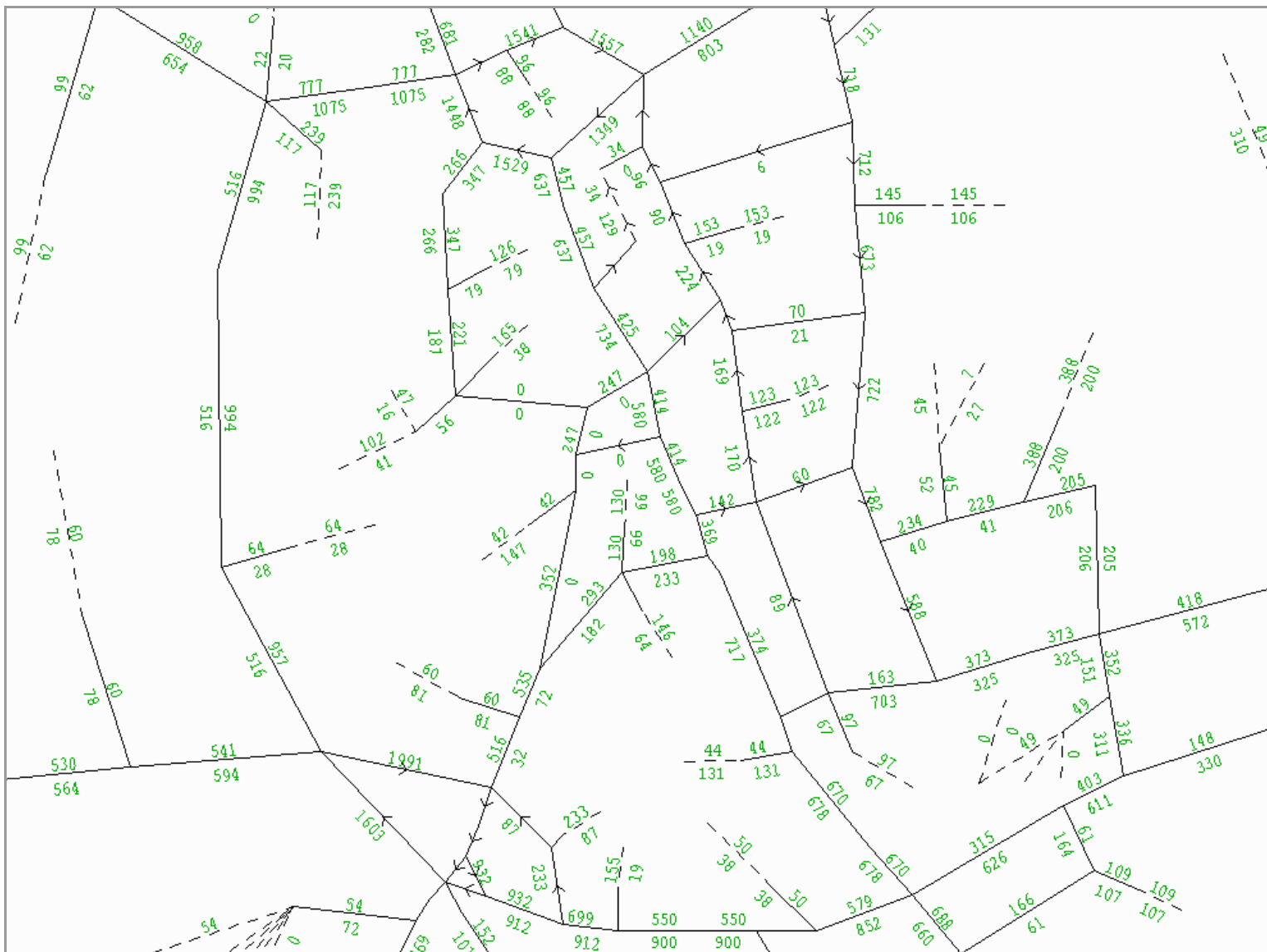




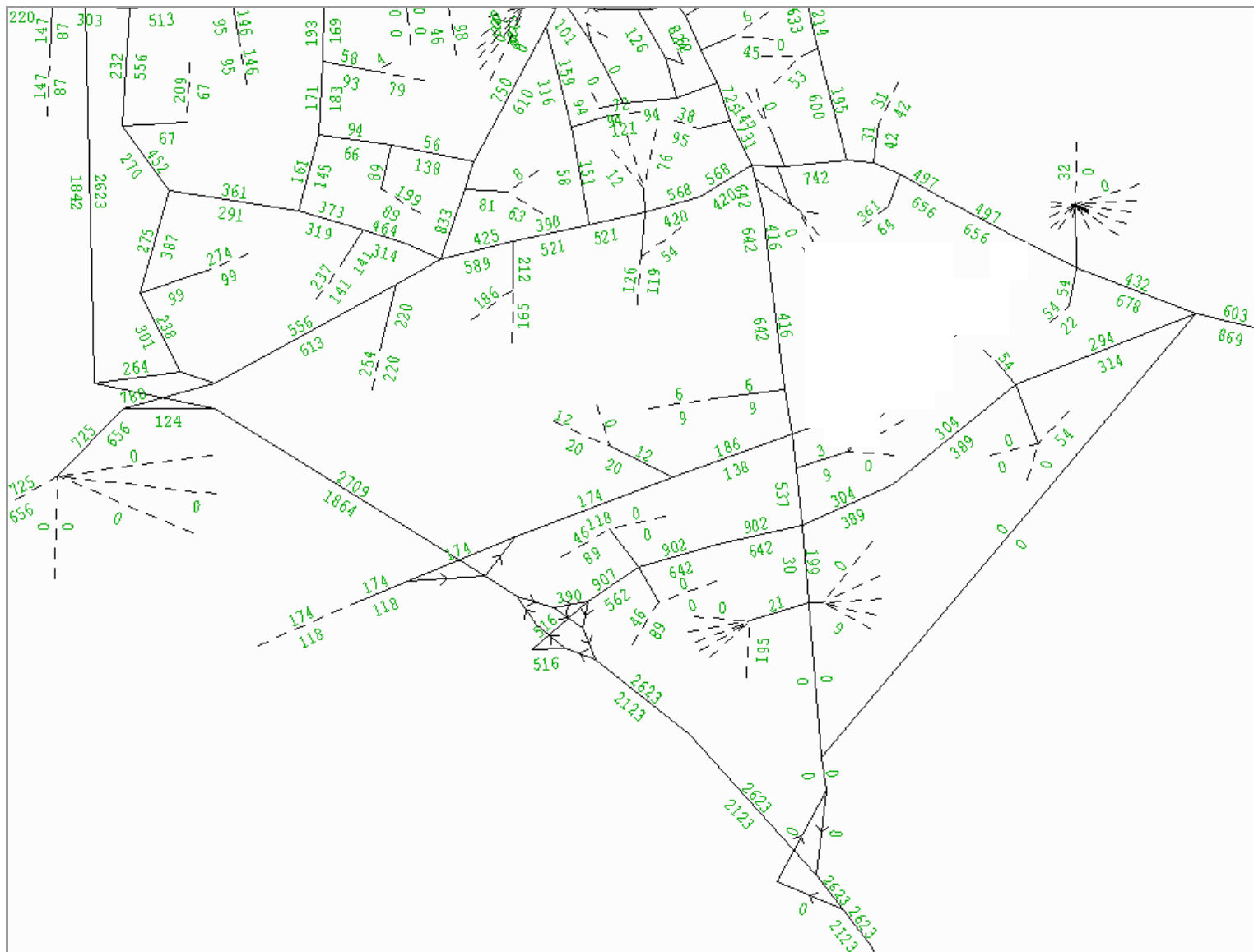
Scenario 3c 2014 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Southern Section



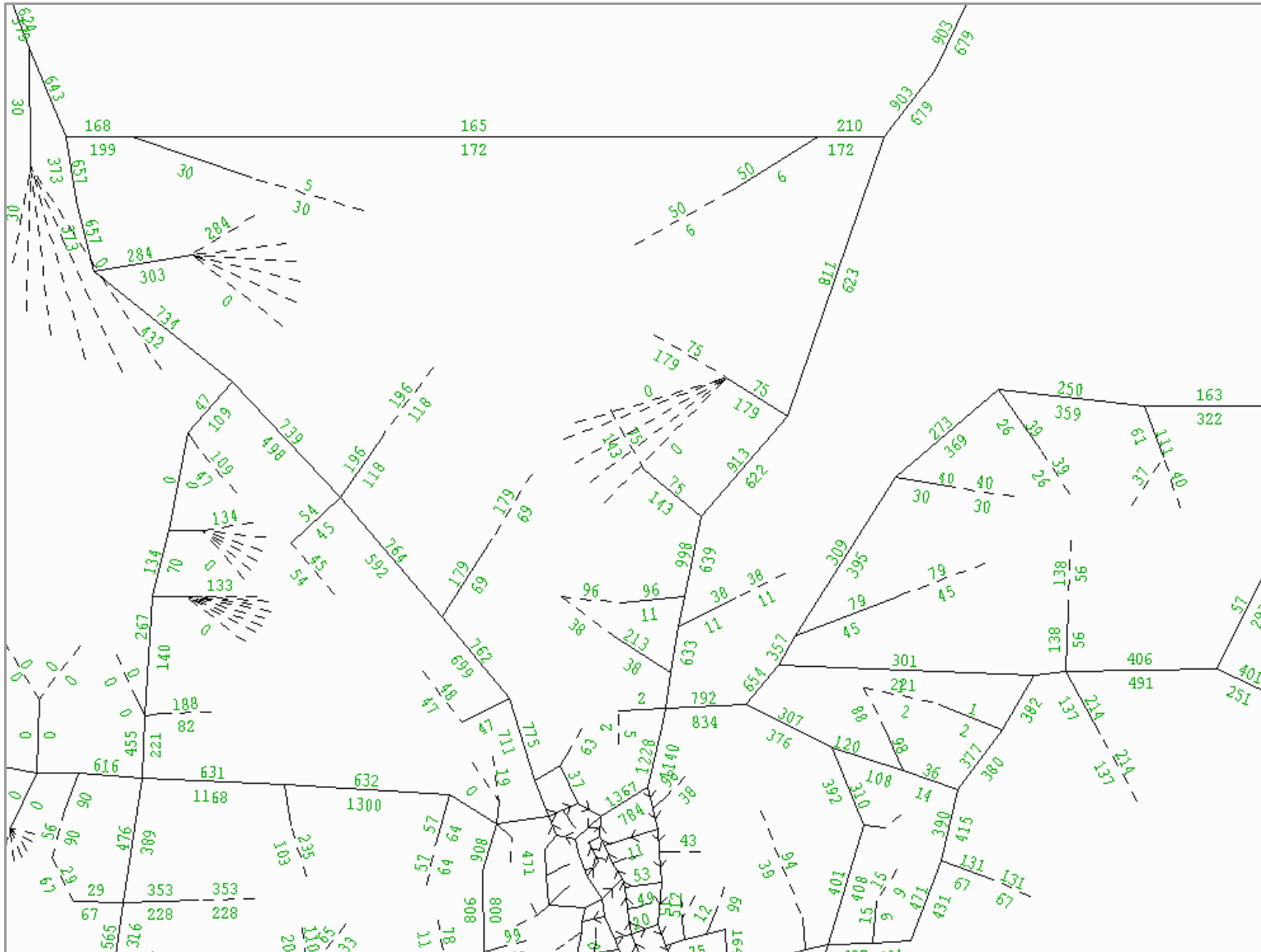
Scenario 4a 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Northern Section



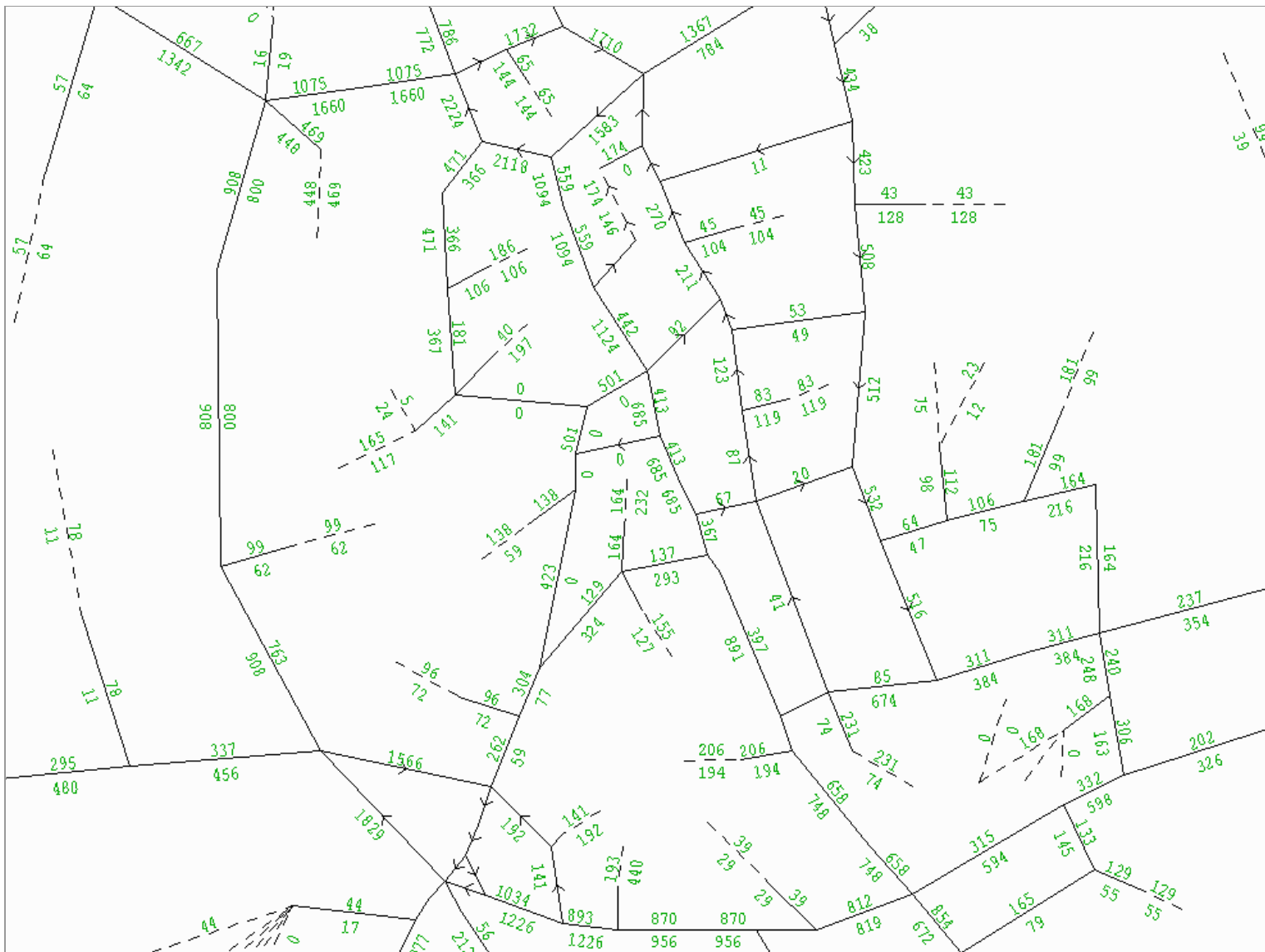
Scenario 4a 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Town Centre



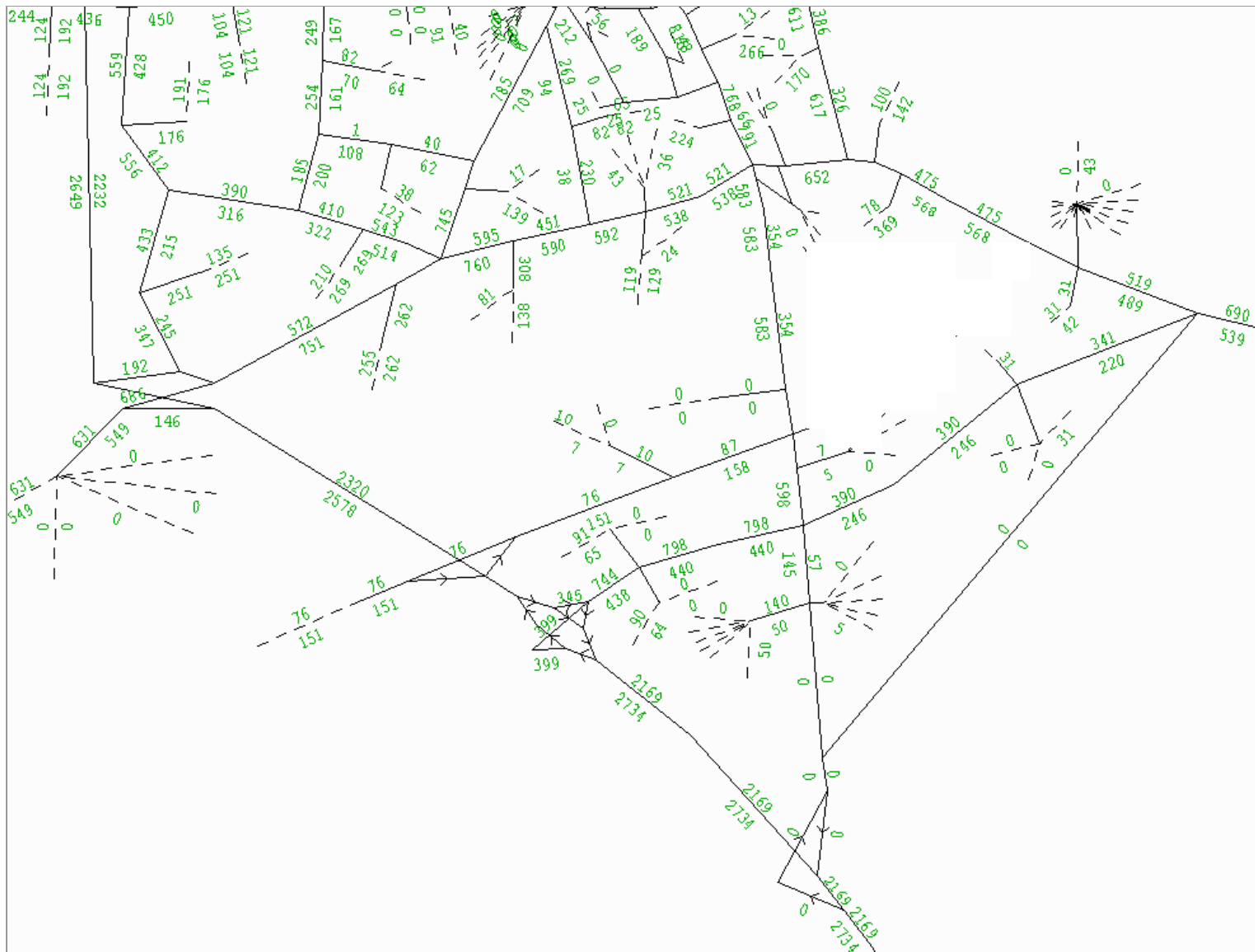
Scenario 4a 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Southern Section



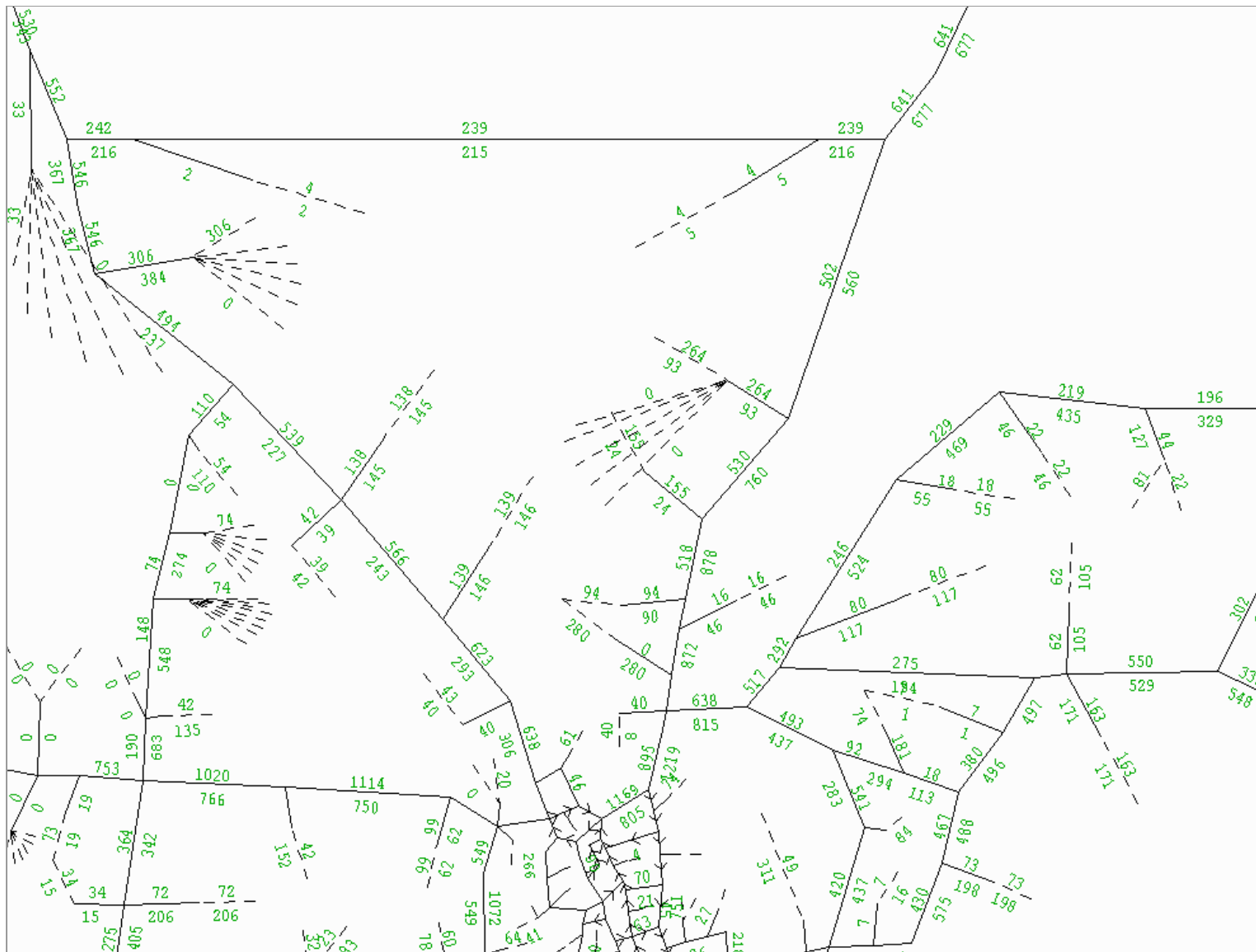
Scenario 4a 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Northern Section



Scenario 4a 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Town Centre

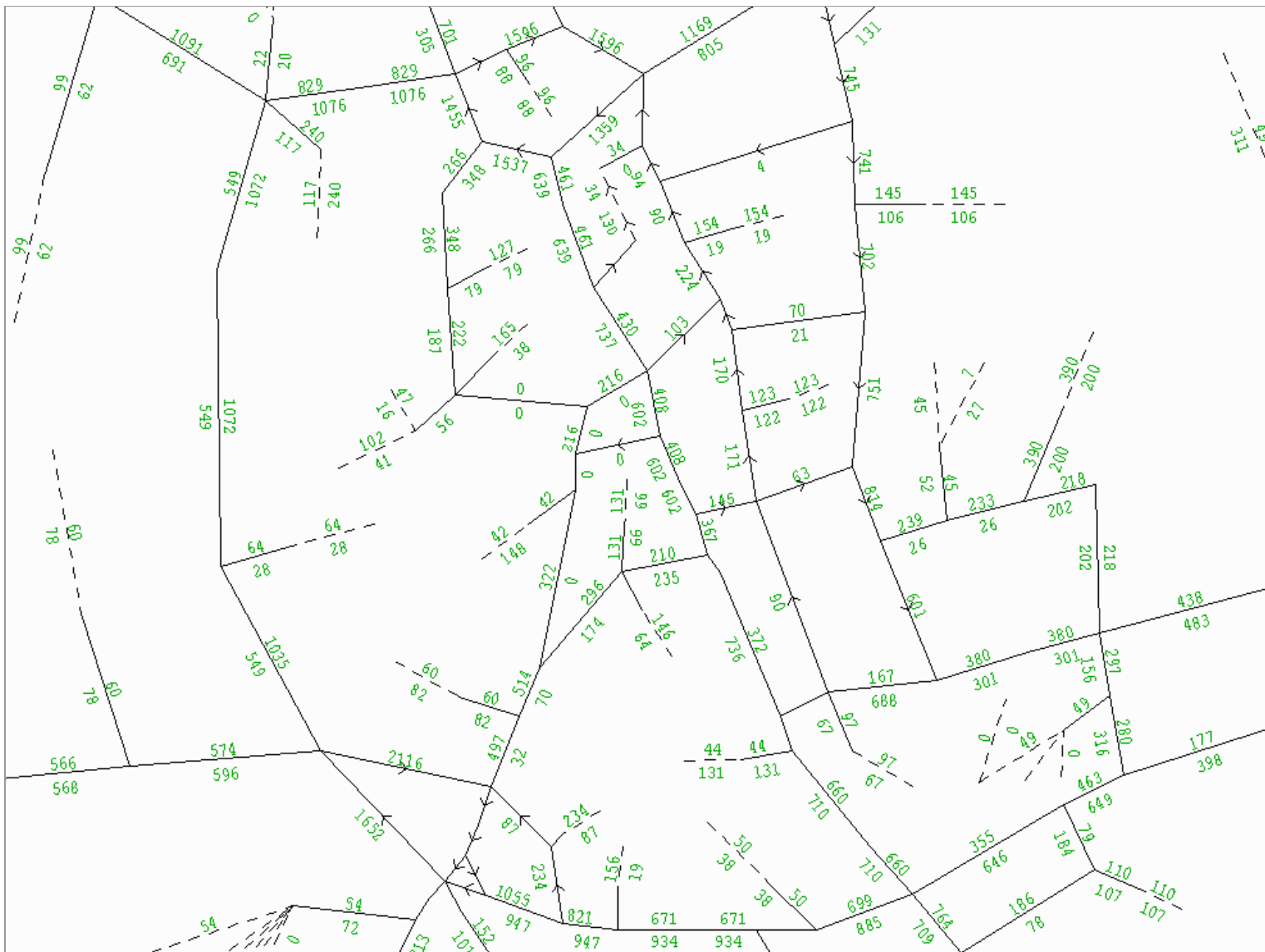


Scenario 4a 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Southern Section

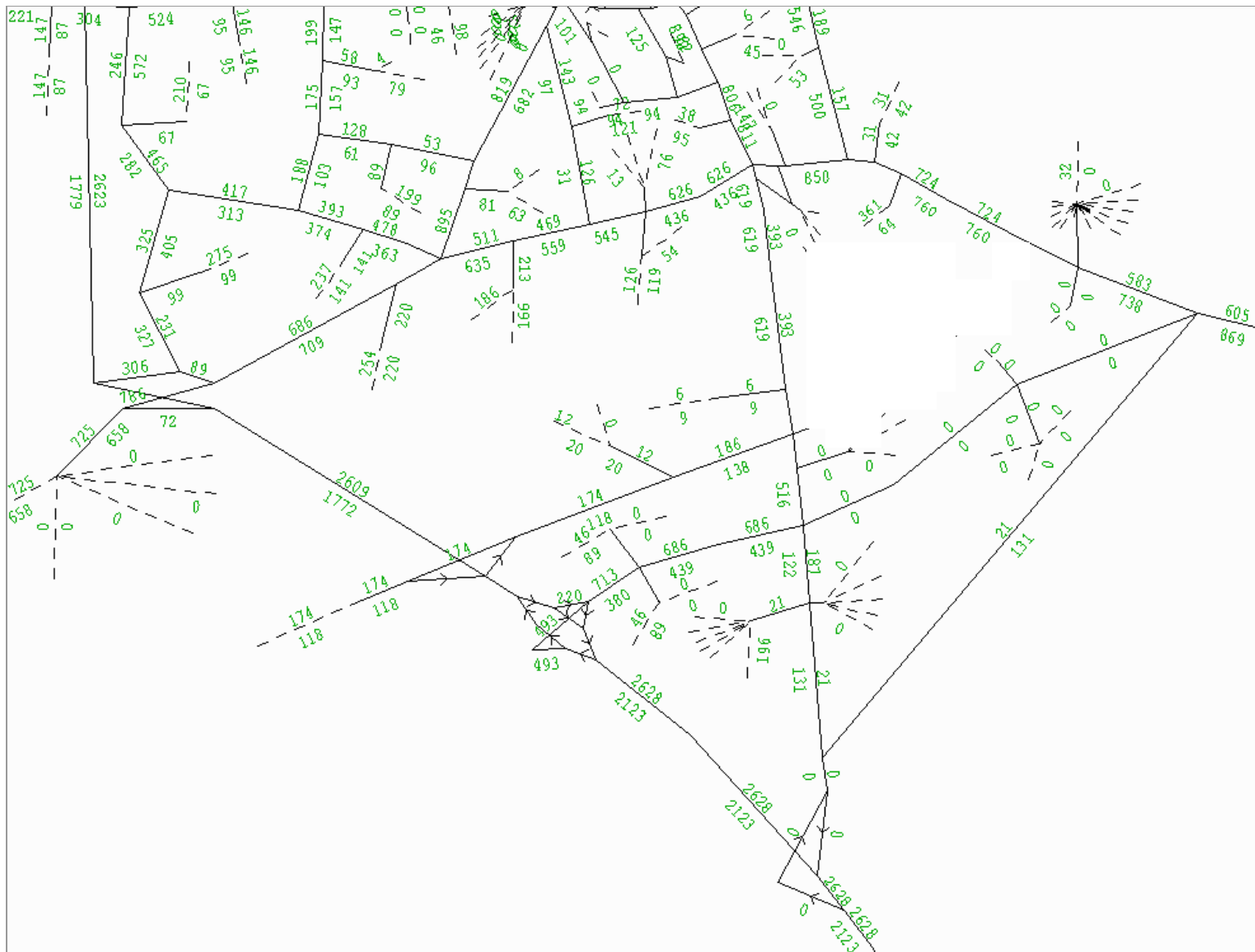


Scenario 4b 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Northern Section

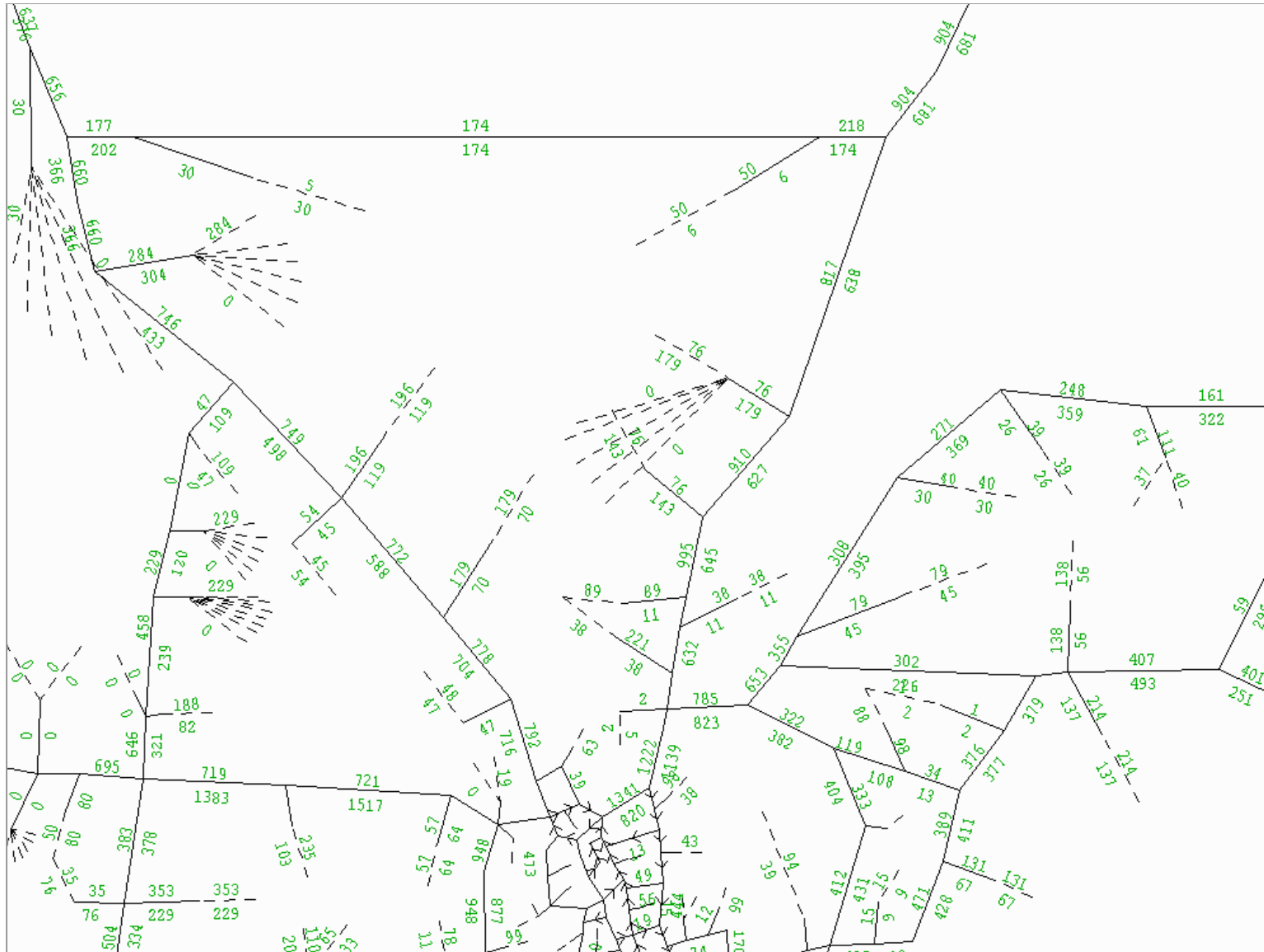




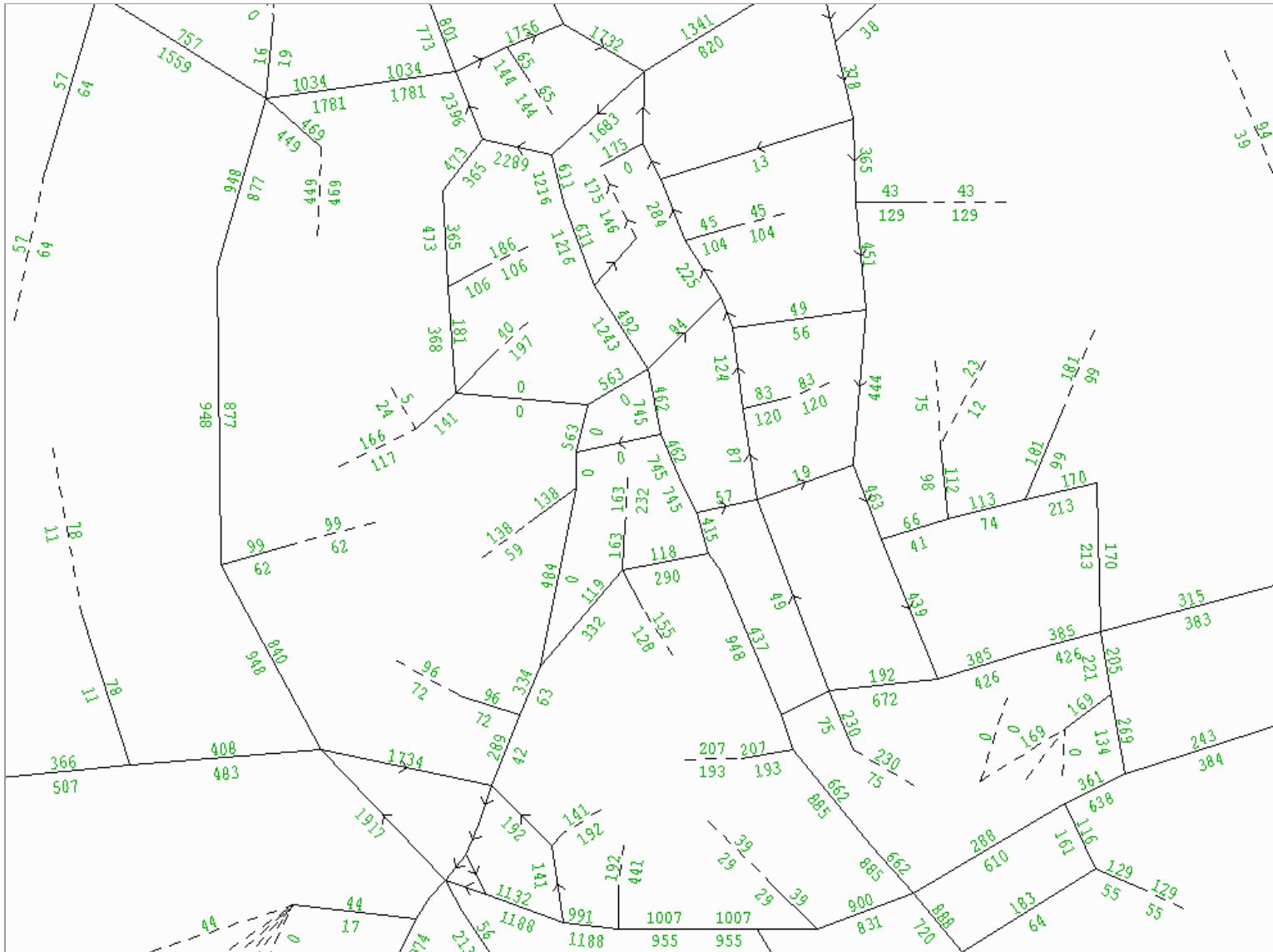
Scenario 4b 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Town Centre



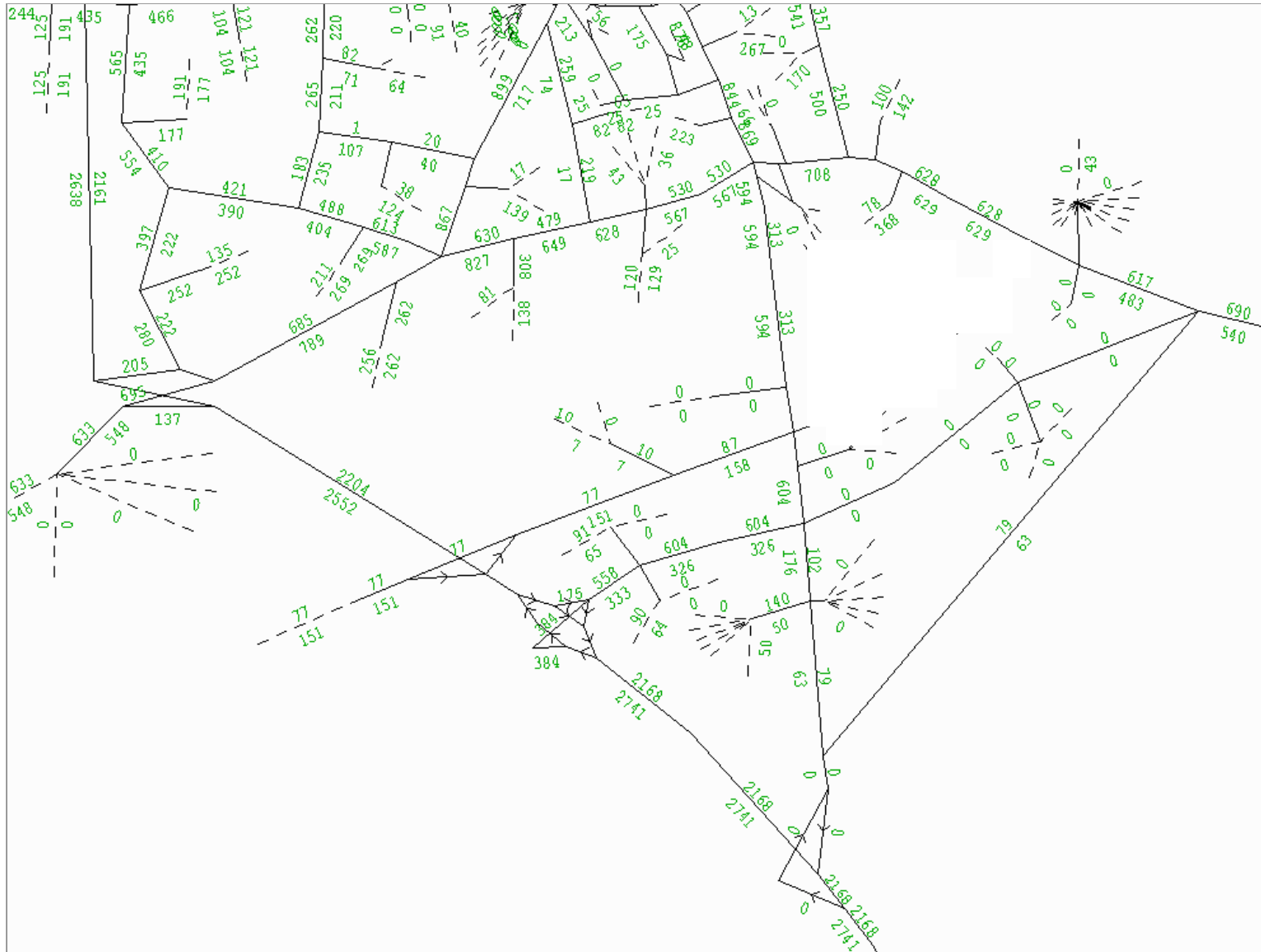
Scenario 4b 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Southern Section



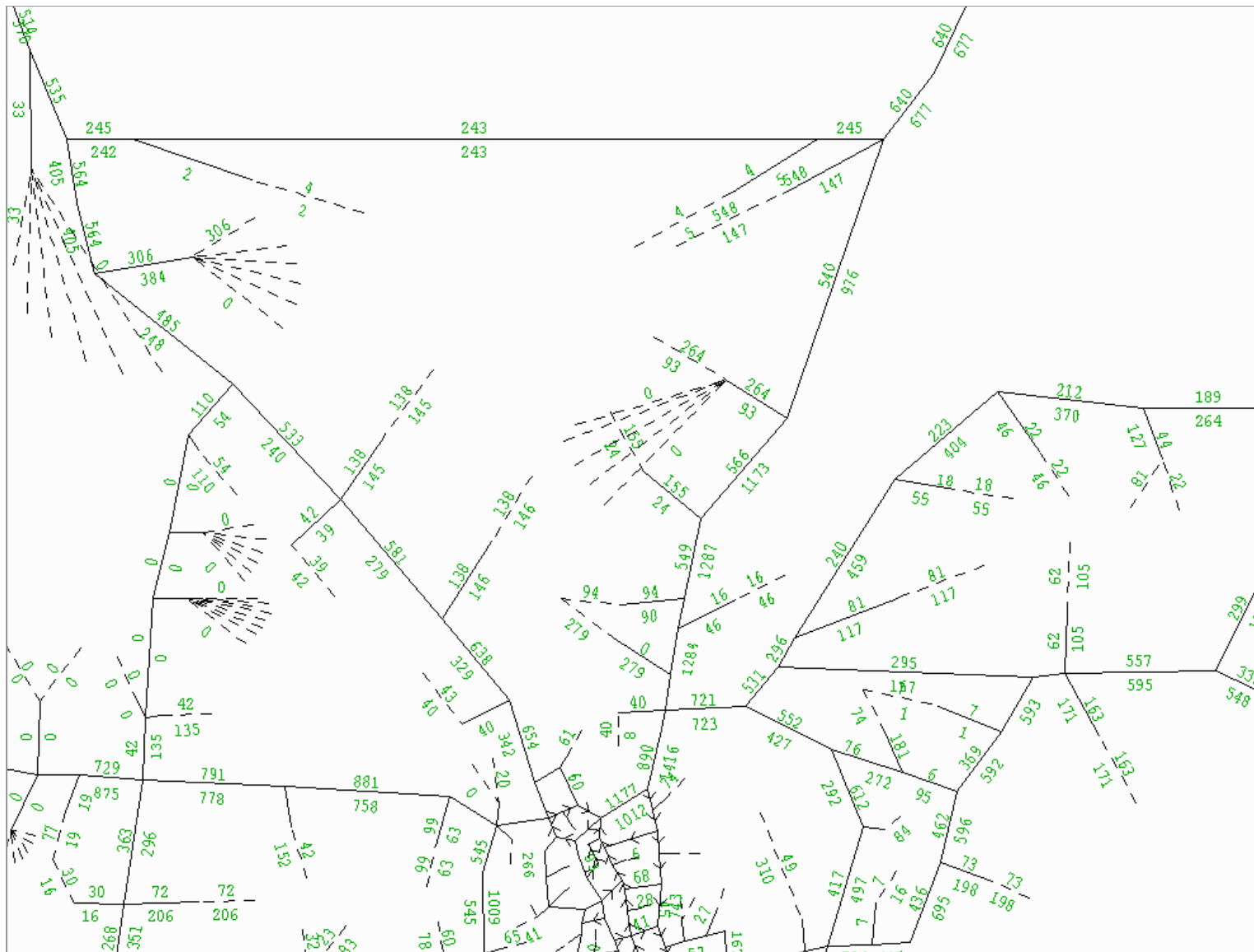
Scenario 4b 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Northern Section



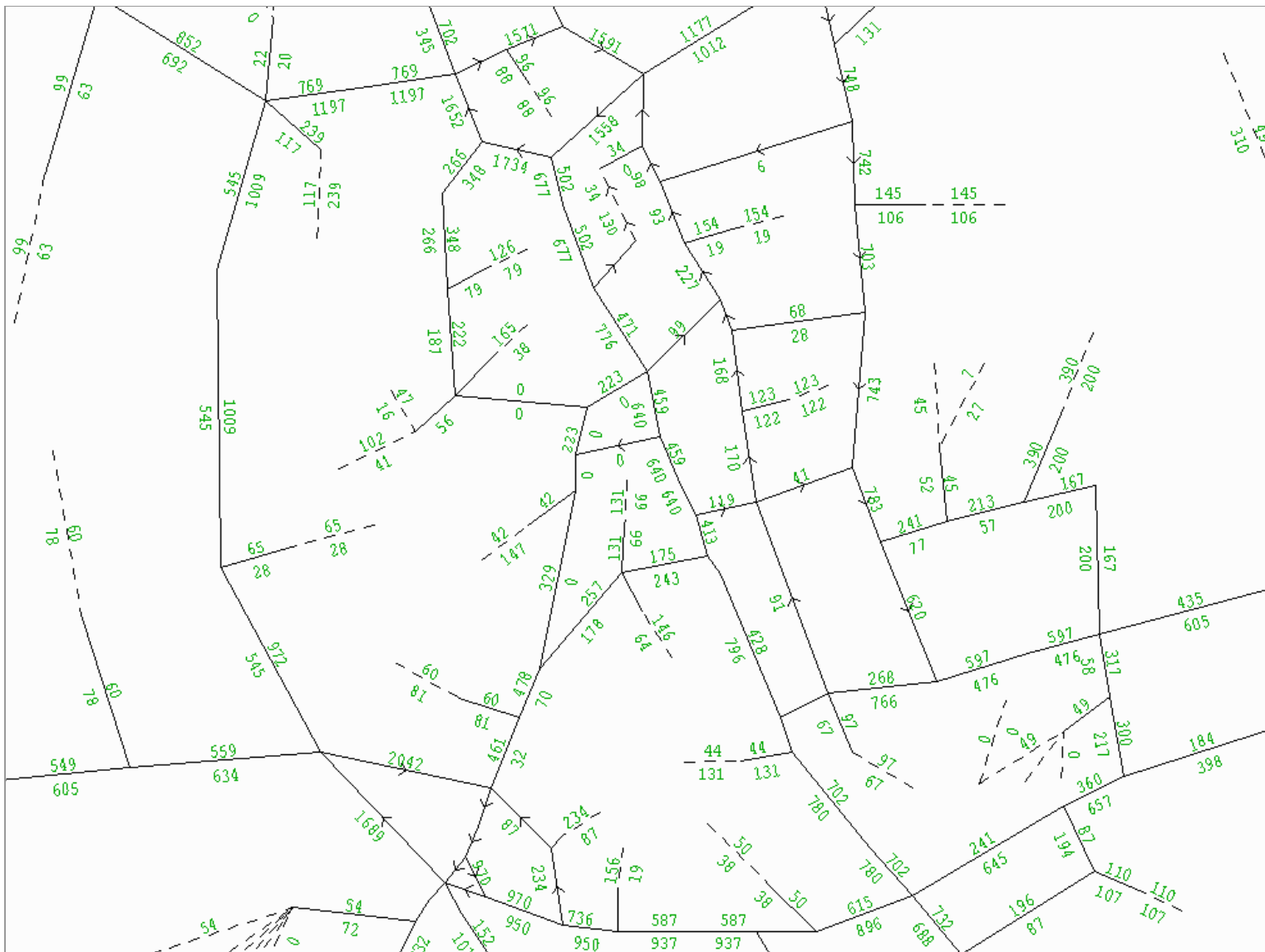
Scenario 4b 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Town Centre



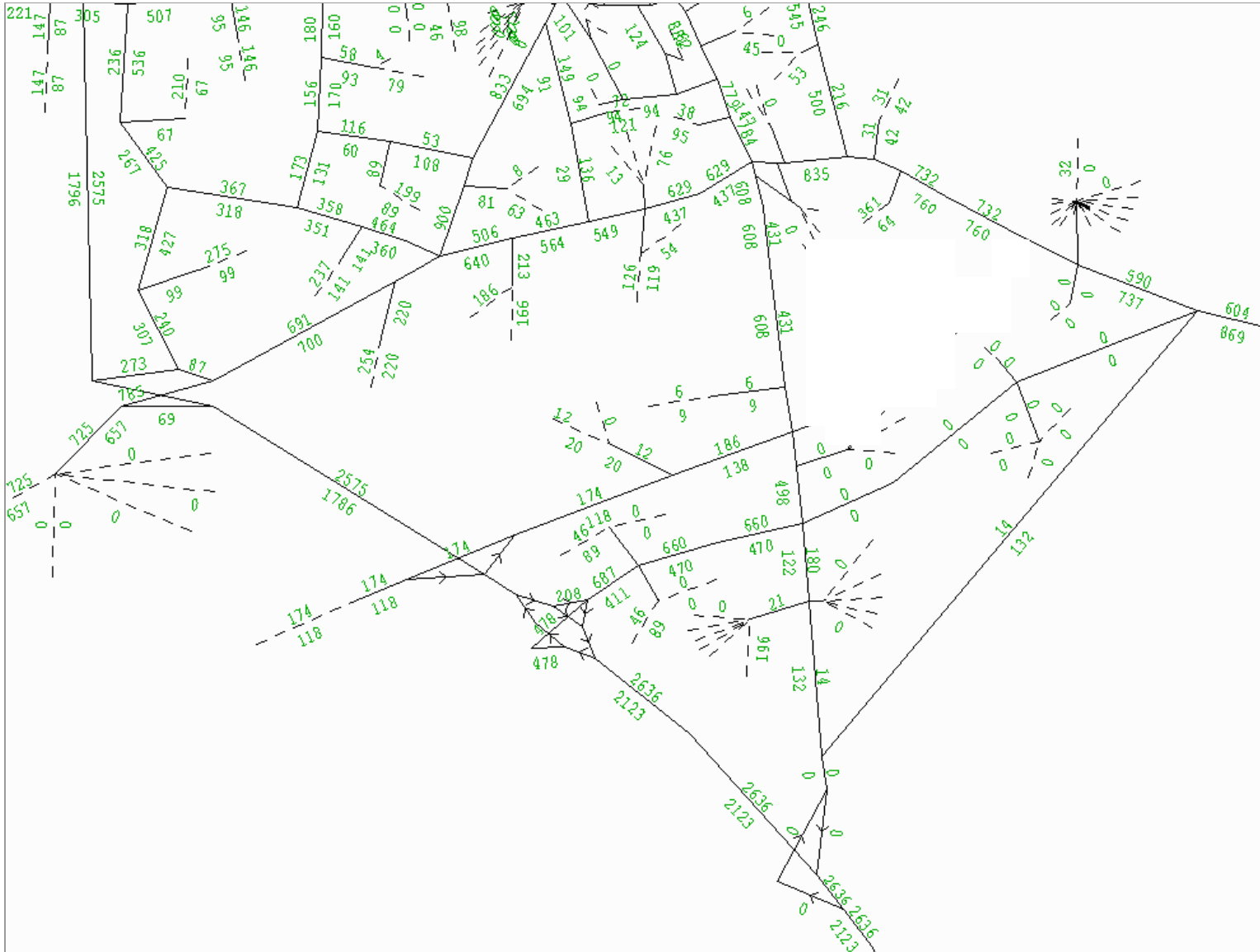
Scenario 4b 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Southern Section



Scenario 4c 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Northern Section

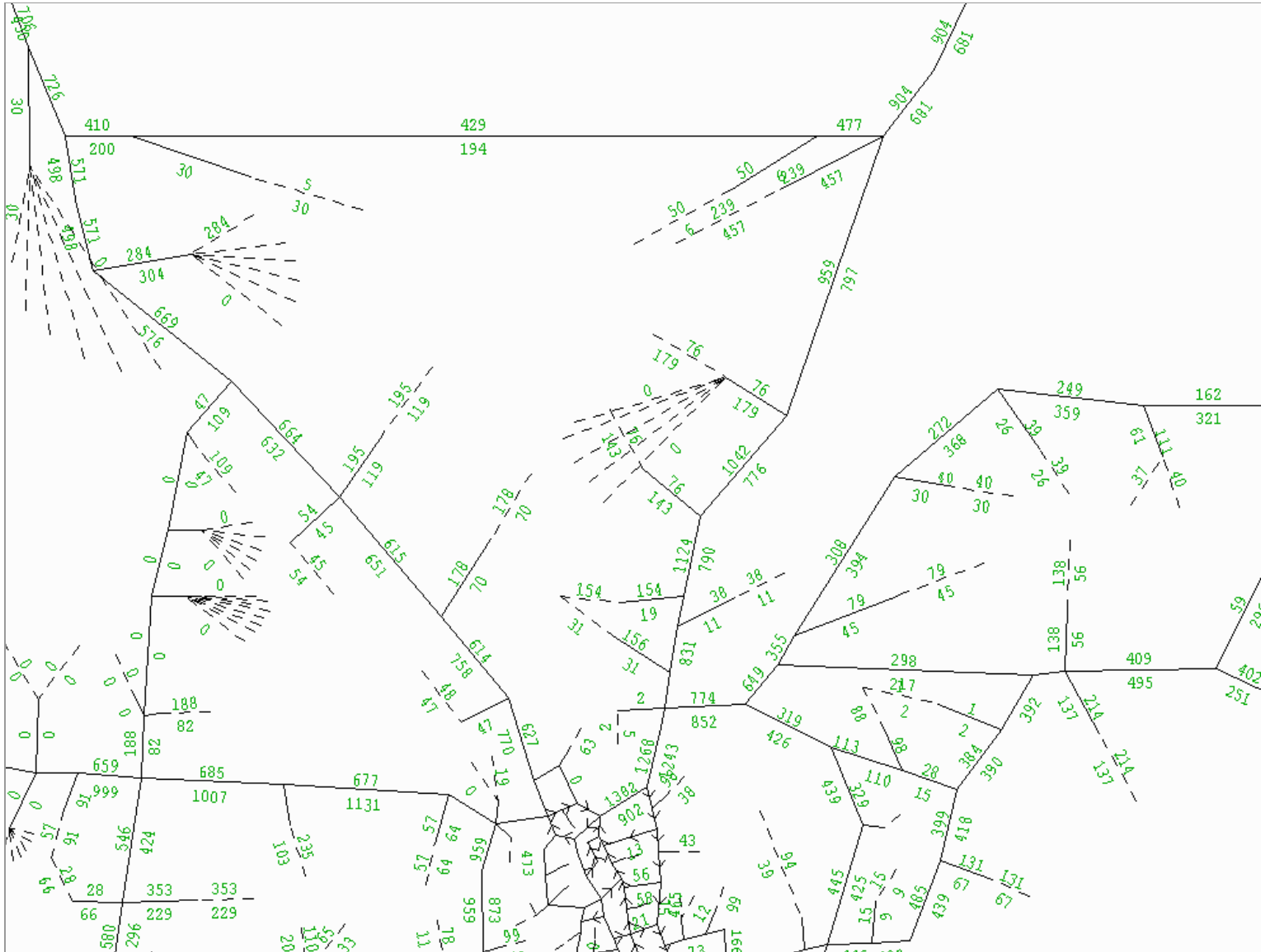


Scenario 4c 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Town Centre

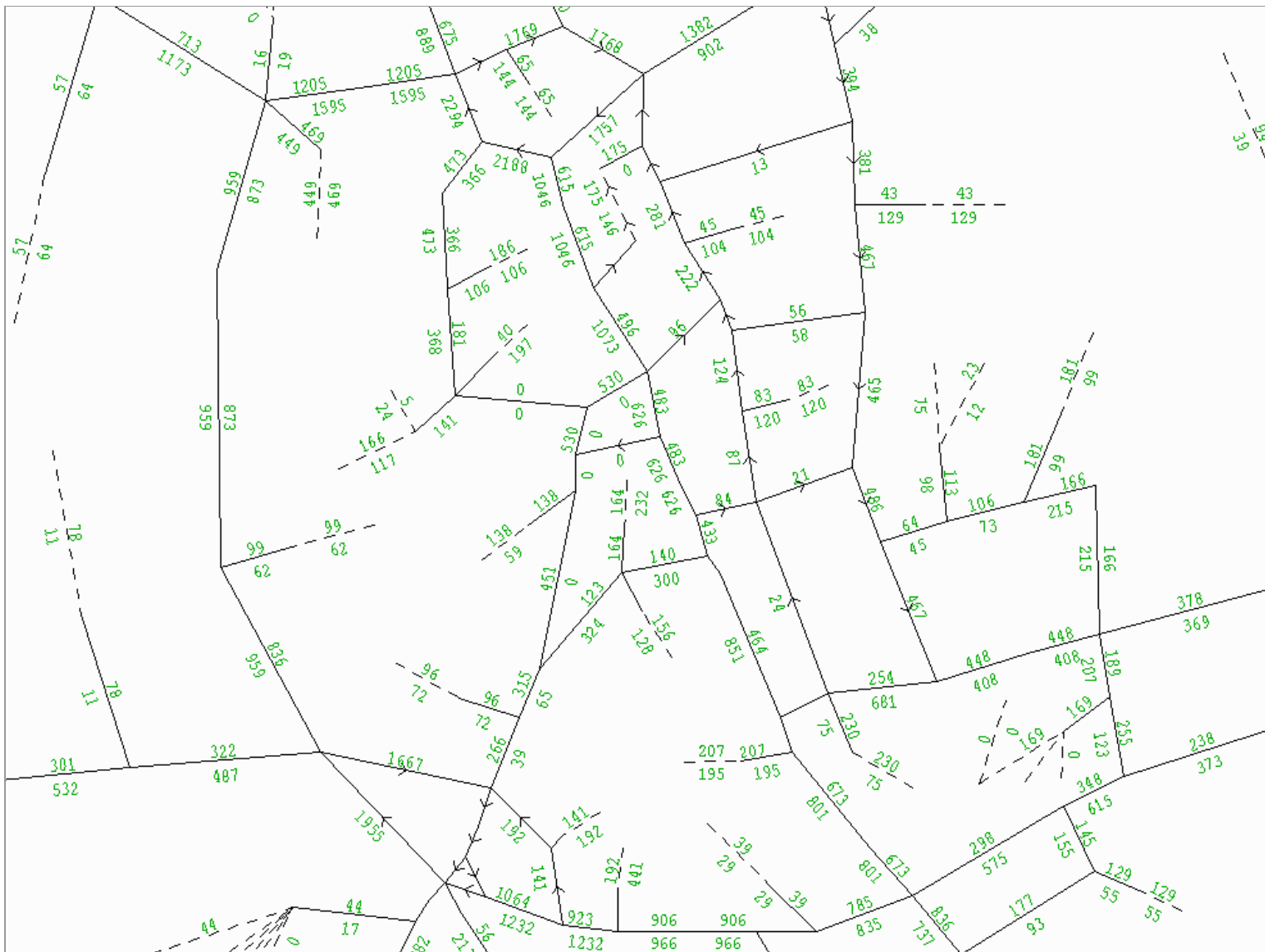


Scenario 4c 2014 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Southern Section

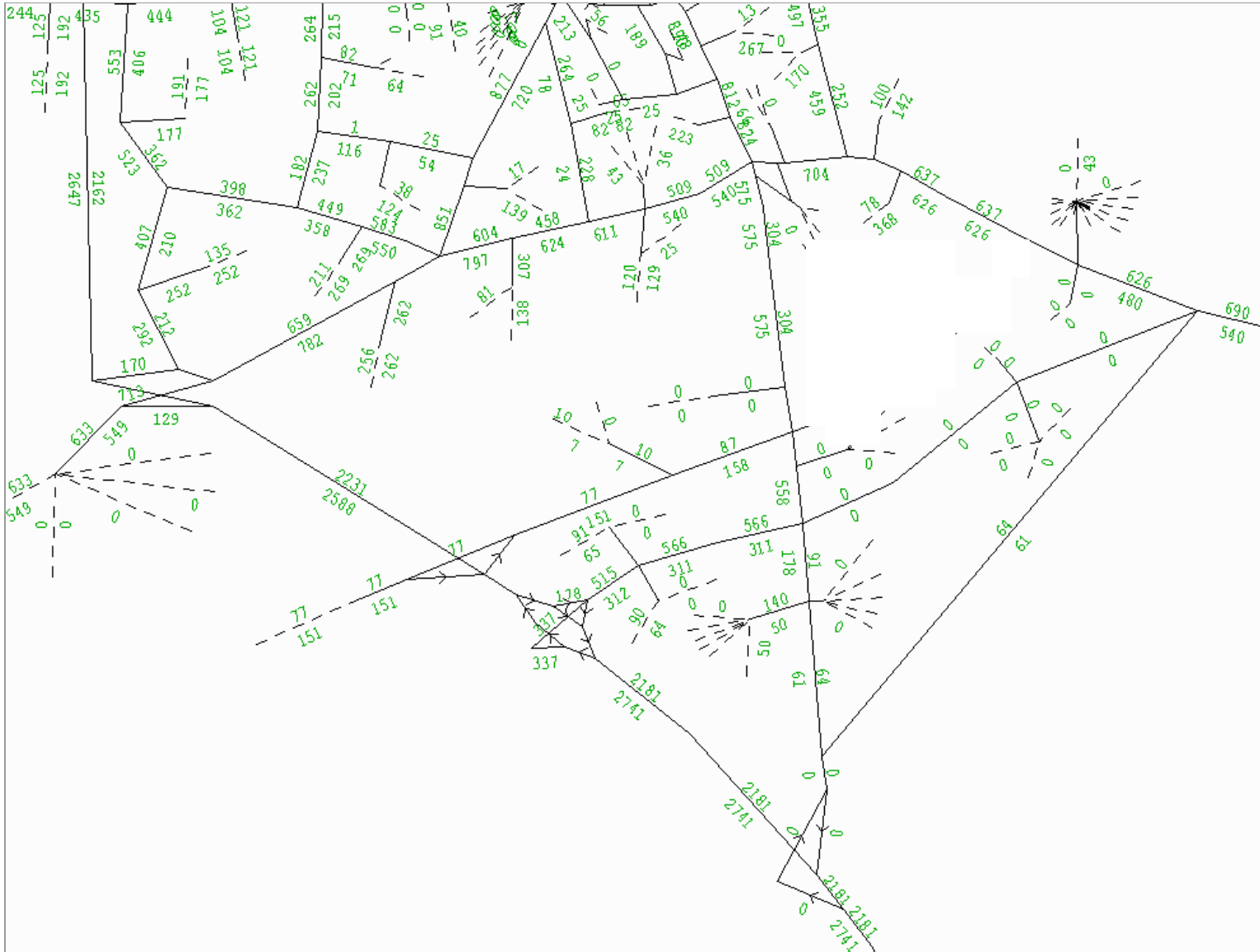




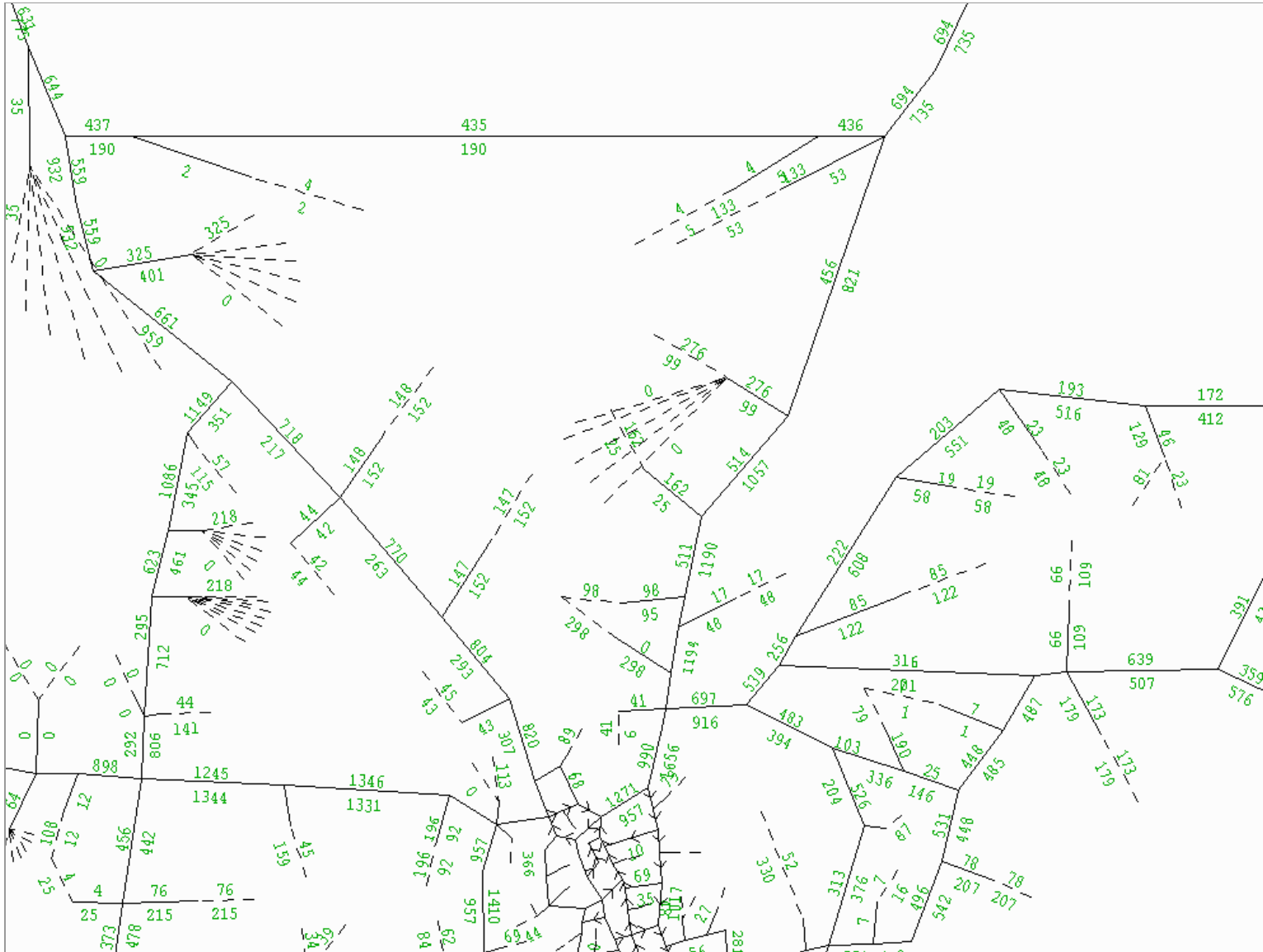
Scenario 4c 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Northern Section



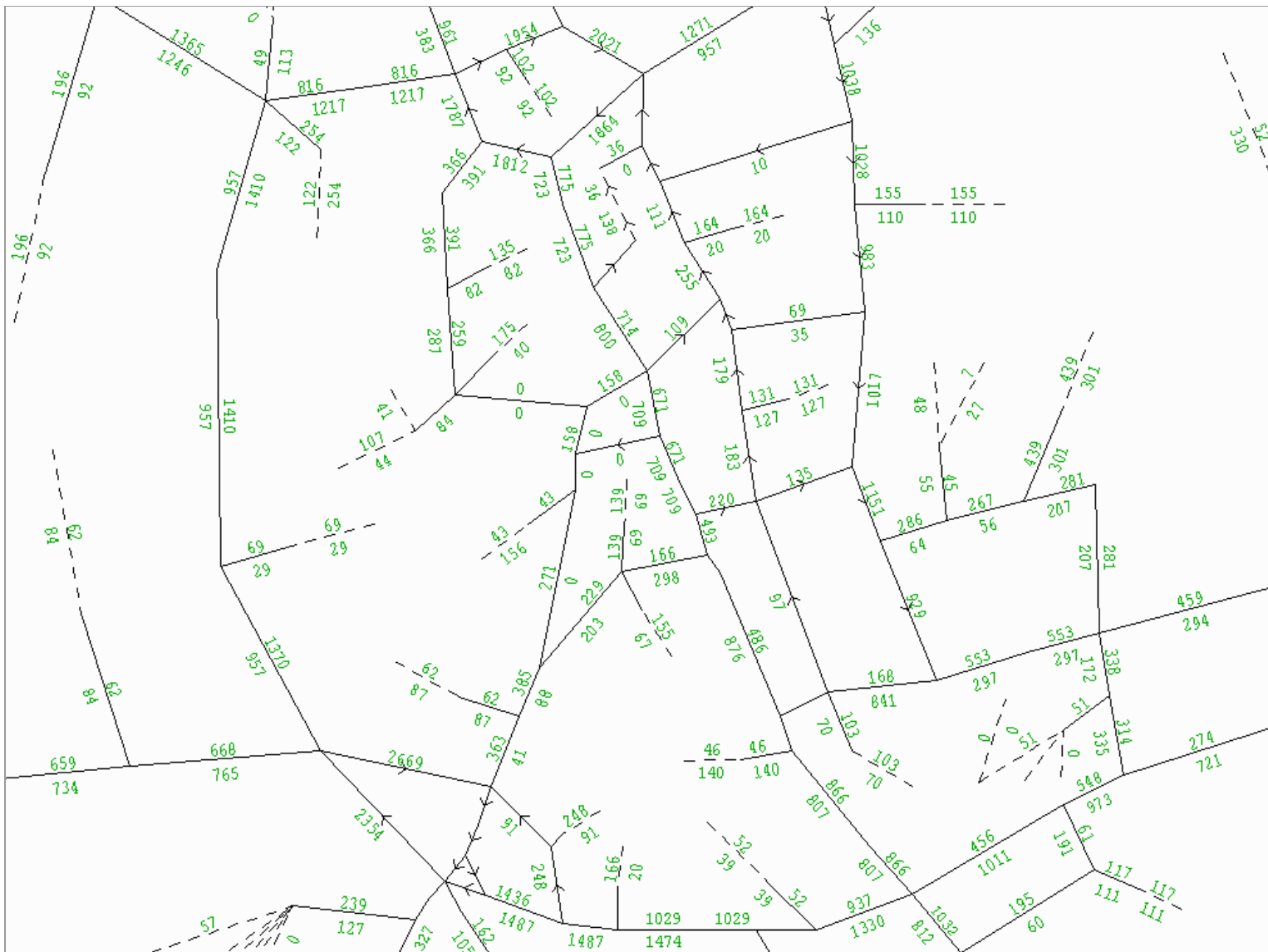
Scenario 4c 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Town Centre



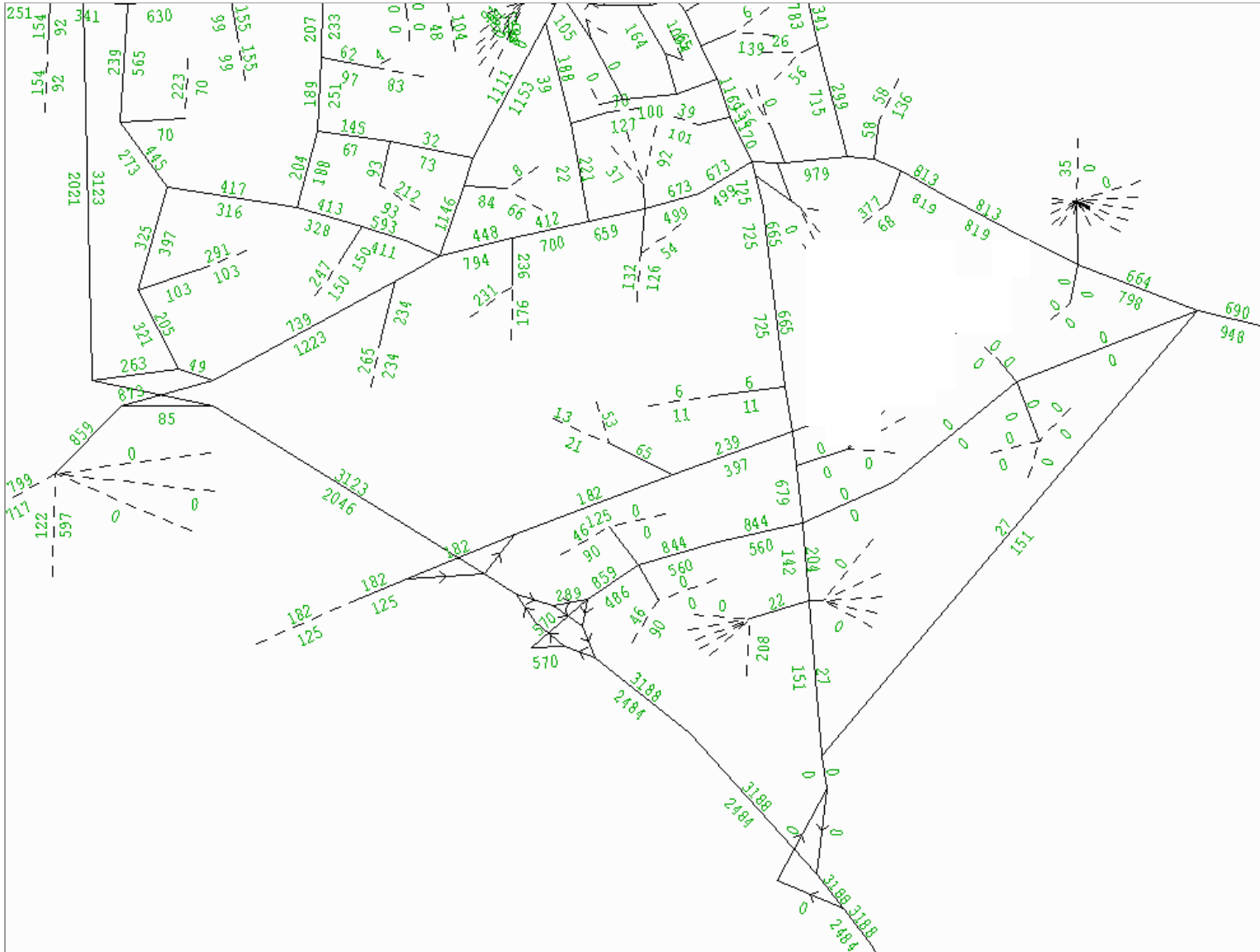
Scenario 4c 2014 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Southern Section



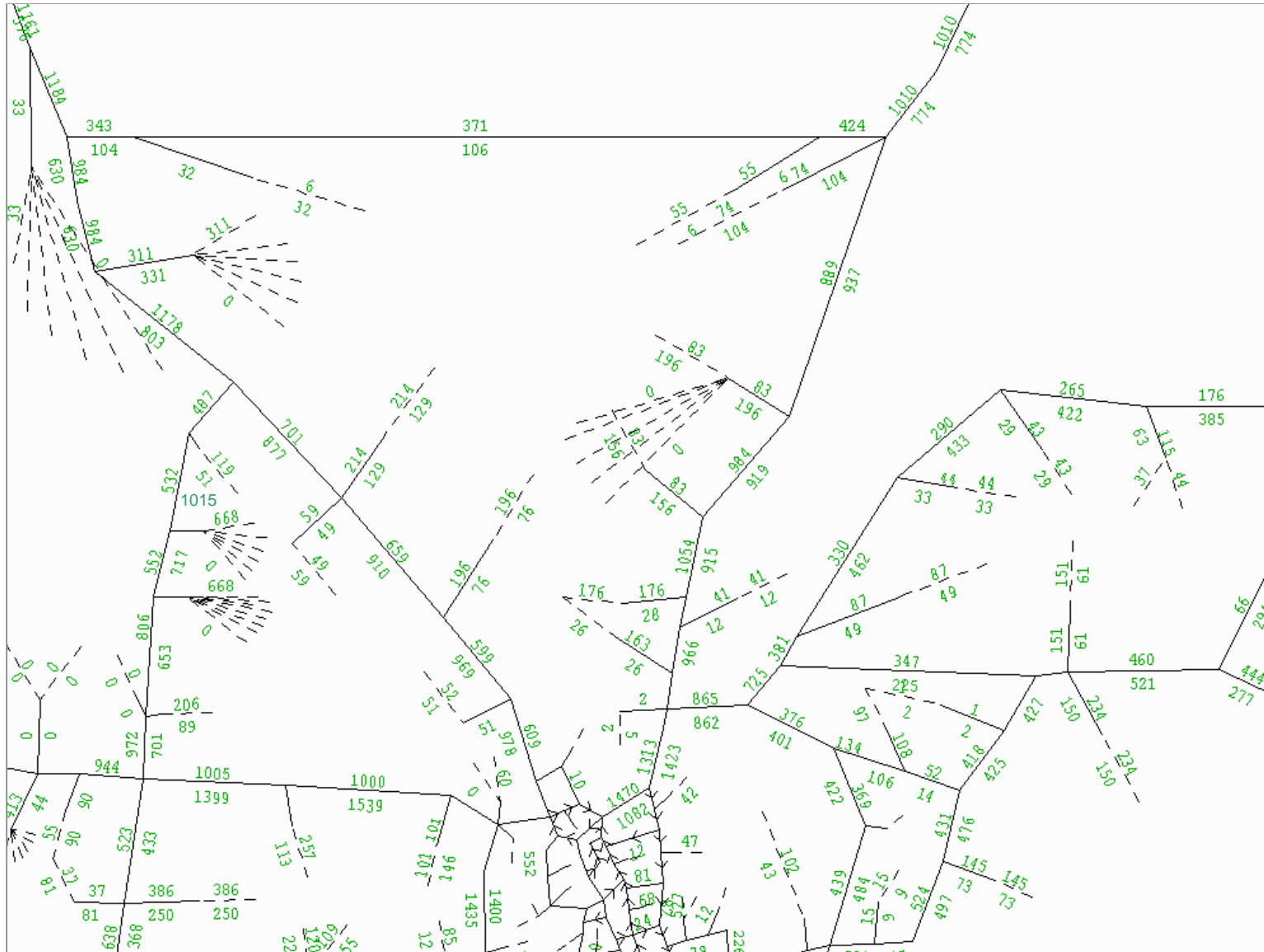
Scenario 5 2029 Reference Case  
Demand Flow – AM (08:00 - 09:00) – Northern Section



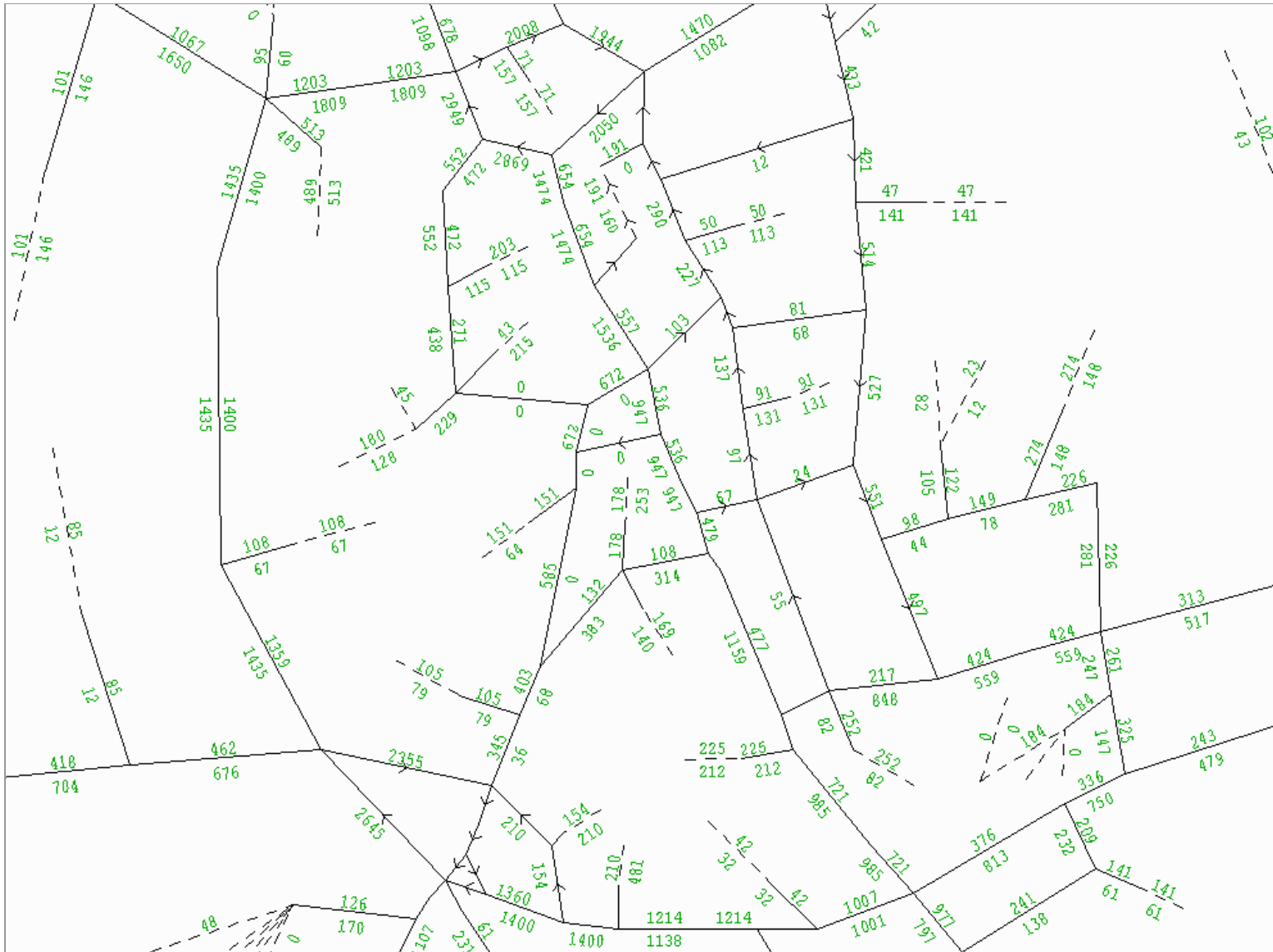
Scenario 5 2029 Reference Case  
Demand Flow – AM (08:00 - 09:00) – Town Centre



Scenario 5 2029 Reference Case  
Demand Flow – AM (08:00 - 09:00) – Southern Section

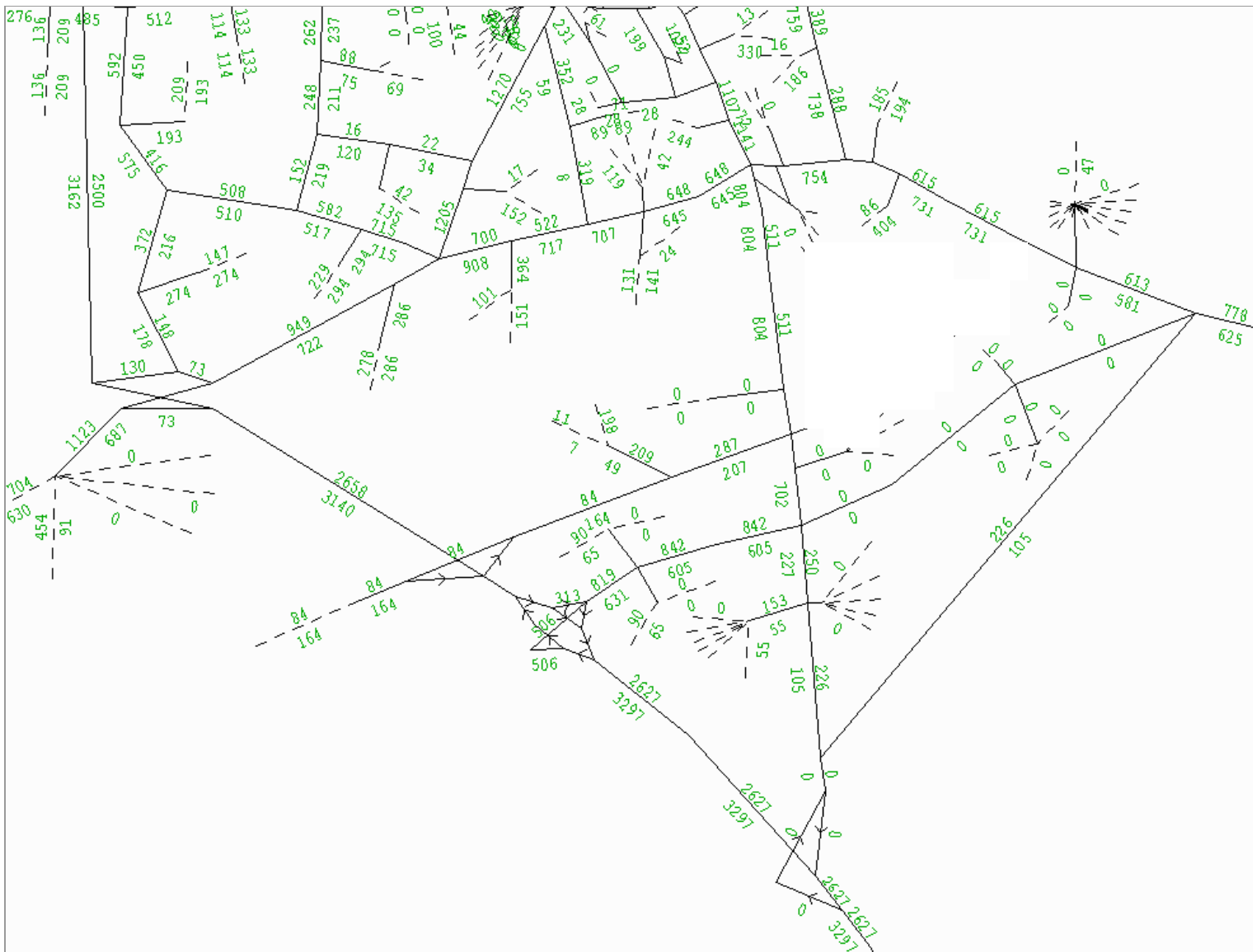


Scenario 5 2029 Reference Case  
Demand Flow – PM (17:00 - 18:00) – Northern Section

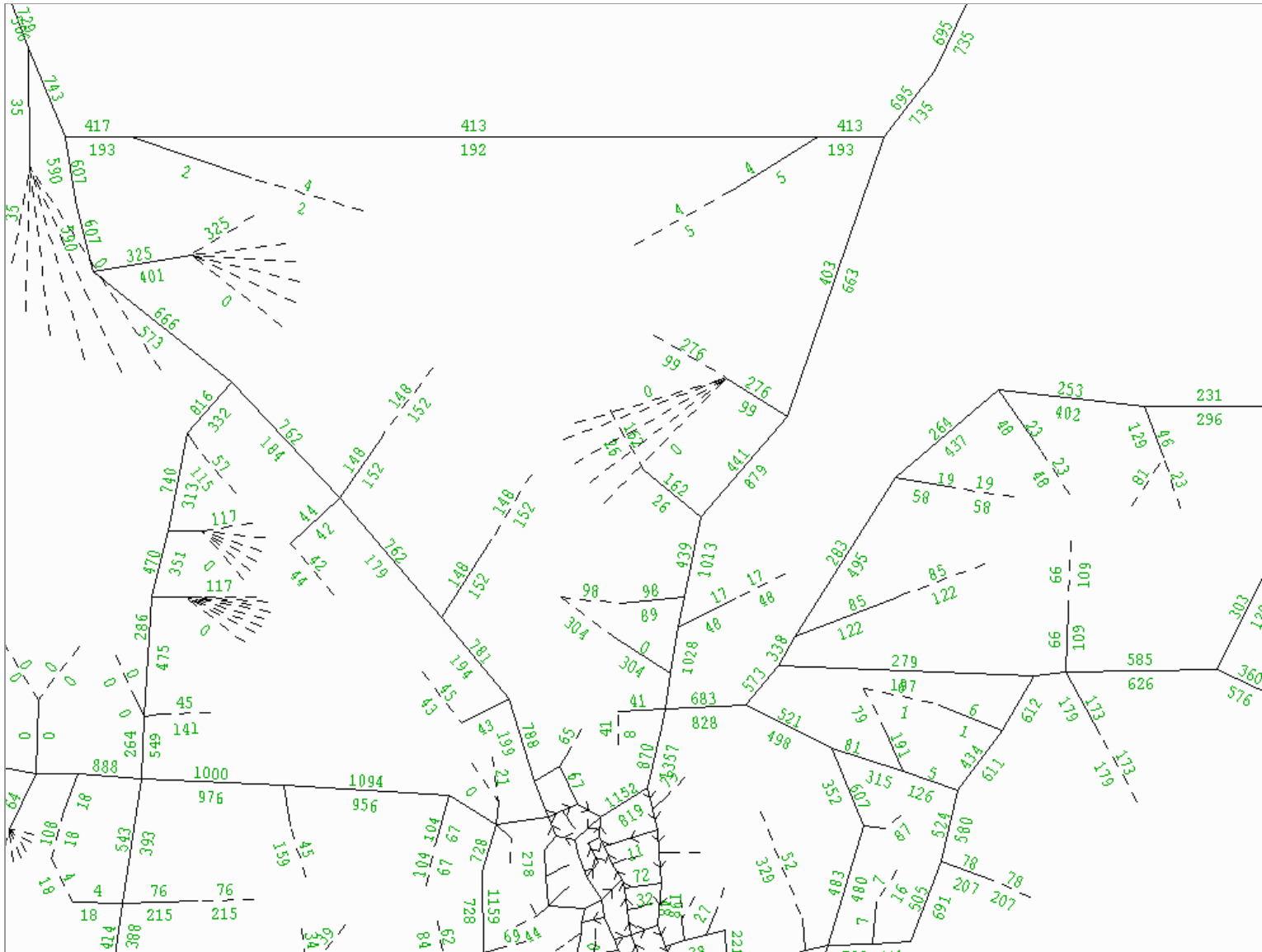


Scenario 5 2029 Reference Case  
Demand Flow – PM (17:00 - 18:00) – Town Centre

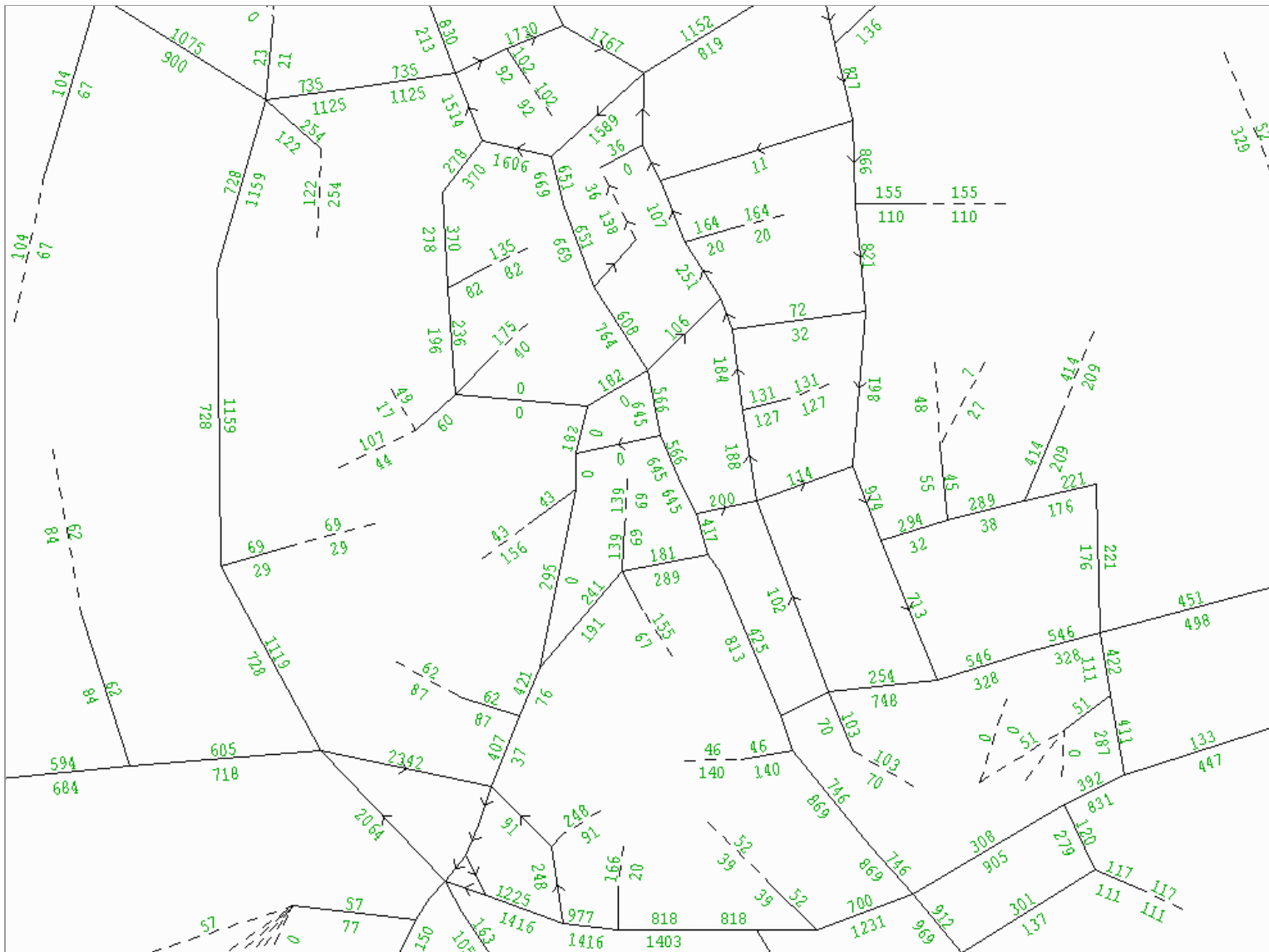




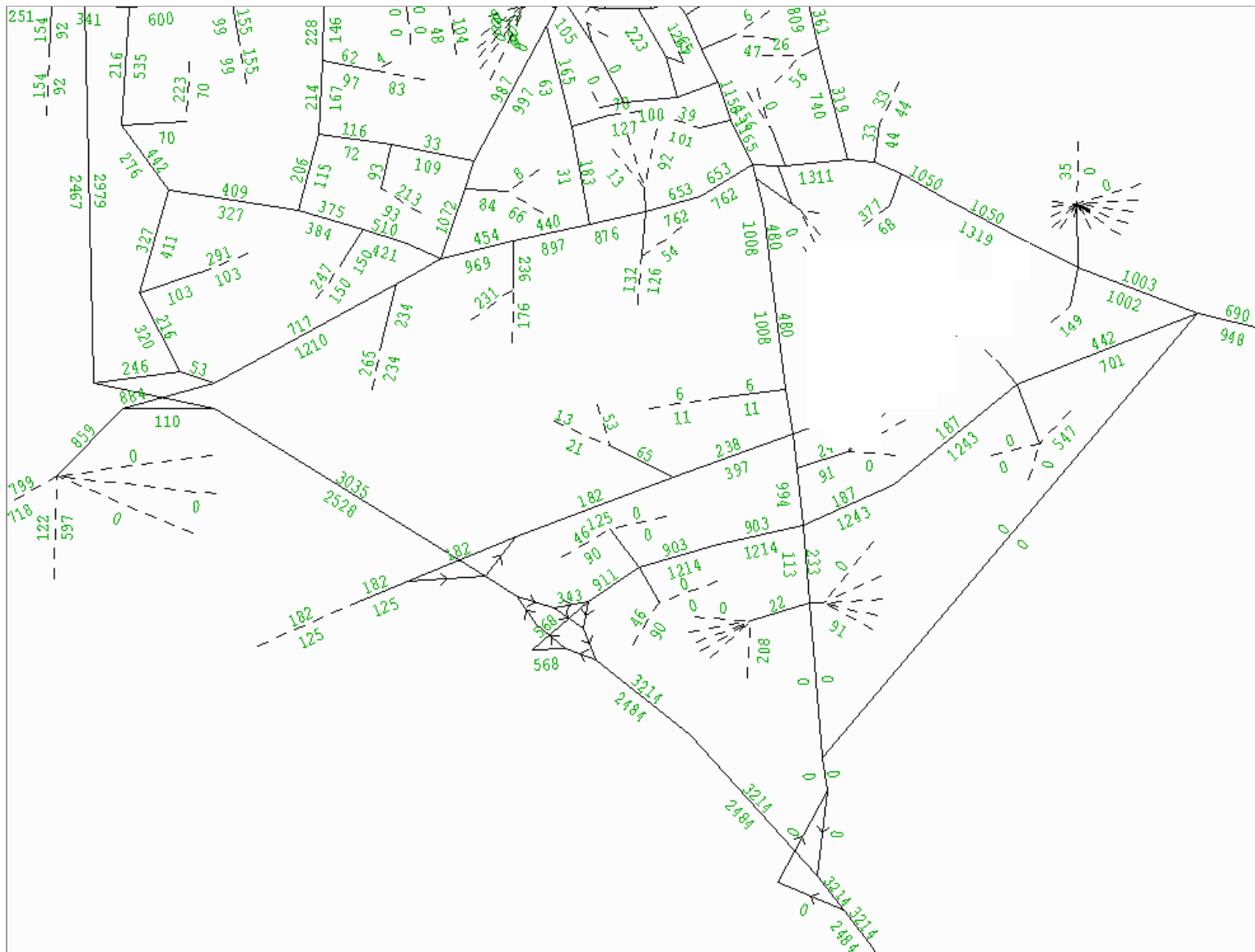
Scenario 5 2029 Reference Case  
Demand Flow – PM (17:00 - 18:00) – Southern Section



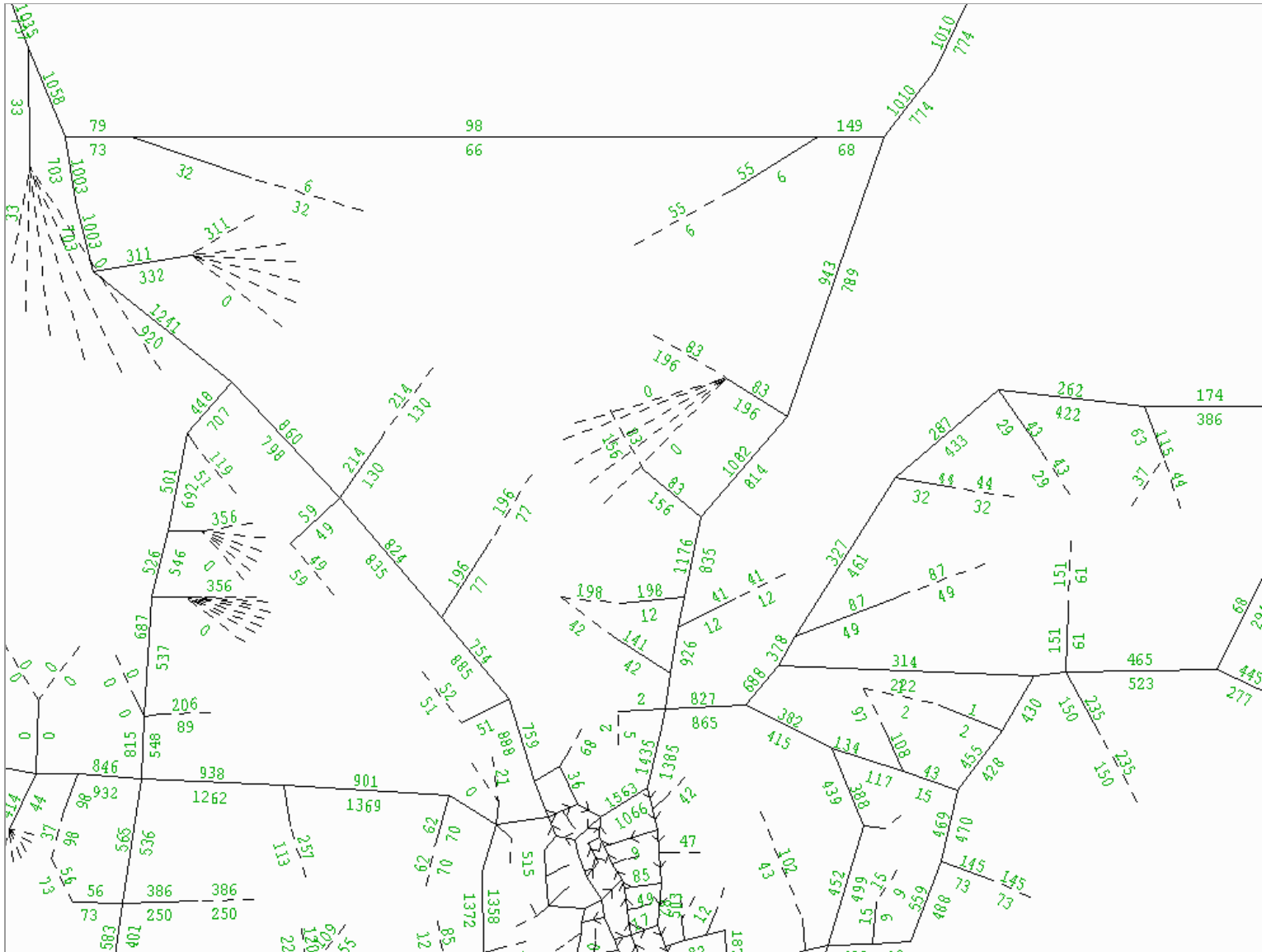
Scenario 6a 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Northern Section



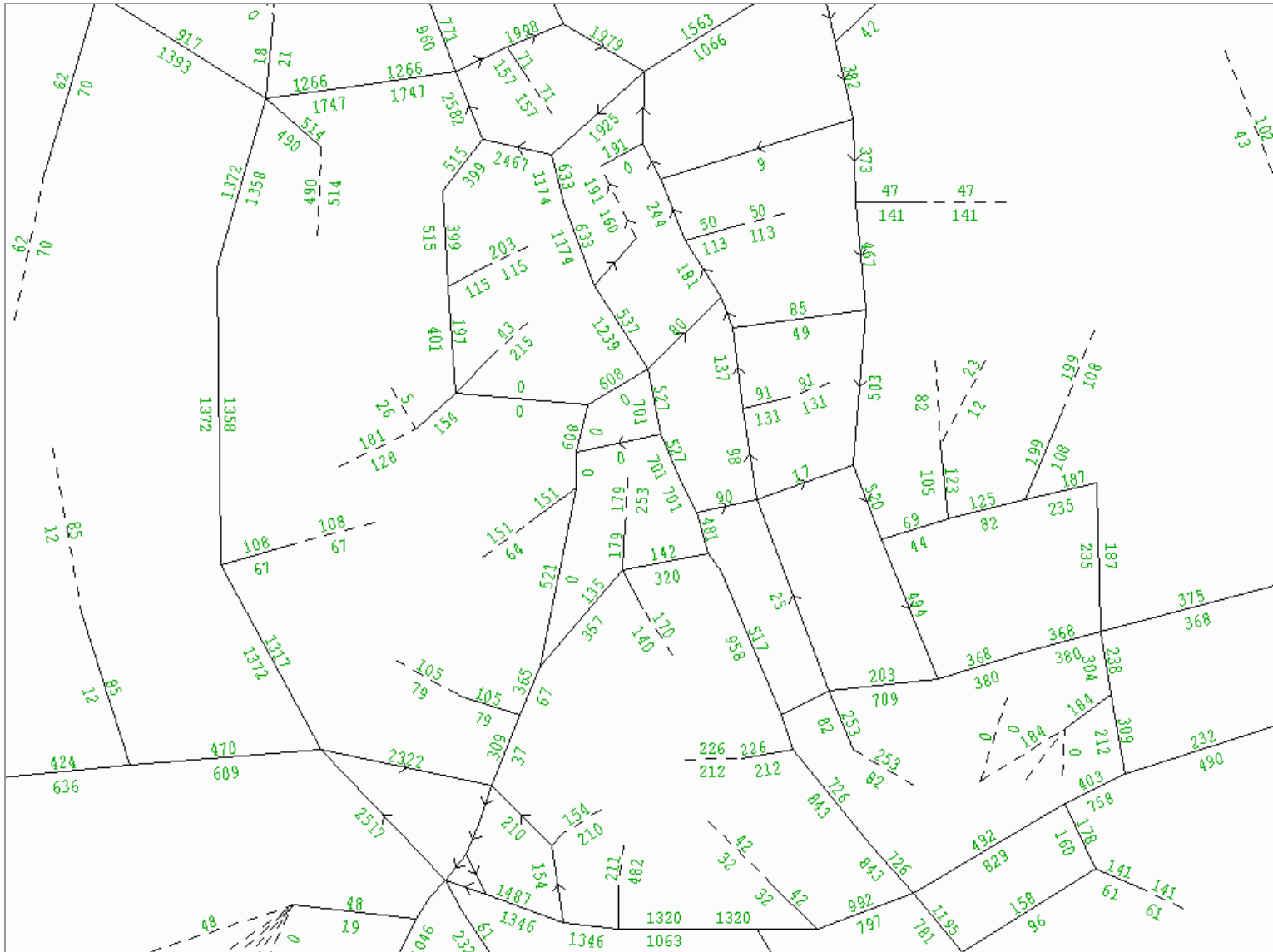
Scenario 6a 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Town Centre



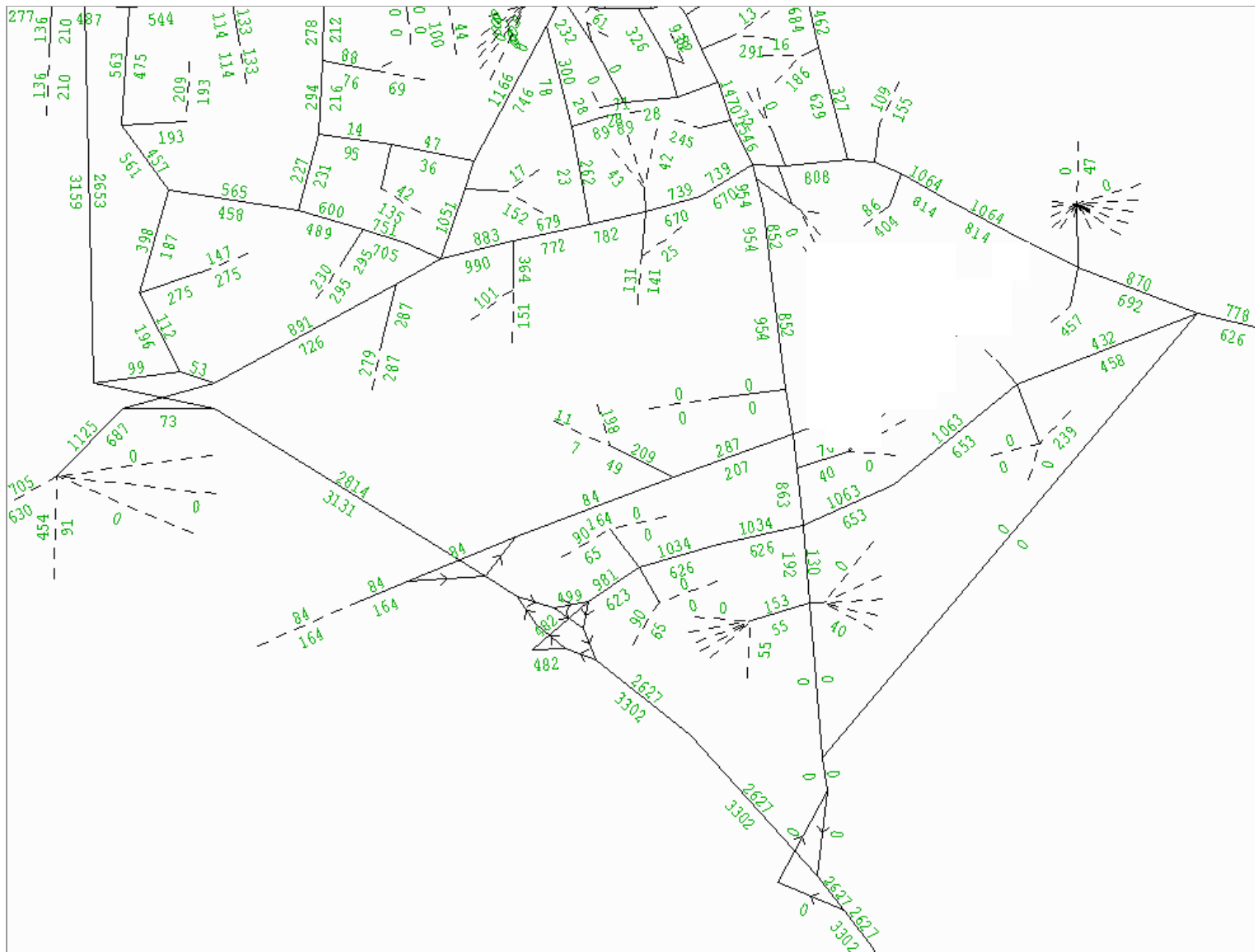
Scenario 6a 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Southern Section



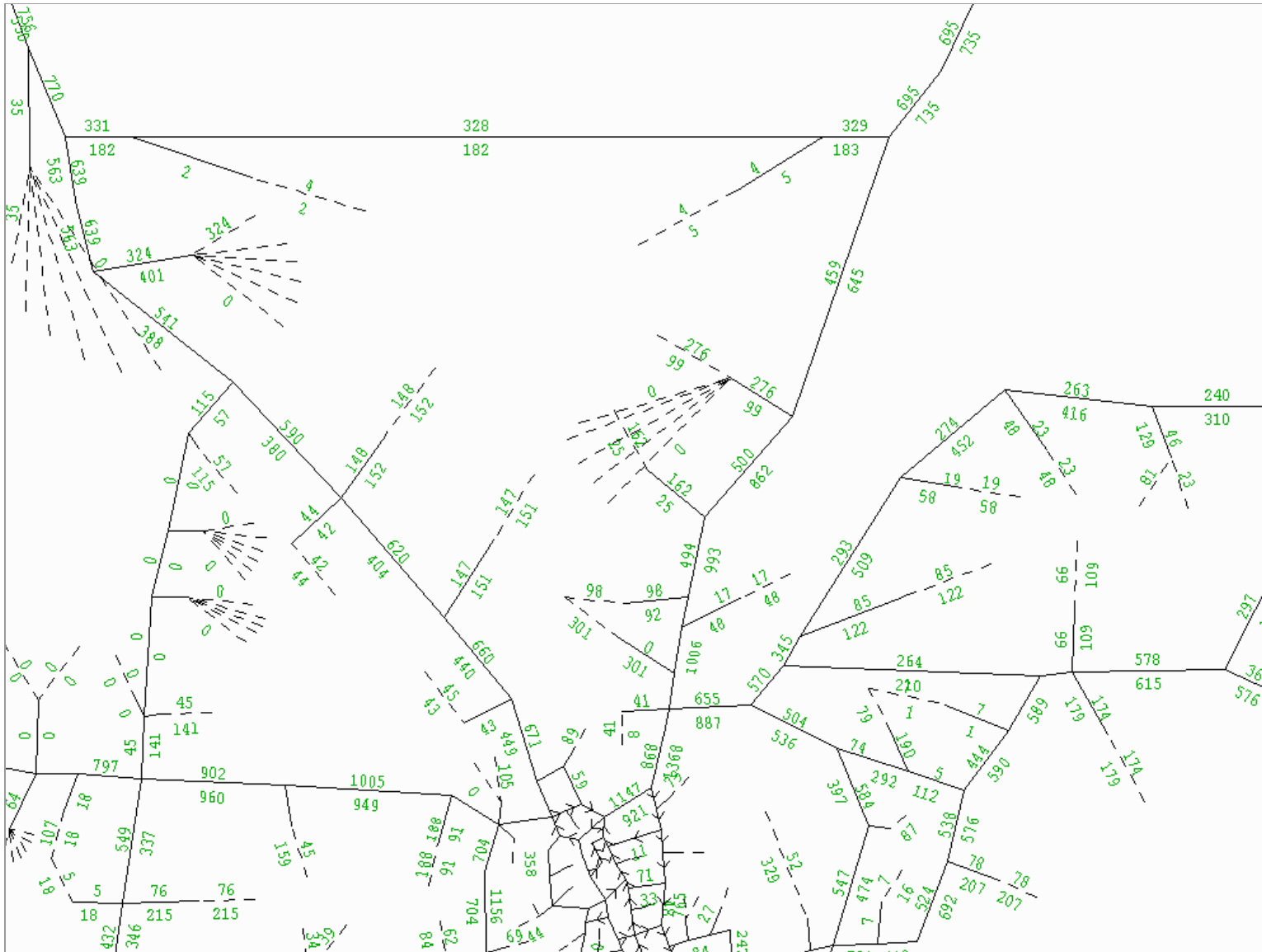
Scenario 6a 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Northern Section



Scenario 6a 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Town Centre

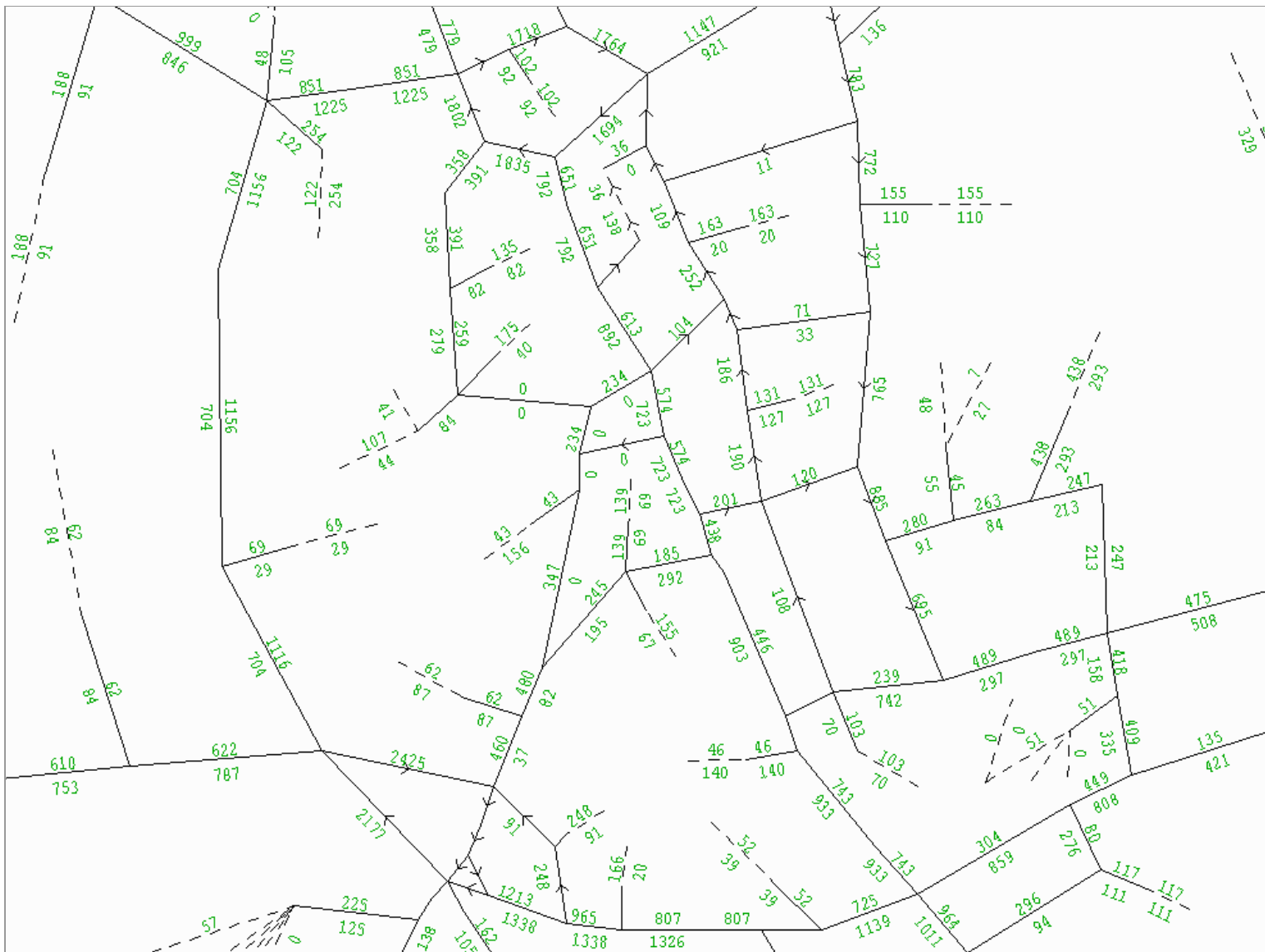


Scenario 6a 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Southern Section

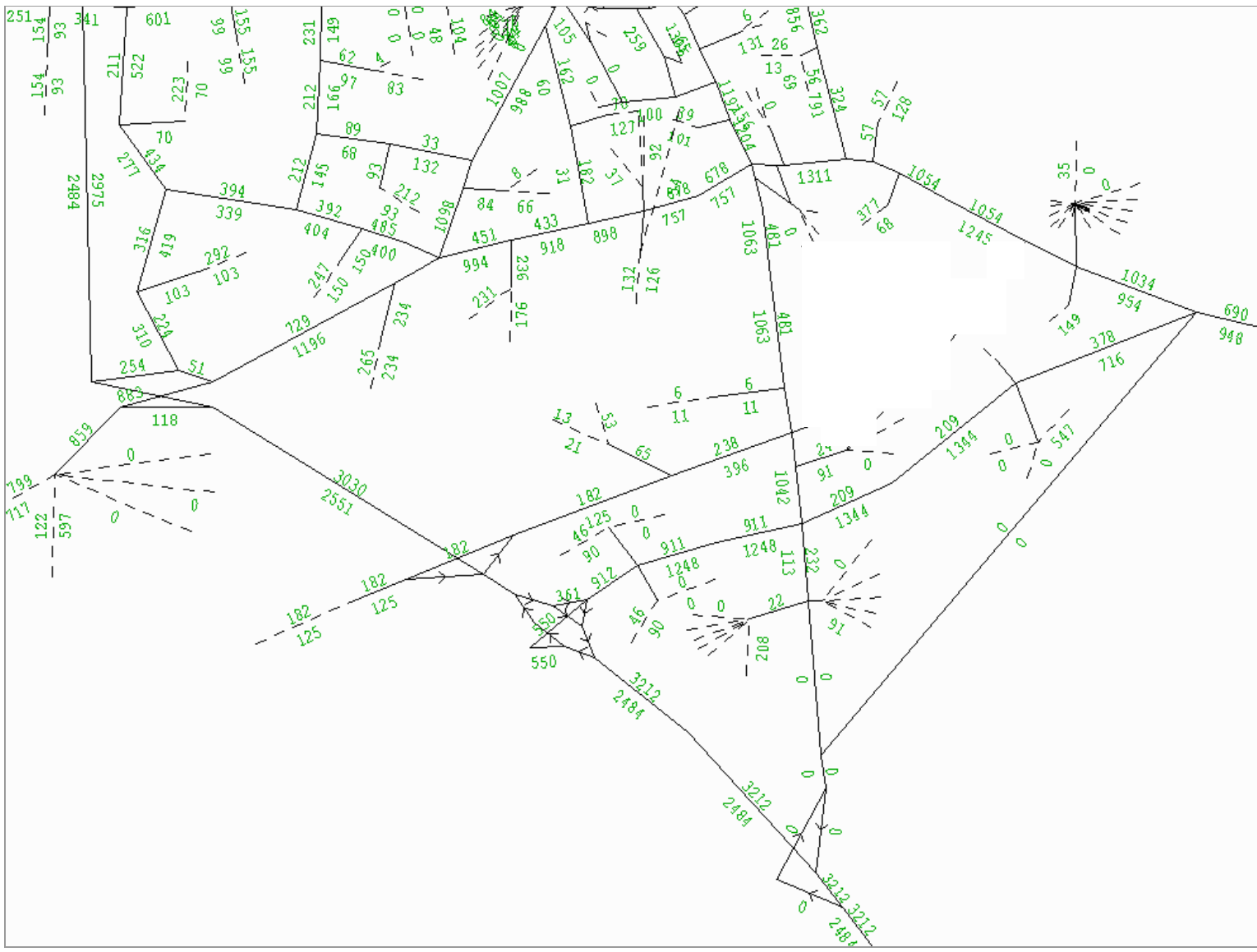


Scenario 6b 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Northern Section

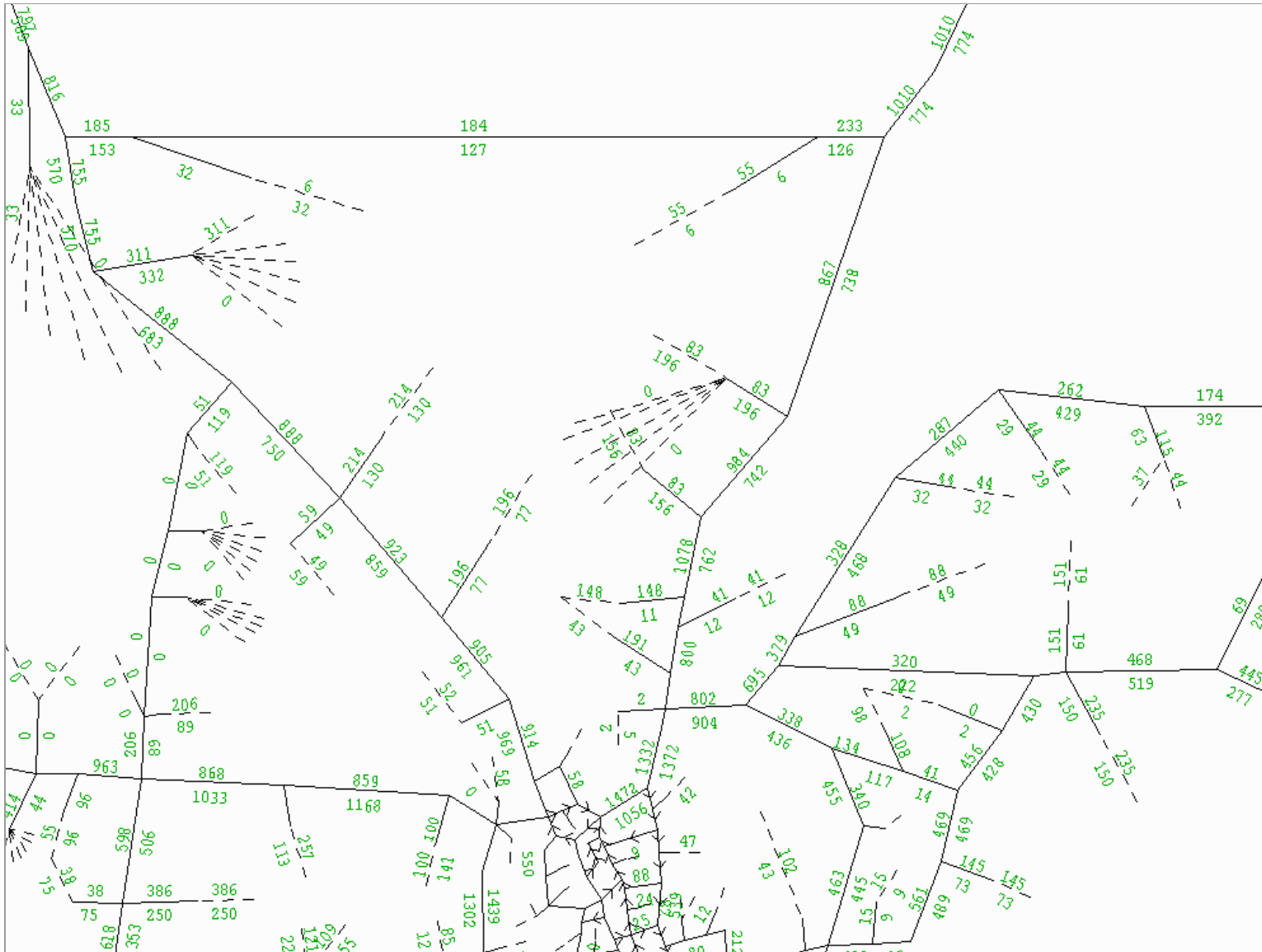




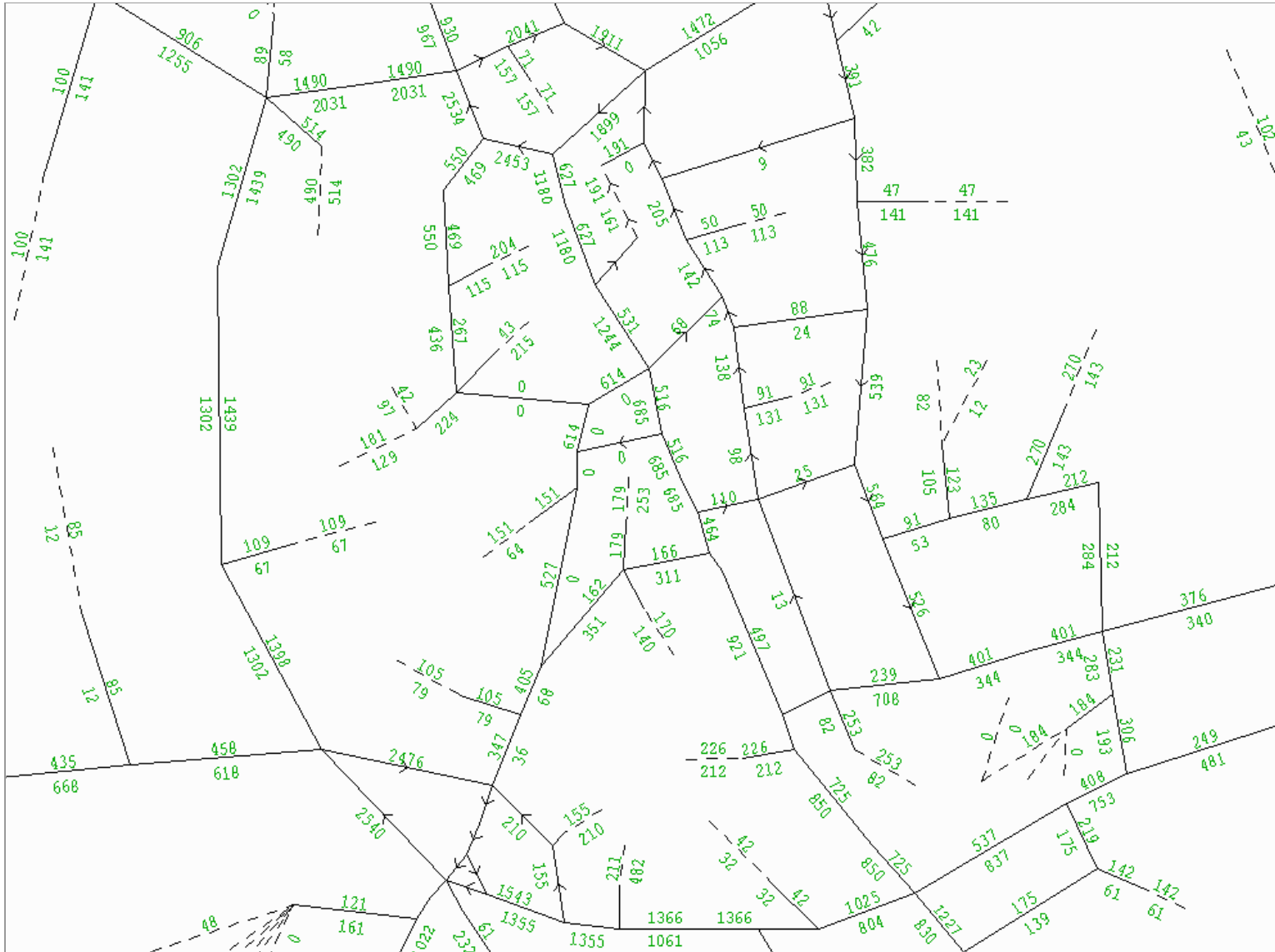
Scenario 6b 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Town Centre



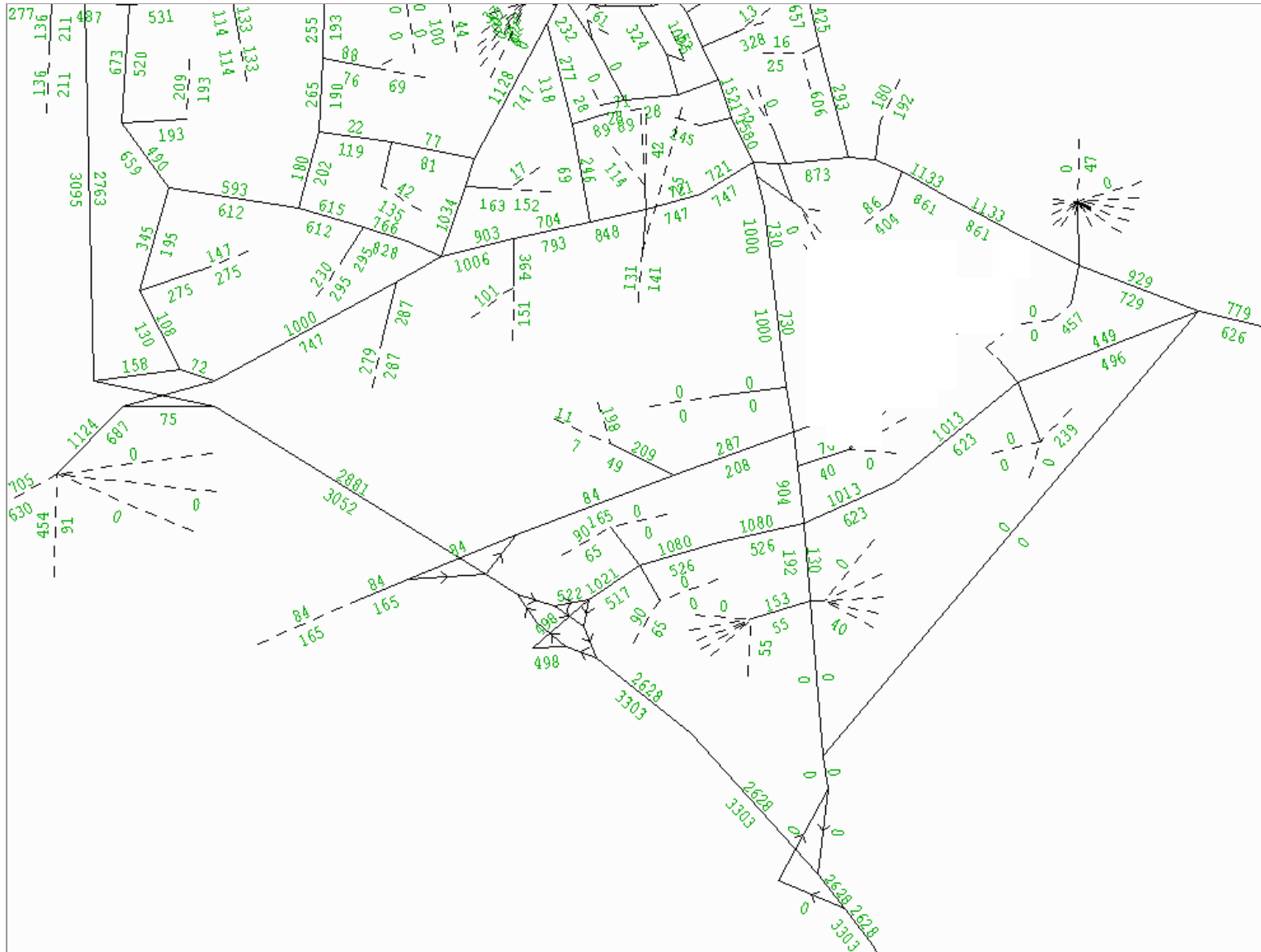
Scenario 6b 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Southern Section



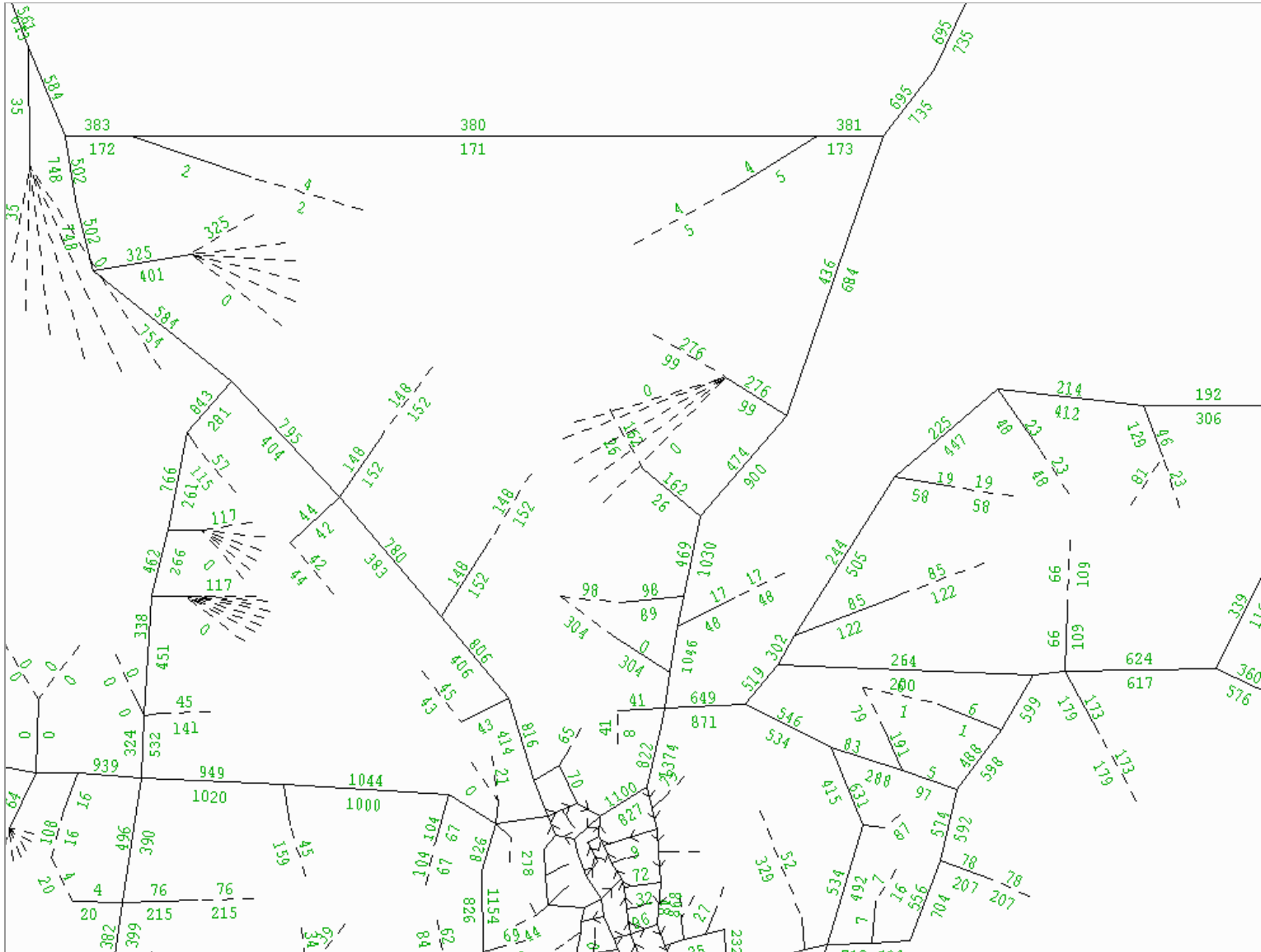
Scenario 6b 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Northern Section



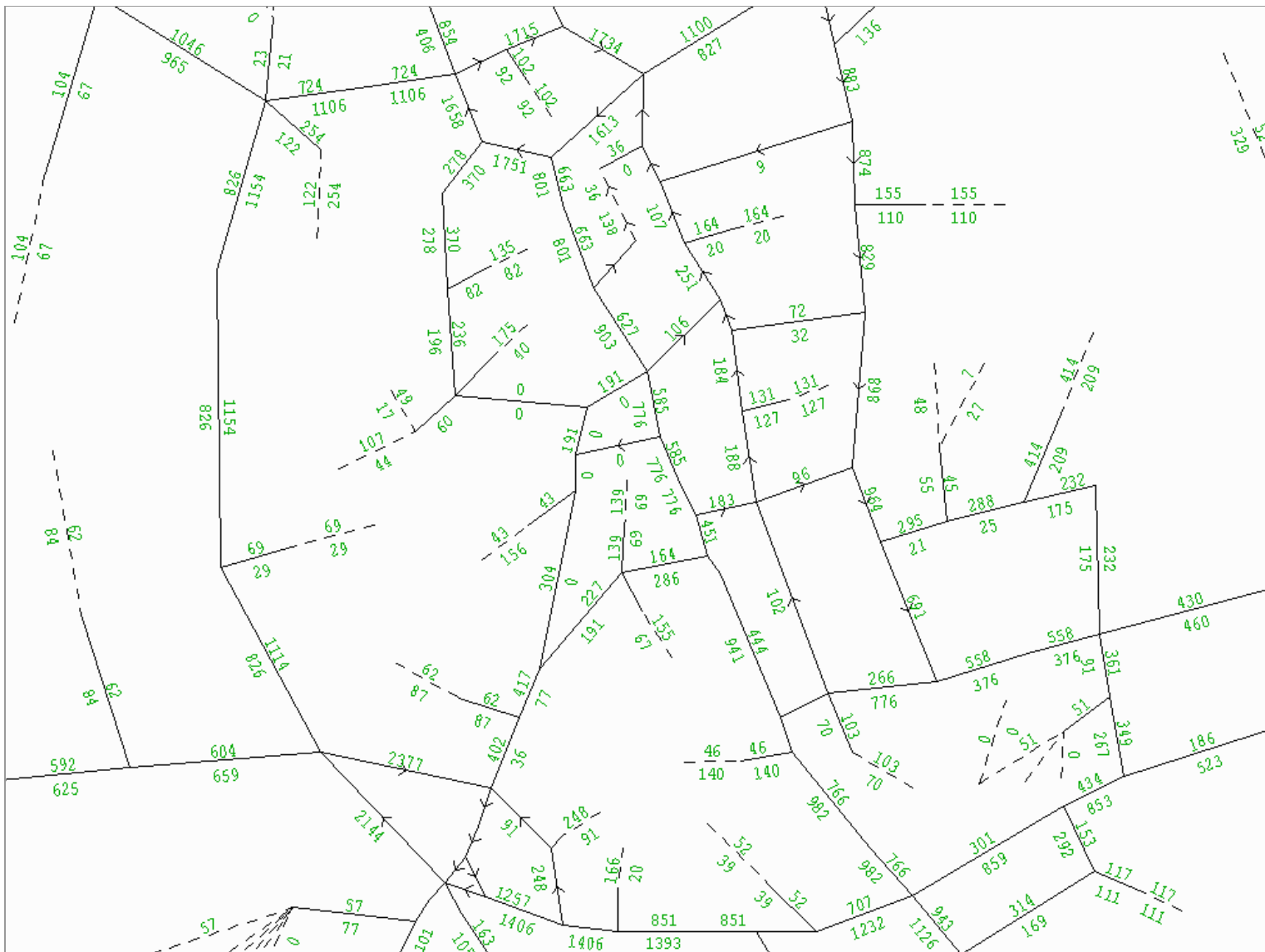
Scenario 6b 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Town Centre



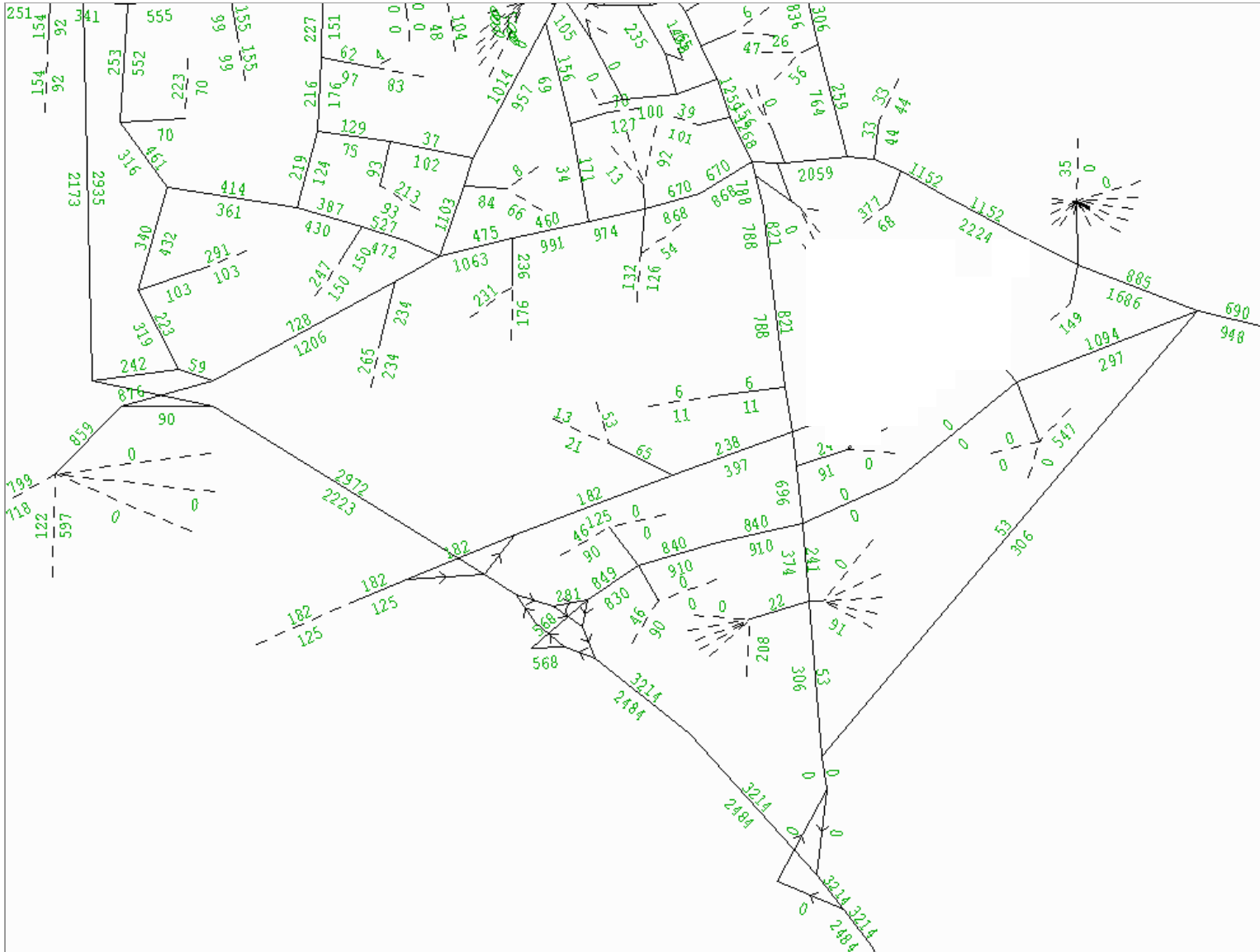
Scenario 6b 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Southern Section



Scenario 6c 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Northern Section

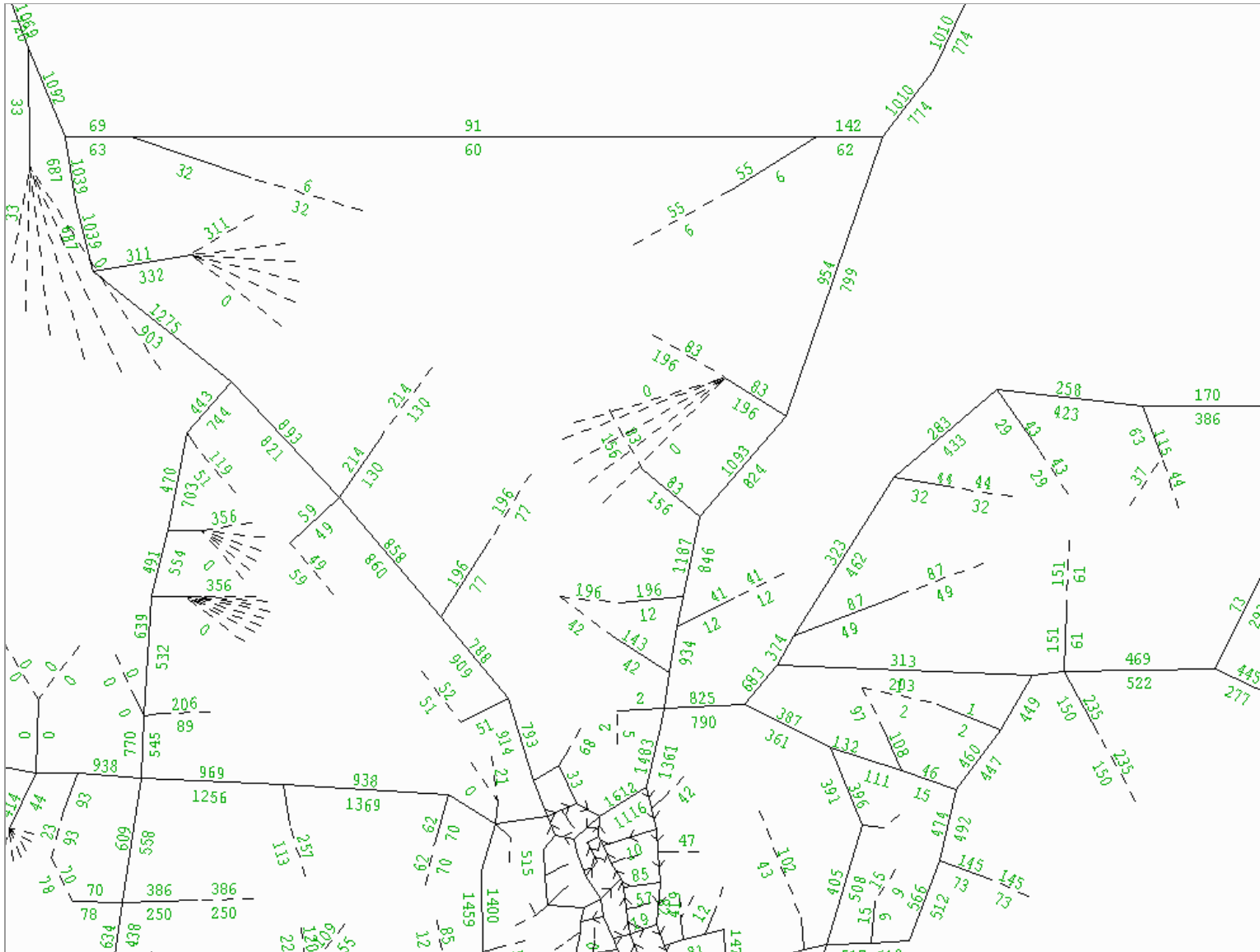


Scenario 6c 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Town Centre

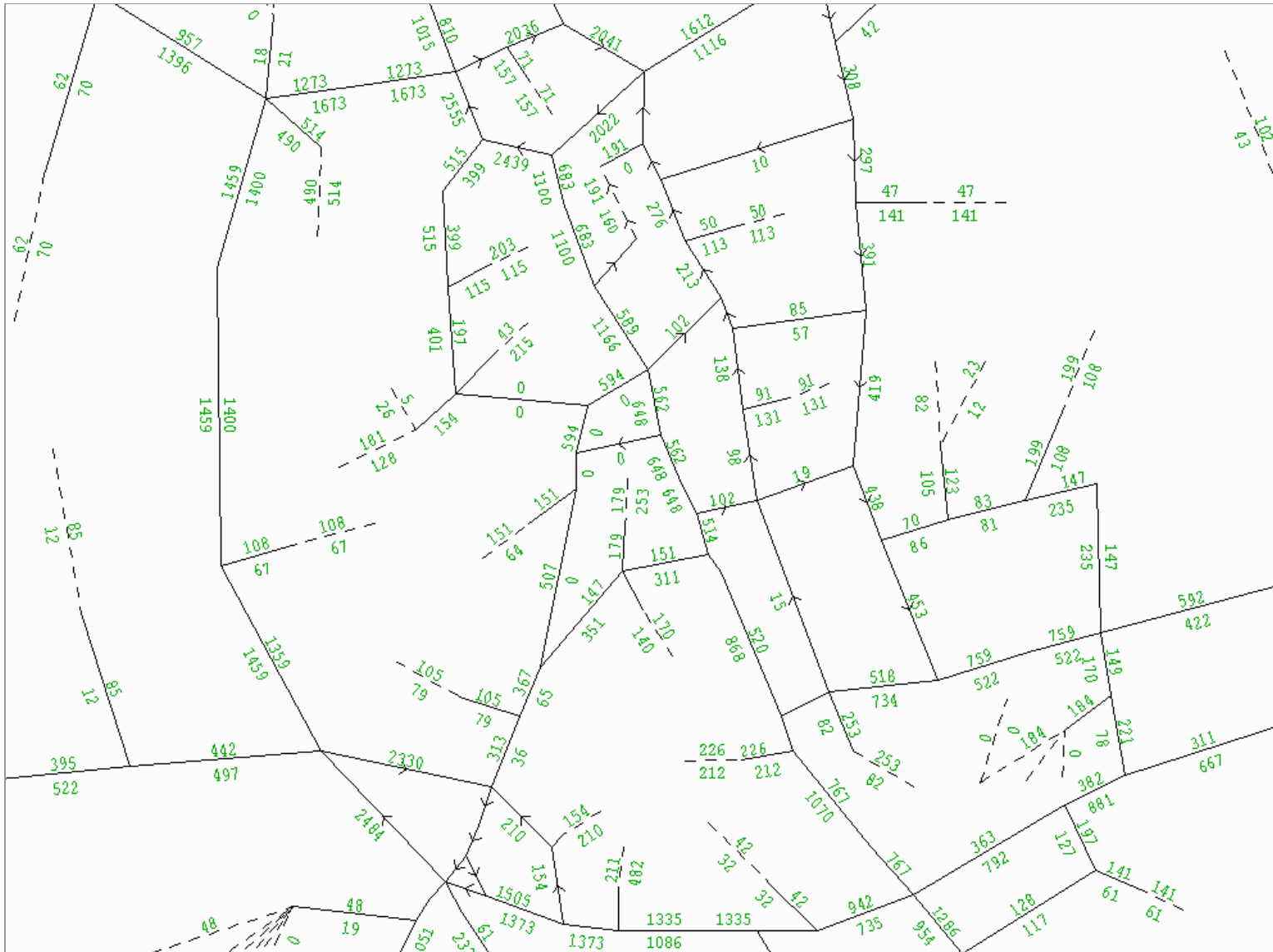


Scenario 6c 2029 Southern Quadrant  
Demand Flow – AM (08:00 - 09:00) – Southern Section

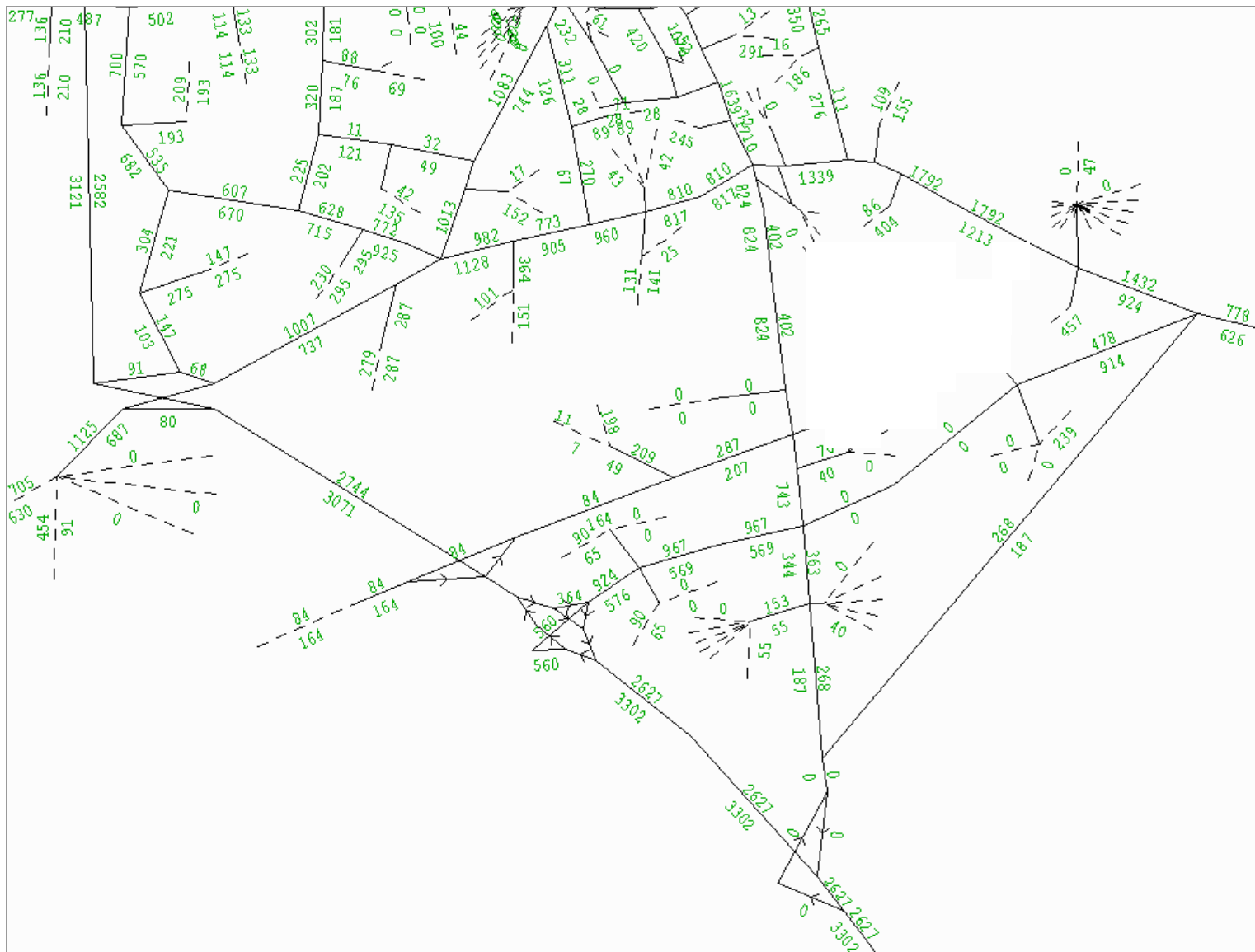




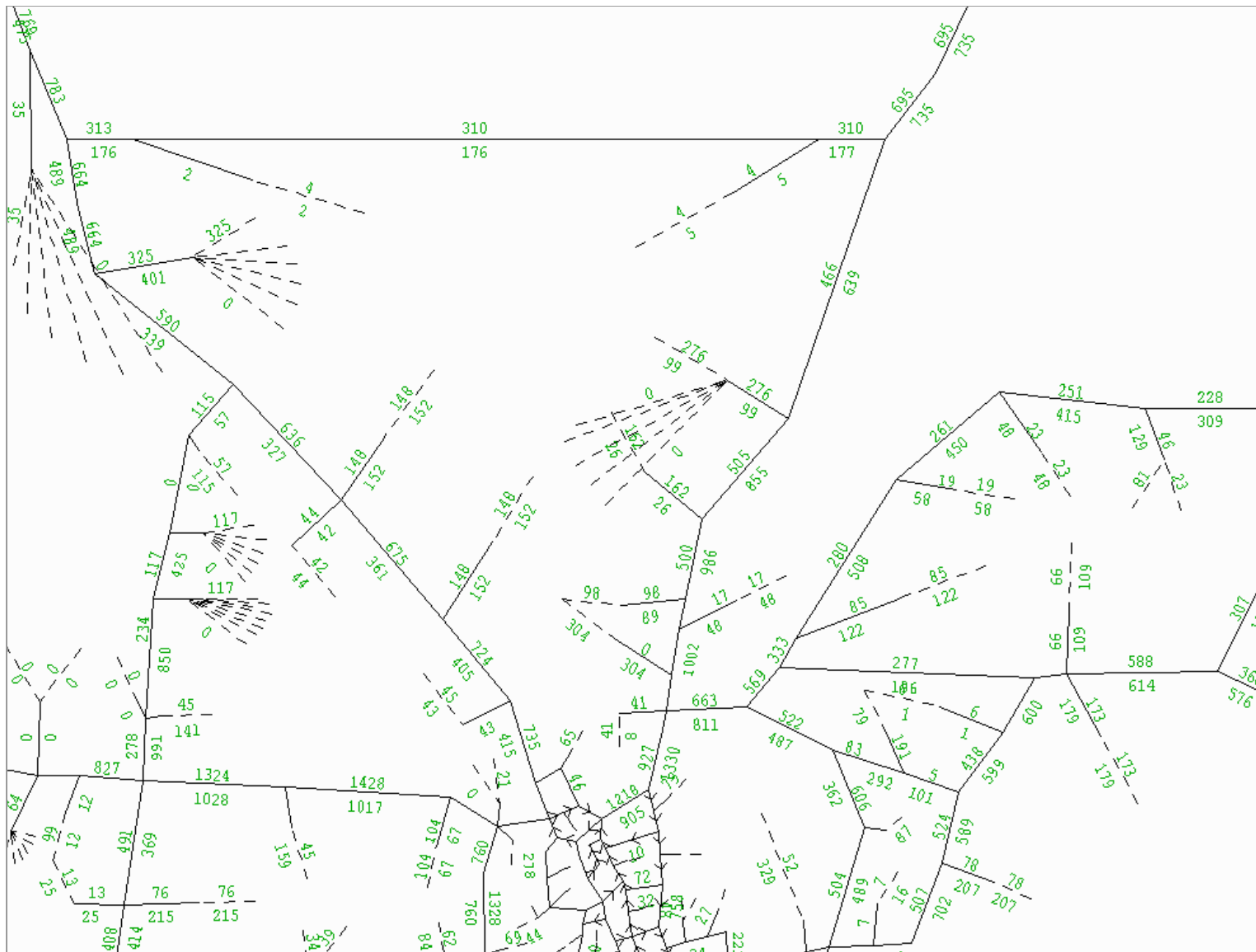
Scenario 6c 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Northern Section



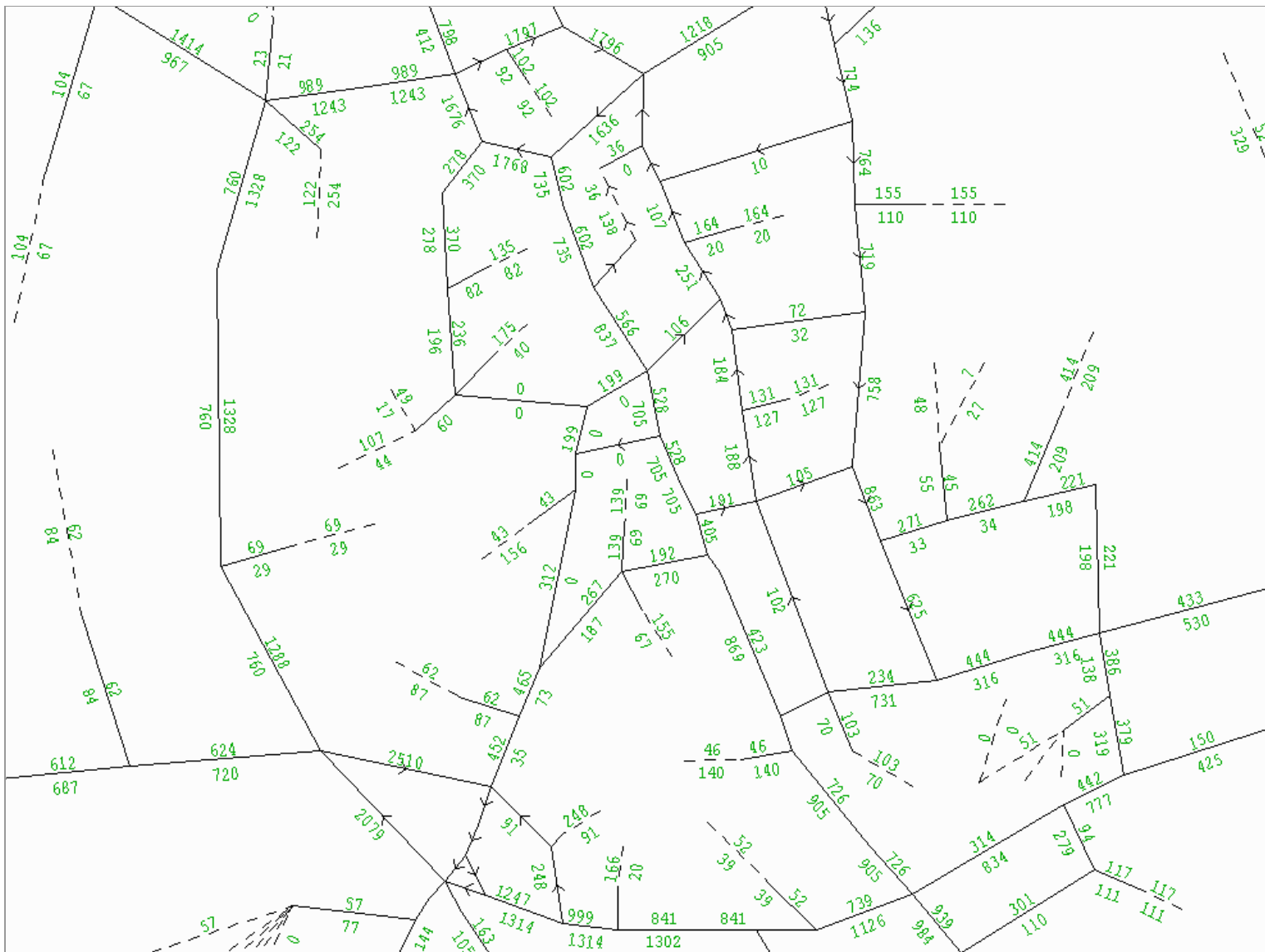
Scenario 6c 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Town Centre



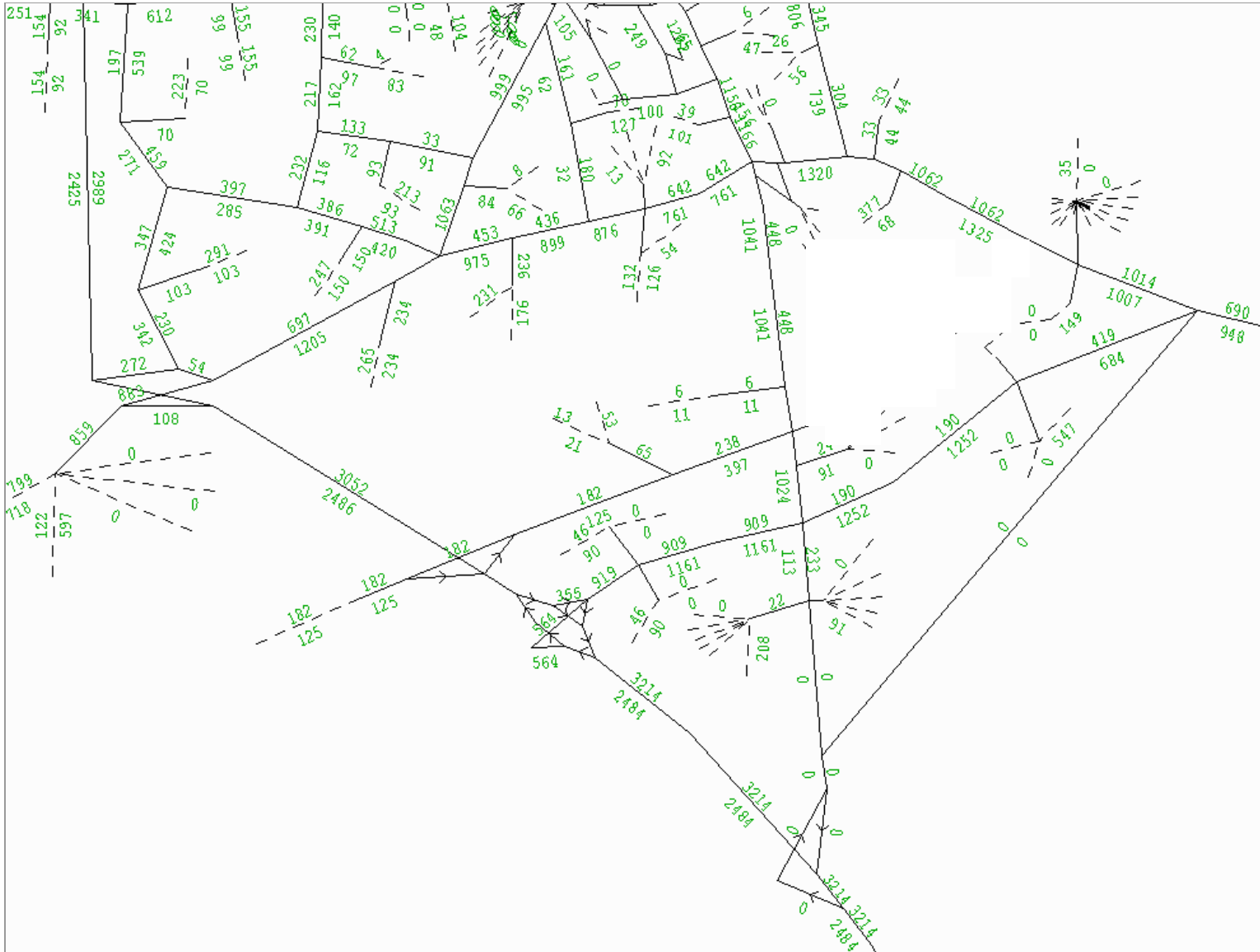
Scenario 6c 2029 Southern Quadrant  
Demand Flow – PM (17:00 - 18:00) – Southern Section



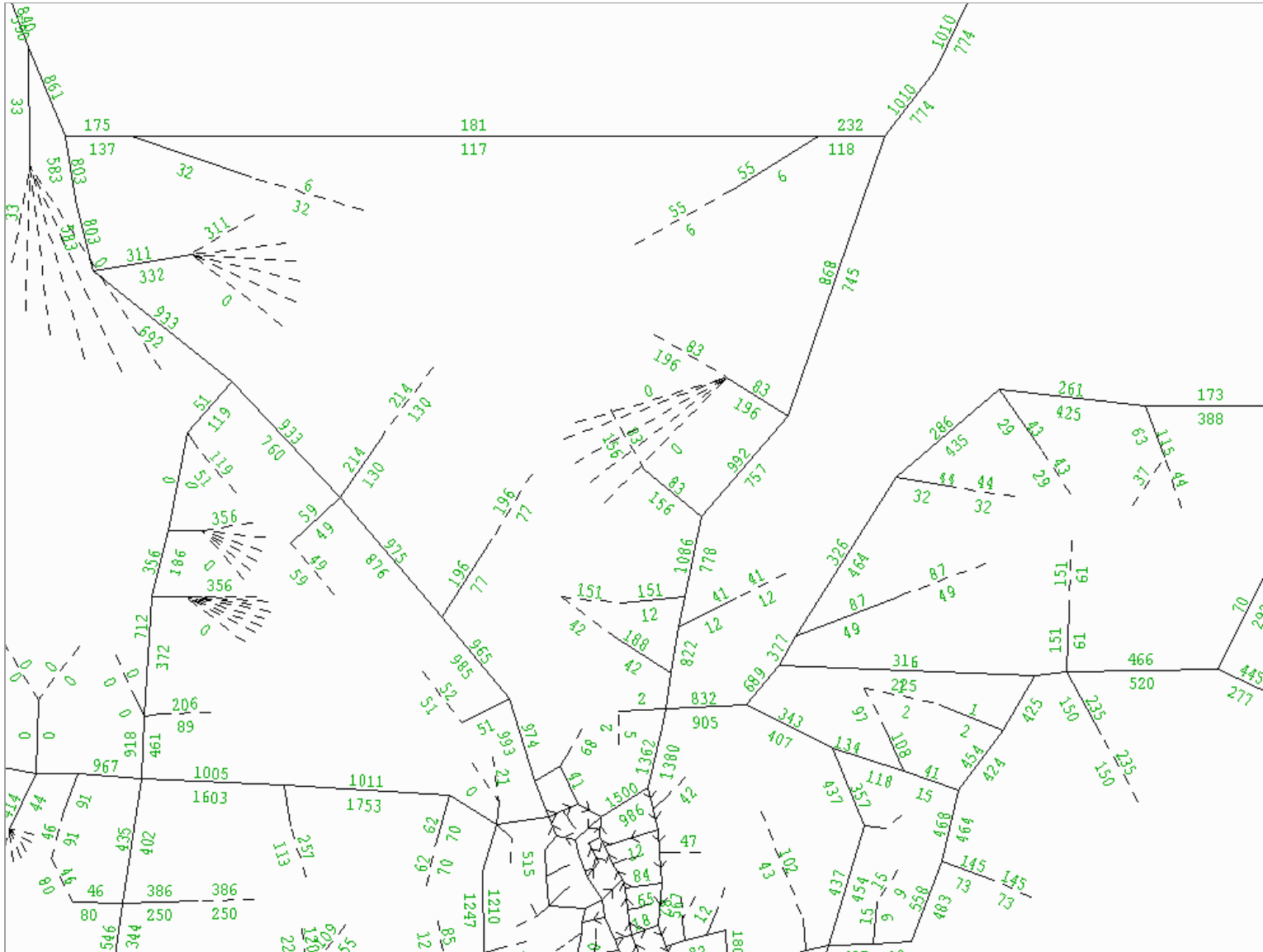
Scenario 7a 2029 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Northern Section



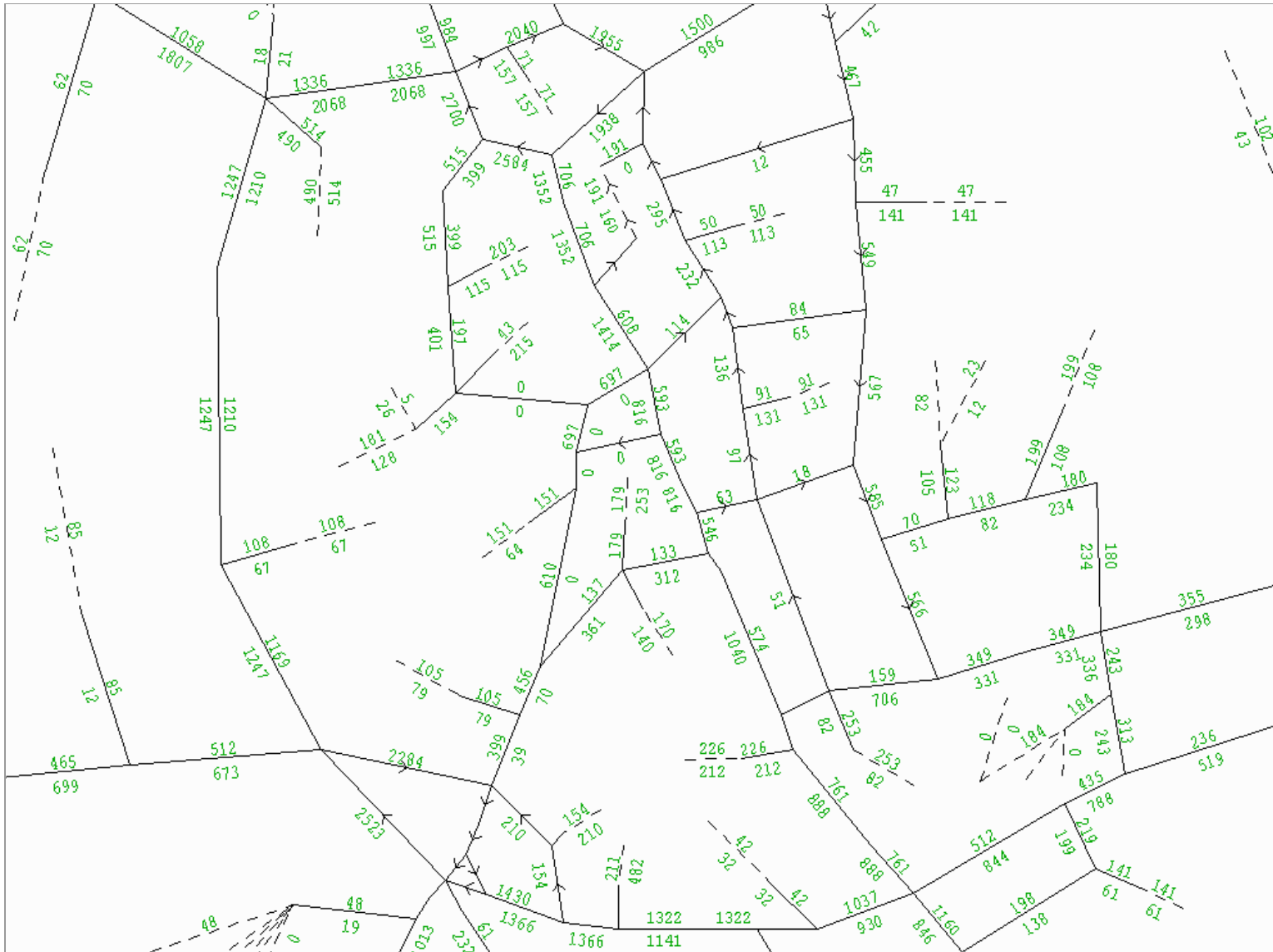
Scenario 7a 2029 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Town Centre



Scenario 7a 2029 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Southern Section

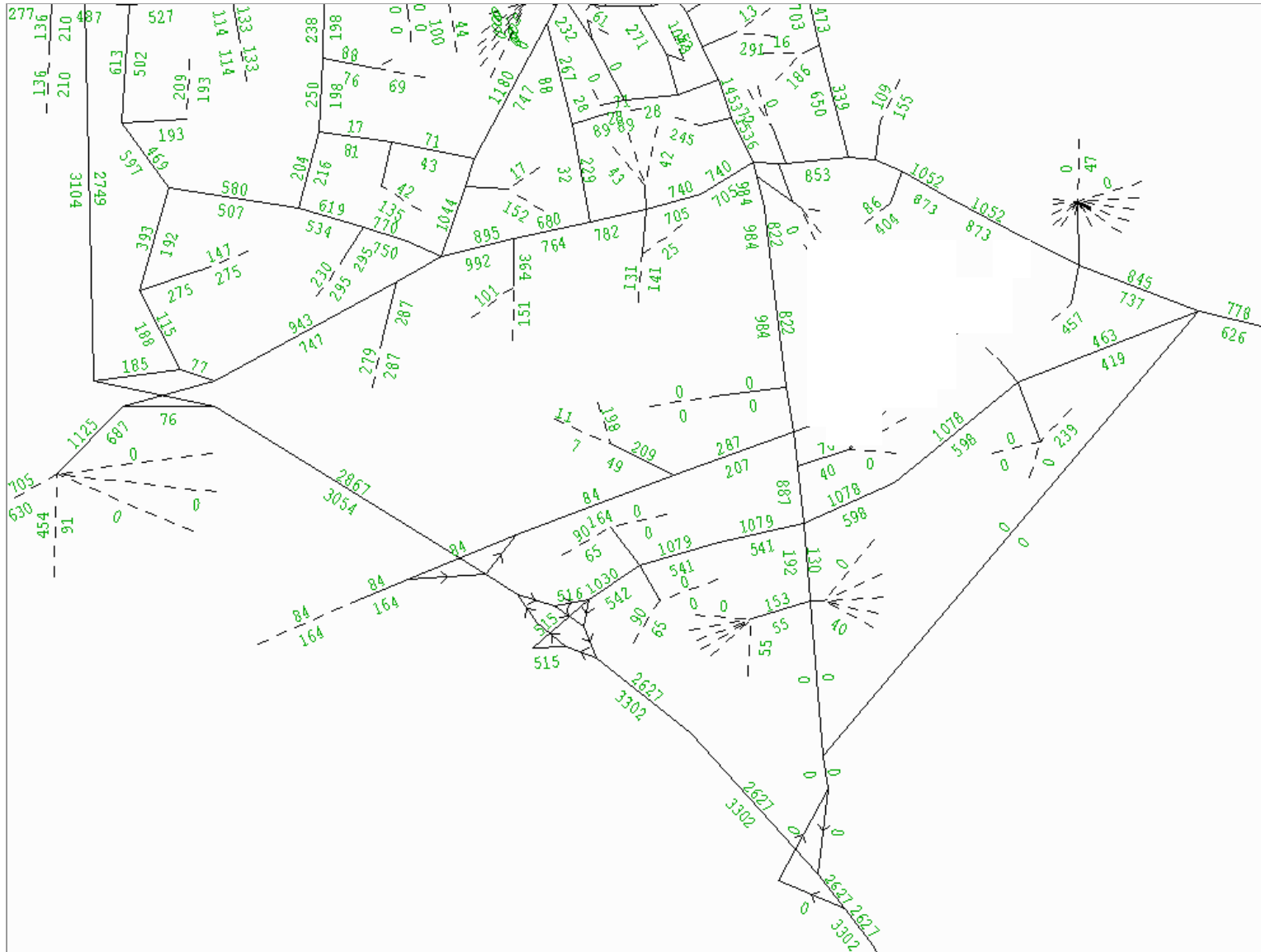


Scenario 7a 2029 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Northern Section

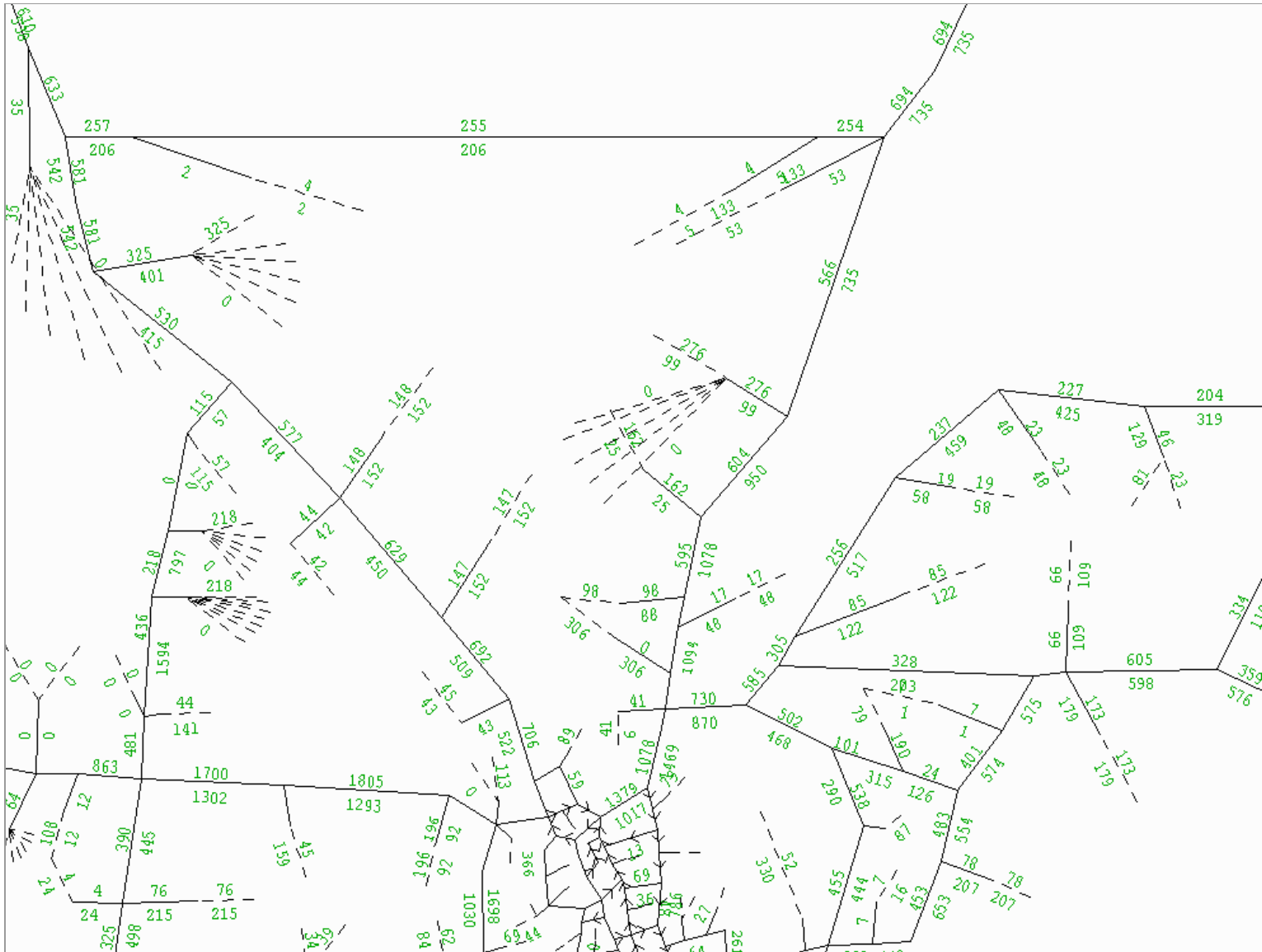


Scenario 7a 2029 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Town Centre

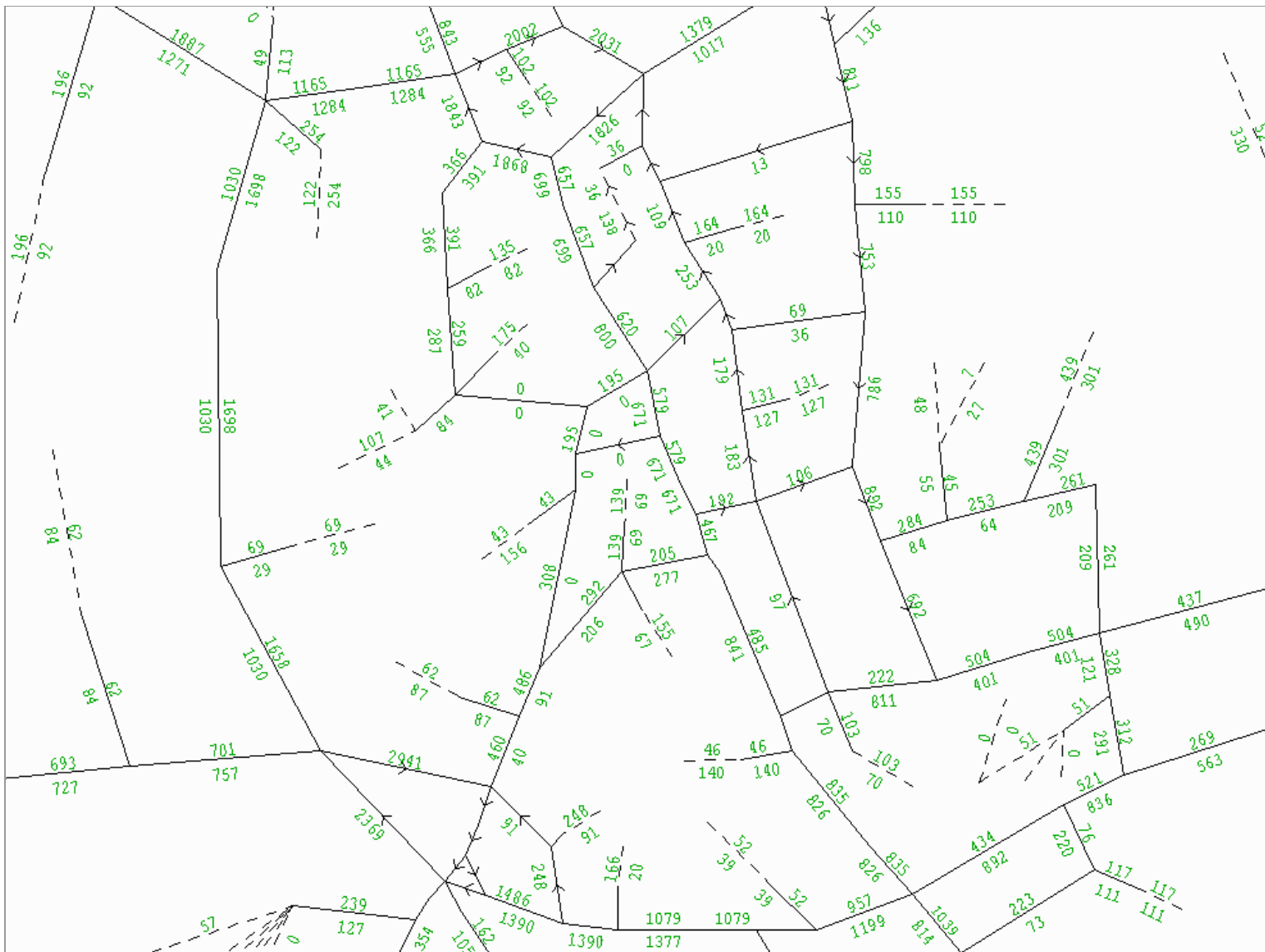




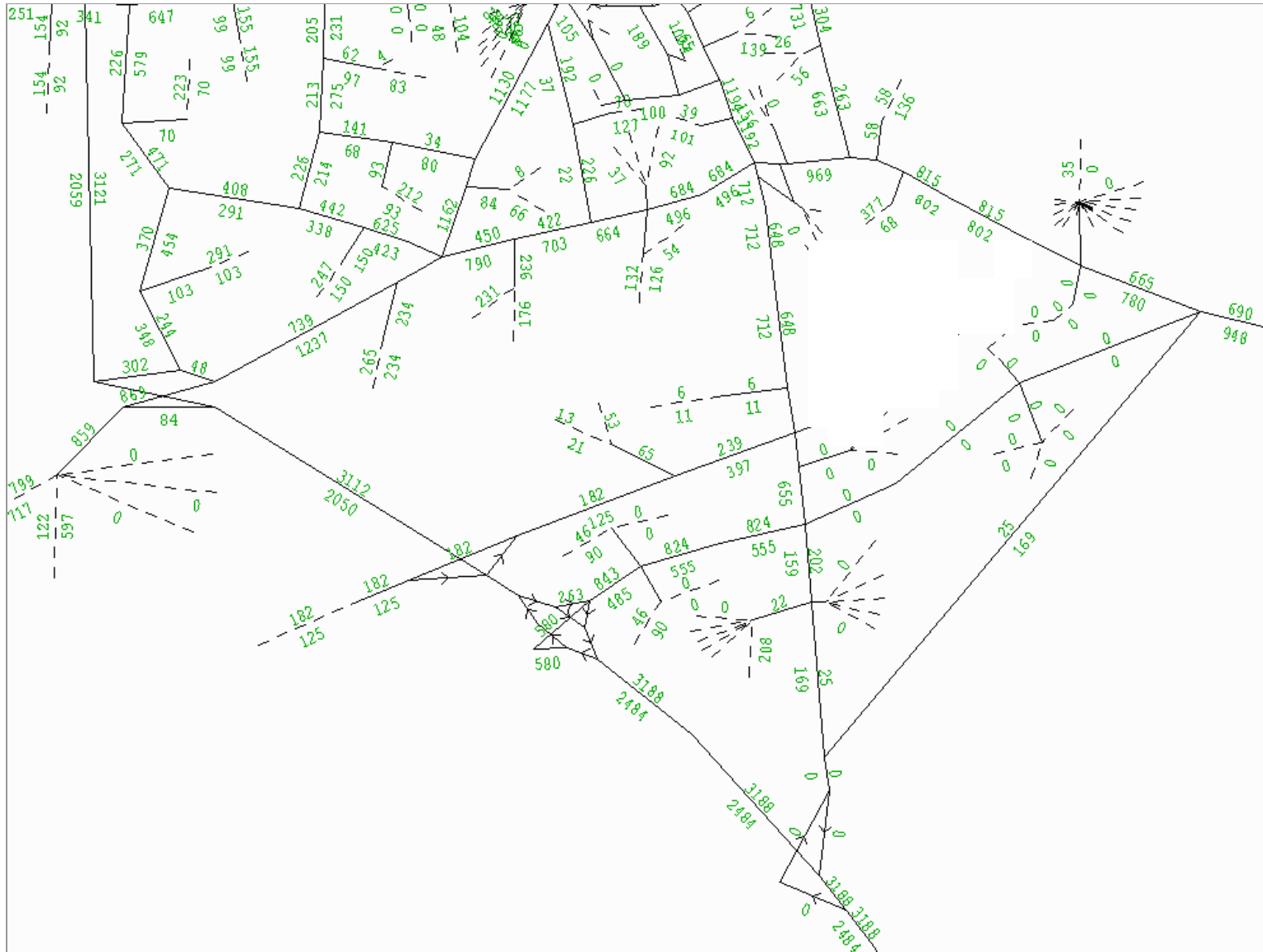
Scenario 7a 2029 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Southern Section

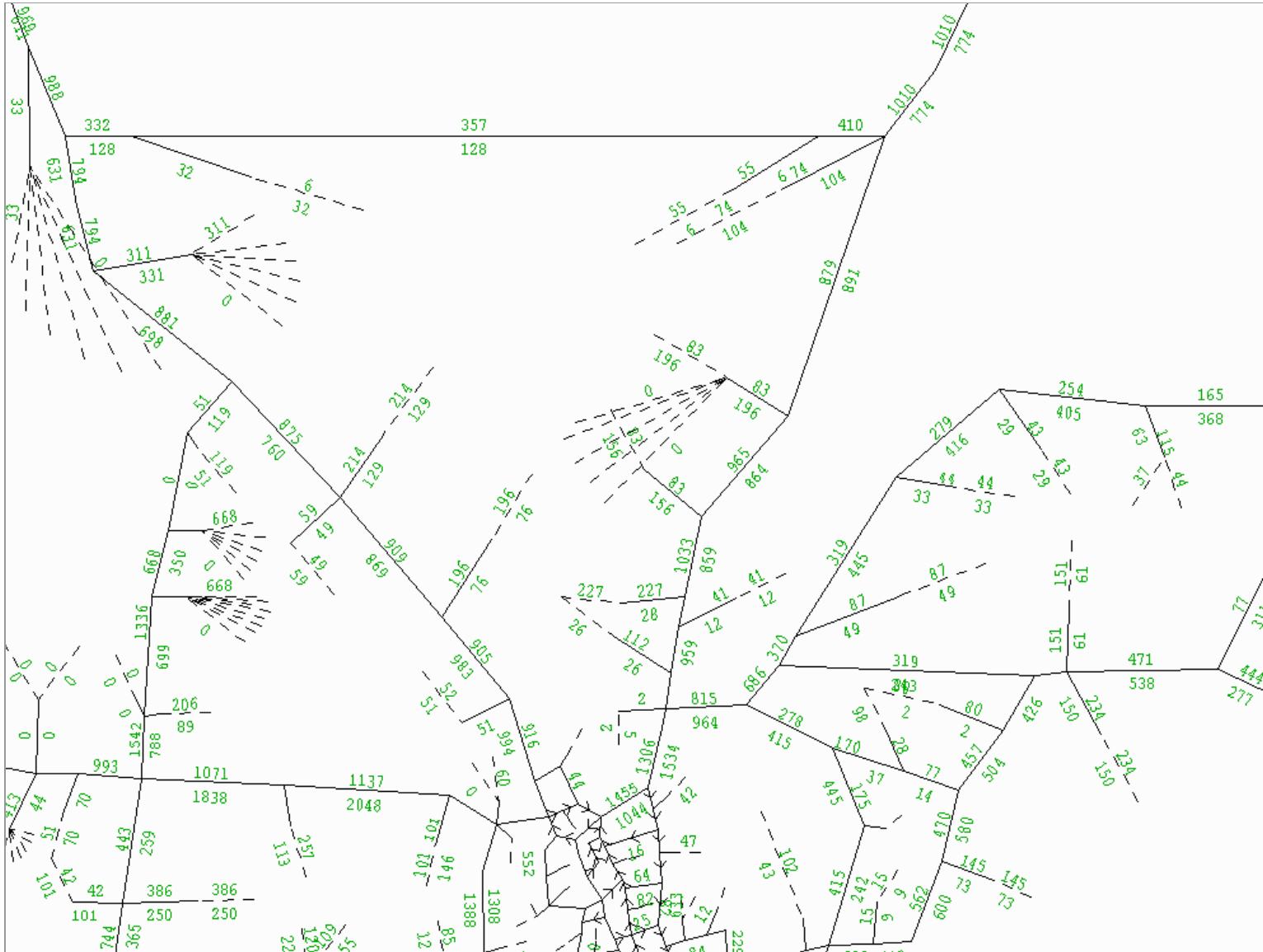


Scenario 7b 2029 No Pennine Way  
Demand Flow – AM (08:00 - 09:00) – Northern Section

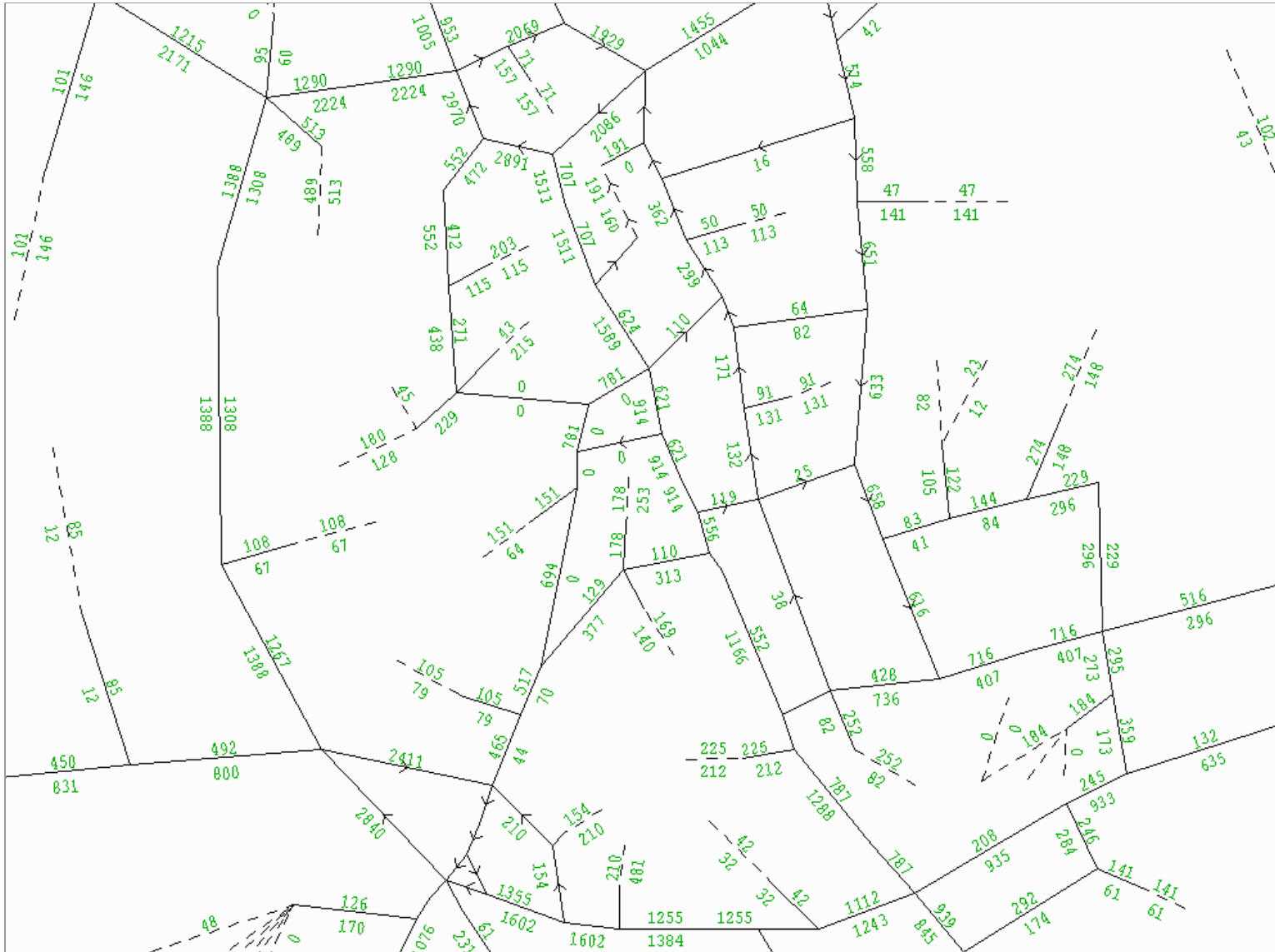


Scenario 7b 2029 No Pennine Way  
Demand Flow – AM (08:00 - 09 :00) – Town Centre

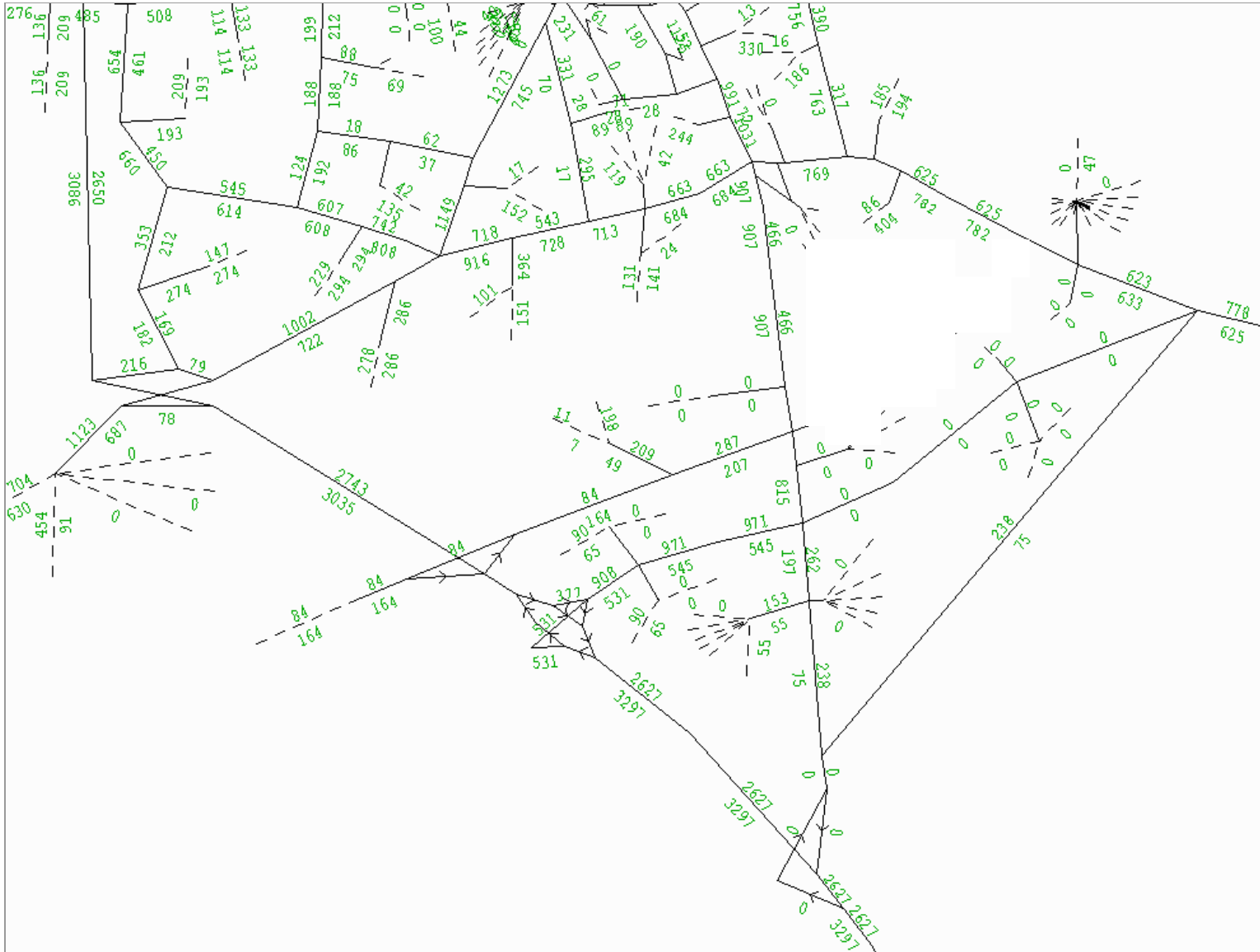




Scenario 7b 2029 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Northern Section



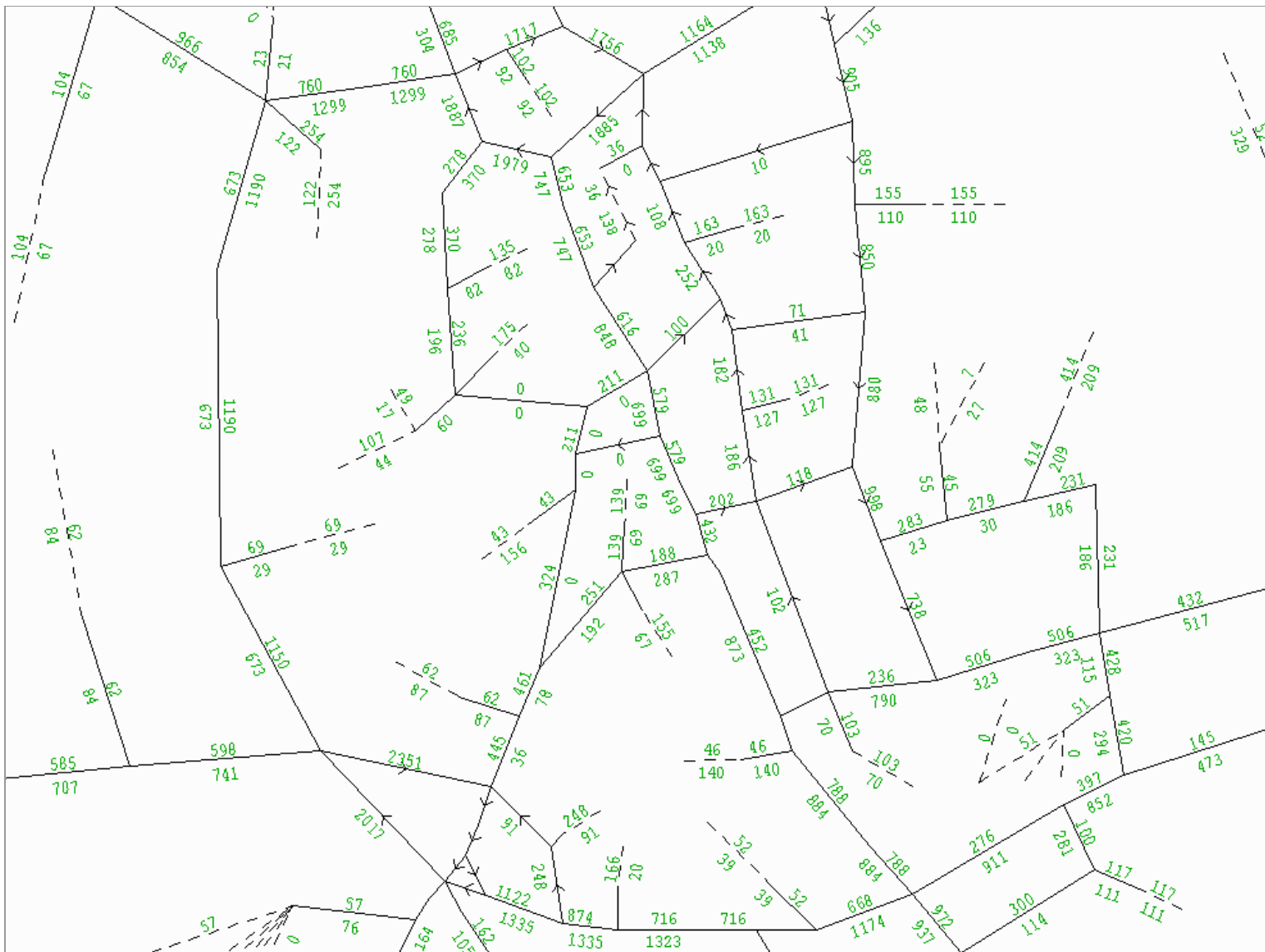
Scenario 7b 2029 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Town Centre



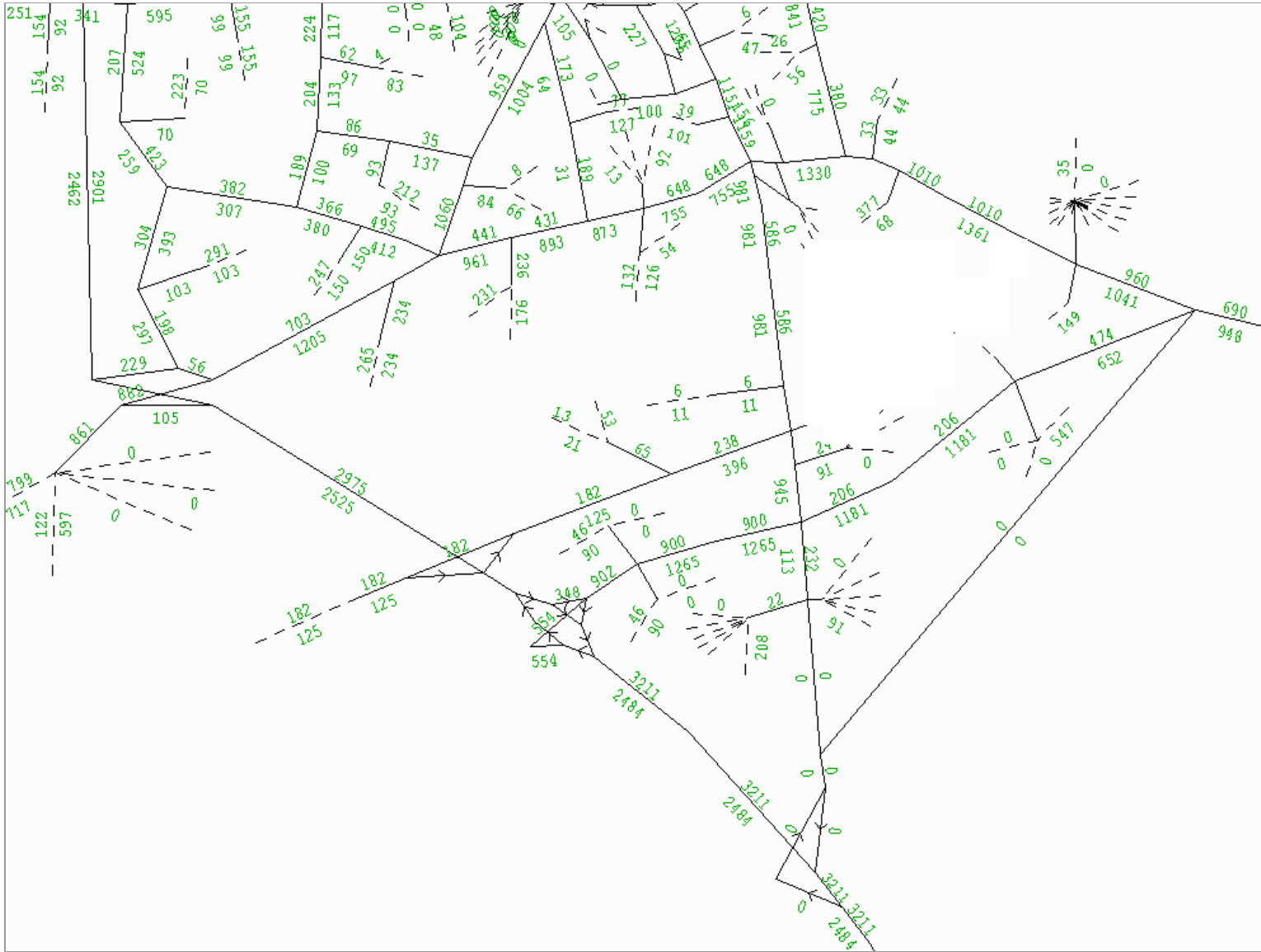
Scenario 7b 2029 No Pennine Way  
Demand Flow – PM (17:00 - 18:00) – Southern Section



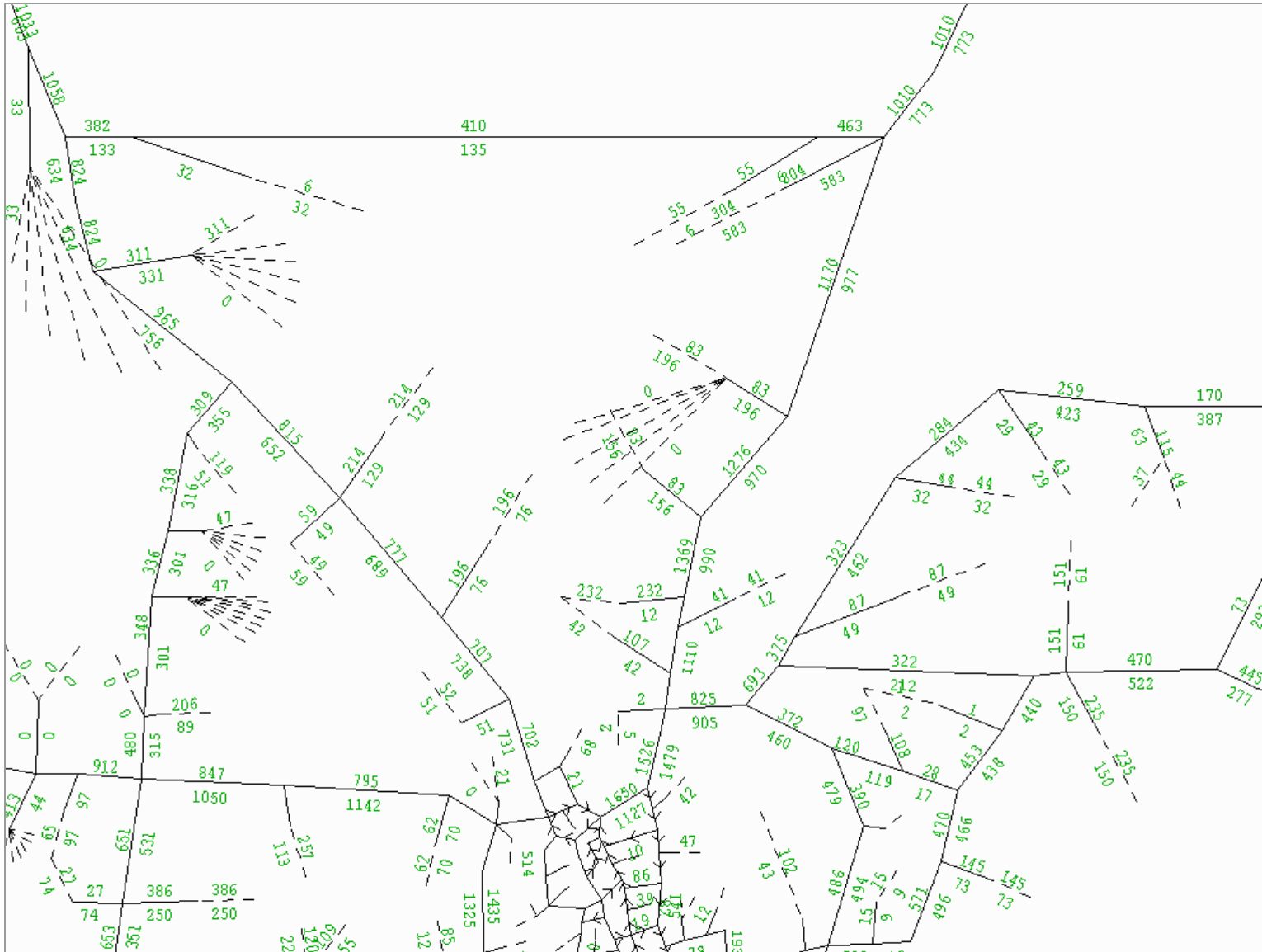




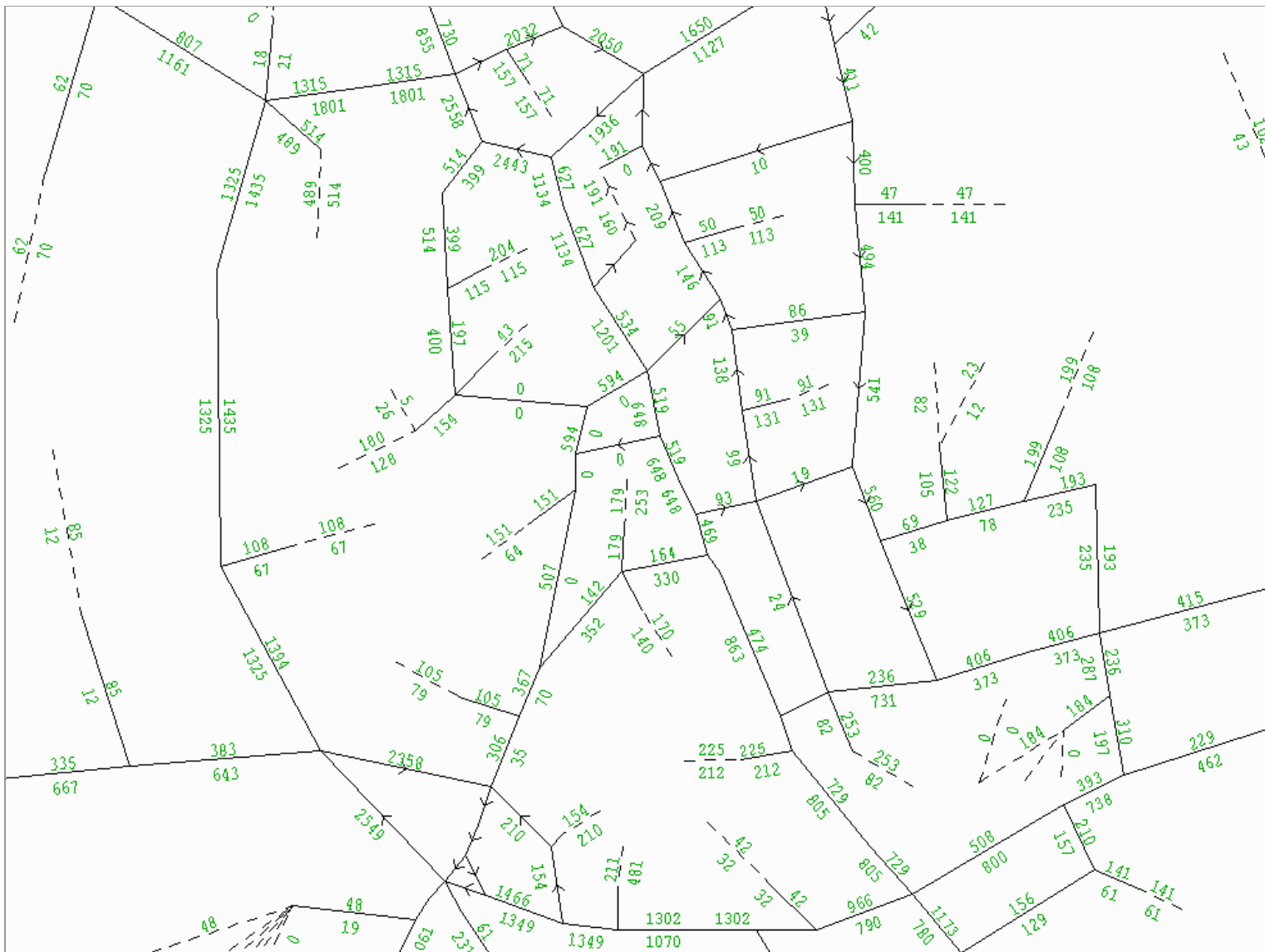
Scenario 8a 2029 Southern Relief Rd + Manthorpe  
Demand Flow – AM (08:00 - 09 :00) – Town Centre



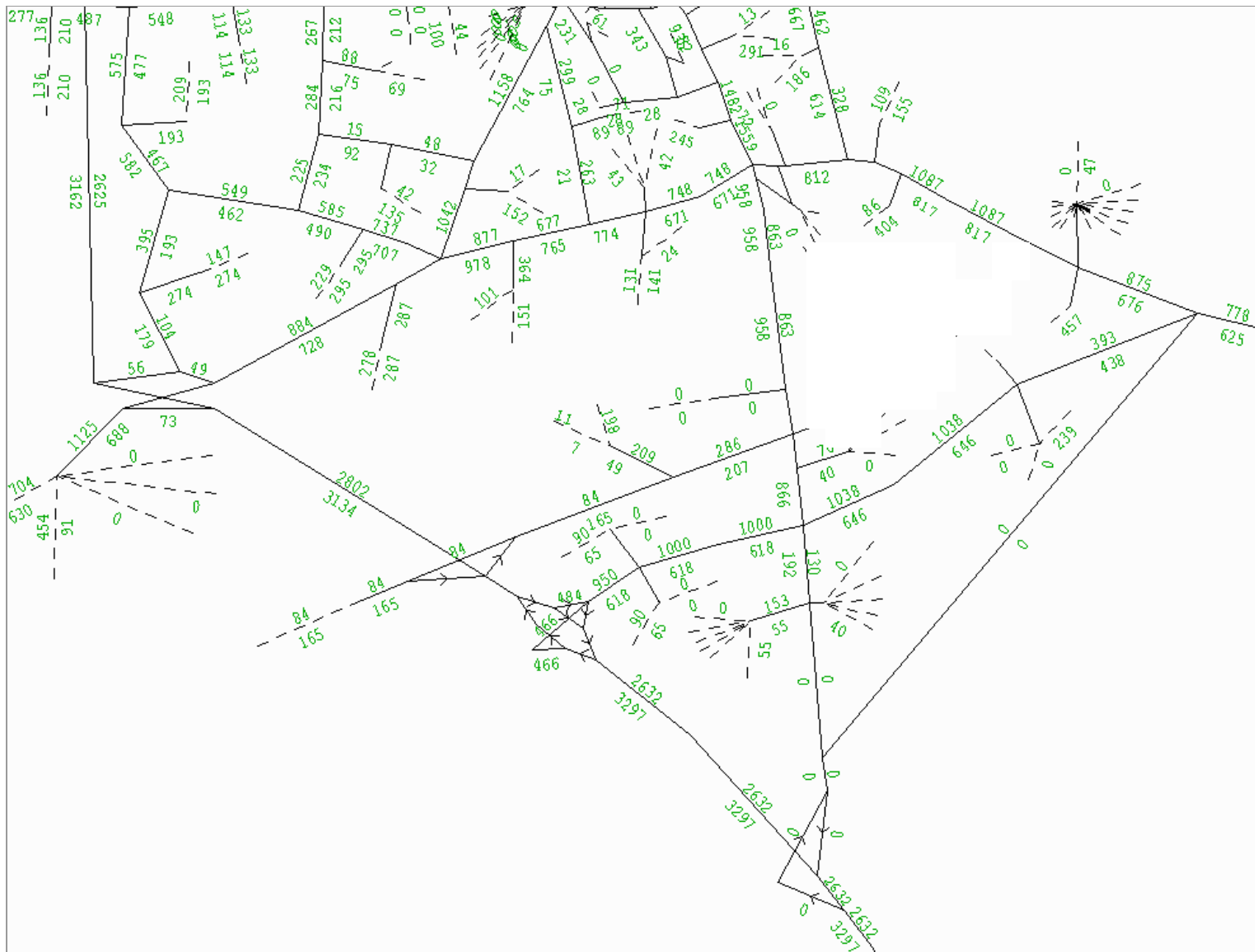
Scenario 8a 2029 Southern Relief Rd + Manthorpe  
Demand Flow – AM (08:00 - 09 :00) – Southern Section



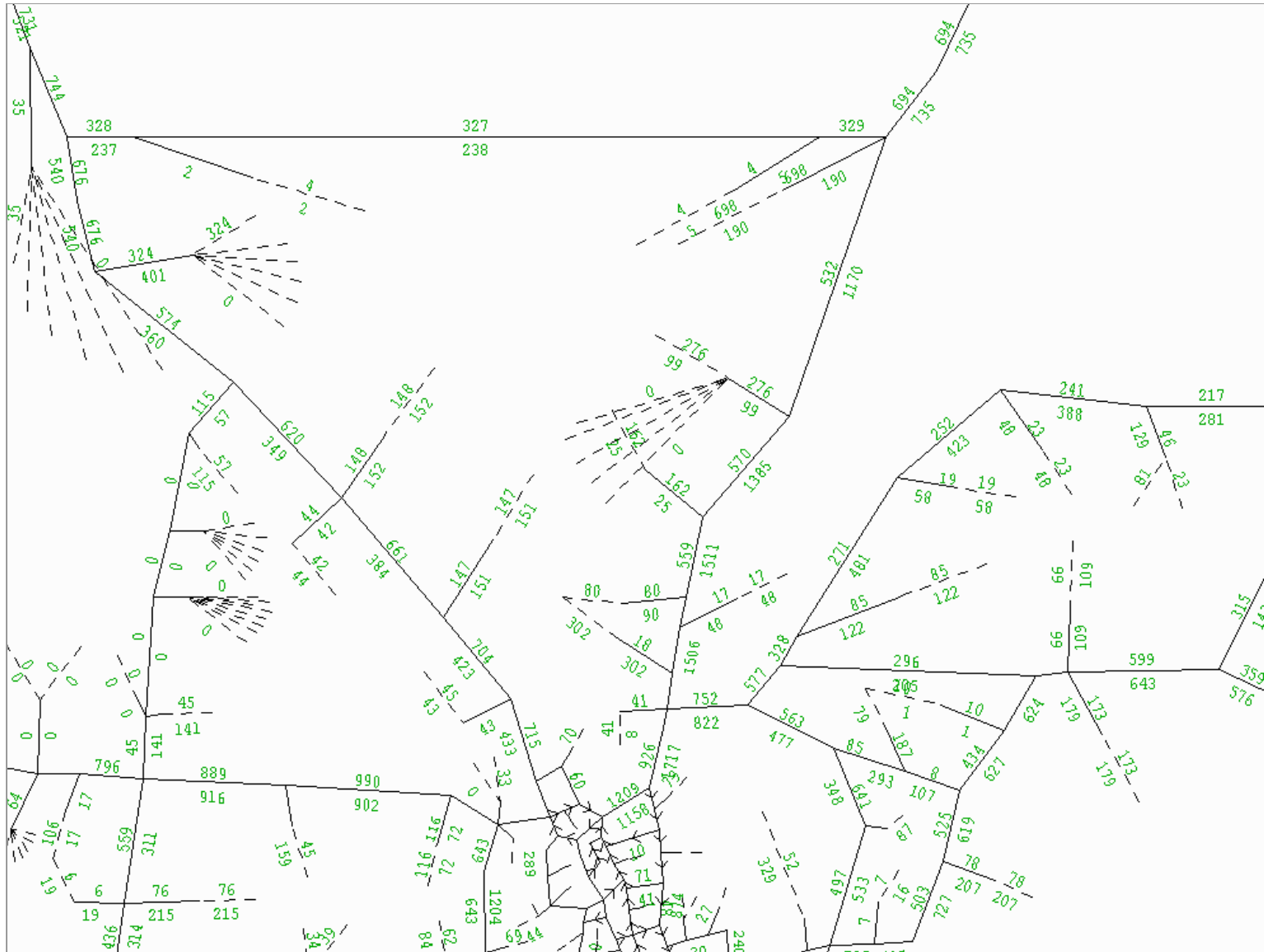
Scenario 8a 2029 Southern Relief Rd + Manthorpe  
Demand Flow – PM (17:00 - 18:00) – Northern Section



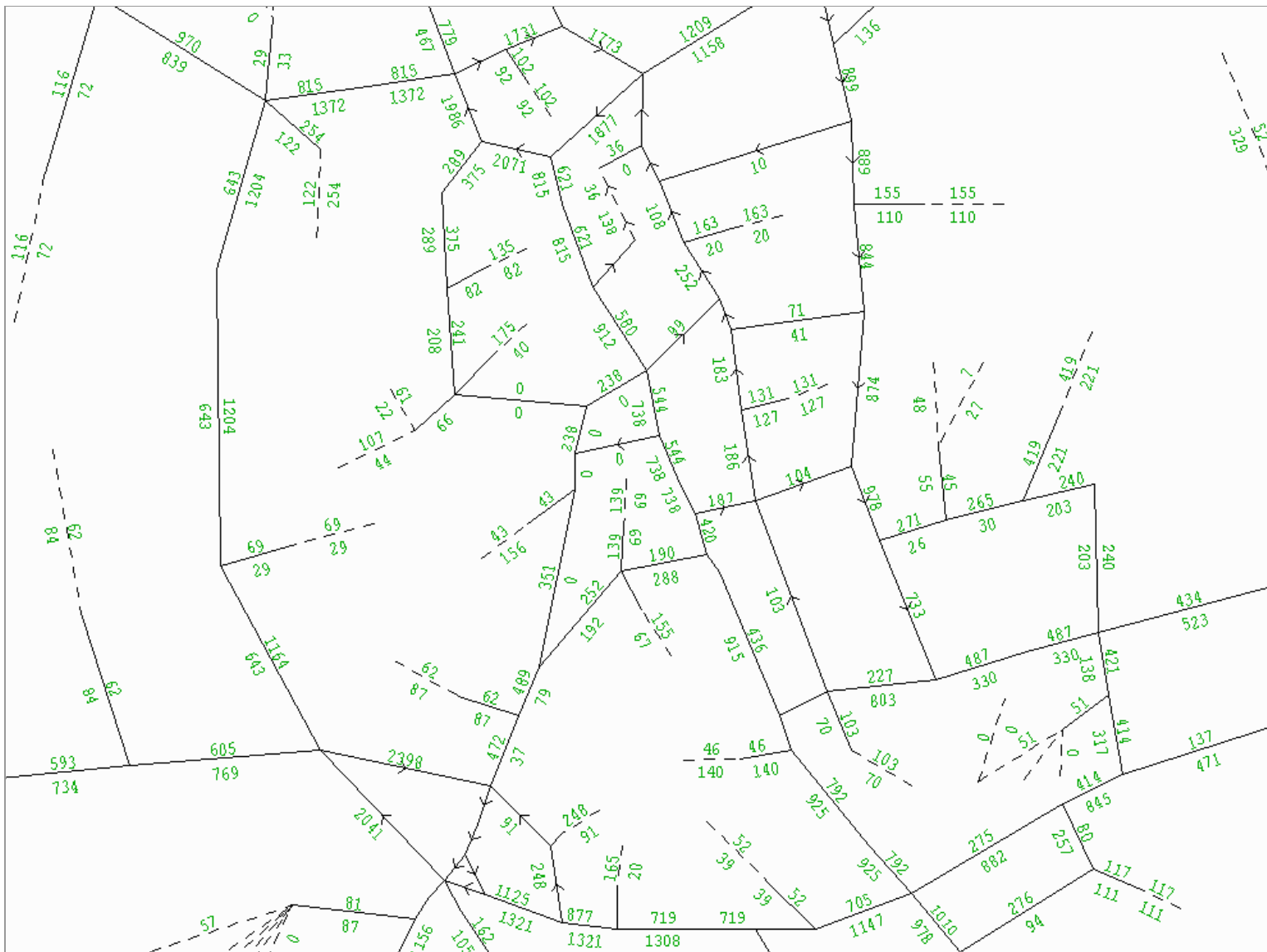
Scenario 8a 2029 Southern Relief Rd + Manthorpe  
Demand Flow – PM (17:00 - 18:00) – Town Centre



Scenario 8a 2029 Southern Relief Rd + Manthorpe  
Demand Flow – PM (17:00 - 18:00) – Southern Section



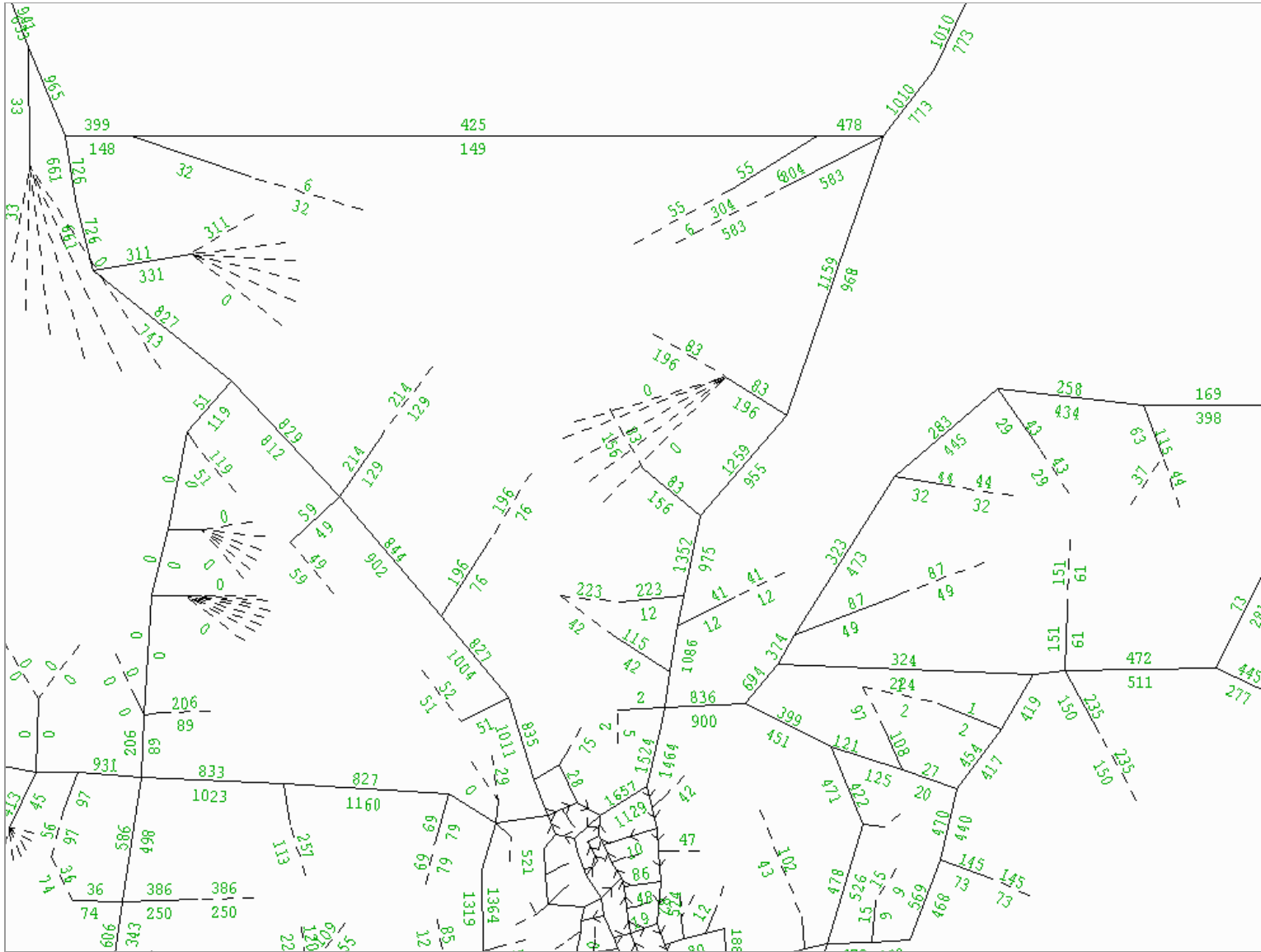
Scenario 8b 2029 Southern Relief Rd + Manthorpe  
Demand Flow – AM (08:00 - 09:00) – Northern Section



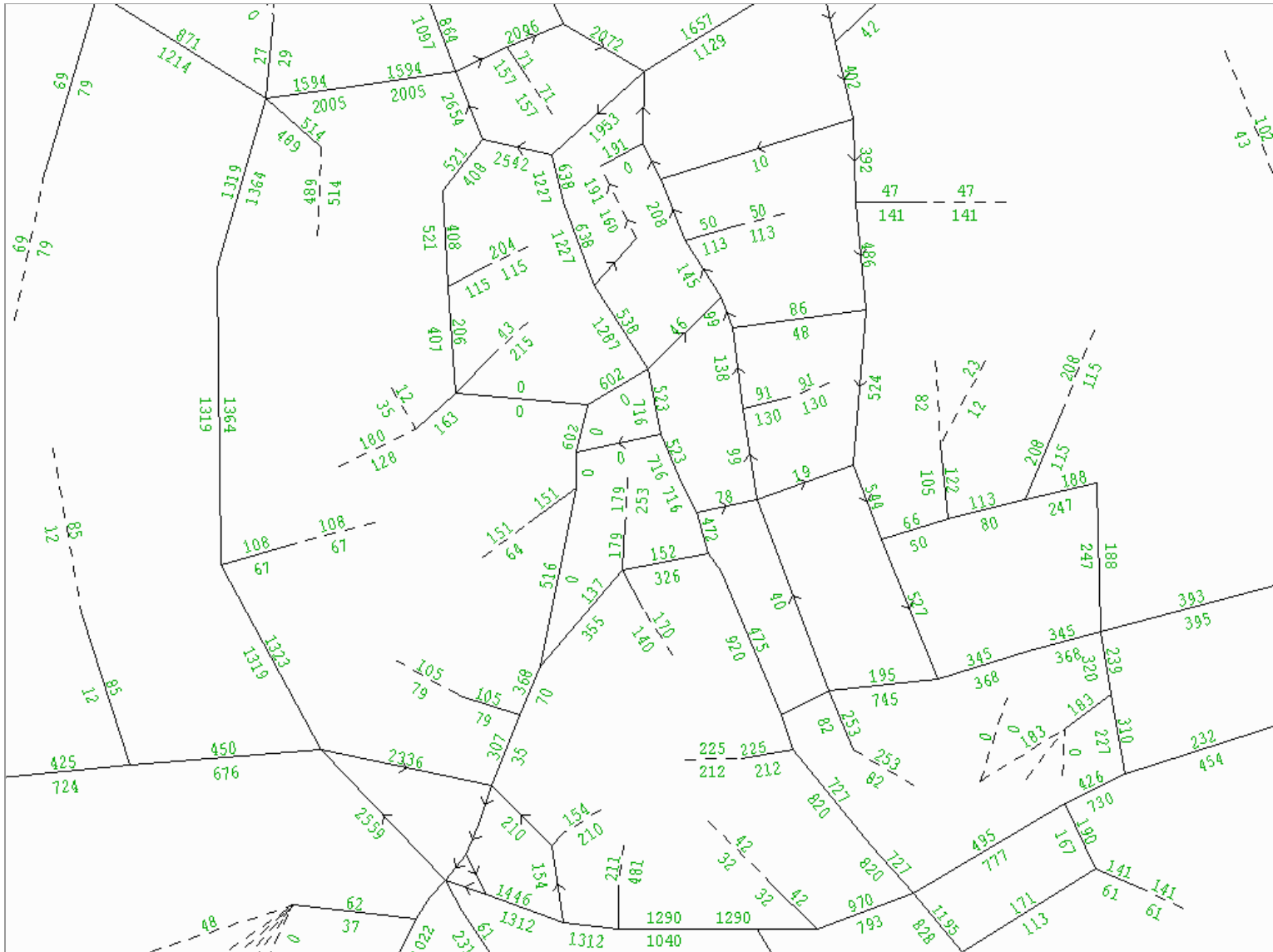
Scenario 8b 2029 Southern Relief Rd + Manthorpe  
Demand Flow – AM (08:00 - 09:00) – Town Centre



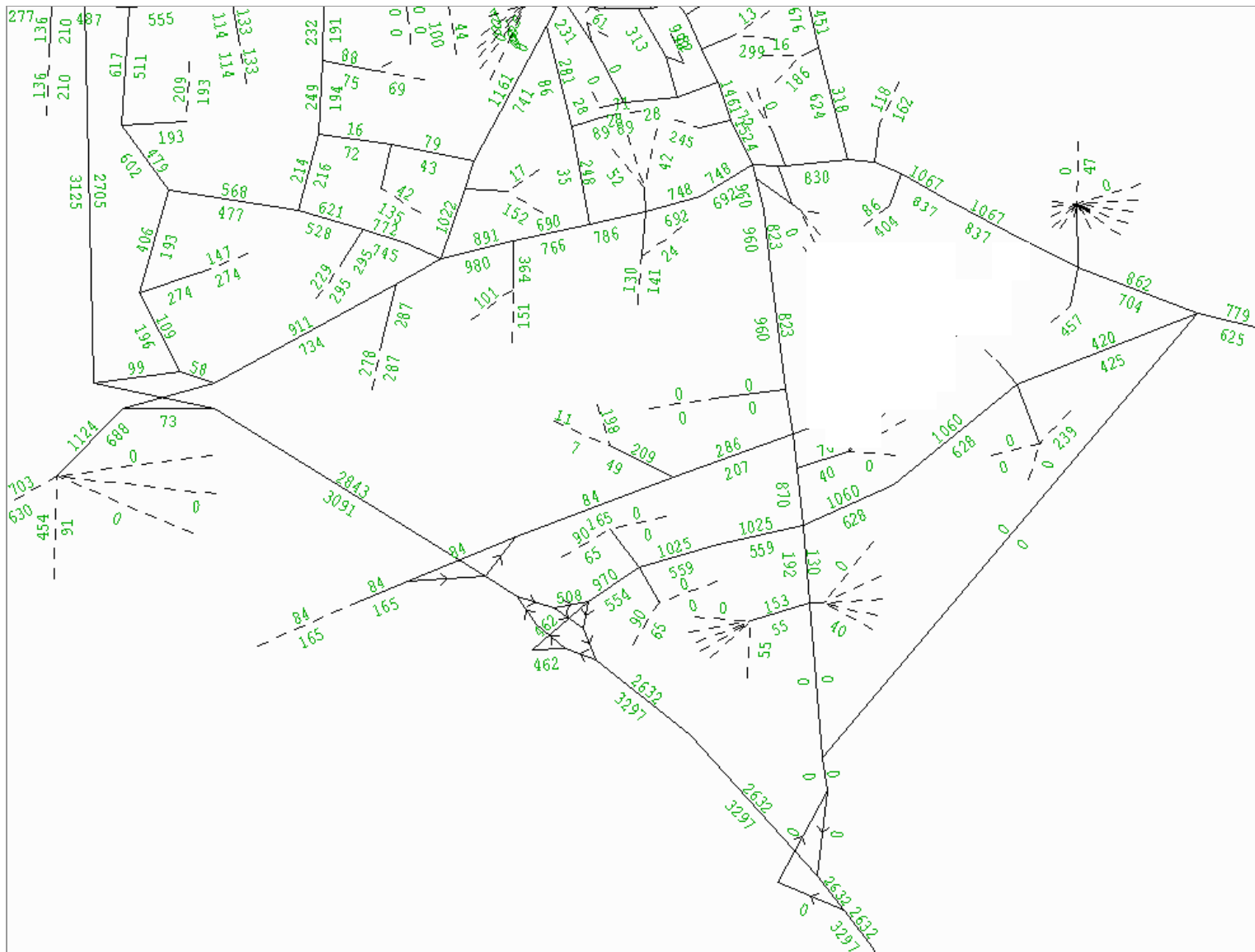




Scenario 8b 2029 Southern Relief Rd + Manthorpe  
Demand Flow – PM (17:00 - 18:00) – Northern Section

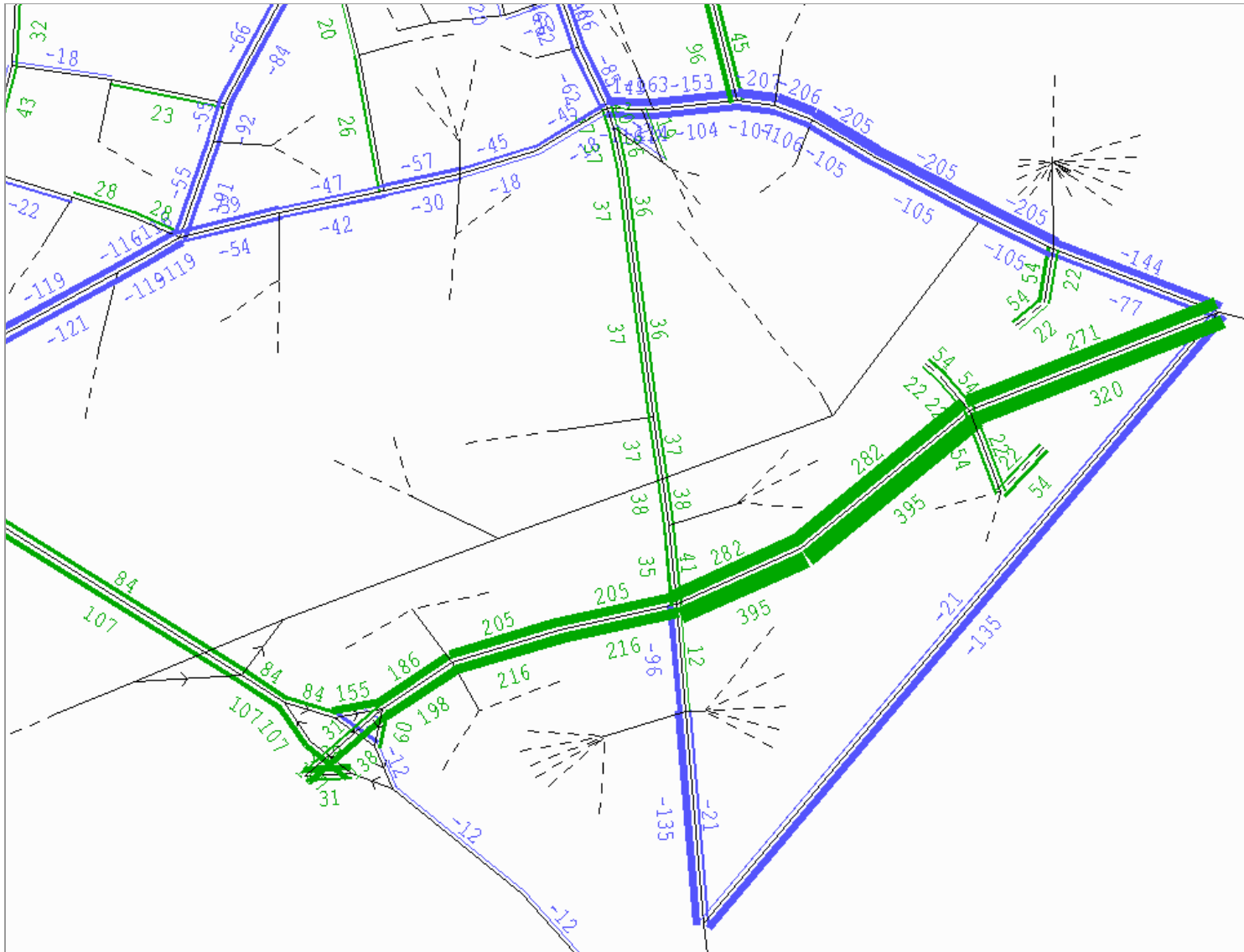


Scenario 8b 2029 Southern Relief Rd + Manthorpe  
Demand Flow – PM (17:00 - 18:00) – Town Centre

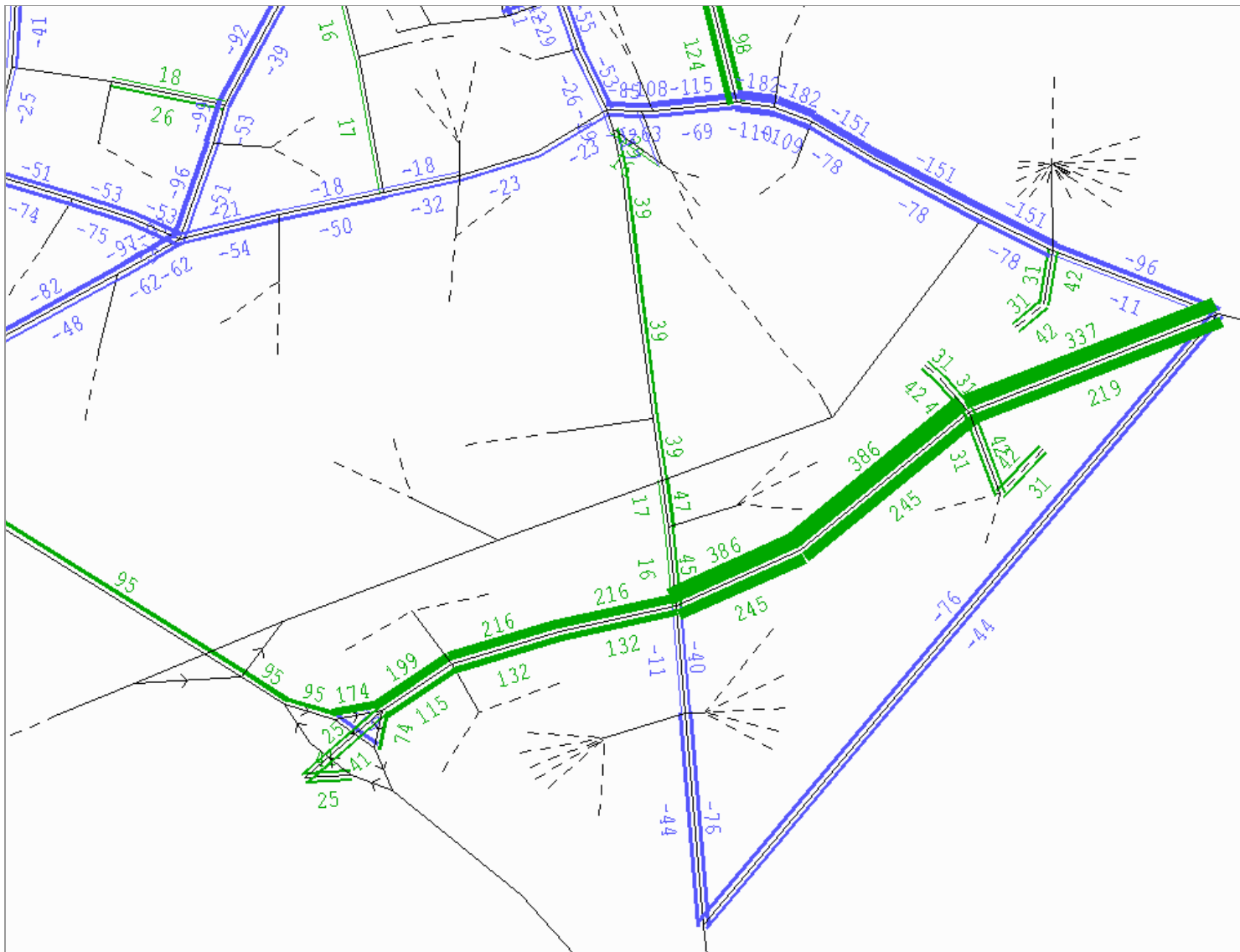


Scenario 8b 2029 Southern Relief Rd + Manthorpe  
Demand Flow – PM (17:00 - 18:00) – Southern Section

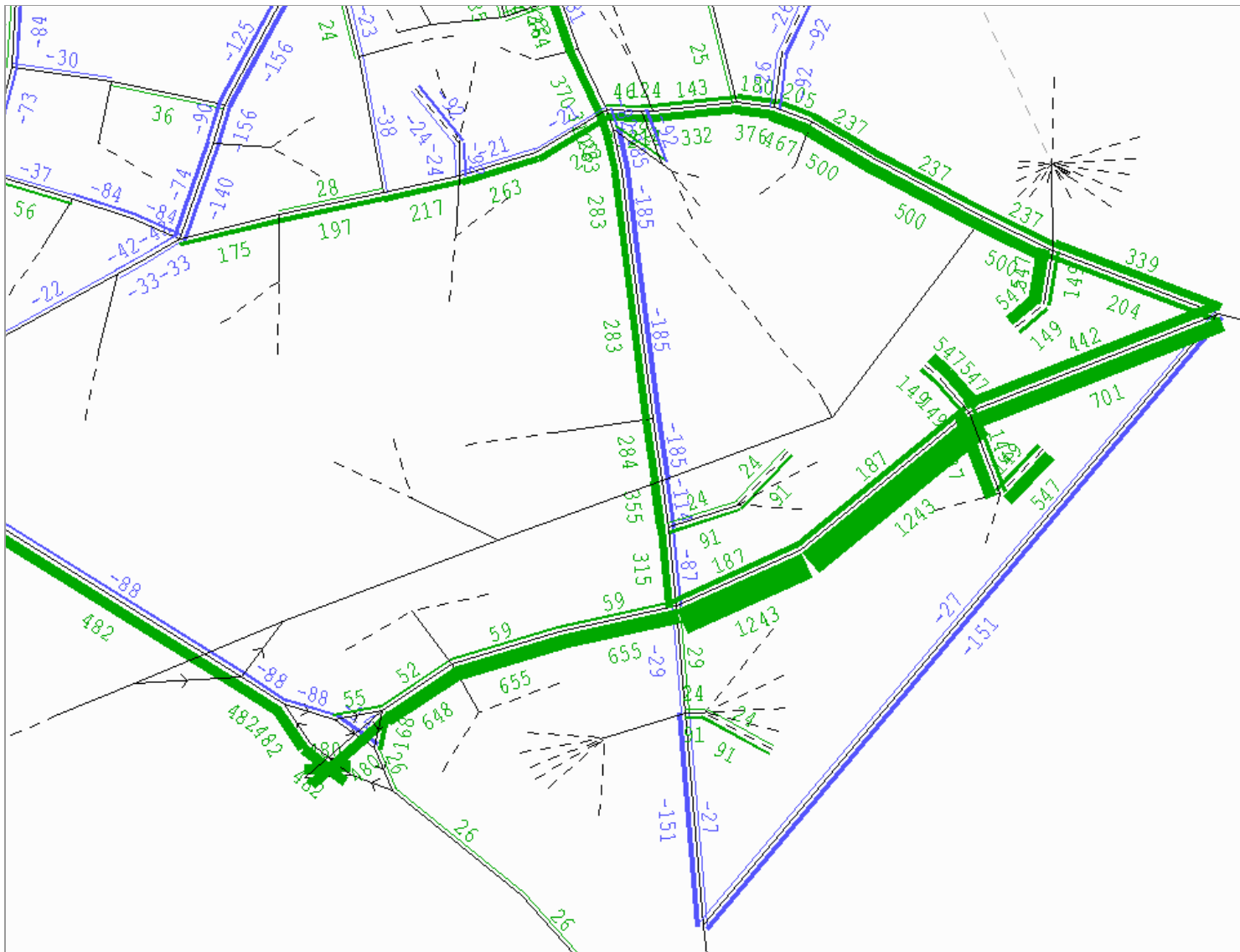
**Appendix C Traffic Volume Difference Comparison Plots**



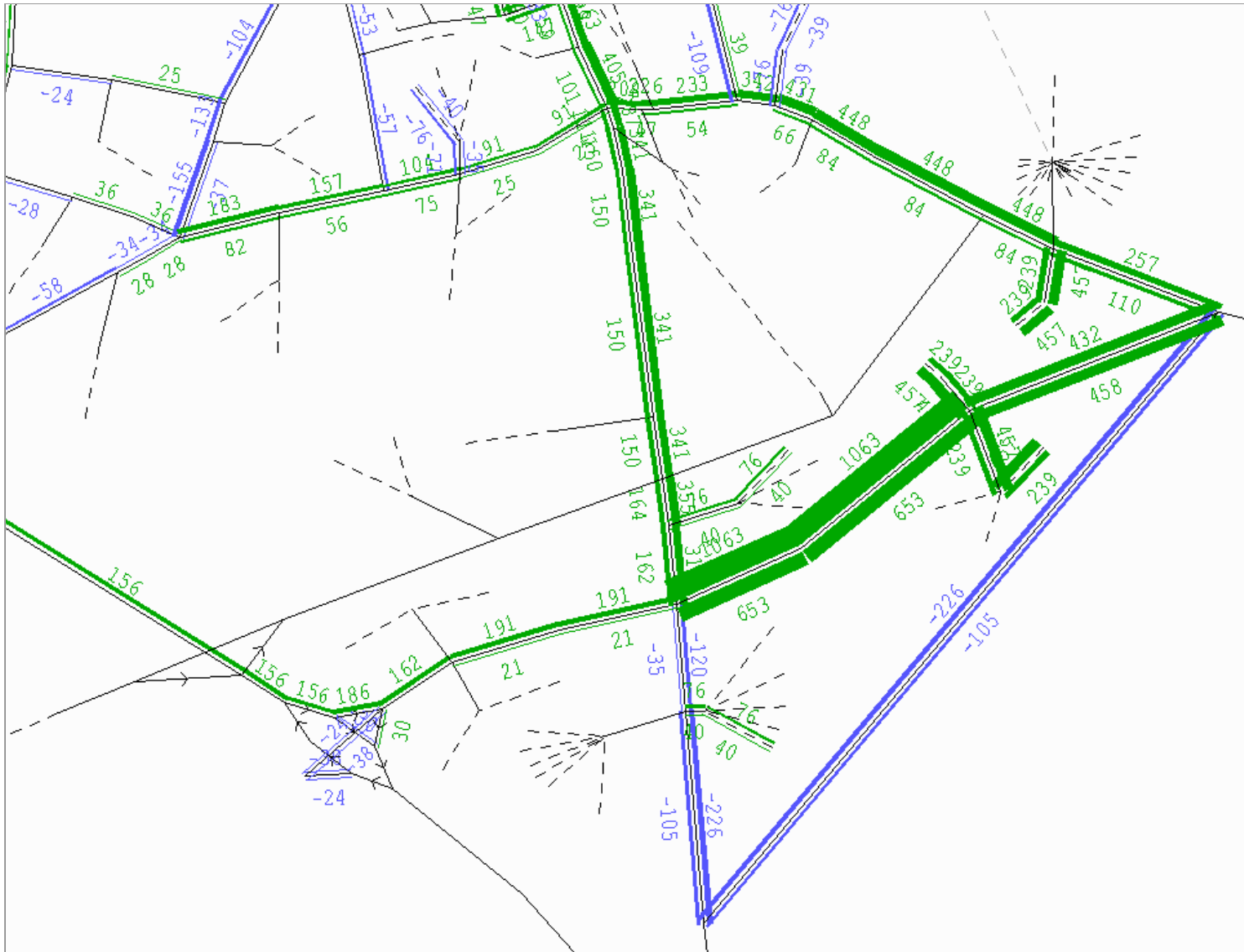
Impact of the Southern Relief Road in 2014  
Scenarios 3a – Scenario 2  
Demand Flow – AM (08:00 - 09:00)



Impact of the Southern Relief Road in 2014  
Scenarios 3a – Scenario 2  
Demand Flow – PM (17:00 - 18:00)

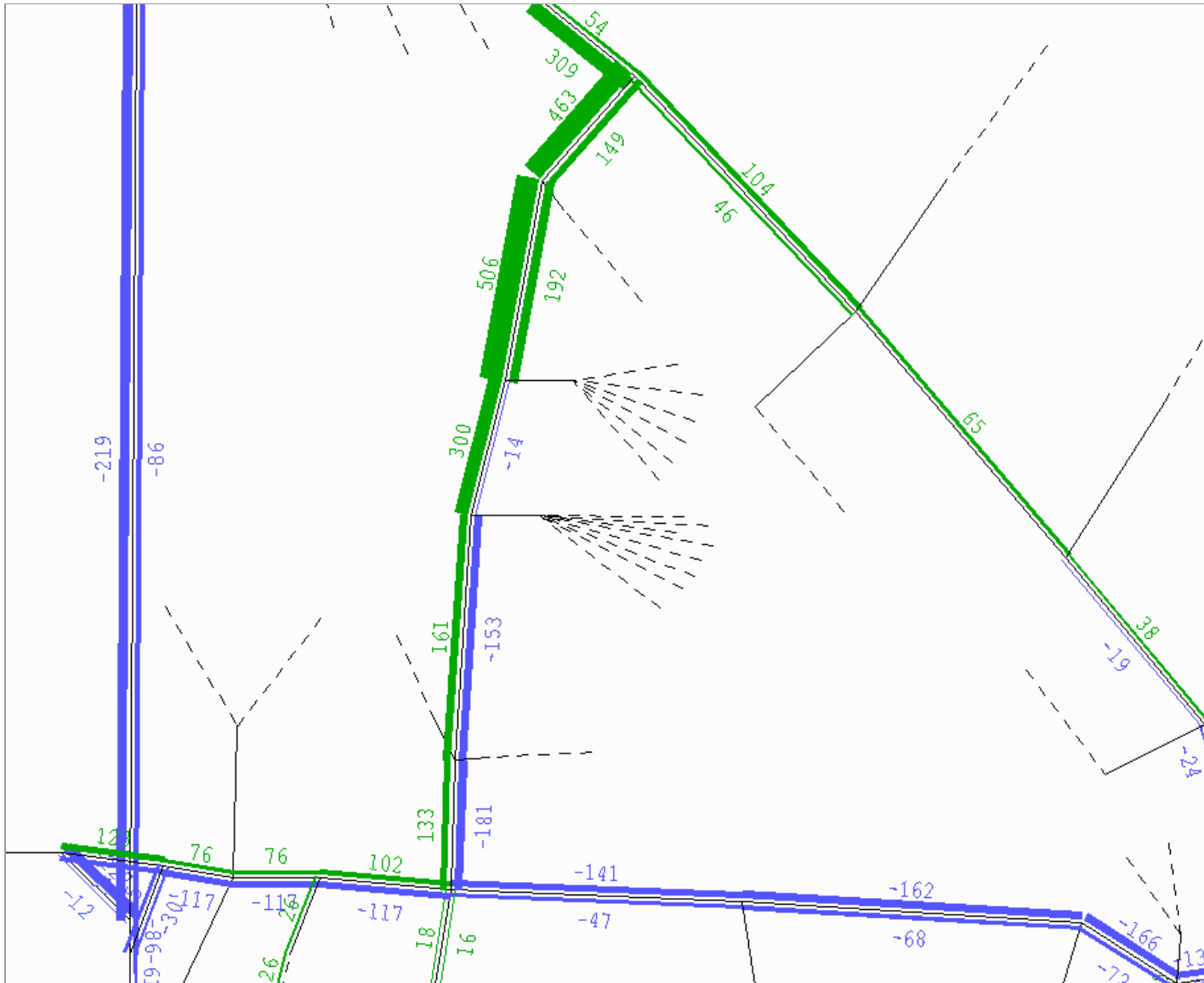


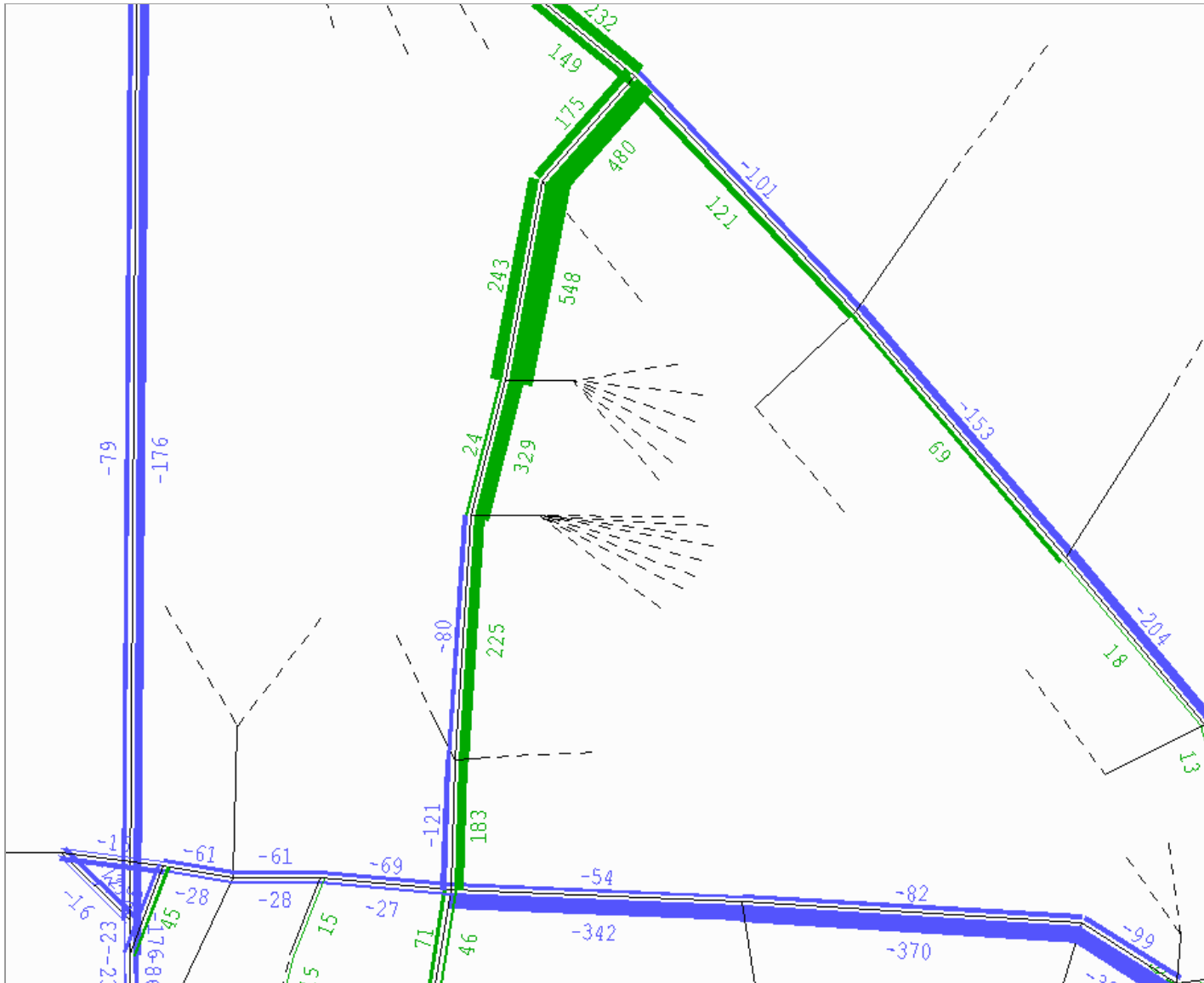
Impact of the Southern Relief Road in 2029  
Scenarios 6a – Scenario 5  
Demand Flow – AM (08:00 - 09:00)

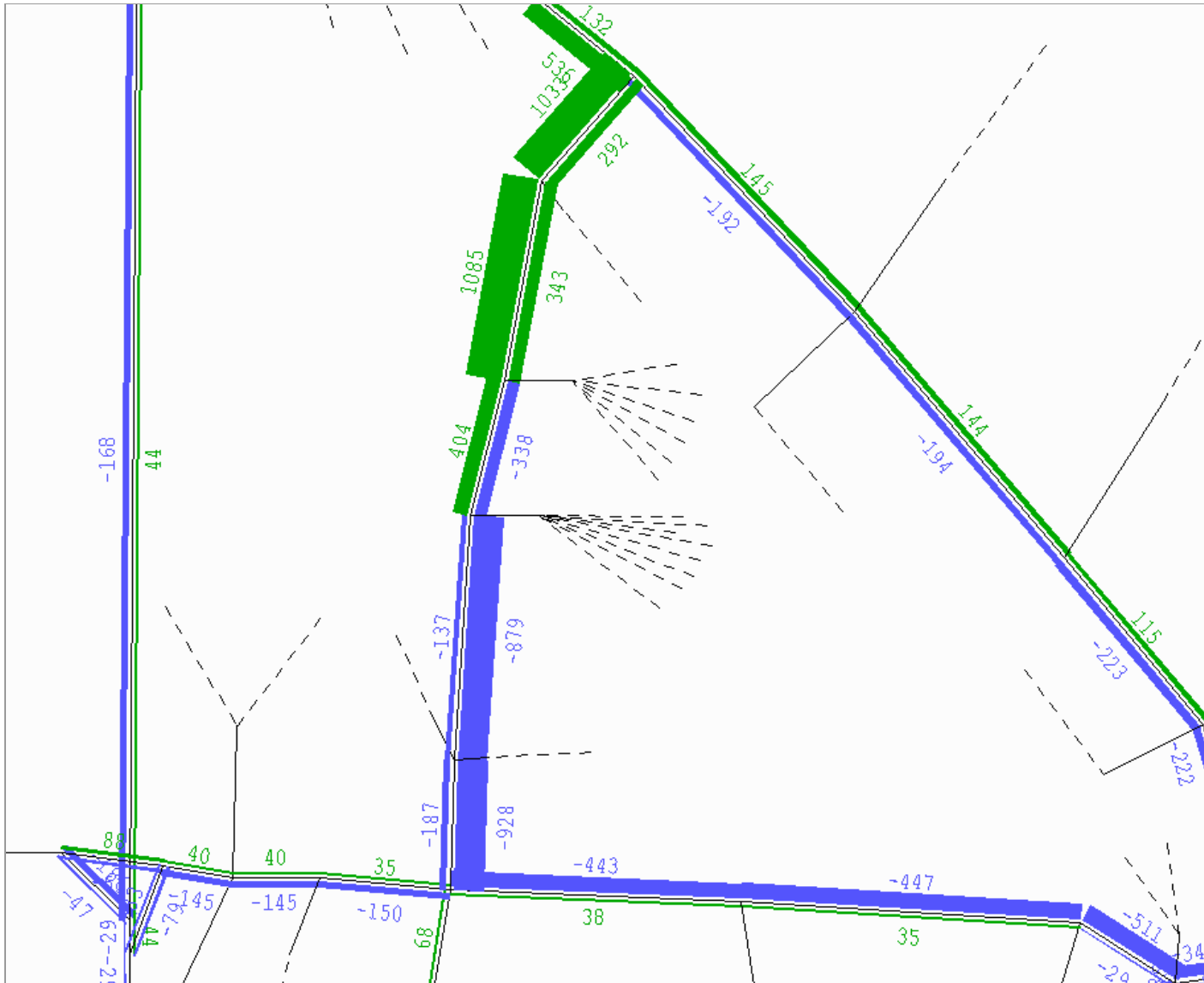


Impact of the Southern Relief Road in 2029  
Scenarios 6a – Scenario 5  
Demand Flow – PM (17:00 - 18:00)

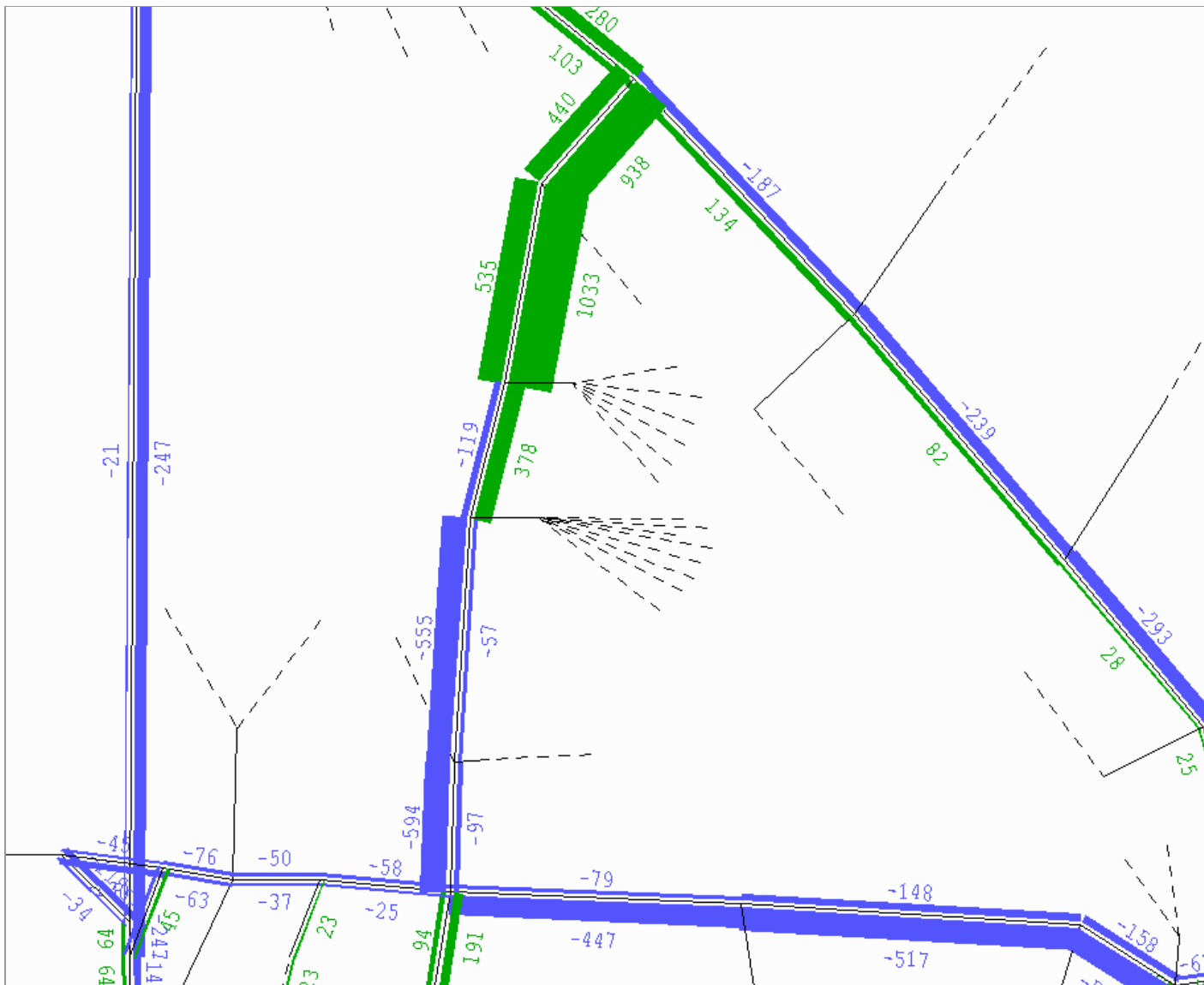




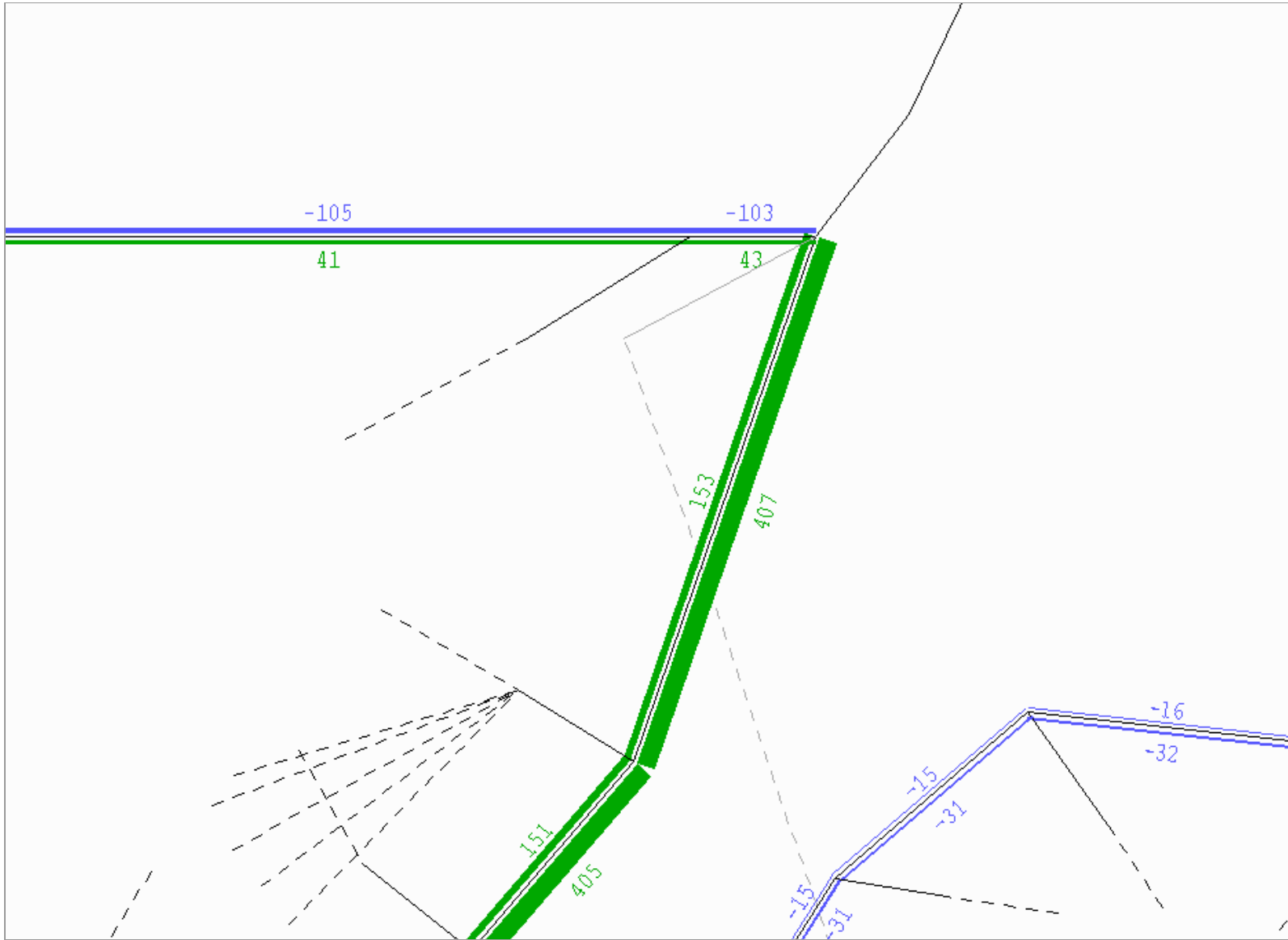




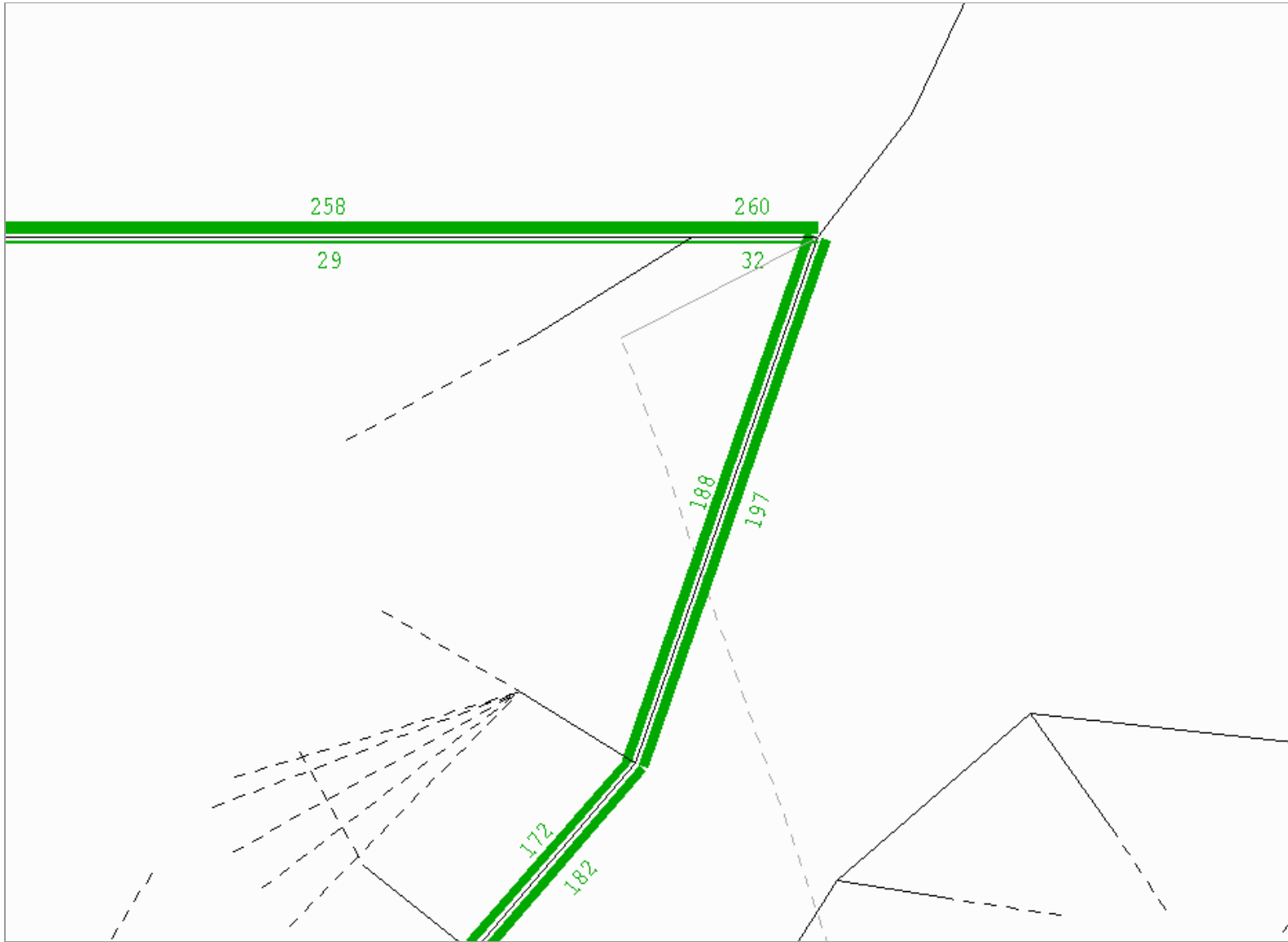
Impact of the Pennine Way in 2029  
Scenarios 5 – Scenario 7b  
Demand Flow – AM (08:00 - 09:00)

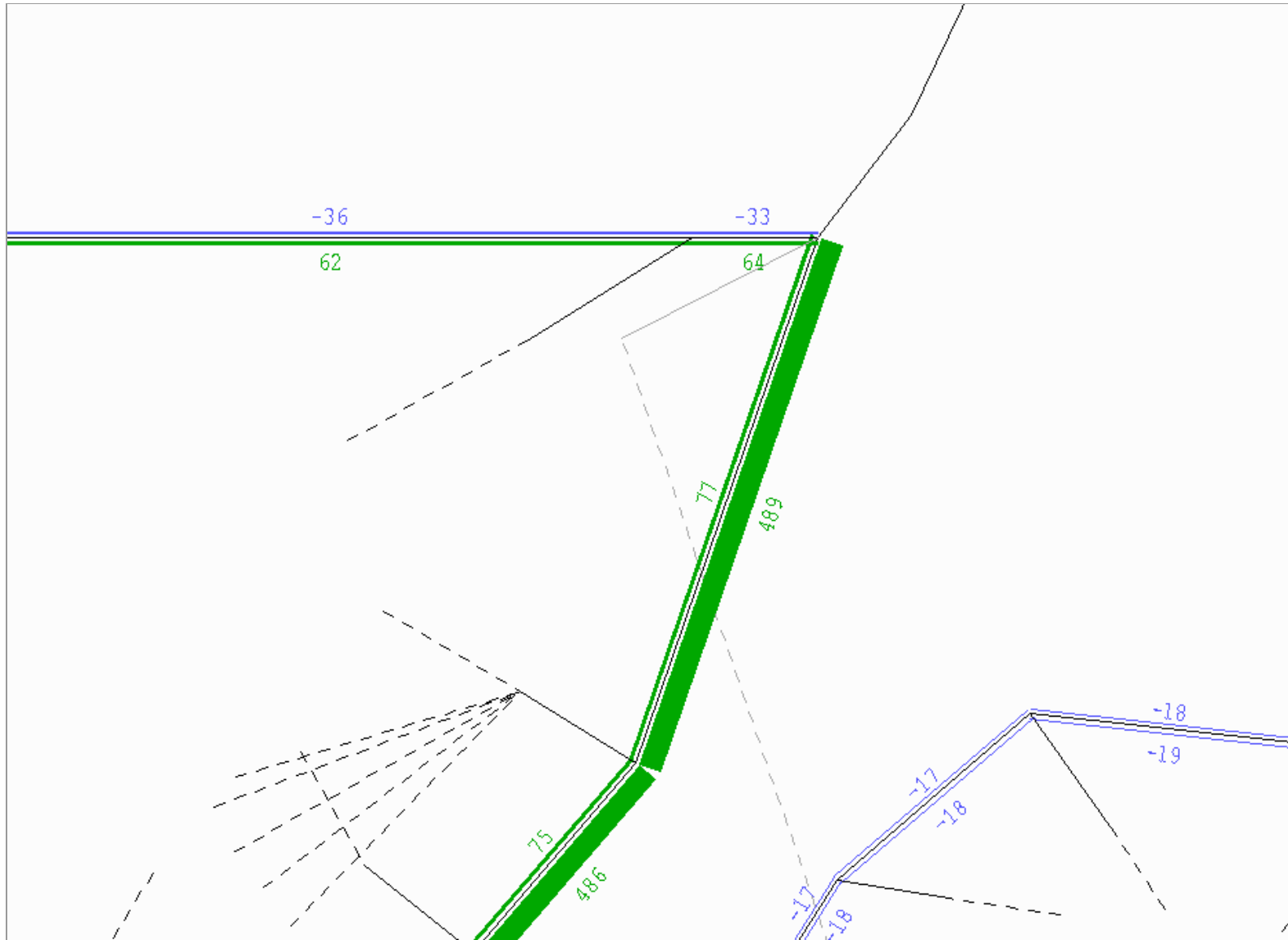


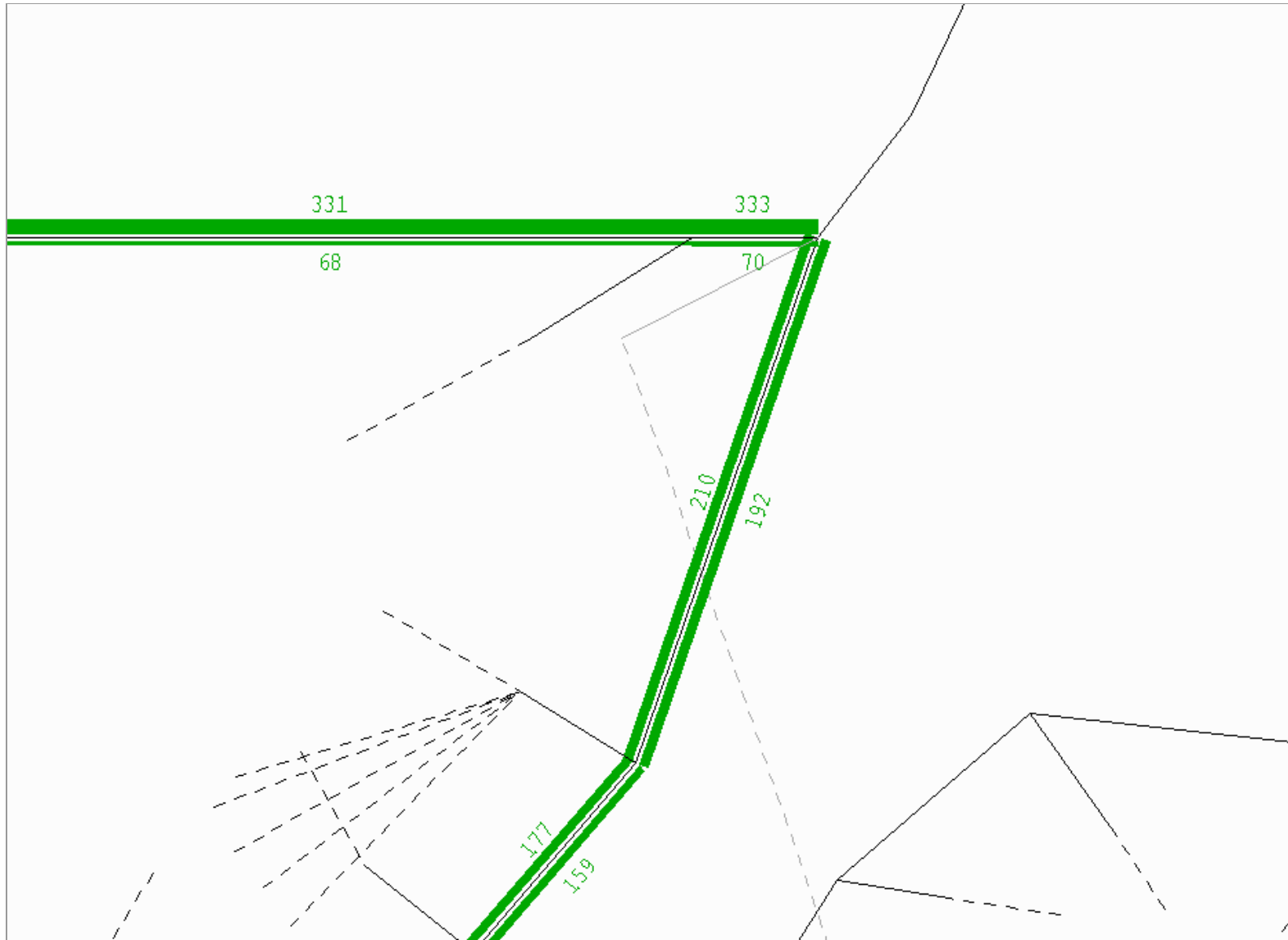
Impact of the Pennine Way in 2029  
Scenarios 5 – Scenario 7b  
Demand Flow – PM (17:00 - 18:00)



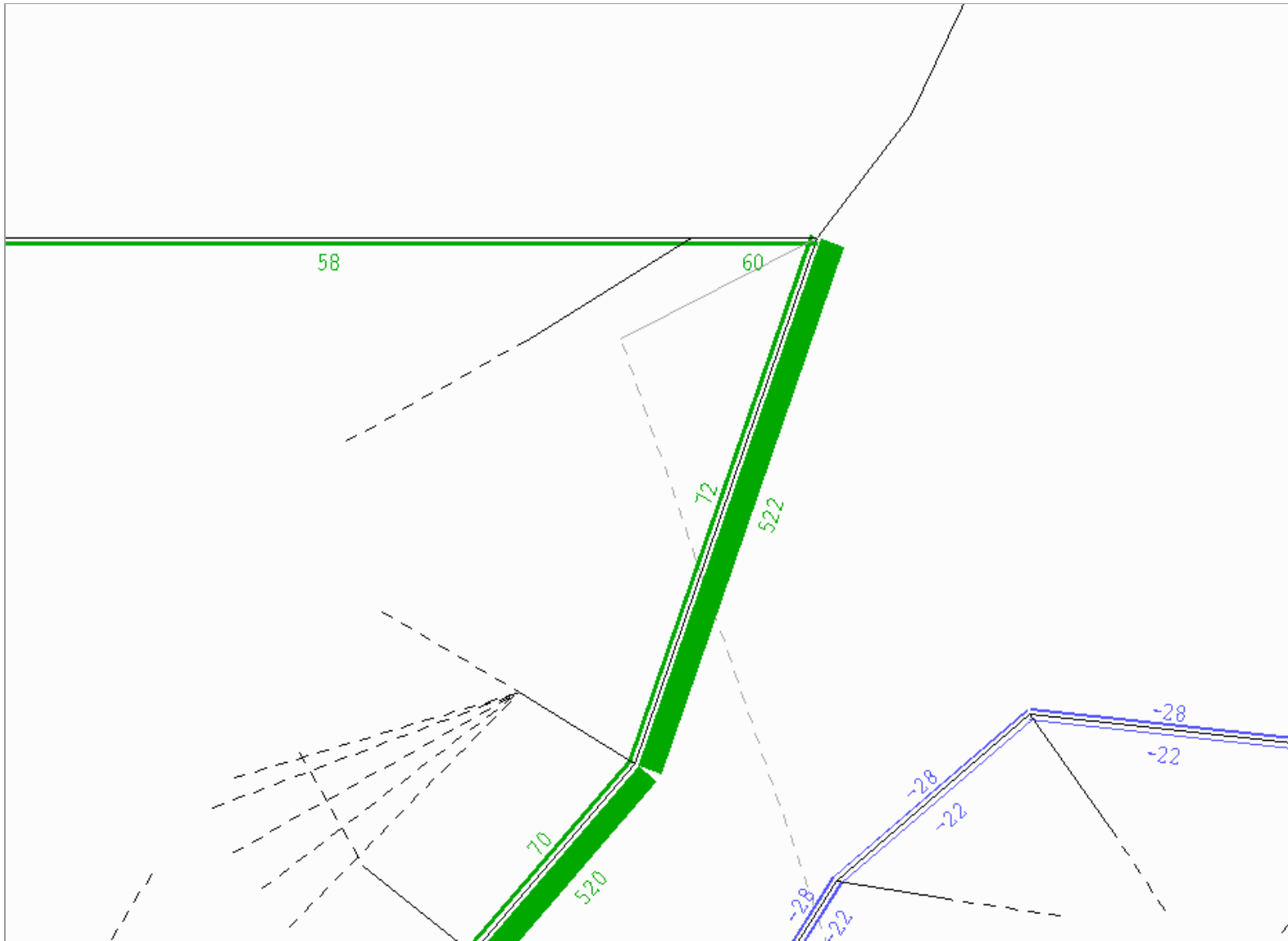
Impact of Manthorpe in 2014  
Scenarios 4c – Scenario 2  
Demand Flow – AM (08:00 - 09:00)

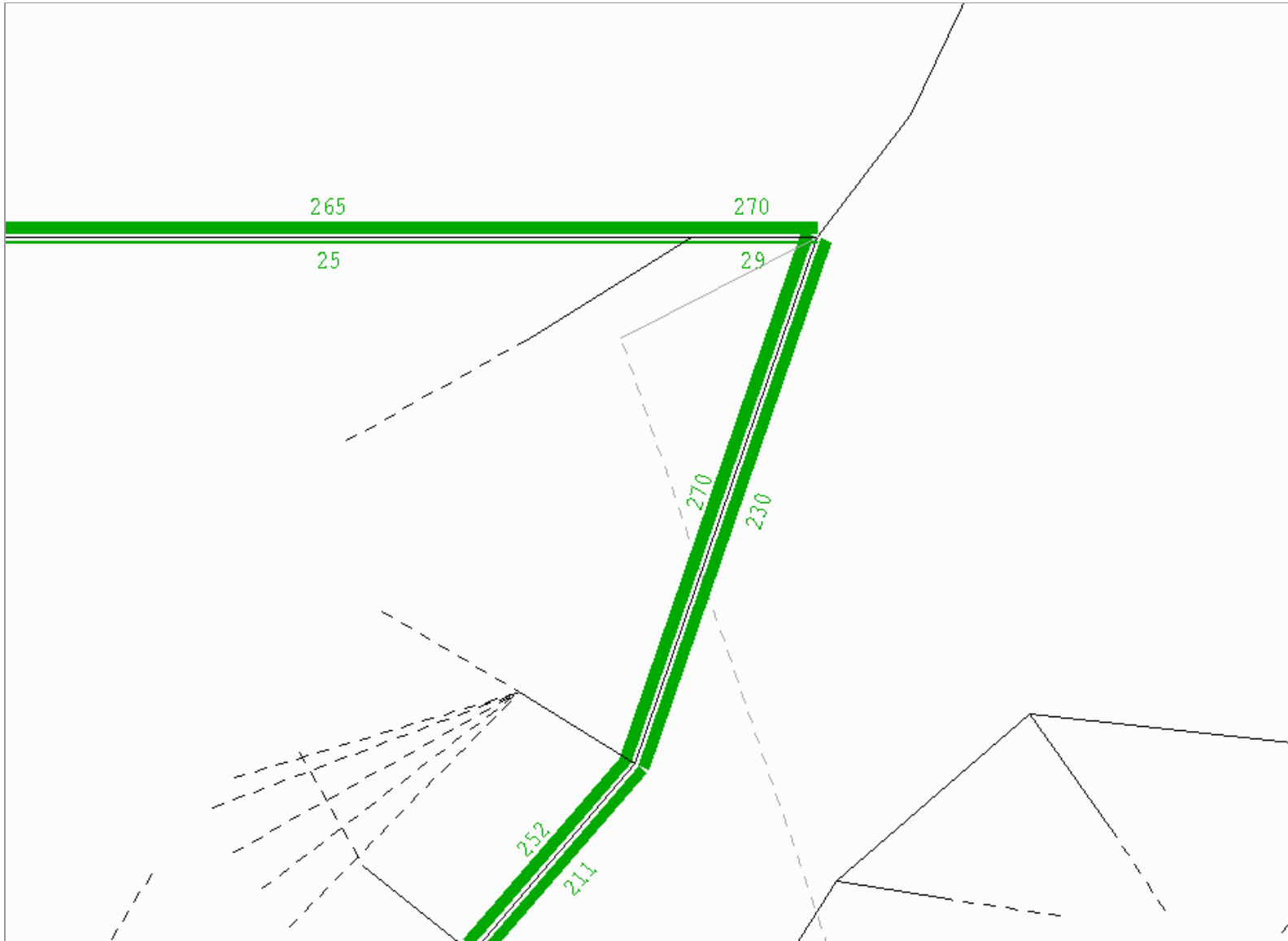












**Appendix D Junction Data**

The following graphs provide an indication of the potential level of congestion that may be experienced in the future at key junctions within Grantham. The measure Volume over Capacity (V/C) provides an indication of whether the junction has the capacity to accommodate the future traffic demand. A value of 85% is considered the maximum practical capacity for priority junctions (90% for signalised junctions) and a value over 100% suggests that the junction will be over capacity. The range of maximum V/Cs resulting from all the scenarios are presented for each junction for both the AM and PM peaks.

**Junction List**

- 193- Barrowby Rd/St Augustine Rdbt
- 809 - Harlaxton Jn
- 129 - London Rd / Wharf Rd
- 403 - London Rd/S Parade / Springfield Rd
- 507 - Harlaxton Rd/Trent Rd/ Springfield Rd
- 102 - North St/Barrowby Rd/ N Parade
- 203 - Rdbt (E) on the Great North Rd
- 202 - Barrowby Rd A52 / Pennine Way
- 190 - Dysart Rd / St Augustin Way
- 100 - Brook St / Castle Gate
- 306 – Manthorpe Road/Belton Lane
- 400 – Stonebridge Rd/Sandon Rd /Beacon Ln/Harrowby Rd



