DELIVERABLE D 1.1.2 - ANNEX

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PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restrictec to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for the members of the consortium (including the Commission Services)	

Nature of Deliverable

R	Report	✓
P	Prototype	
D	Demonstrator	
O	Other	

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1 TECHNICAL MODEL DESCRIPTIONS

In this chapter, we describe how the traffic models for each site have been implemented or modified for the Cityhush project, and how they have been validated. Here we provide additional detail not included in the main text, in order to make the main text more result oriented.

1.1 BRATISLAVA

1.1.1 Original model

A Visum application exists for Bratislava. It was developed in context with a previous noise mapping project, and comprises the municipality of Bratislava. Data from this application was made available to the CityHush project. The network contains 302 zones, 3,833 nodes and 10,472 links. The relationship between network load and travel times is described by a single common volume delay function of the form

Link travel time = free flow time * (1 + (volume / (capacity)^2) where

free flow time and capacity are link specific and provided in the data, and volume is the number of cars on the link at calculation time.

Turn penalties are also provided in the data with associated time delay functions. The following functions are defined:

Table 1 Turn penalty functions (minutes)

Penalty function number	Function definition (time in minutes)
5	0,083333*(1+(pvolau/up1)^2)
10	0,166667*(1+(pvolau/up1)^2)
15	0,25*(1+(pvolau/up1)^2)
20	0,333333*(1+(pvolau/up1)^2)
25	0,416667*(1+(pvolau/up1)^2)
30	0,5*(1+(pvolau/up1)^2)
35	0,583333*(1+(pvolau/up1)^2)
40	0,666667*(1+(pvolau/up1)^2)

where pvolau is the number of cars on the specific turn, and up1 is the capacity of the turn which is provided in the data.

The application only considers car traffic. Public transport bus, tram and train lines are also not included in the database. For demand, only a full day car trip matrix was available, containing 843396 trips. No information on heavy traffic was available.

1.1.2 Cityhush implementation

The network data, associated functions and matrix were converted to Emme format and an Emme database was established. In doing this, volume delay functions on connectors were defined. In Visum, shares for different connectors can be defined. To establish a close approximation to this, a capacity based volume delay function was introduced, having capacities corresponding to the volumes assigned in the Visum application, The function was defined as

Link travel time (minutes) = (volume / (assigned Visum volume + 1)) ^ 4

For Cityhush, two main modifications were made. The first modification was to provide a distribution of the demand matrix on different value of time segments (as described in the main text). This modification was done with no regard to origin and destination – the segment shares were uniformly applied to the entire matrix.

The second modification was to split the demand on low noise vehicles (LNV) and standard vehicles (SV). The trip matrix, segmented on values of time, is therefore further segmented on LNV and SV, comprising 10 segments in total. The segmentation is done with equal LNV shares in all value of time segments. This modification is scenario specific, in that the LNV ownership was different with respect to levels and origin zones in different scenarios.

The trip matrix is a full day trip matrix, containing outbound as well as inbound trips. It is not known how many trips that have their origin (and therefore would be residents) in a specific zone, and thus might have a different level of LNV ownership. This makes it difficult to evaluate the assumption on different residential LNV ownership in different zones. The assumed LNV ownership, defined as an origin specific share on the full day trip matrix, is therefore only an approximation of the LNV ownership in resident zones. The larger the share of traffic generated in the zone, the better an approximation. However, this share is not known in the Bratislava case.

1.1.3 Validation

No counts were available in the Bratislava application. Therefore, the validation was done with respect to the assignment results from the Visum application (standard equilibrium assignment), which was available. The fit of the forecasted volumes with respect to the Visum assignment results are shown on figure 1 for the total network, and on figure 2 for the noise map area. The figure displays the forecasted volumes on all links plotted against the Visum results. If they would coincide fully, they would all lie on a line through origo with slope 1. A regression shows that the slope is 0.97, and that the corresponding R square is 0.88. The regression line is shown on the figure, with a 95 percent confidence band. For the part of the network that belongs to the noise mapping area, the slope is 1.06 and the R square is 0.89. The forecast and the Visum results do not match exactly, which is explained by the differences in assignment methodology (particularly handling of connectors). No particular bias is observed.

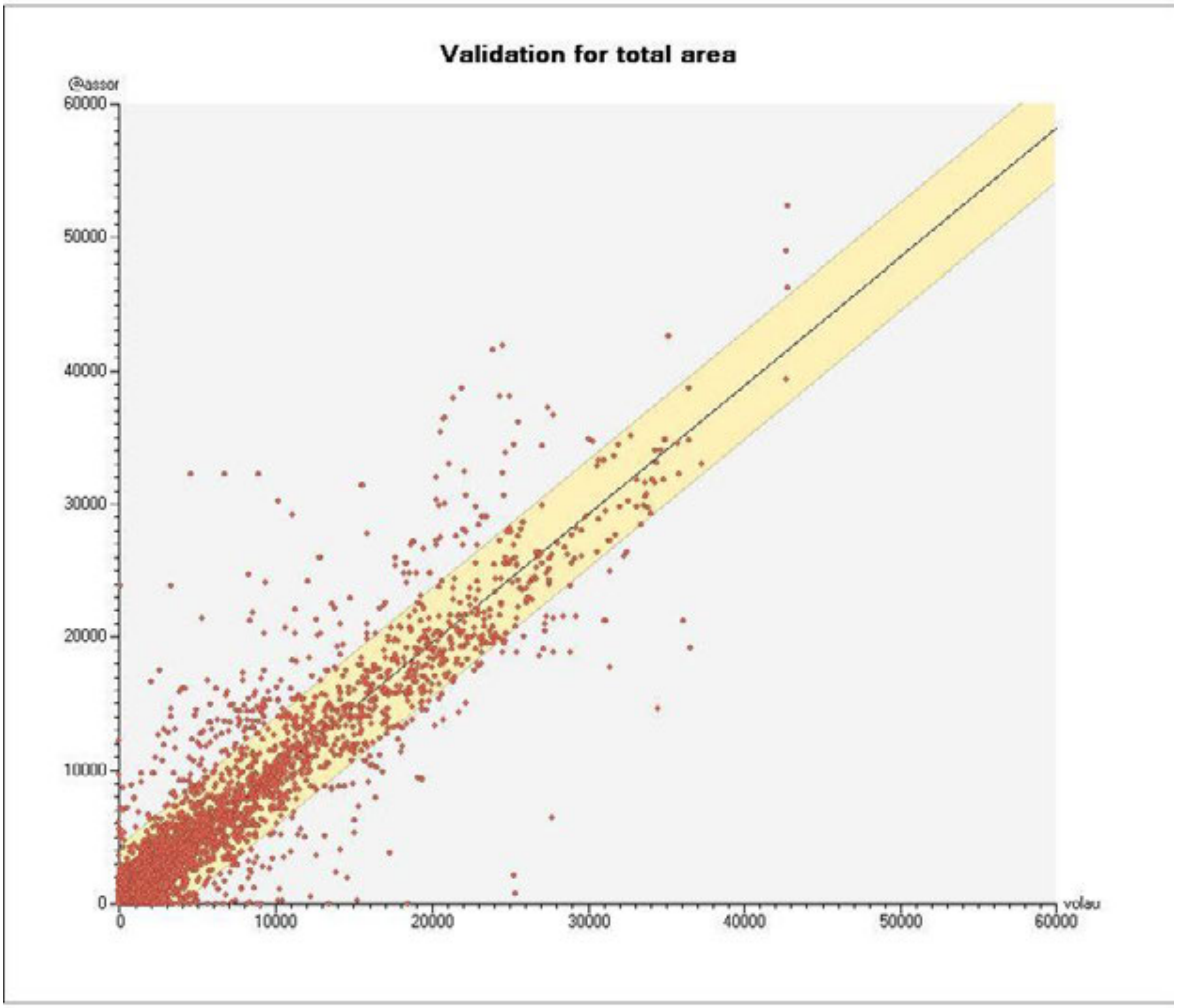

Figure 1.1 Total area validation for Bratislava

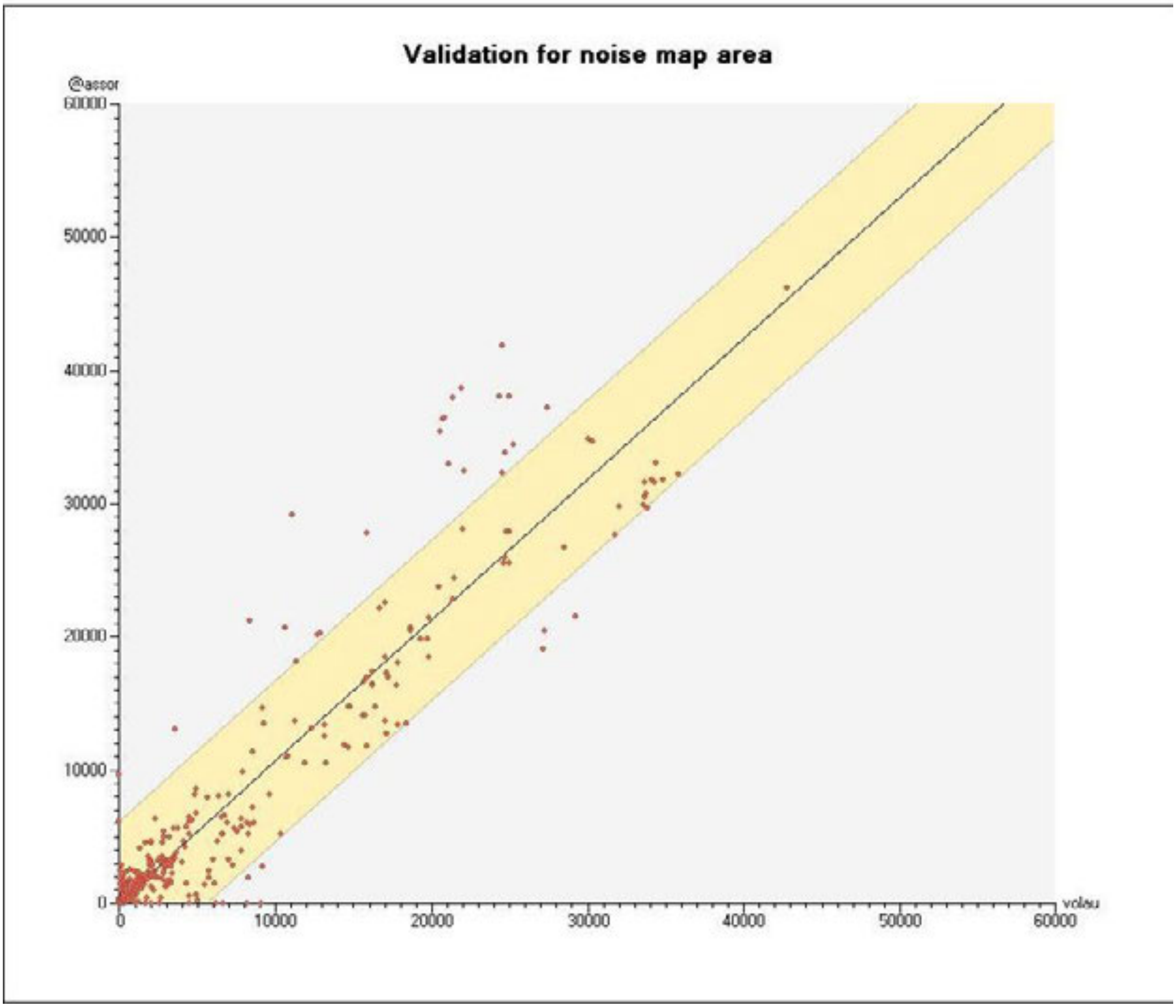

Figure 1.2 Noise map area validation for Bratislava

1.2 BRISTOL

1.2.1 Original model

Different traffic models exist for Bristol. For the CityHush project, data from a Saturn software application was made available. The application was used in context with previous noise mapping, and comprises the city of Bristol. The Saturn application concerns car and HGV traffic. The network contains 263 zones, 1580 nodes and 3,400 links. Public transport was not included in the Saturn application. The relationship between network load and travel time is described by speed flow functions for links and delays at junction.

The Saturn application only considers car traffic. Public transport bus, tram and train lines are also not included in the database. For demand, a peak hour car trip matrix and a peak hour HGV trip matrix were available.

Count data were also included in the database, for links and for turns. In addition to the data in the Saturn database, hourly count data was supplied for a number of streets in the intended QZ neighbourhood.

1.2.2 Cityhush implementation

The network data, associated functions and matrices were converted to Emme format and an Emme database was established. As junction delays are depending on signal settings that cannot be used in Emme, a simplified adaptation was done, built on the speed flow functions and information on penalized turns.

The speed flow functions were defined by the speeds at capacity and at free flow, with an exponent to give the sensitivity to loads over the capacity. These functions were transformed into volume delay functions used by Emme. The general form of the volume delay function is

Link travel time (minutes) = length * (60 / free flow speed + (60 / speed at capacity - 60 / free flow speed) * (volume / capacity) ^ el1) * el2

where el1 is a link specific exponent (given in the data set) and el2 is an adjustment factor introduced in the Cityhush application for calibration purposes.

Some links have dedicated speed flow functions. In table 2, a list of these functions, converted to volume delay functions, are displayed.

Table 2 Volume delay functions (minutes)

Function number	Function definition
9	0,895522 +0,437811*(volau/1010) ^ 1,79
14	0,983607 + 1,416393*(volau/1285) ^3,76
23	1,052632 + 0,947368*(volau/1000) ^3,39
70	General function described above
90	Connector time from link specific speed

From the Saturn data base, it was possible to derive what turns that were subject to turn penalties. The different junction codes were then converted to Emme turn penalty function numbers. The Saturn turn penalty codes were converted as follows:

Saturn turn code	Saturn turn description	Emme turn penalty function number
Blank		Forbidden turn
G	A turn which must give way (from a minor road) at a priority junction	1

X	Opposed right turn from a major road at a priority junction which needs to cross the major flow in the opposite direction, OR an opposed right turn at traffic signals which must cross the major flow from opposite arms.	2

Different values on the turn penalty functions were tested, but did not appear to improve the fit of the model compared to count data. Therefore, only information on prohibited turns was used. This also means that total travel times will be underestimated, as times in junctions are not considered. On the other hand, the speeds that are calculated on the links are more realistic because stand still time is not included in the link times. In the Cityhush project we are not looking at total travel times but at changes of total travel times. It is likely, but not certain, that changes in travel time will also be underestimated.

For Cityhush, two main modifications were made in addition to the conversion to the Emme environment. The first modification was to provide a distribution of the car demand matrix on different value of time segments (as described in the main text). This modification was done with no regard to origin and destination – the segment shares were uniformly applied to the entire matrix. The truck matrix was assigned the highest Value of Time.

The second modification was to split the demand on low noise vehicles (LNV) and standard vehicles (SV). The trip matrix, segmented on values of time, is therefore further segmented on LNV and SV, comprising 10 segments in total. The segmentation was done with equal LNV shares in all value of time segments. This modification is scenario specific, in that the LNV ownership was different with respect to levels and origin zones in different scenarios. The truck matrix was made a class of its own (no LNV ownership) .

As the trip matrices are (morning) peak hour matrices, they can be assumed to contain only outbound trip legs. The assumed LNV ownership, defined as an origin specific share on the full day trip matrix, should therefore be a good approximation of the LNV ownership in resident zones.

In order to establish a day (12 h) forecast, the period in the day outside the morning peak also needs to be addressed. We have made the assumption that the afternoon peak is a reversed copy of the morning peak. We have also made the assumption that the off peak demand can be described by the average of the morning peak and its transpose, adjusted to a fraction corresponding to the average demand for an off peak hour. The fractions – separate for cars and trucks - were derived from count data available for QZ neighbourhood streets. The fractions used for off peak were 80 percent for cars, and 100 percent for trucks. The analyses of the traffic distribution over the day lead us to calculate the day traffic as

Total day traffic = peak hour traffic * 4 + off peak traffic * 8

1.2.3 Validation

Count data for the peak hour were available in the Saturn data set. The fit of the forecasted volumes with respect to count data are shown on figure 1 for the total network, and on figure 2 for the noise map area. The figure displays the forecasted volumes on all links plotted against count data (for links having count data). If they would coincide fully, they would all lie on a line through origo with slope 1. A regression shows that the slope is 0.92, and that the corresponding R square is 0.89. This is a reasonably good fit. The regression line is shown on the figure, with a 95 percent confidence band. For the part of the network that belongs to the noise mapping area, the slope is 0.76 and the R square is 0.70. For the noise mapping area, there is a bias towards large flows being underestimated compared to counts. A calibration was carried out to replicate counts in the QZ area to make the bias less important in the QZ area.

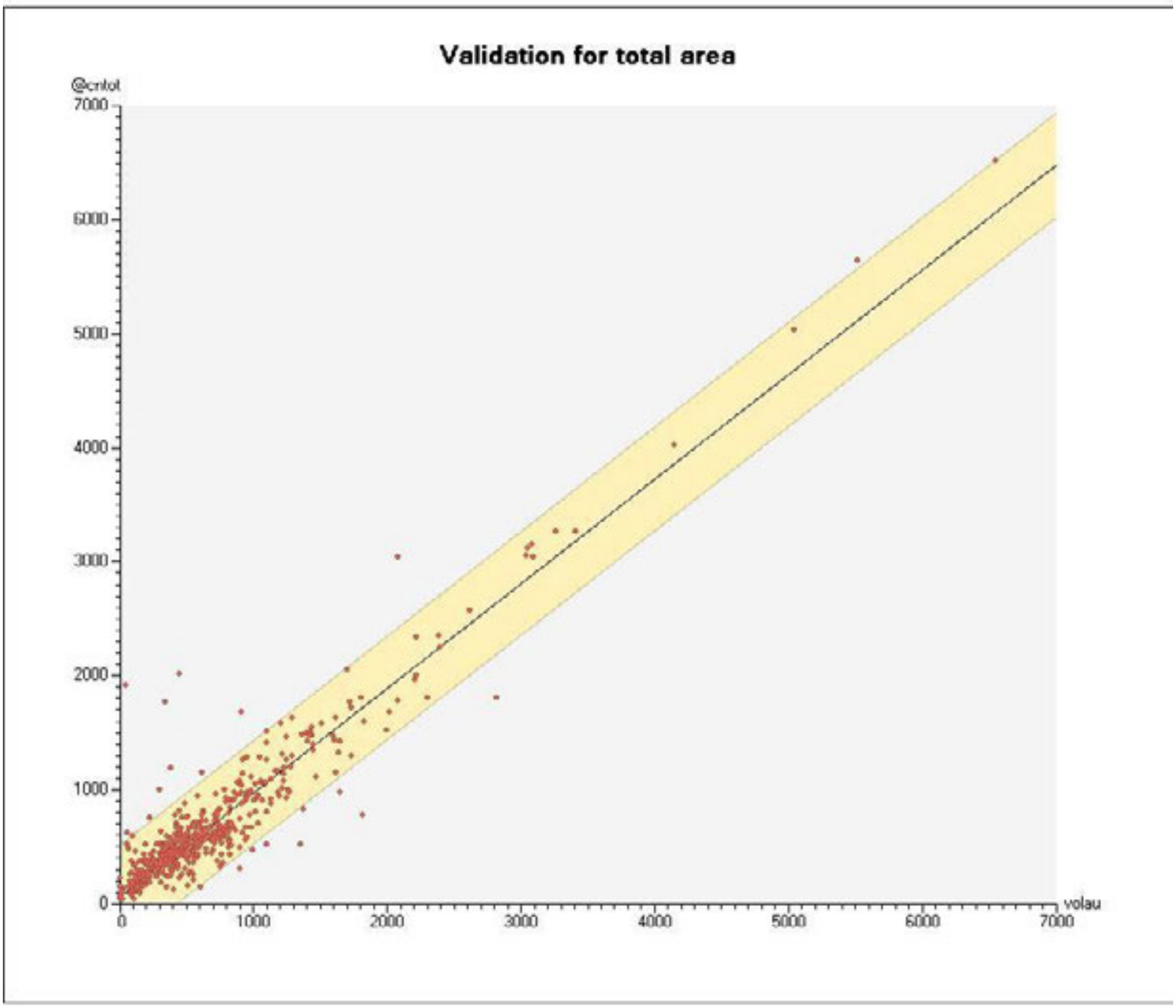

Figure 1.1 Total area validation for Bristol

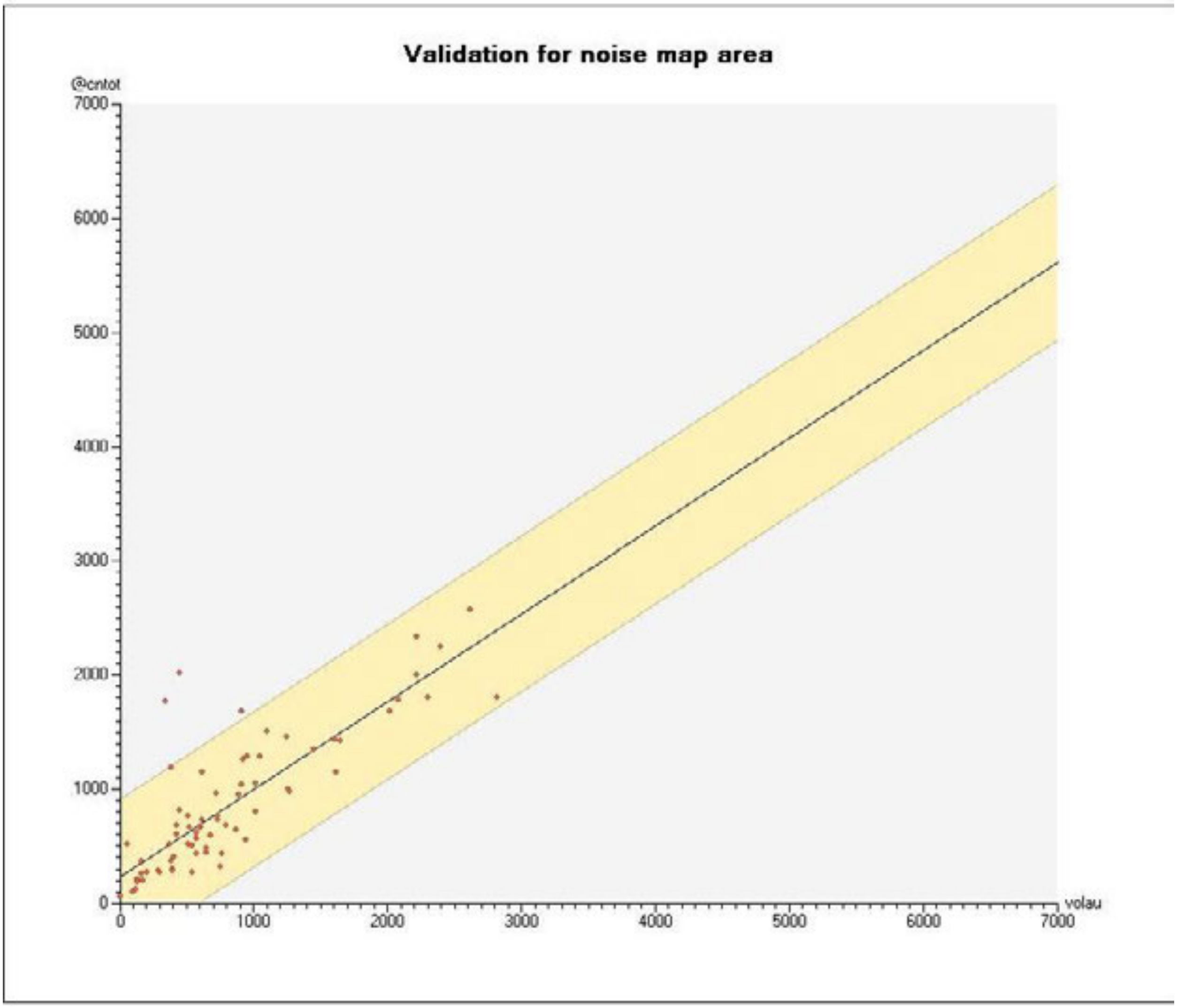

Figure 1.2 Noise map area validation for Bristol

1.3 ESSEN

1.3.1 Original model

For Essen, data from a traffic model application of the PSV system has been made available. The application contains car traffic in Essen and the surrounding region. For analysis within the Cityhush project, the data has been converted to the Emme network assignment software. The application contains 604 traffic zones, 10044 nodes and 31800 (after conversion).

In the PSV system, traffic assignment is done on an hourly basis. Link congestion is treated by using link specific volume-delay functions for all regular links (i.e. not connectors). Junction delay is modelled taking traffic signal setting into account.

Mode and destination choice is not treated in the current application. A full day Origin-Destination internal car matrix is available as is a full day through traffic matrix. No count data was available, but instead assignment results from the original assignment. The assignment is done using hourly demand, derived as a fraction of the full matrix for the specific time of day period that is assigned.

1.3.2 Cityhush implementation

The network data, associated functions and matrices were converted to Emme format and an Emme database was established. As junction delays are depending on signal settings that cannot be used in Emme, a simplified adaptation was done, built on the speed flow functions.

The speed flow functions were defined by the travel time per length unit at free flow and two traffic volume levels. This gives a piecewise linear volume delay function which will describe how congestion affects travel times. The general form of the volume delay function is

Travel time (minutes) = travel time at free flow up to capacity 1+ extra travel time 1 per car * cars over capacity 1 + extra travel time 2 per car * cars over capacity 2

where capacity 1 and 2 and extra travel time 1 and 2are provided in the data set. There also a calibration factor applied on the travel times, also in the database.

For Cityhush, two main modifications were made in addition to the conversion to the Emme environment. The first modification was to provide a distribution of both car demand matrices on different value of time segments (as described in the main text). This modification was done with no regard to origin and destination – the segment shares were uniformly applied to the entire matrices.

The second modification was to split the demand on low noise vehicles (LNV) and standard vehicles (SV). The trip matrix, segmented on values of time, is therefore further segmented on LNV and SV, comprising 10 segments in total. The segmentation was done with equal LNV shares in all value of time segments. This modification is scenario specific, in that the LNV ownership was different with respect to levels and origin zones in different scenarios. The truck matrix was made a class of its own (no LNV ownership) .

The trip matrix is a full day trip matrix, containing outbound as well as inbound trips. It is not known how many trips that have their origin (and therefore would be residents) in a specific zone, and thus might have a different level of LNV ownership. This makes it difficult to evaluate the assumption on different residential LNV ownership in different zones. The assumed LNV ownership, defined as an origin specific share on the full day trip matrix, is therefore only an approximation of the LNV ownership in resident zones. The larger the share of traffic generated in the zone, the better an approximation. However, this share is not known in the Essen case.

In the original Essen PSV application, the day was divided into different periods, each having a fraction of the full day matrix. For each period, an assignment was made based on the average hourly traffic within this period. Then the periods were aggregated to the full day. In order to establish a day (12 h) forecast in the Cityhush project, the day was divided into two periods – peak and off peak. We have assumed that the afternoon peak is a reversed copy of the morning peak (and therefore can be described by the morning peak assignment. The sam fraction as for th original morning peak period was used (0,x). For the off peak period, the fraction was calculated based on counts for some major roads that were available (0.y). Then the peak and off peaks periods were aggregated to the 12 h day by the following formula:

Total day traffic = peak hour traffic * 4 + off peak traffic * 8

1.3.3 Validation

Count data was not supplied for the Essen data. Instead, validation was made with respect to the original Essen assignment results (full day). These were available as the sum of traffic volumes in both directions. The Cityhush assignment results for the peak hour were grossed up to the full day matrix by the peak period fraction.

The fit of the forecasted volumes with respect to count data are shown on figure 1 for the total network, and on figure 2 for the noise map area. The figure displays the forecasted volumes on all links plotted against count data (for links having count data). If they would coincide fully, they would all lie on a line through origo with slope 1. A regression shows that the slope is 0.94, and that the corresponding R square is 0.92. This is a reasonably good fit. The regression line is shown on the figure, with a 95 percent confidence band. For the part of the network that belongs to the noise mapping area, the slope is 0.87 and the R square is 0.92. For the noise mapping area, there is some bias towards large flows being underestimated compared to the original Essen assignment.

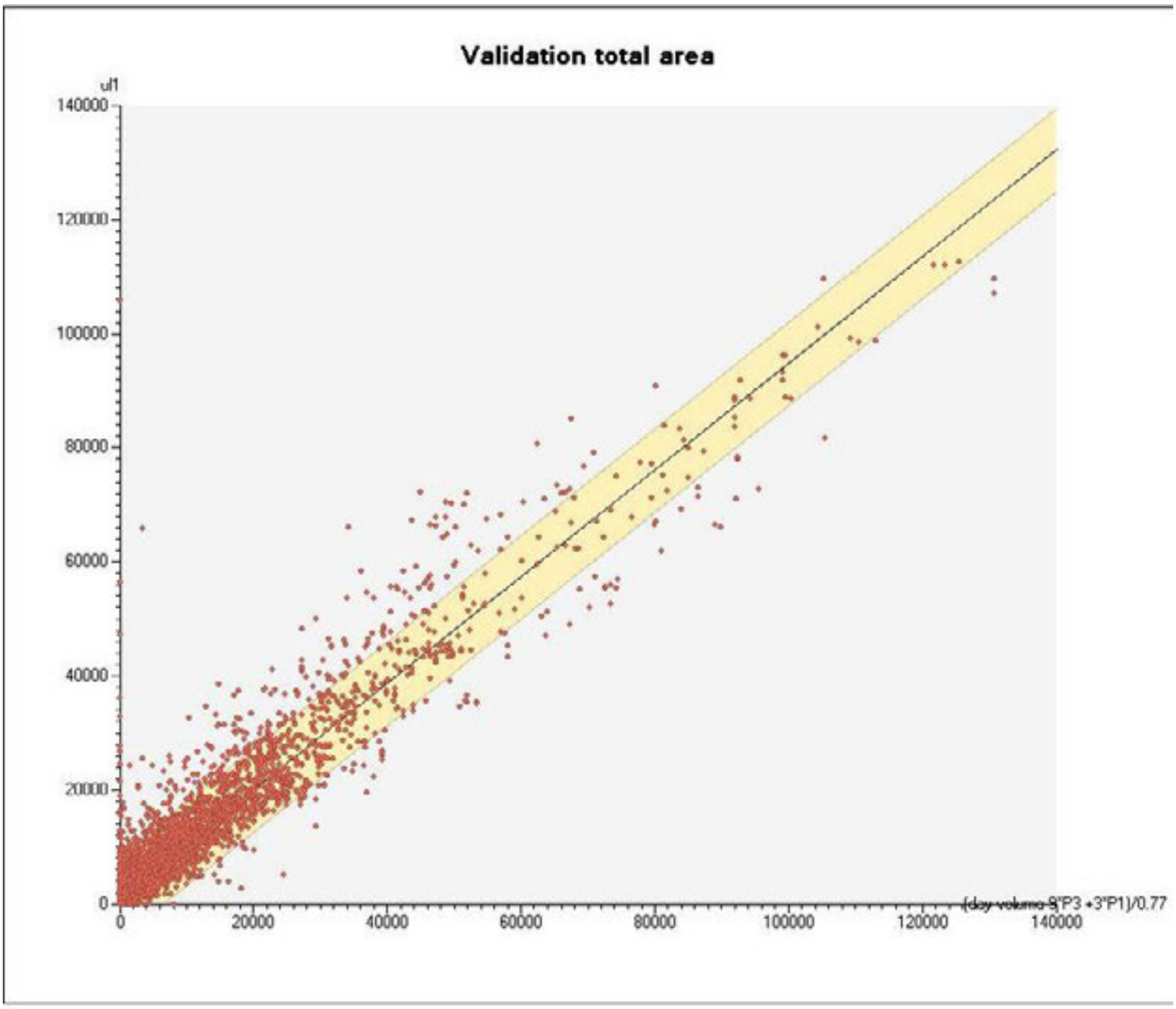

Figure 1.1 Total area validation for Essen

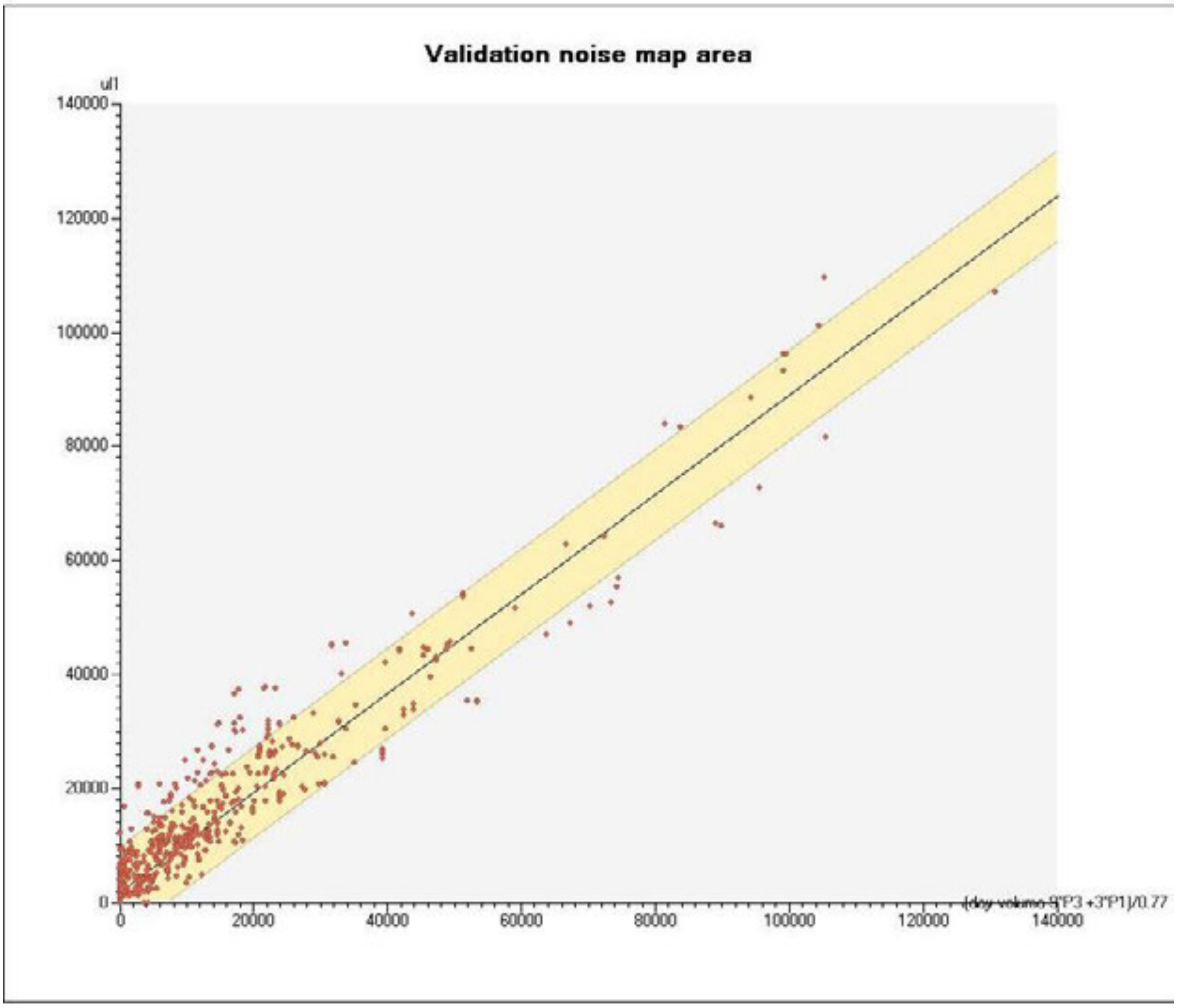

Figure 1.2 Noise map area validation for Essen

1.4 GOTHENBURG

1.4.1 Original model

Gothenburg is included in the national Sampers forecasting system. The Emme network assignment model is integrated in the Sampers system. For CityHush, the Sampers regional model for the Western part of Sweden is used. It contains 2700 zones, 24000 nodes and 65 000 links. Public transport lines are also included in the model.

In the Sampers system, traffic assignment is done for the morning peak hour and one midday hour. Congestion is treated by using link specific volume-delay functions for all regular links (i.e. not connectors). Multiclass assignment is used, in order to regard different values of time as described in the main text.

The travel demand models in Sampers include mode and destination choice models.

1.4.2 Cityhush adaptation

More detail was added to the central part of the network for links as well as zones. The coordinate system of the original database (RT90) was also transferred to Sweref 99 18.00. Together with the added detail of the traffic network, this enabled a conversion of the traffic network to a shape file required by the Cadna noise mapping software as input.

Gothenburg currently has no congestion charging system. There is a decision taken to implement such a system in the future, but the simulations are done with respect to the current situation. To be able to analyse fee effects, the same assignment procedure as has previously been used for Stockholm was implemented. This includes the implementation of five value of time segments, each of which ís further subdivided into one low noise vehicle segment and one standard vehicle segment.

The 12 h day traffic was calculated by the following formula:

Total day traffic = peak hour traffic * 4 + off peak traffic * 8

1.4.3 Validation

The Sampers forecasting system was used with only minor changes concerning network coding in the inner city of Gothenburg. Therefore, the Cityhush implementation was validated against the original database with respect to previous assignment results. For the total area, the network scattergram (Figure bbb) slope was 1.01, and the R square was 0.99. For the noise mapping area (figure ccc), the slope was 0.94 and the R square was 0.92. The two numbers would be expected to be different from 1 because of the changes in the network.

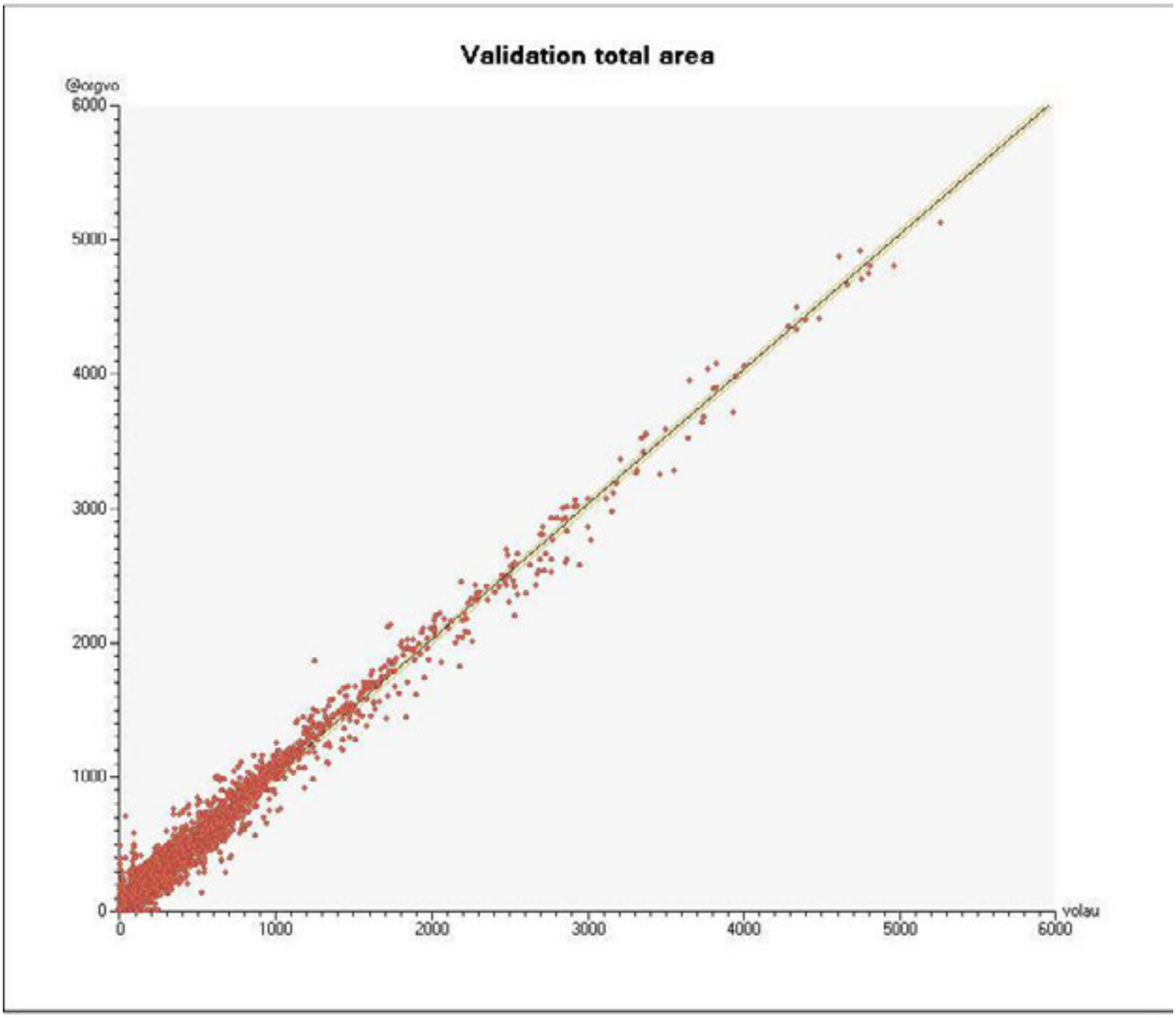

Figure X.X

Total area validation for Gothenburg

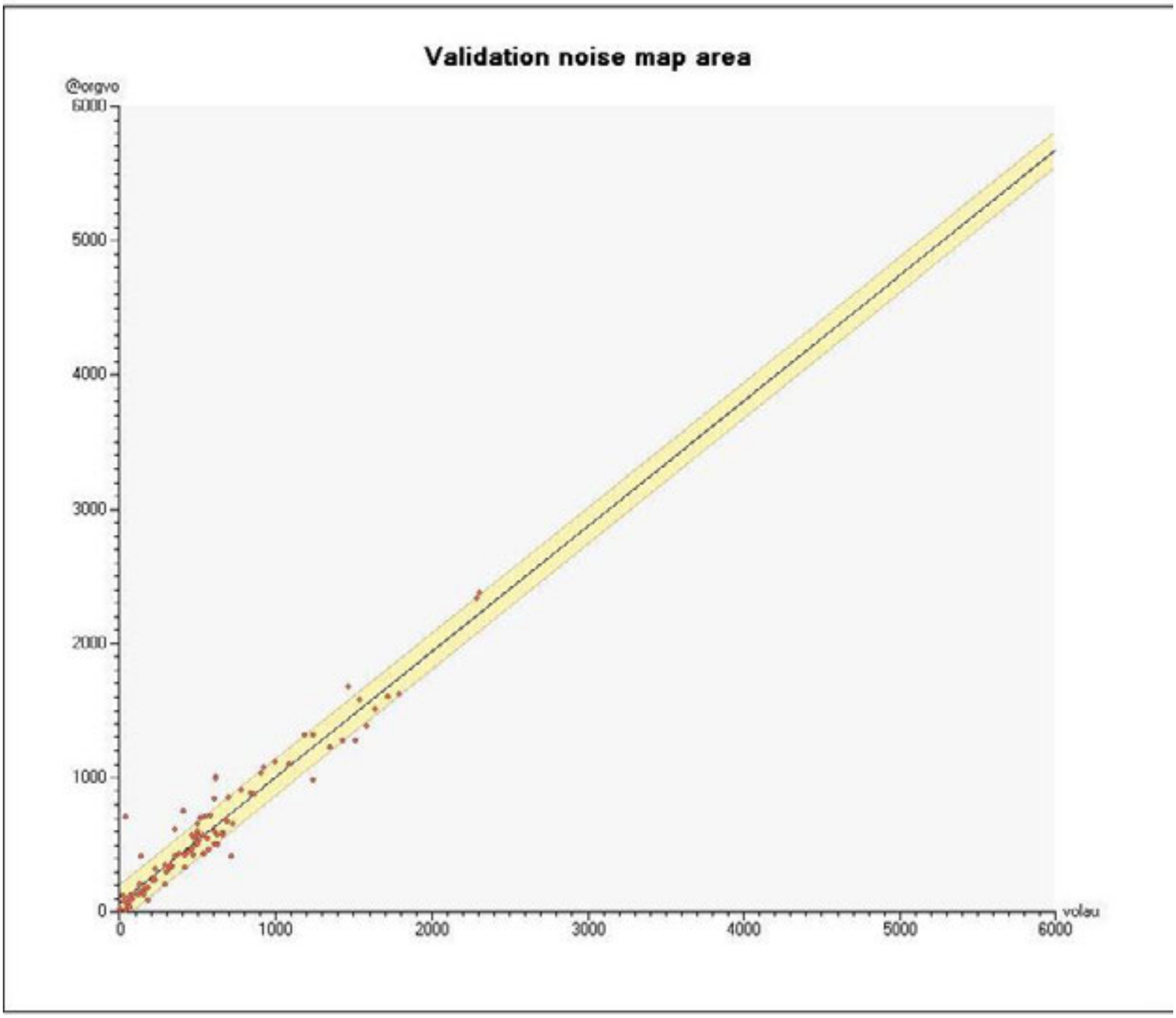

Figure X.X Noise map area validation for Gothenburg

1.5 STOCKHOLM

1.5.1 Original model

Stockholm is (as Gothenburg) included in the national Sampers forecasting system. The Emme network assignment model is integrated in the Sampers system. For CityHush, the Sampers regional model for the Mälardalen part of Sweden is used, but limited to the Stockholm county. It contains 1500 zones, 6000 nodes and 20 000 links. Public transport lines are also included in the model.

In the Sampers system, traffic assignment is done for the morning peak hour and one midday hour. Congestion is treated by using link specific volume-delay functions for all regular links (i.e. not connectors). Multiclass assignment is used, in order to regard different values of time as described in the main text.

The travel demand models in Sampers include mode and destination choice models.

1.5.2 Cityhush adaptation

More detail was added to the central part of the network for links. The coordinate system of the original database (RT90) was also transferred to Sweref 99 18.00. Together with the added detail of the traffic network, this enabled a conversion of the traffic network to a shape file required by the Cadna noise mapping software as input.

Stockholm already has a congestion charging system. The standard assignment procedure for Stockholm therefore already includes five value of time segments. For Cityhush, each of these segments was further subdivided into one low noise vehicle segment and one standard vehicle segment.

The 12 h day traffic was calculated by the following formula:

Total day traffic = peak hour traffic * 4 + off peak traffic * 8

1.5.3 Validation

As the standard Sampers setup was used, no further validation was performed.

2 ADDITIONAL TRAFFIC RESULTS

In this chapter, figures from all scenarios will be presented for each site. The figures represent differences from the base case in most cases. The base case scenario itself is also always presented.

2.1 BRATISLAVA

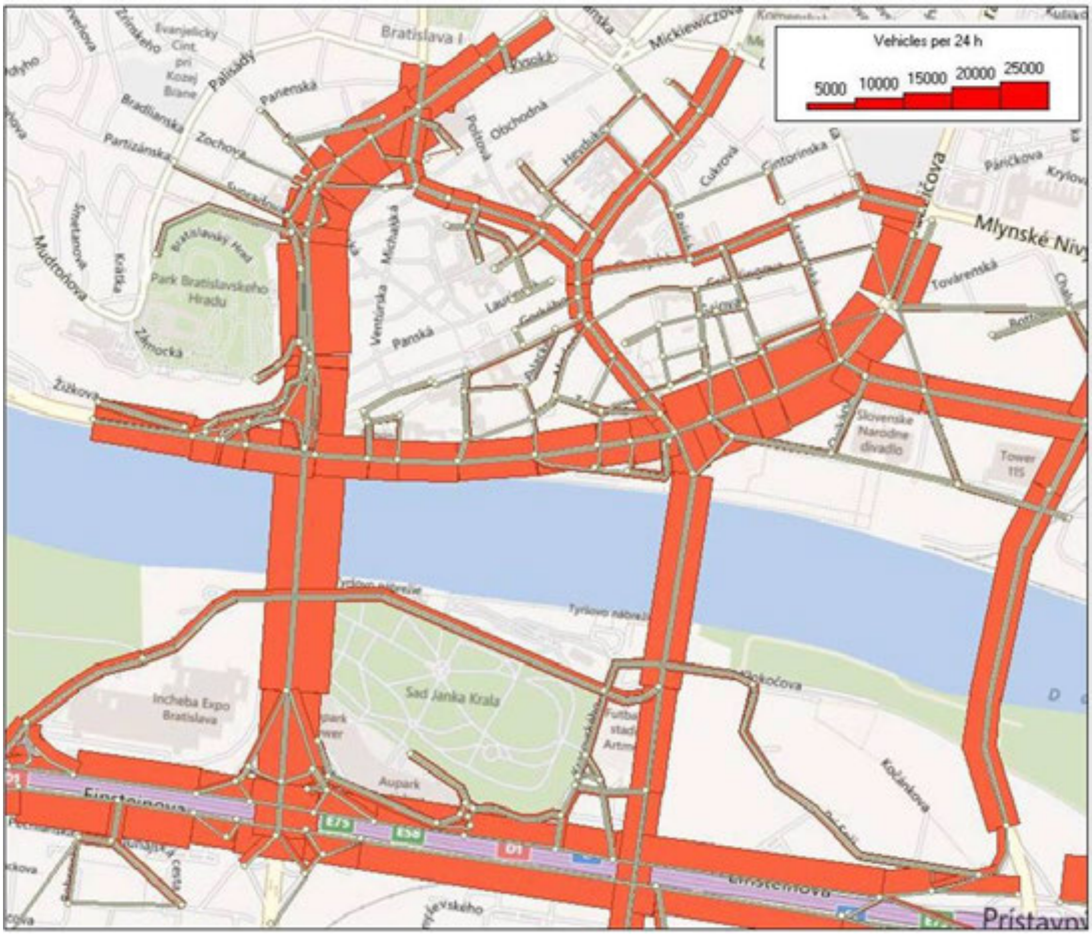

Figure 2.1.1 Base case standard vehicles traffic volumes for Bratislava

In figure 2.1.1, standard vehicle (99 percent of all vehicles) traffic volumes are presented as bands along the road links, the bandwidth being proportional to traffic volumes as is shown on the scale. In the following figures, differences from the Base Case are shown for the different scenarios. In these figures, traffic volume reductions are visualized using green colour, and increased volumes are visualized using green colour.

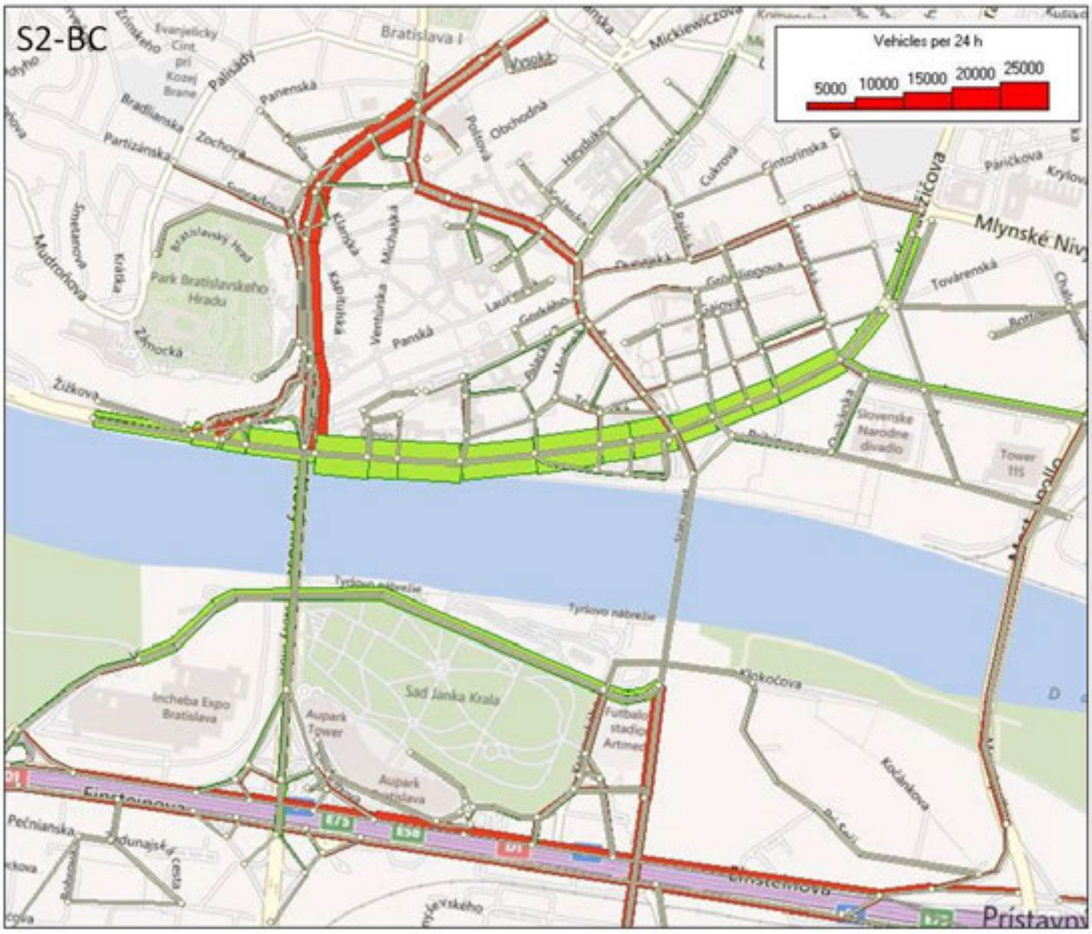

Figure 2.1.2 Scenario 2 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

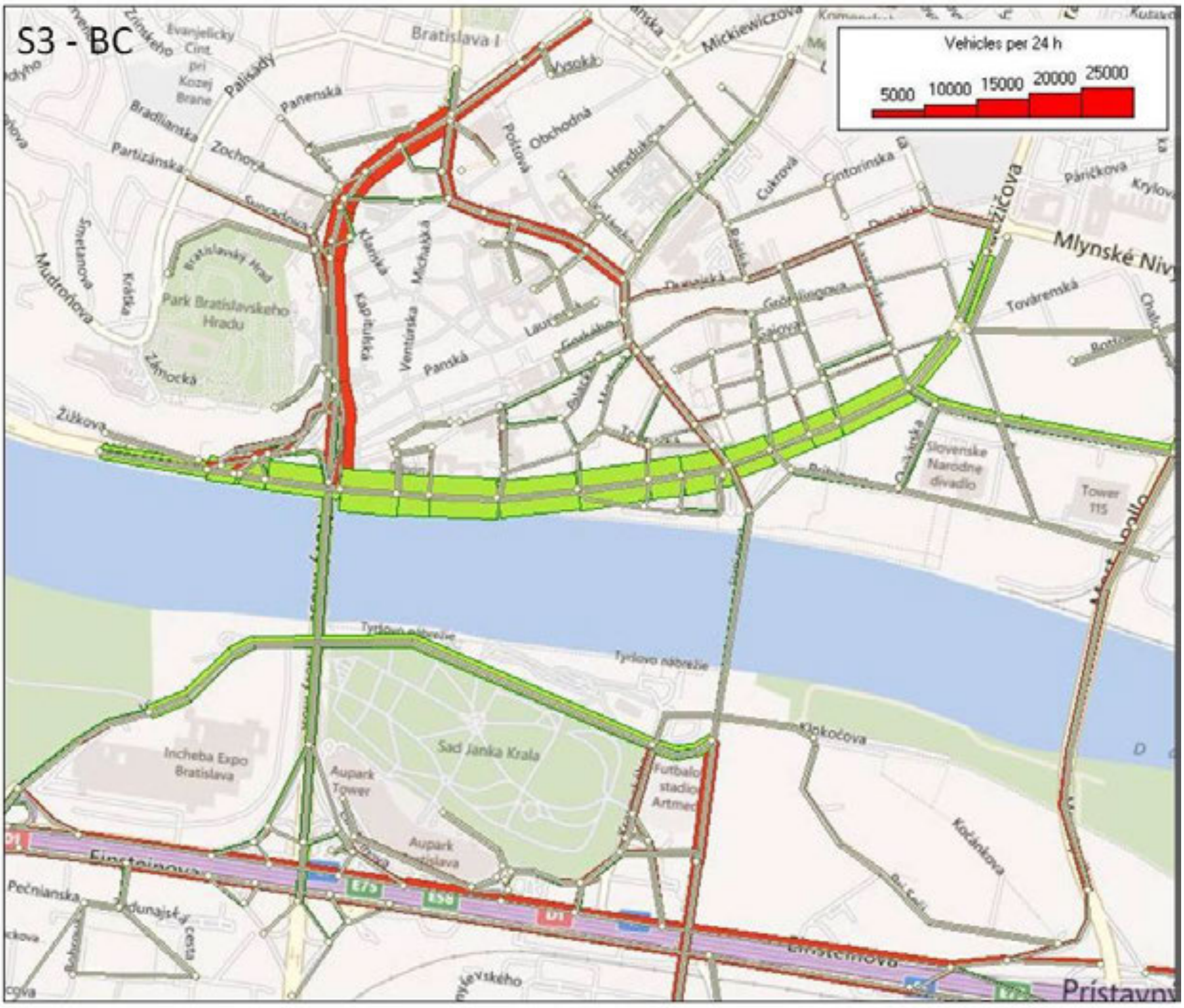

Figure 2.1.3 Scenario 3 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

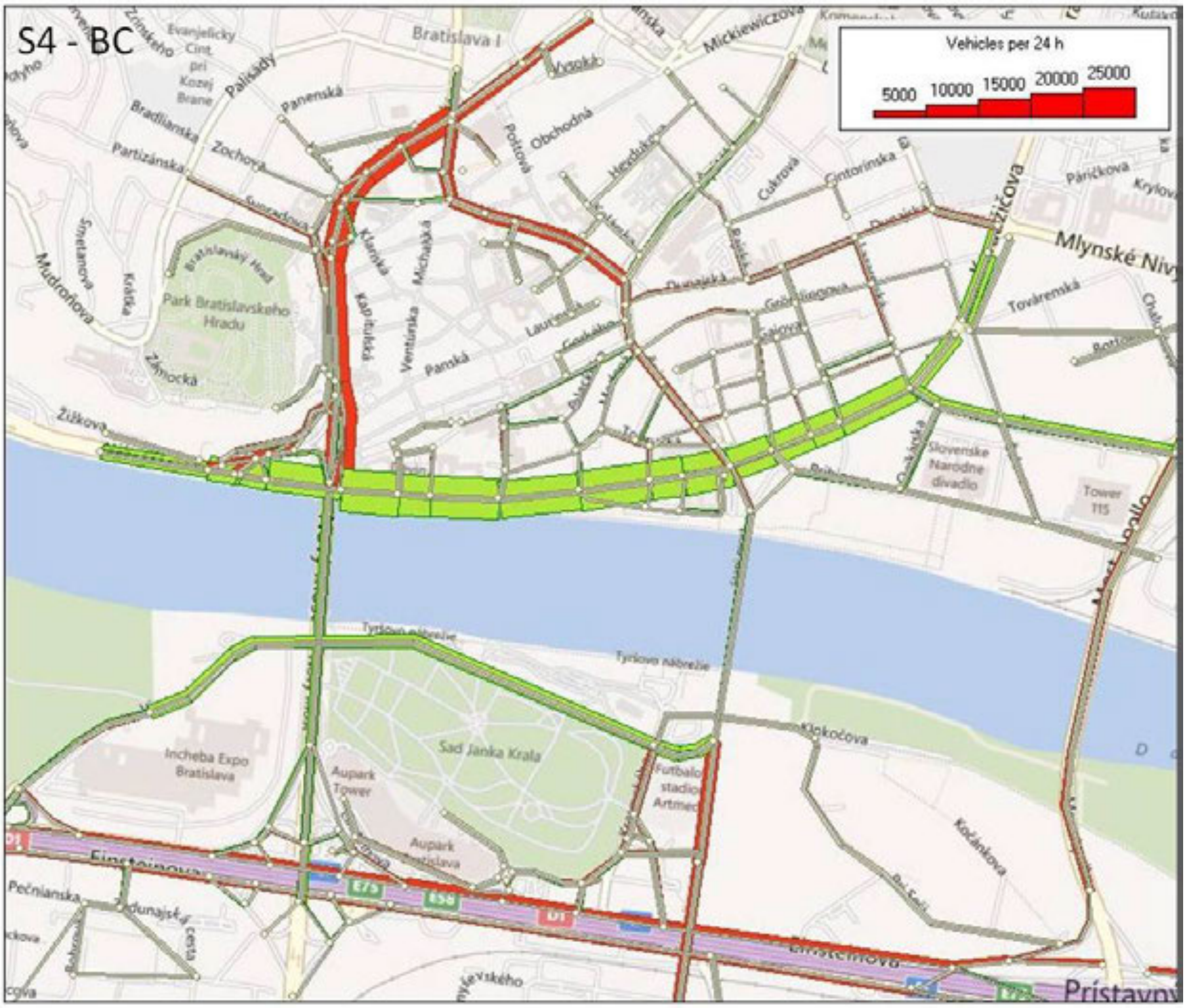

Figure 2.1.4 Scenario 4 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

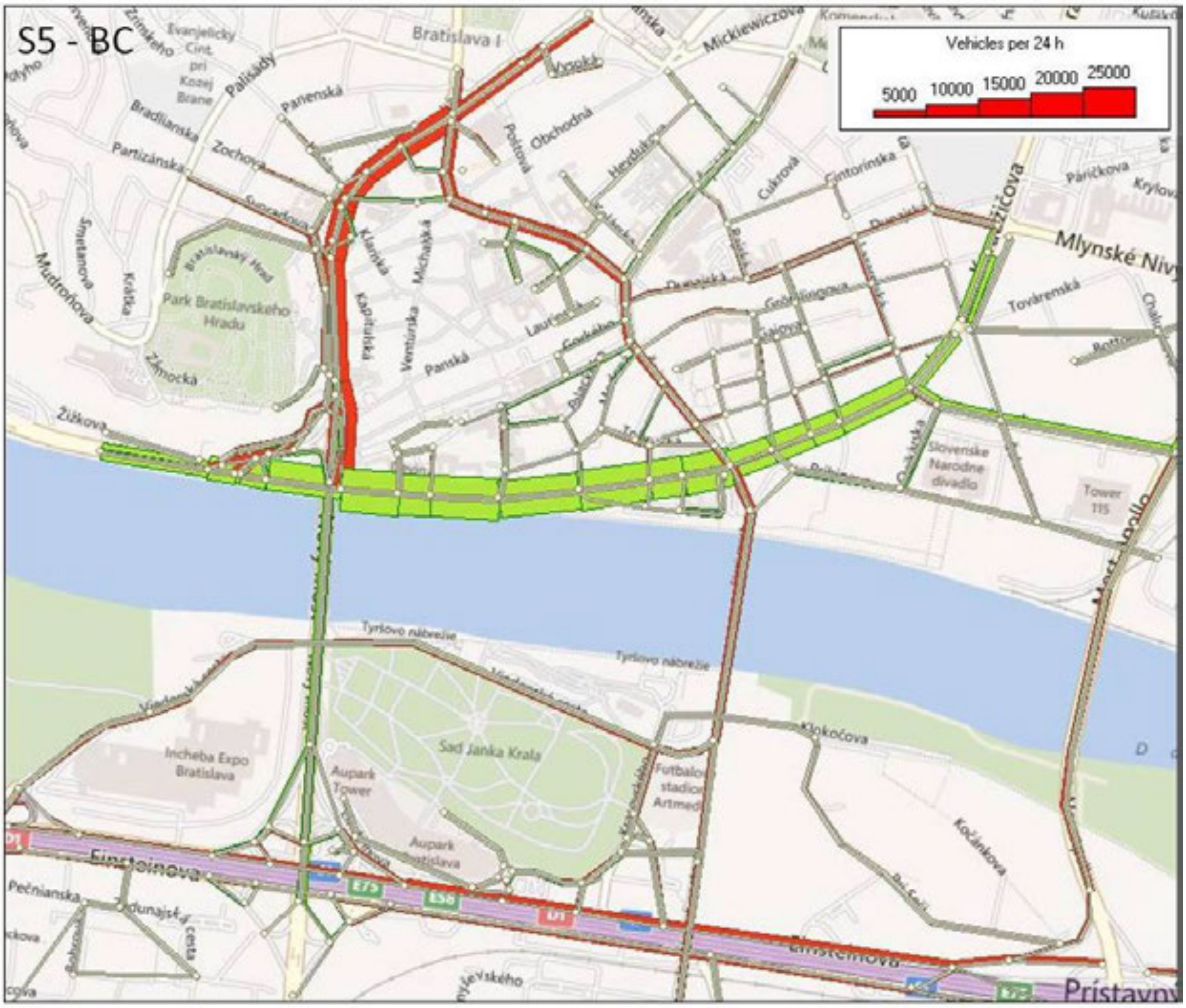

Figure 2.1.5 Scenario 5 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

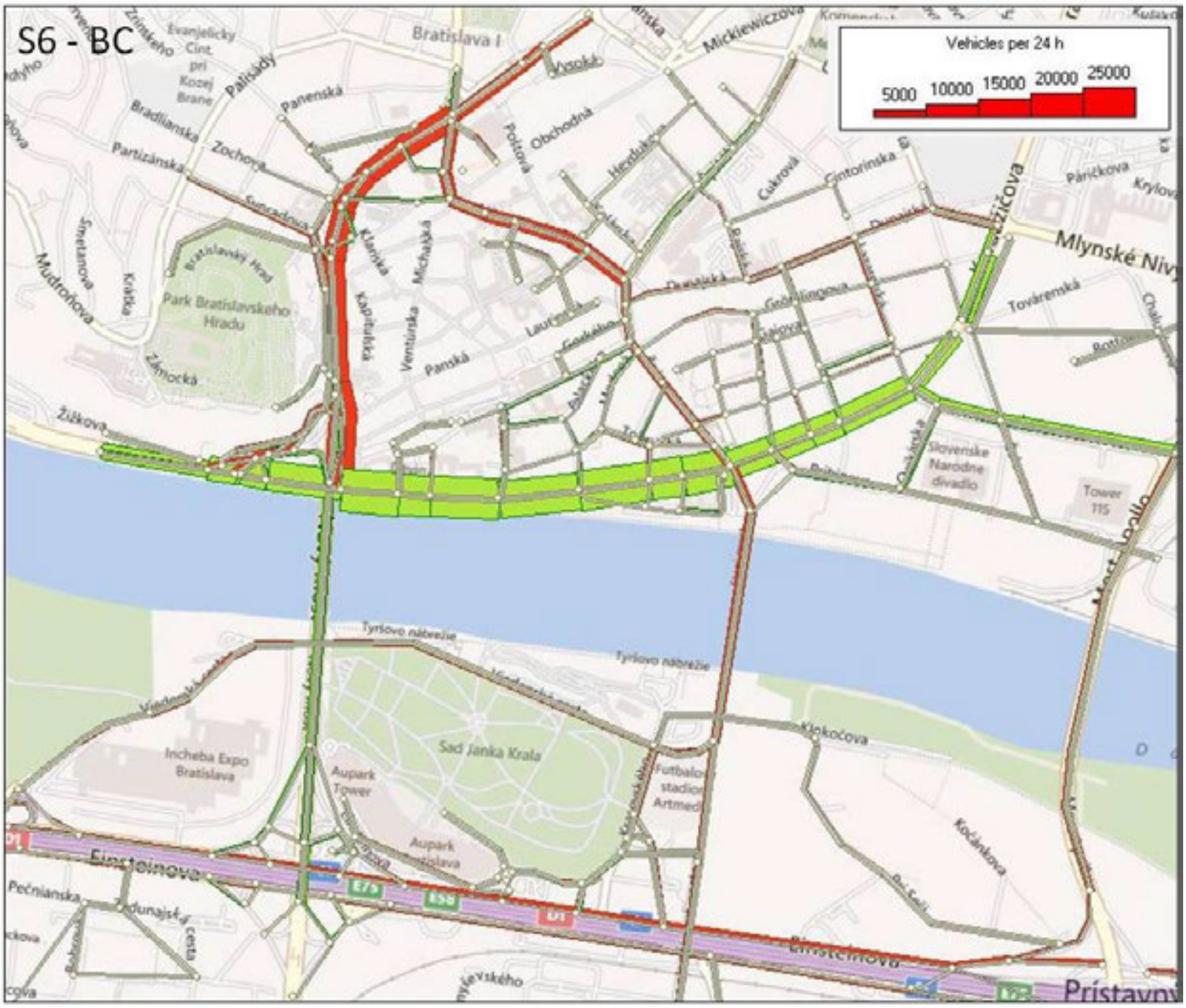

Figure 2.1.6 Scenario 6 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

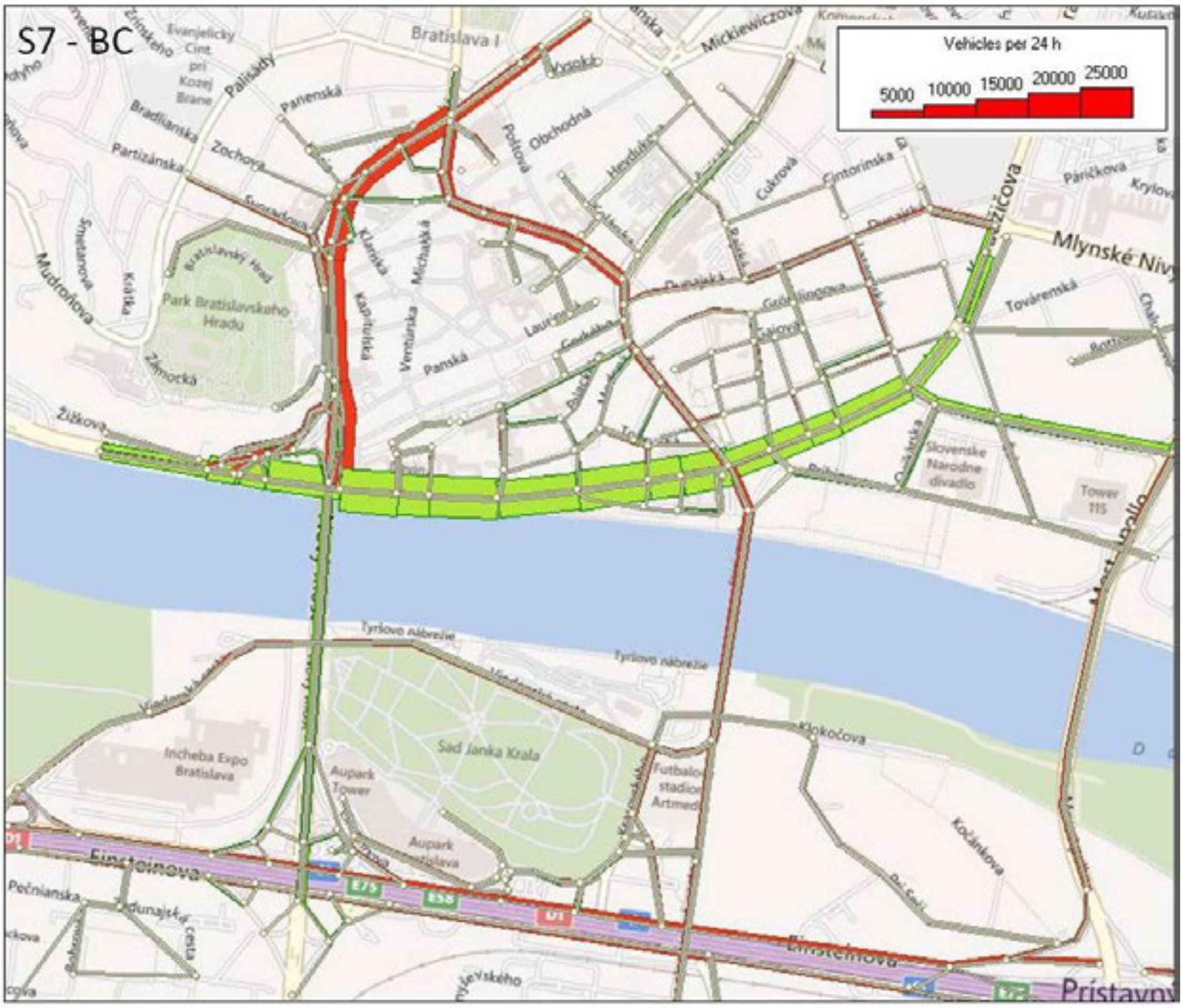

Figure 2.1.7 Scenario 7 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

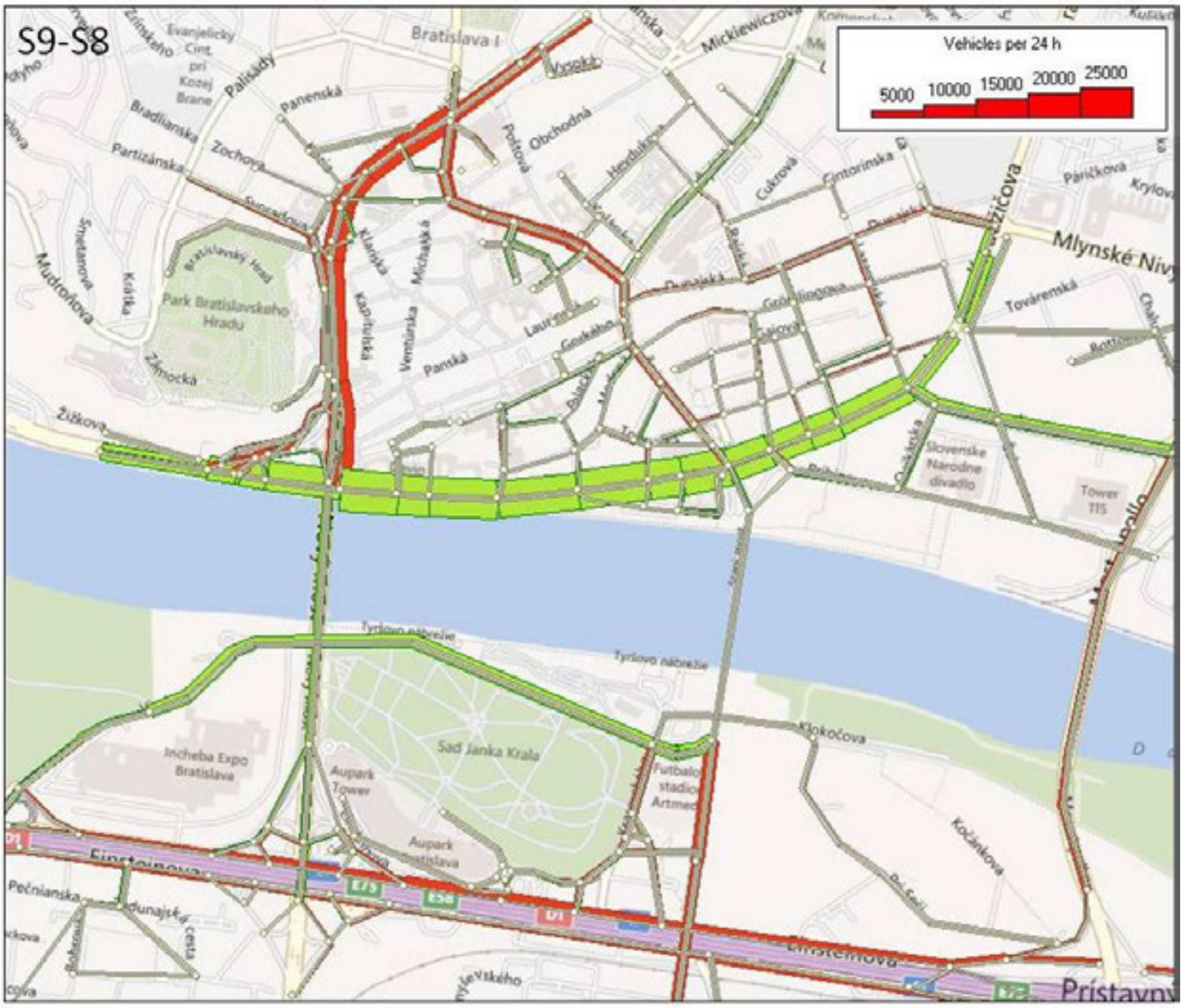

Figure 2.1.8 Scenario 9 difference from standard vehicle traffic volumes in Scenario 8 (increase in red, decrease in green)

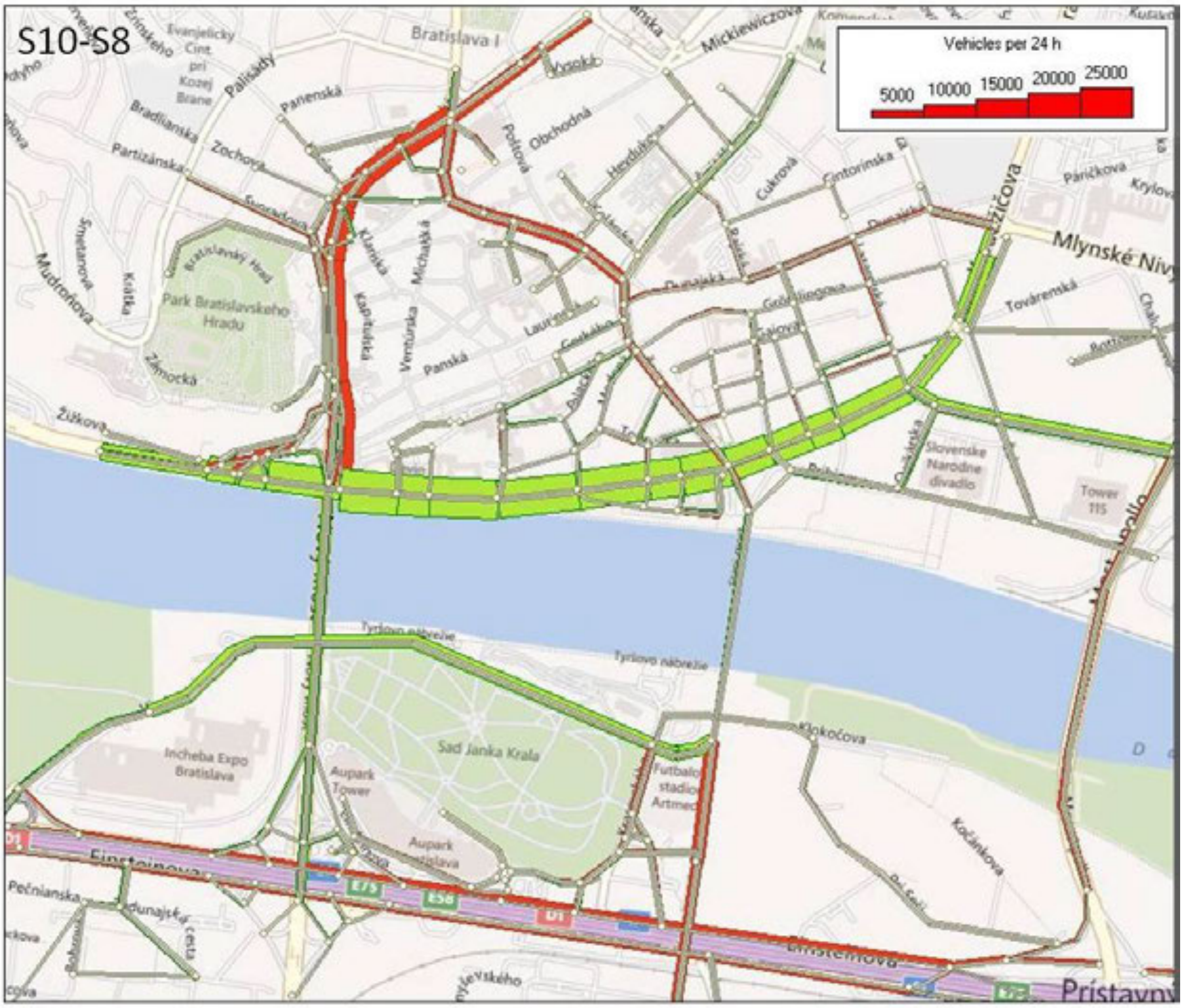

Figure 2.1.9 Scenario 10 difference from standard vehicle traffic volumes in Scenario 8 (increase in red, decrease in green)

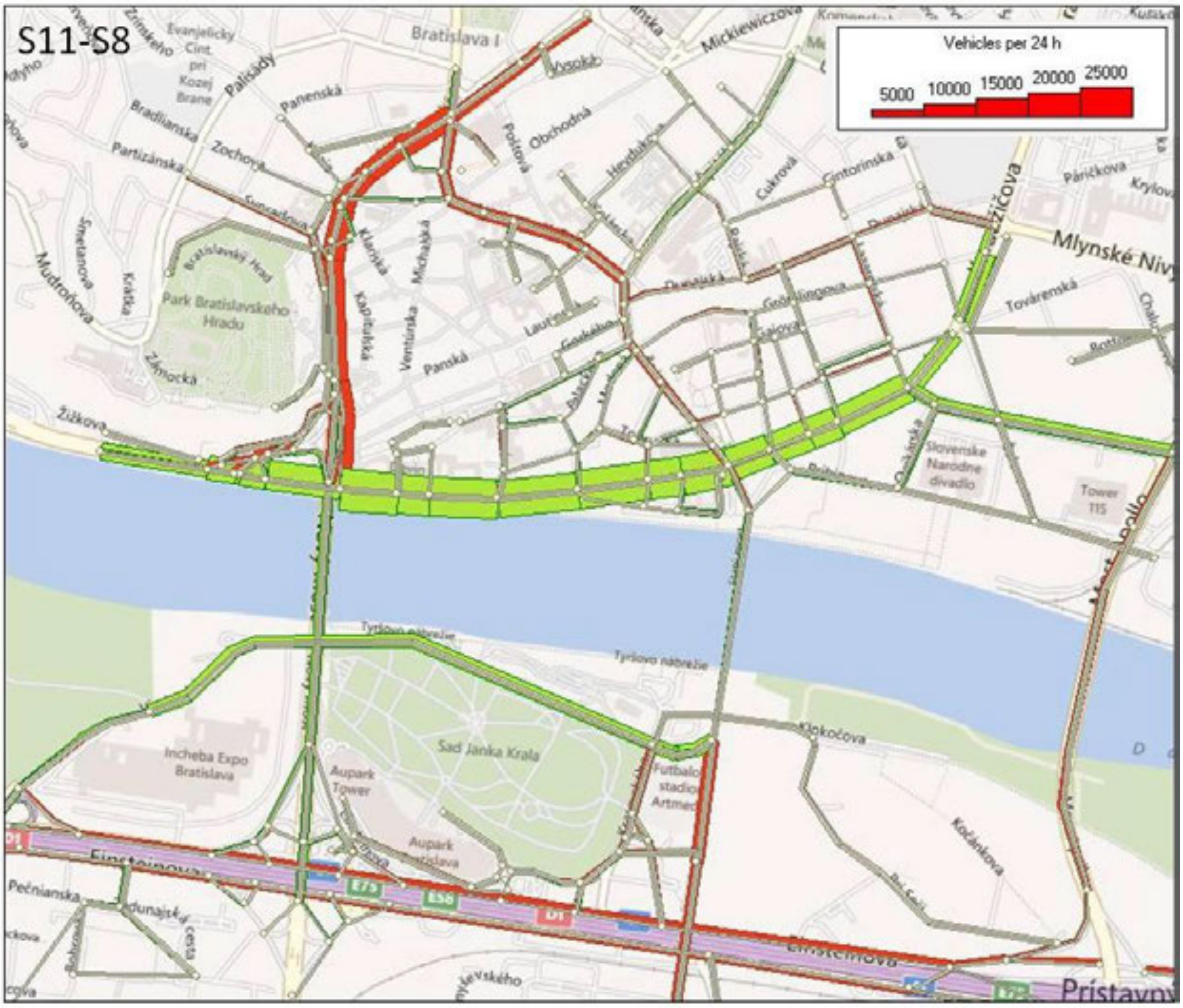

Figure 2.1.10 Scenario 11 difference from t standard vehicle raffic volumes in Scenario 8 (increase in red, decrease in green)

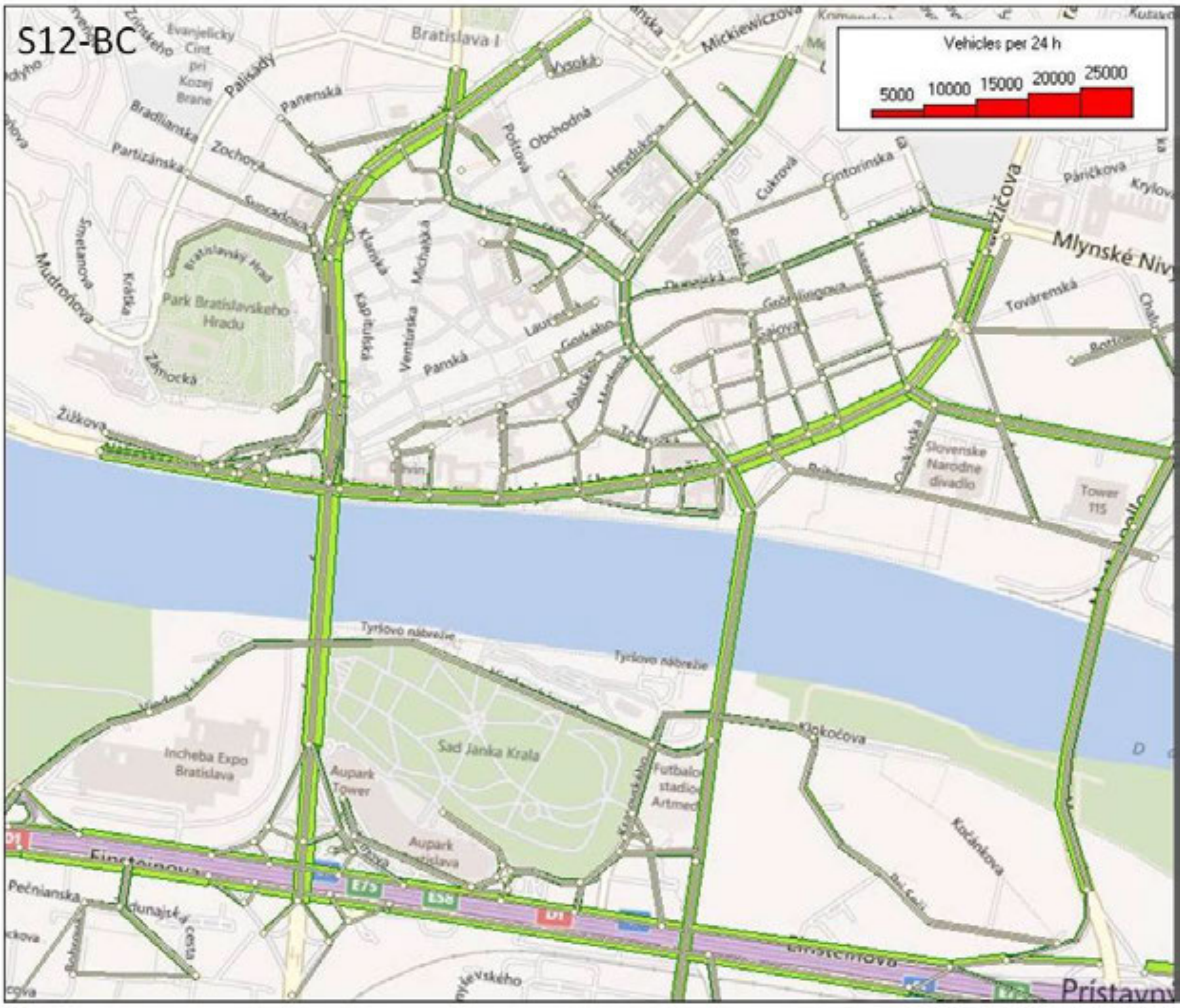

Figure 2.1.11 Scenario12 difference from standard vehicle traffic volumes in Base case (increase in red, decrease in green)

Figure 2.1.11 shows the effect on standard vehicles flows of the increased LNV ownership inside (100 percent) and outside (20 percent) the QZ.

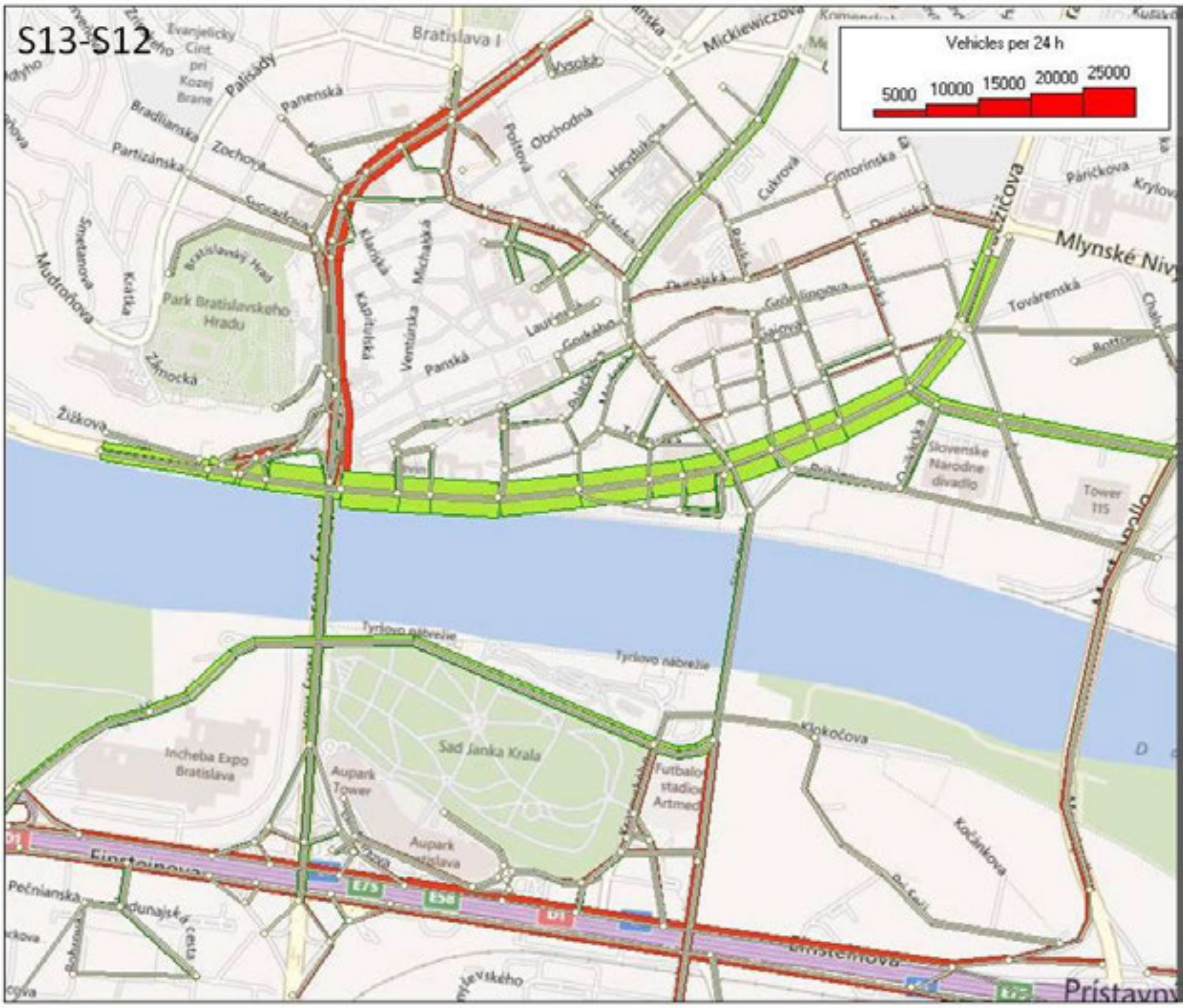

Figure 2.1.12 Scenario13 difference from standard vehicle traffic volumes in Scenario 12 (increase in red, decrease in green)

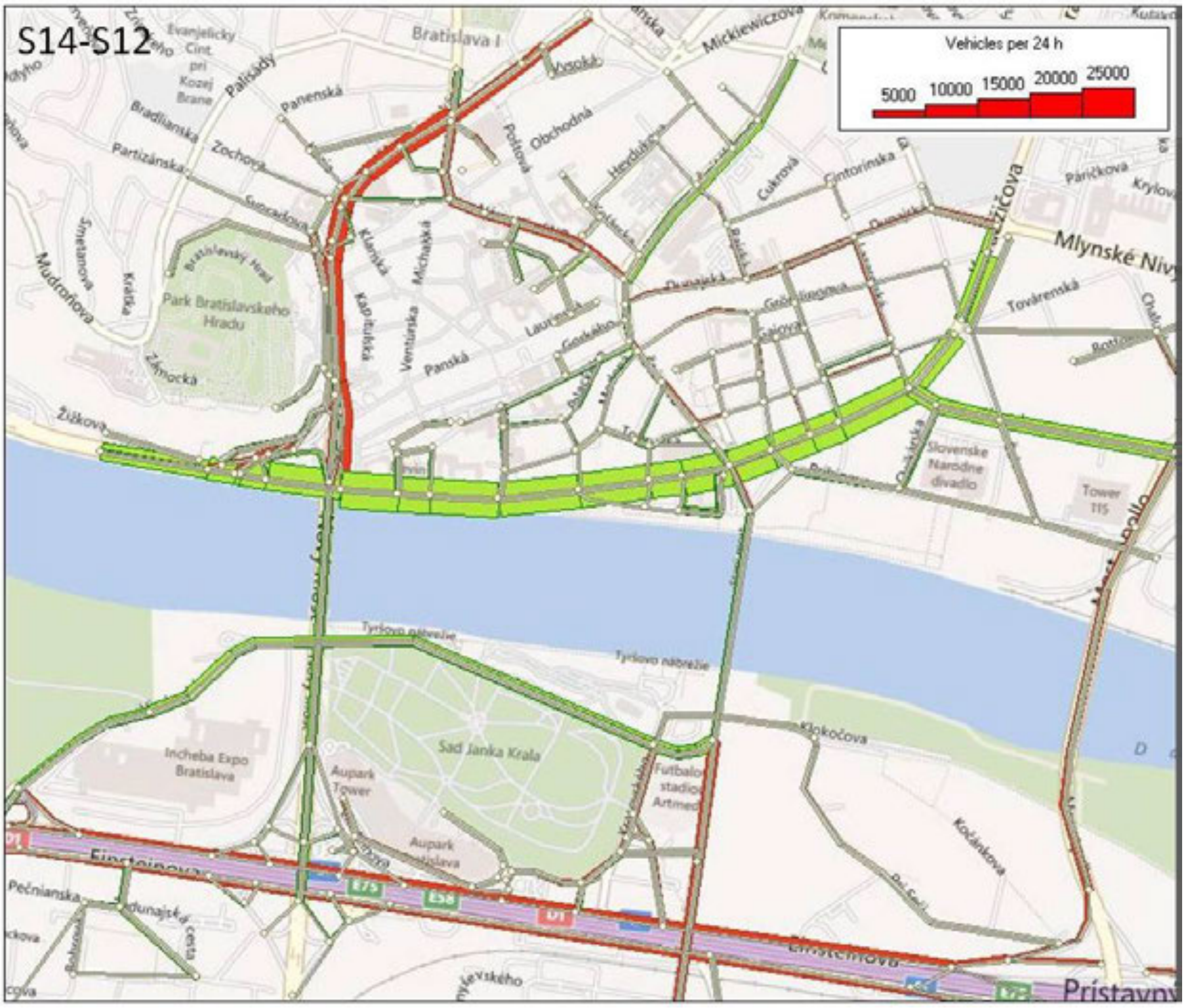

Figure 2.1.13 Scenario14 difference from standard vehicle traffic volumes in Scenario 12 (increase in red, decrease in green)

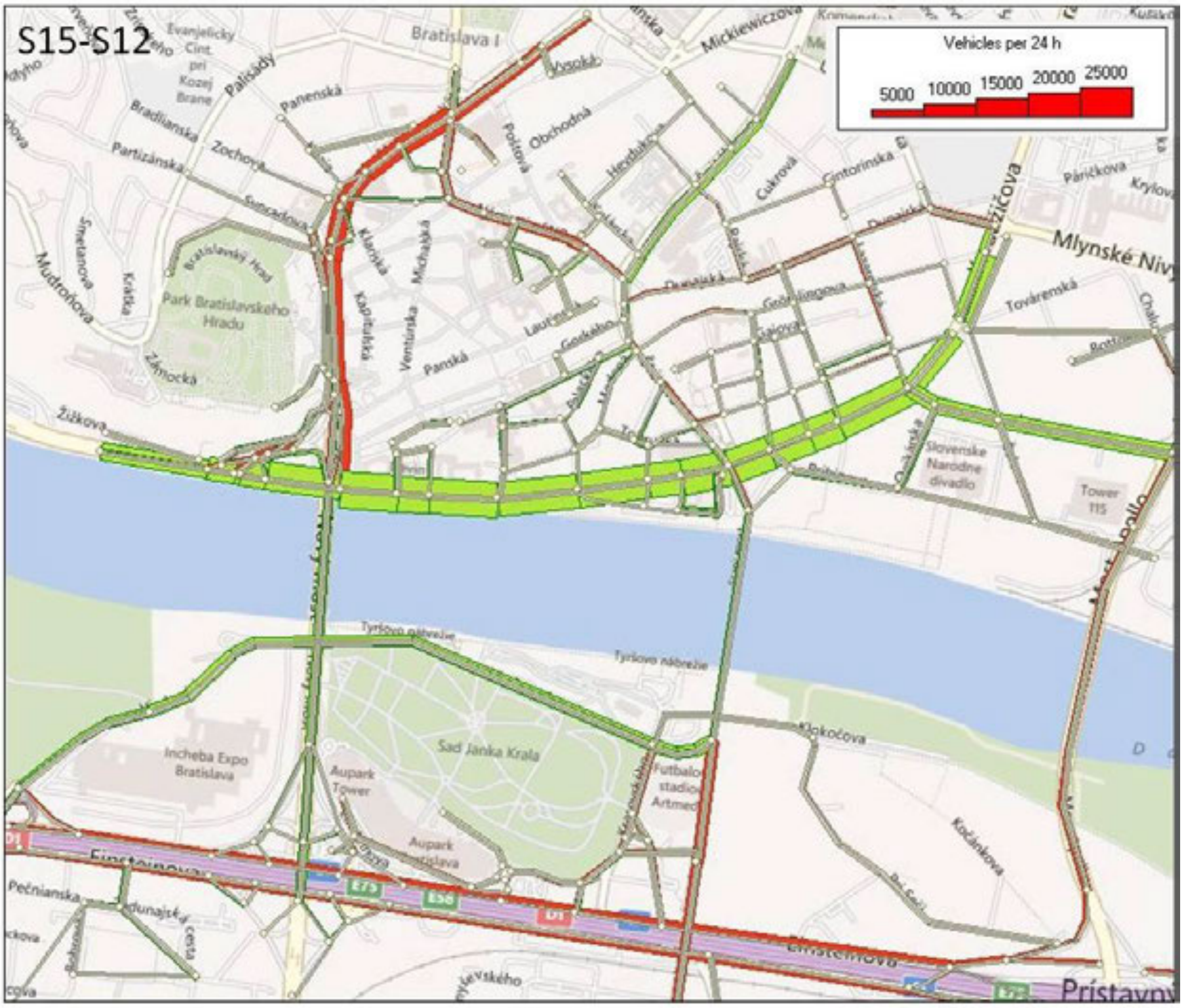

Figure 2.1.14 Scenario15 difference from standard vehicle traffic volumes in Scenario 12 (increase in red, decrease in green)

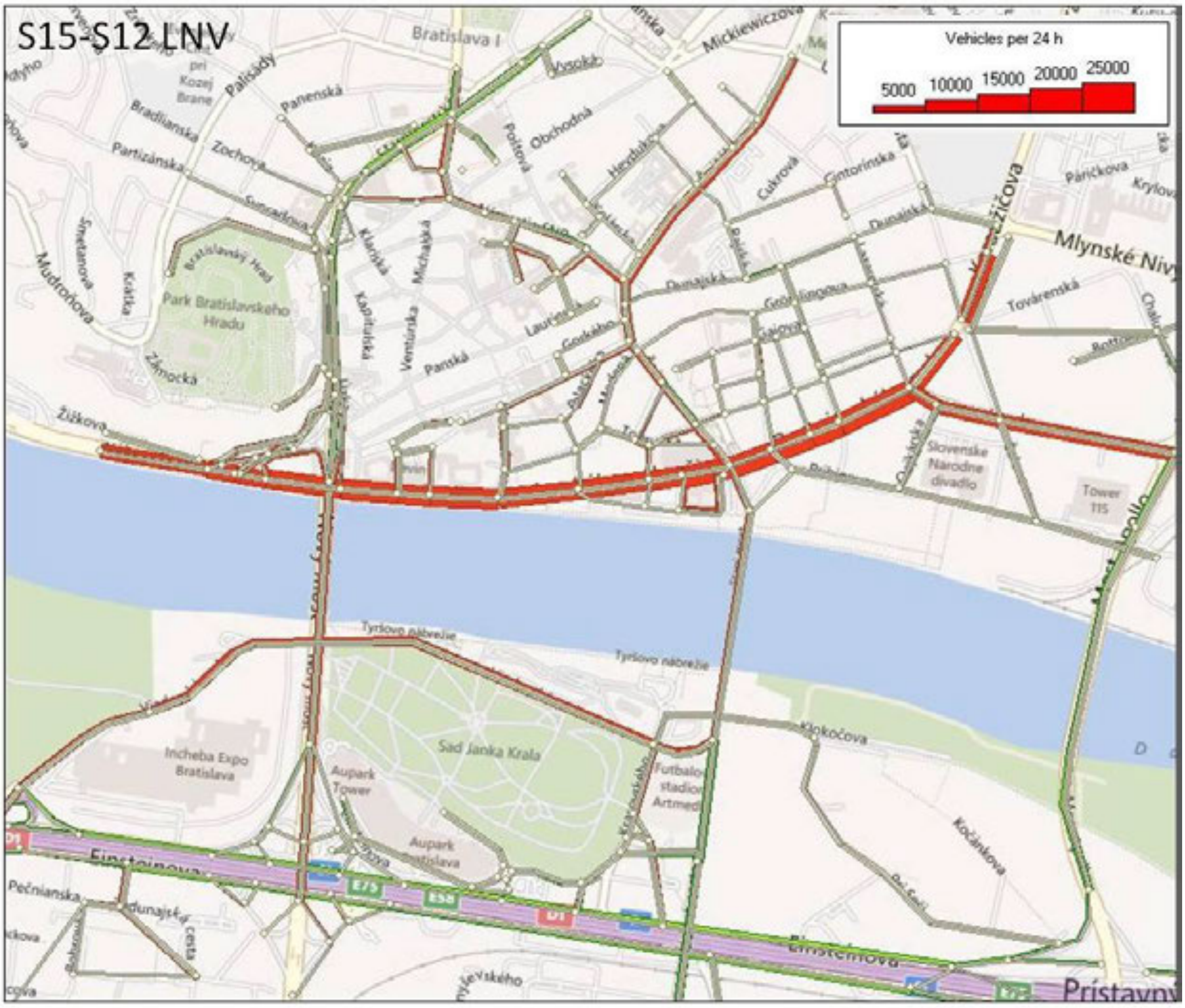

Figure 2.1.15 Scenario15 difference from low noise vehicle traffic volumes in Scenario 12 (increase in red, decrease in green) S!???

2.2 BRISTOL

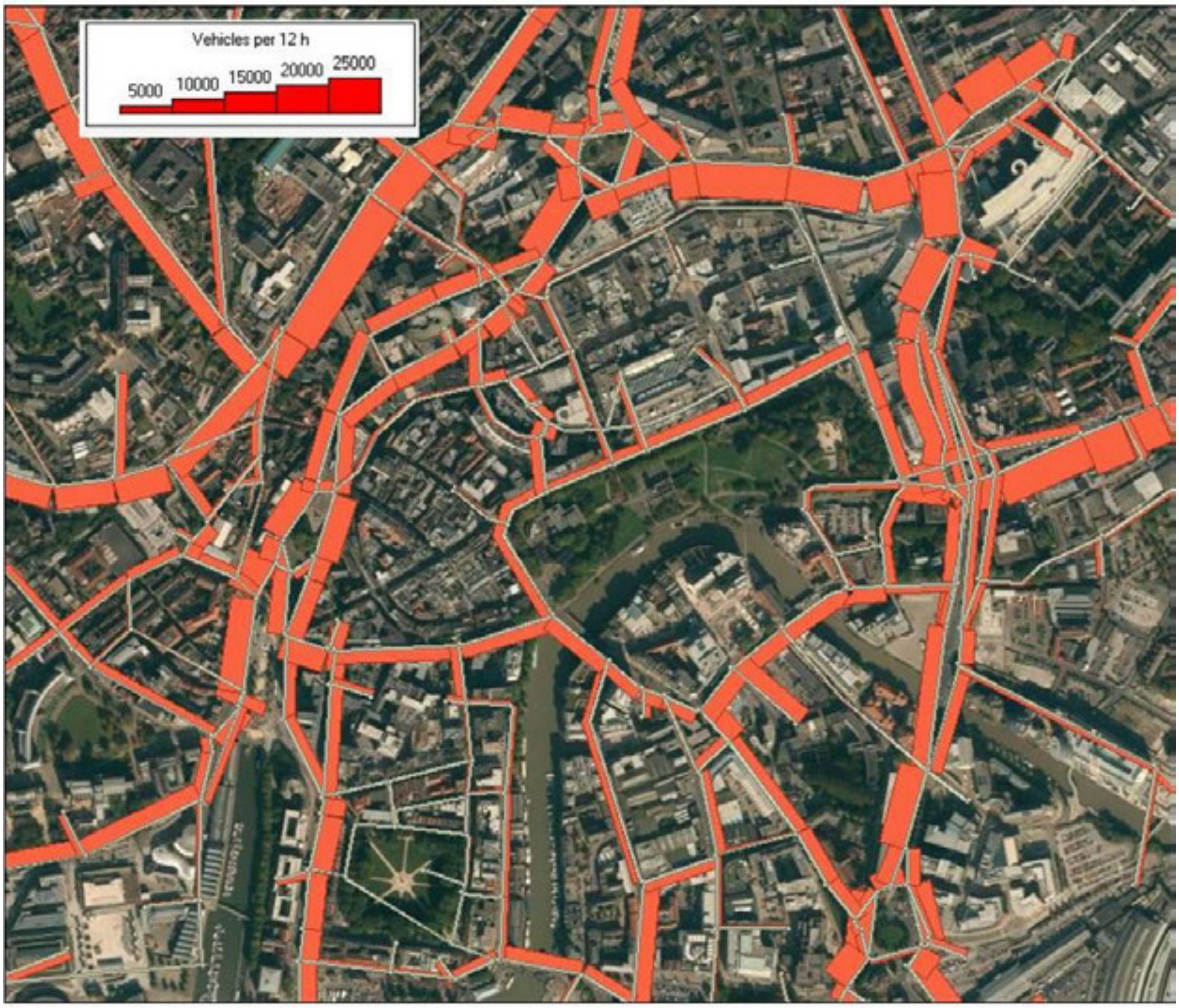

Figure 2.2.1 Base case standard vehicles traffic volumes for Bristol

In figure 2.2.1, standard vehicle (99 percent of all vehicles) traffic volumes are presented as bands along the road links, the bandwidth being proportional to traffic volumes as is shown on the scale. In the following figures, differences from the Base Case are shown for the different scenarios. In these figures, traffic volume reductions are visualized using green colour, and increased volumes are visualized using green colour.

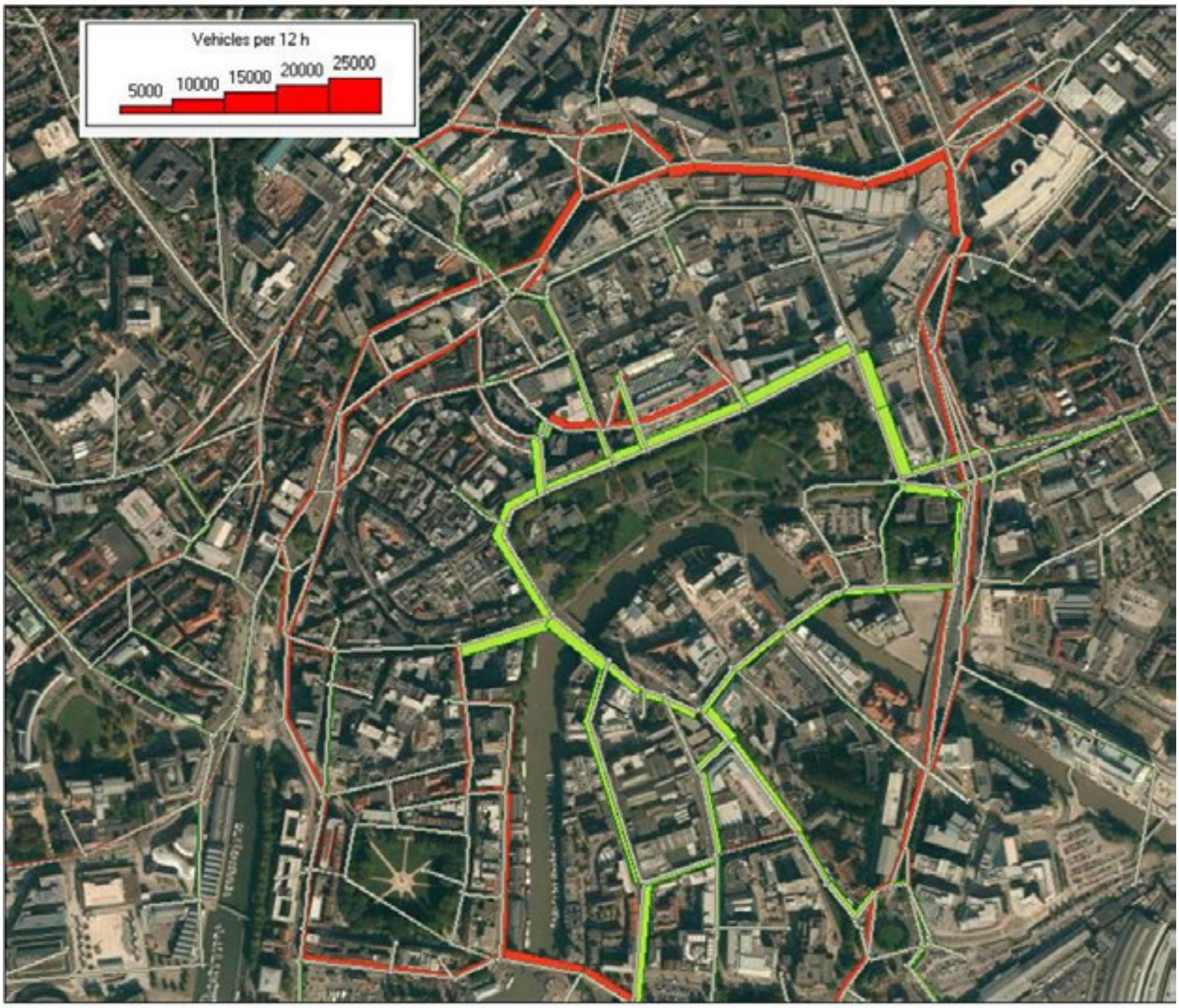

Figure 2.2.2 Scenario 2 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

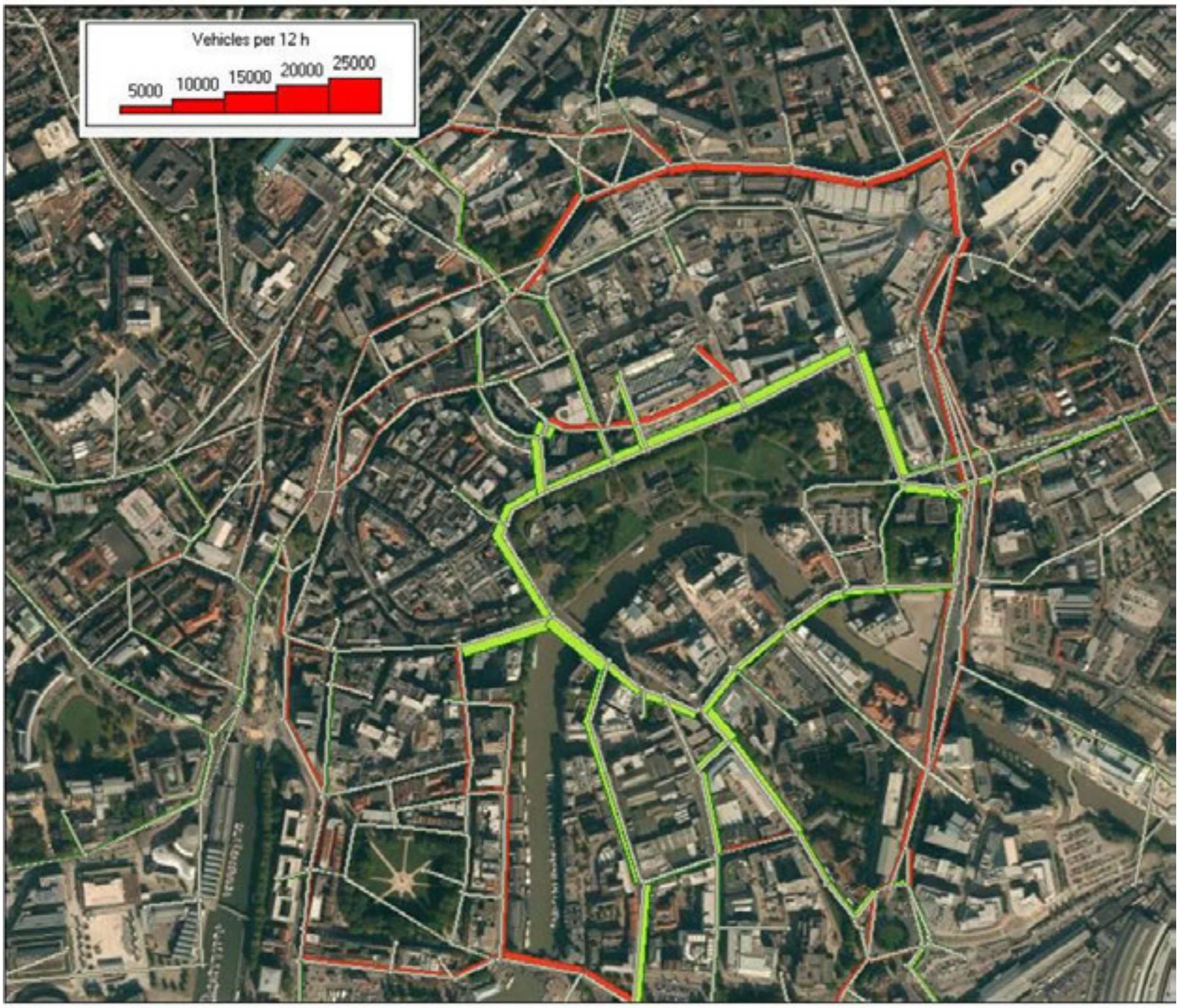

Figure 2.2.3 Scenario 3 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

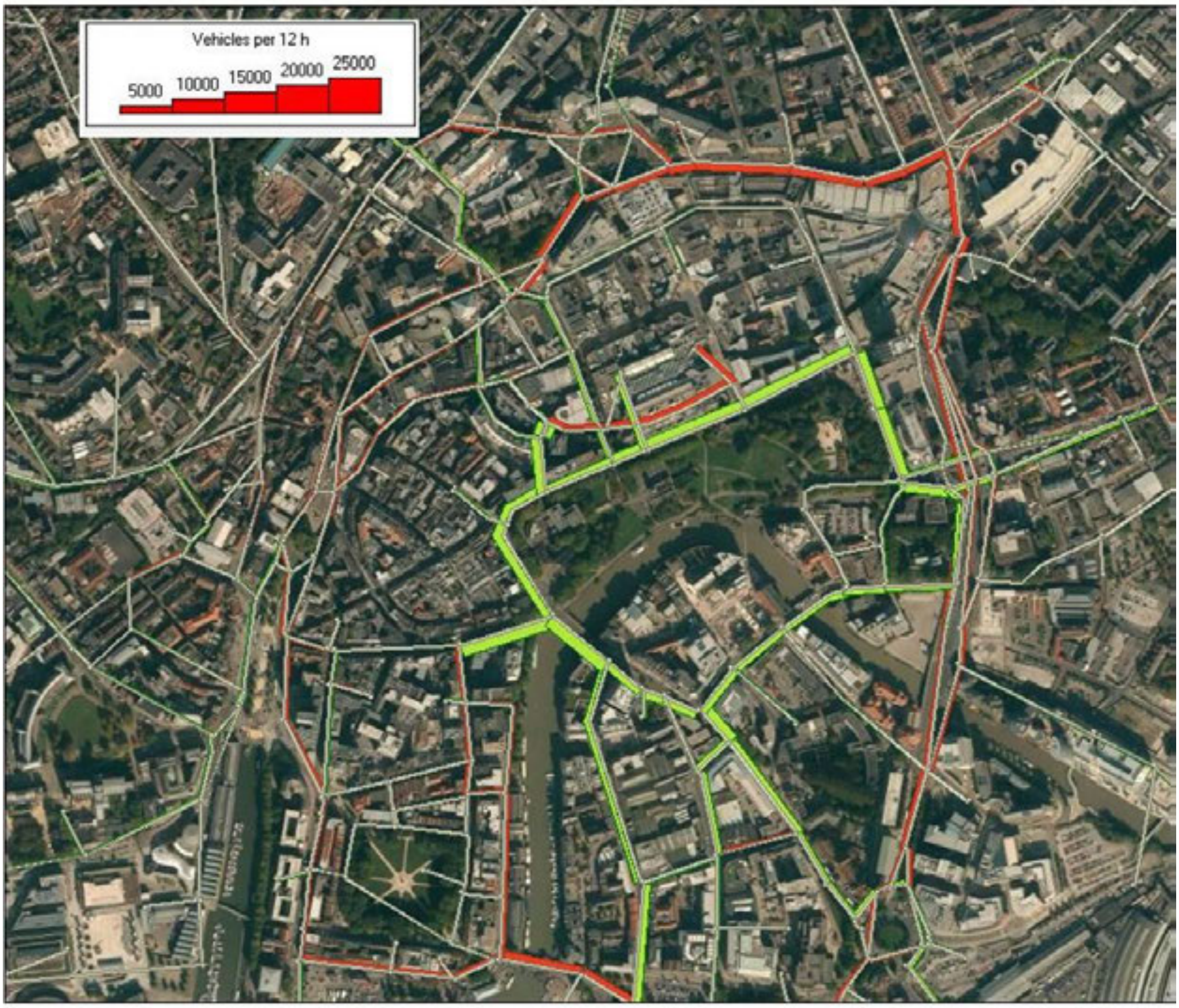

Figure 2.2.4 Scenario 4 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

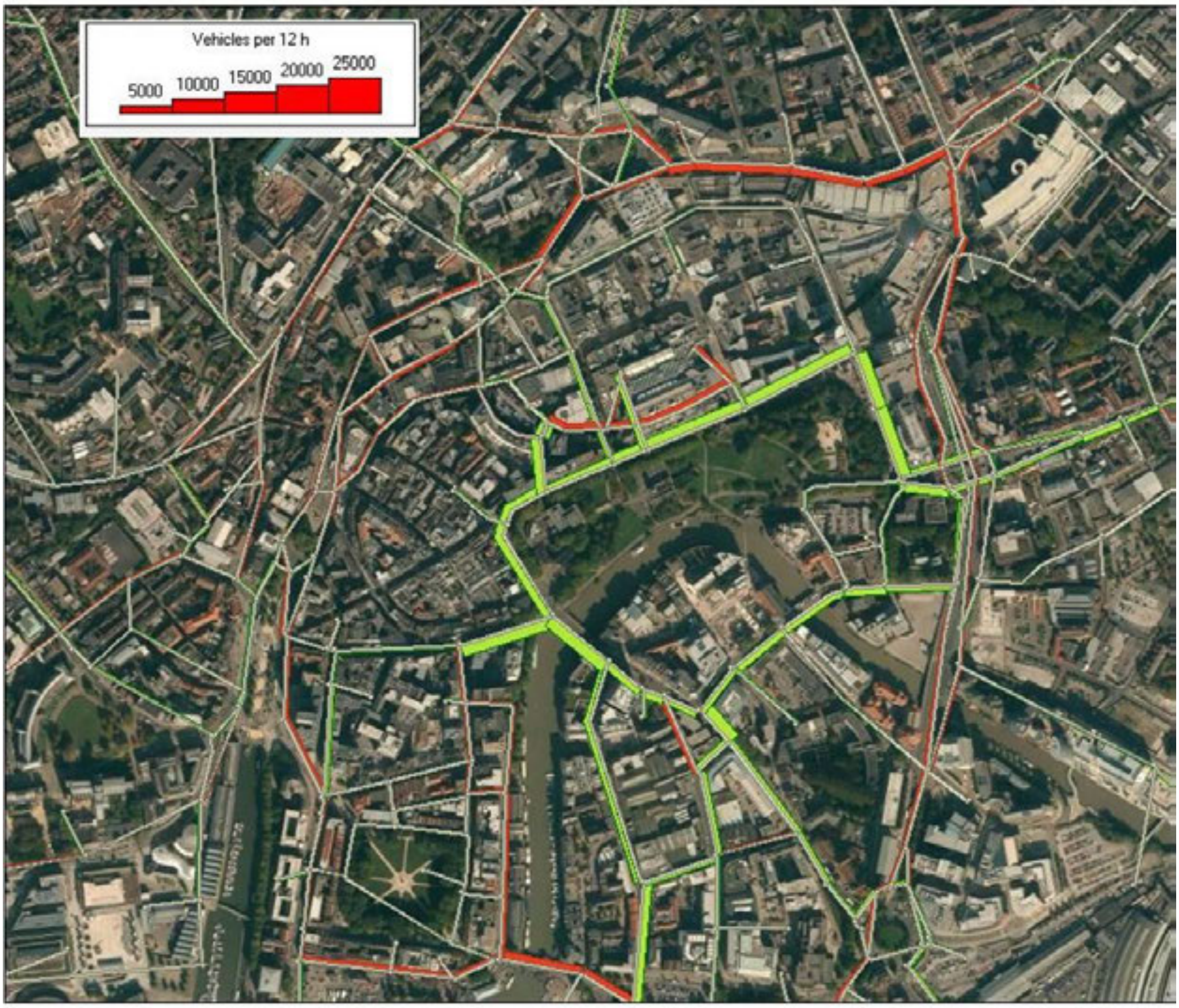

Figure 2.2.5 Scenario 9 difference from Scenario 8 standard vehicle traffic volumes (increase in red, decrease in green)

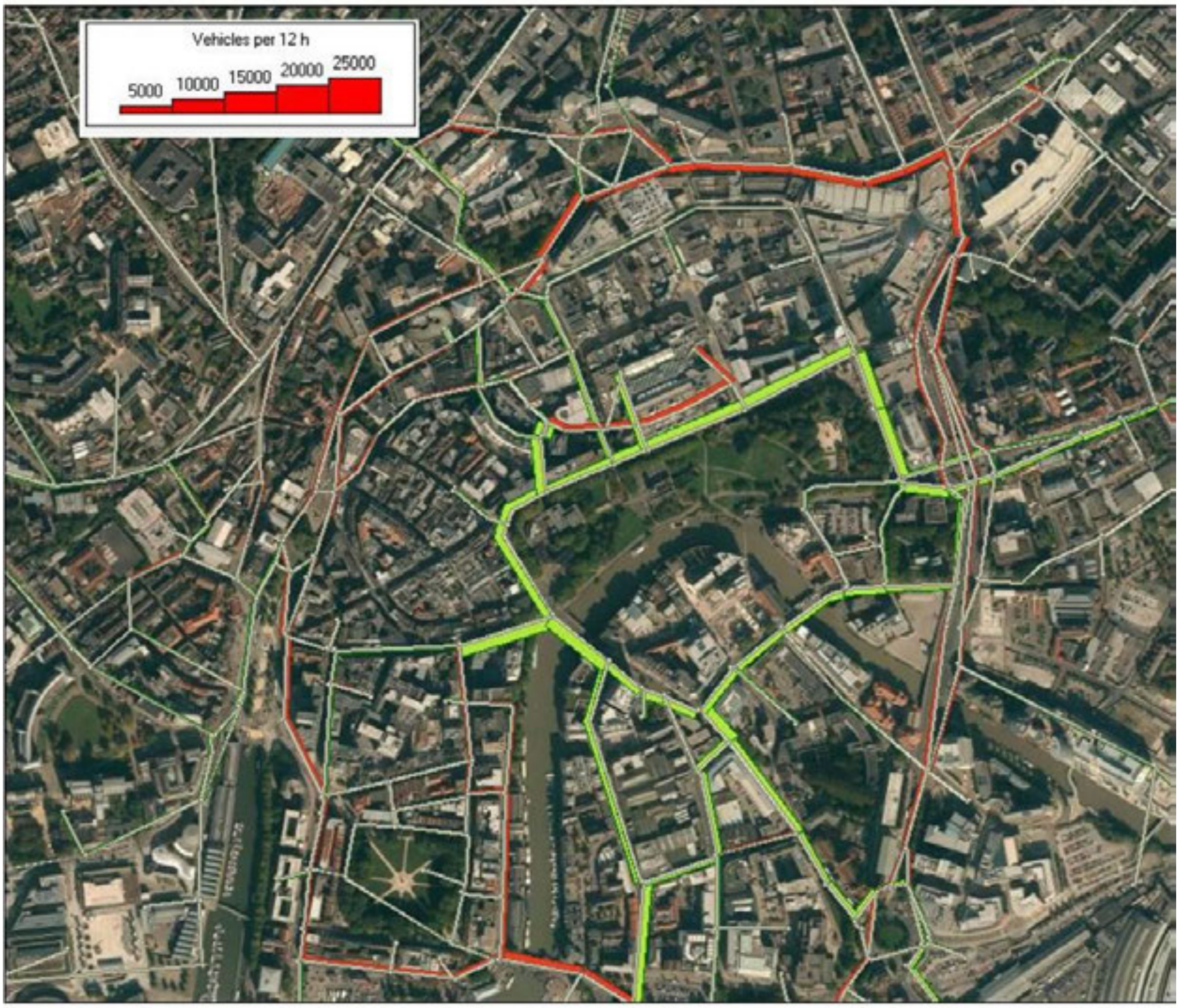

Figure 2.2.6 Scenario 10 difference from Scenario 9 standard vehicle traffic volumes (increase in red, decrease in green)

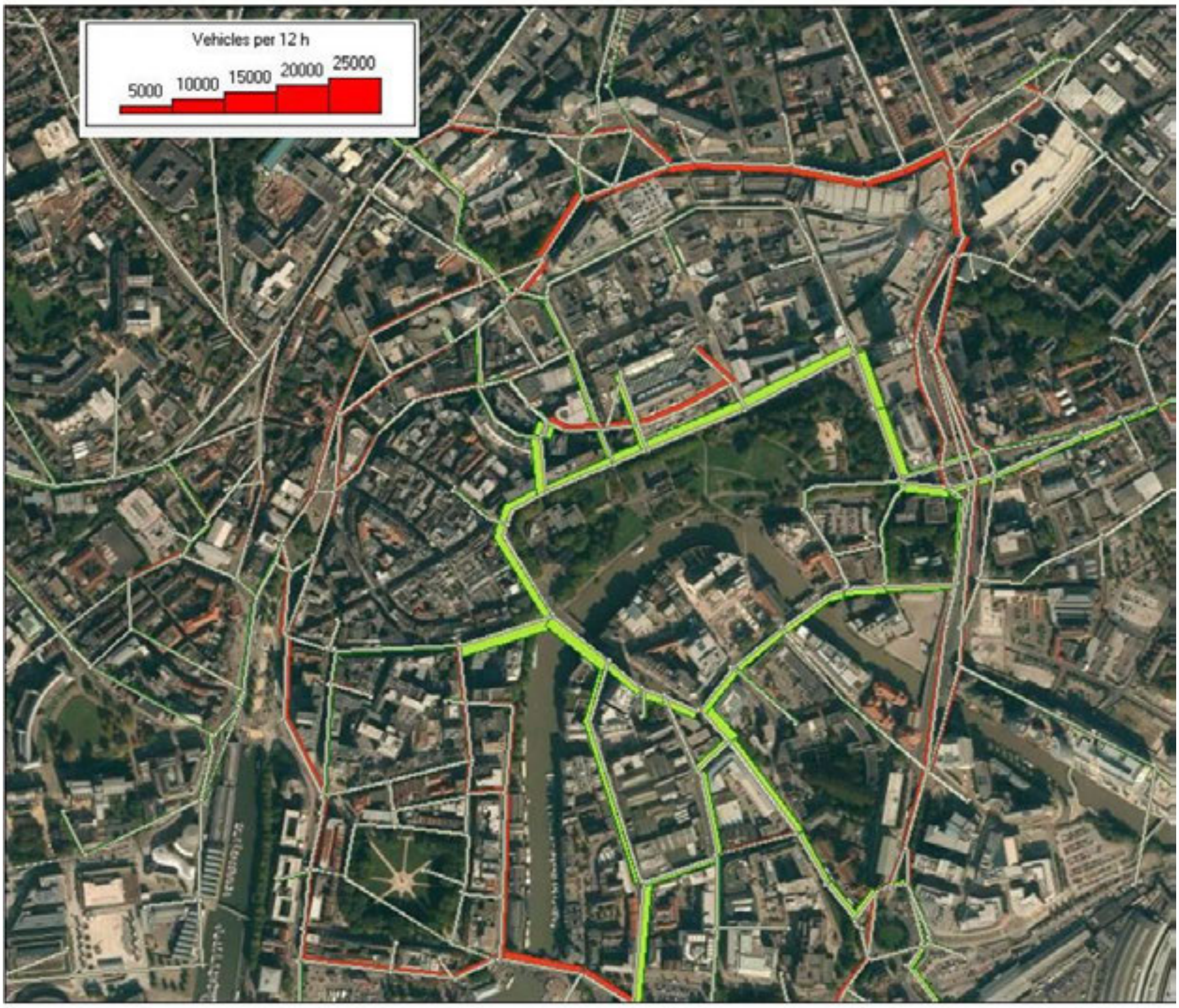

Figure 2.2.7 Scenario 11 difference from Scenario 8 standard vehicle traffic volumes (increase in red, decrease in green)

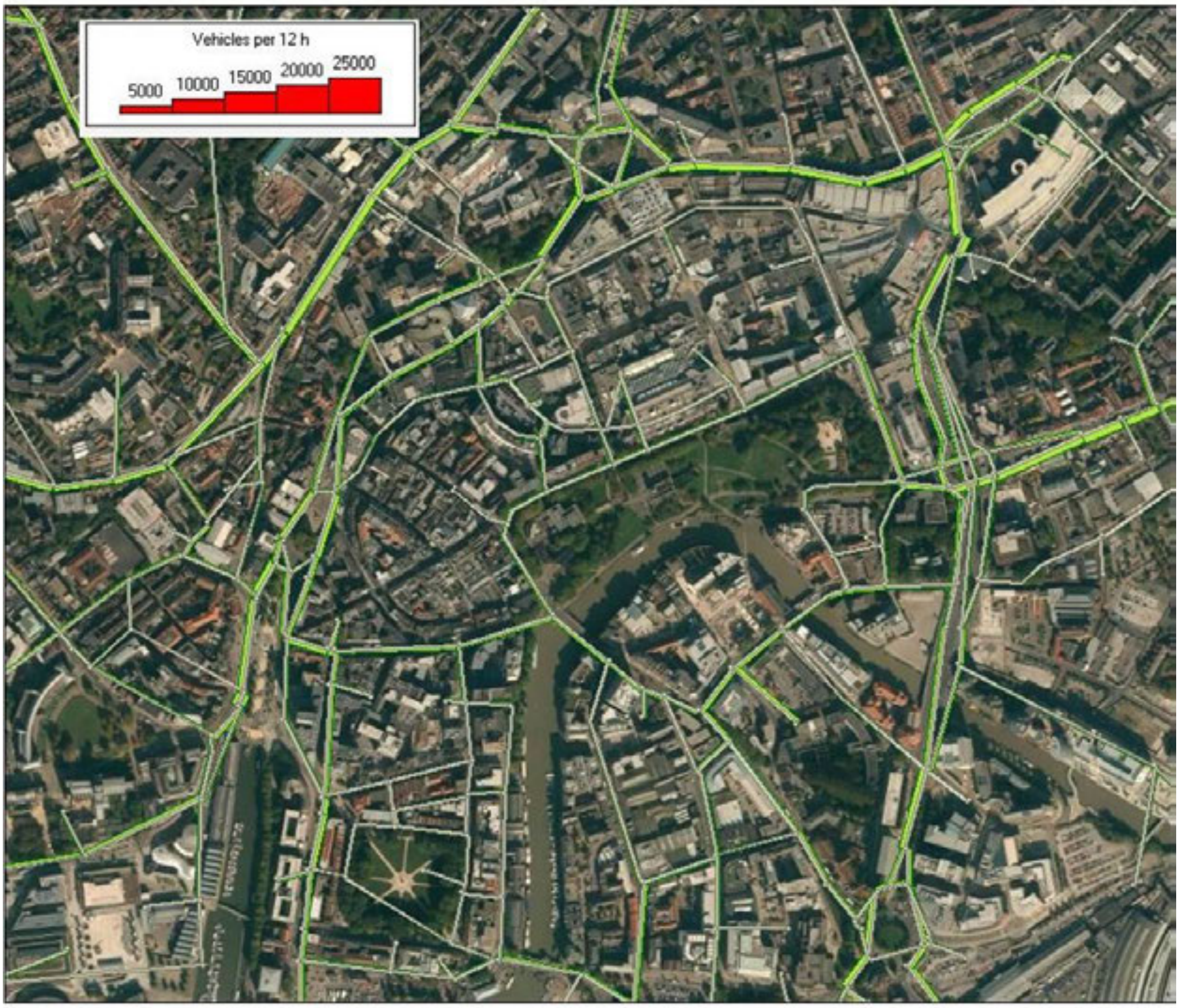

Figure 2.2.8 Scenario 12 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

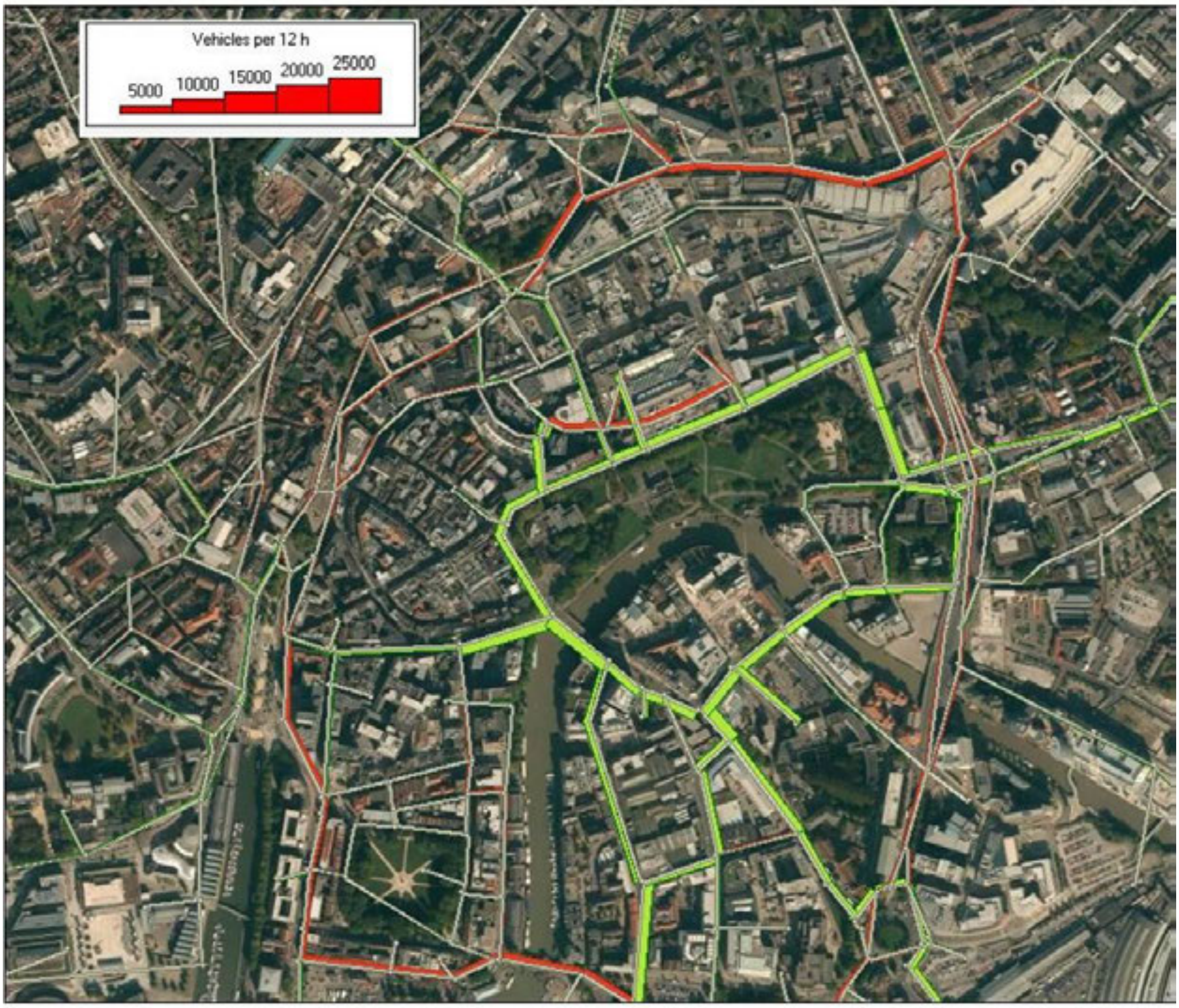

Figure 2.2.9 Scenario 13 difference from Scenario 12 standard vehicle traffic volumes (increase in red, decrease in green)

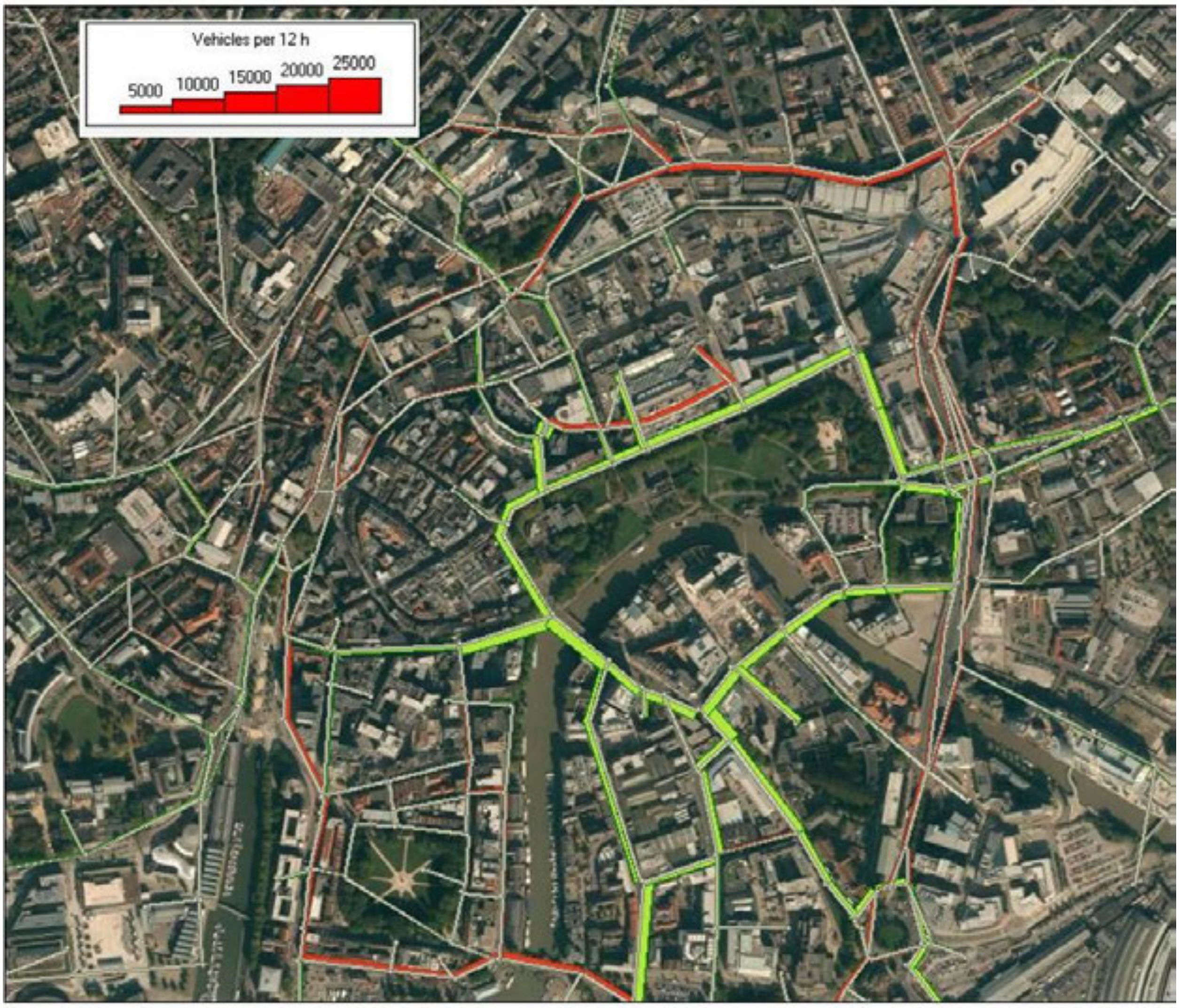

Figure 2.2.10 Scenario 14 difference from Scenario 12 standard vehicle traffic volumes (increase in red, decrease in green)

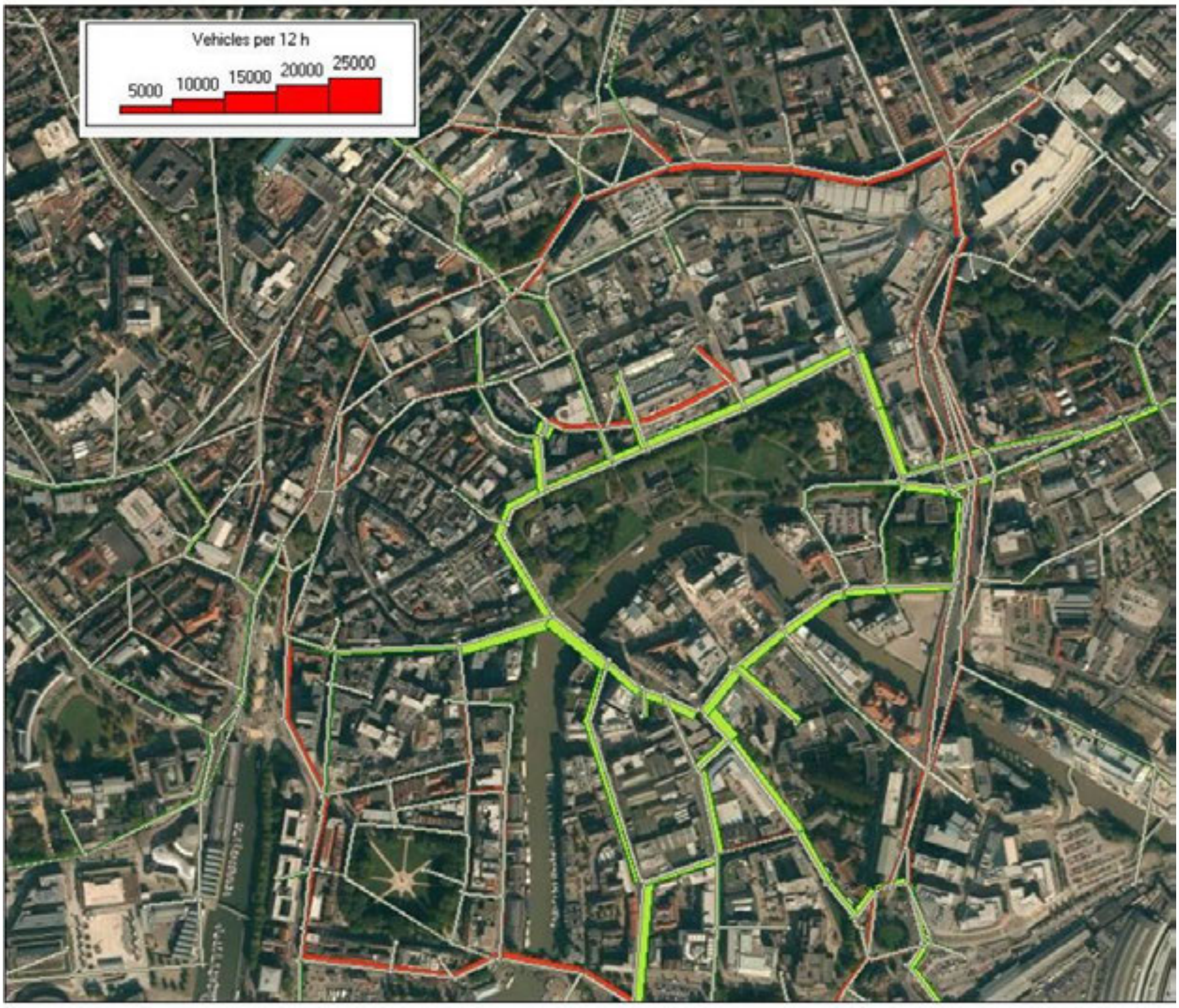

Figure 2.2.11 Scenario 15 difference from Scenario 12 standard vehicle traffic volumes (increase in red, decrease in green)

2.3 ESSEN

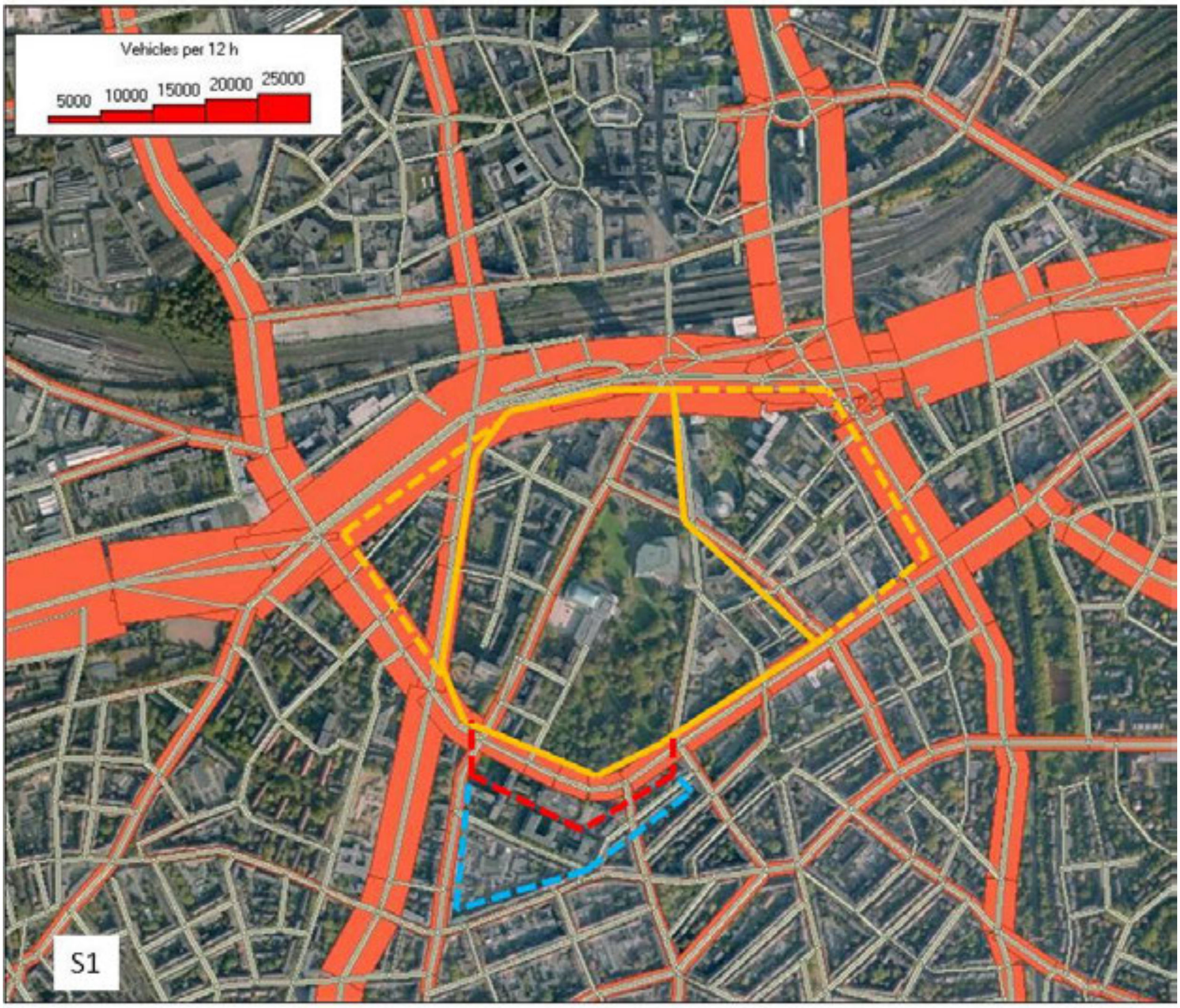

Figure 2.3.1 Base case standard vehicles traffic volumes for Essen

In figure 2.3.1, standard vehicle (99 percent of all vehicles) traffic volumes are presented as bands along the road links, the bandwidth being proportional to traffic volumes as is shown on the scale. In the following figures, differences from the Base Case are shown for the different scenarios. In these figures, traffic volume reductions are visualized using green colour, and increased volumes are visualized using green colour.

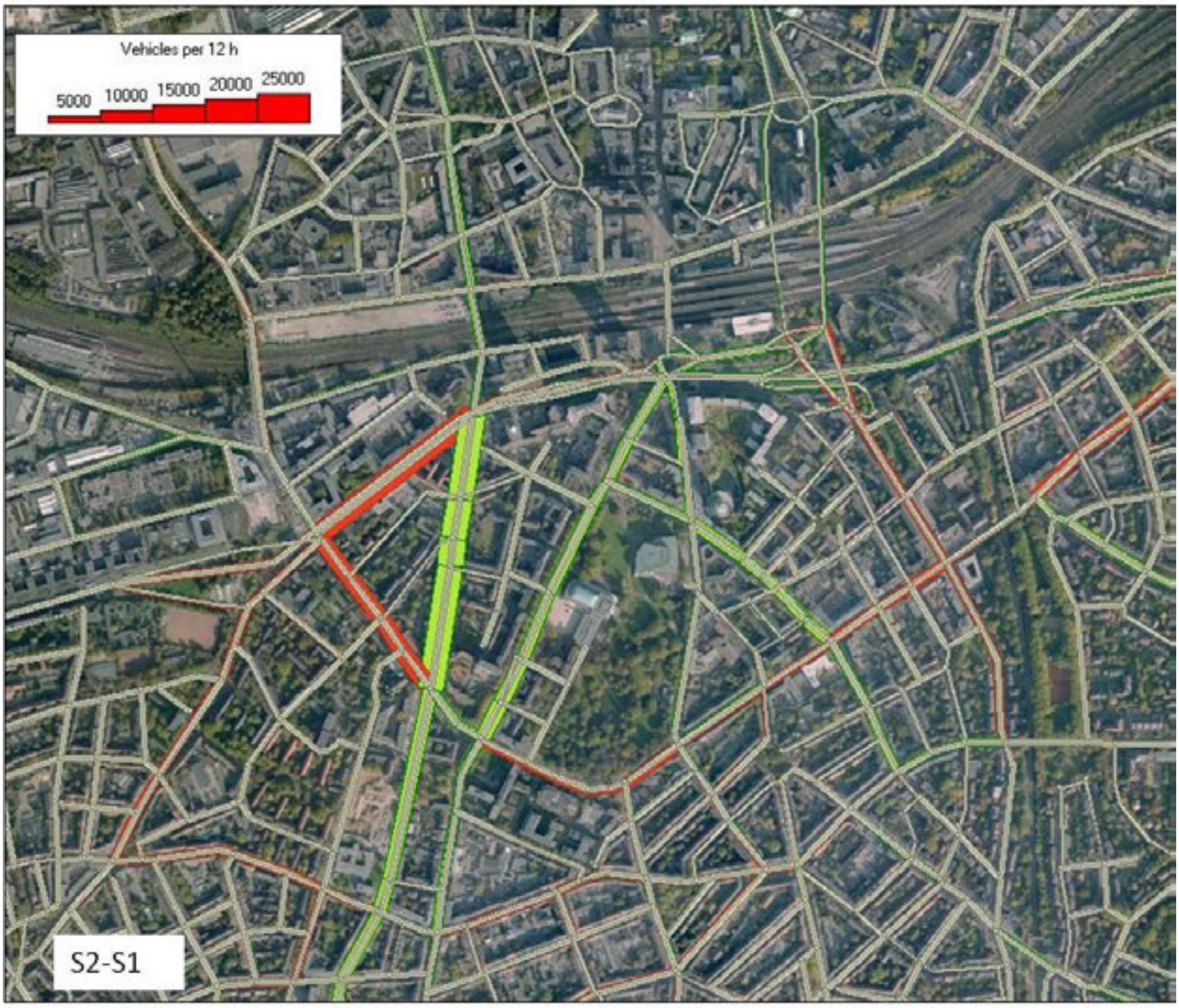

Figure 2.3.2 Scenario 2 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

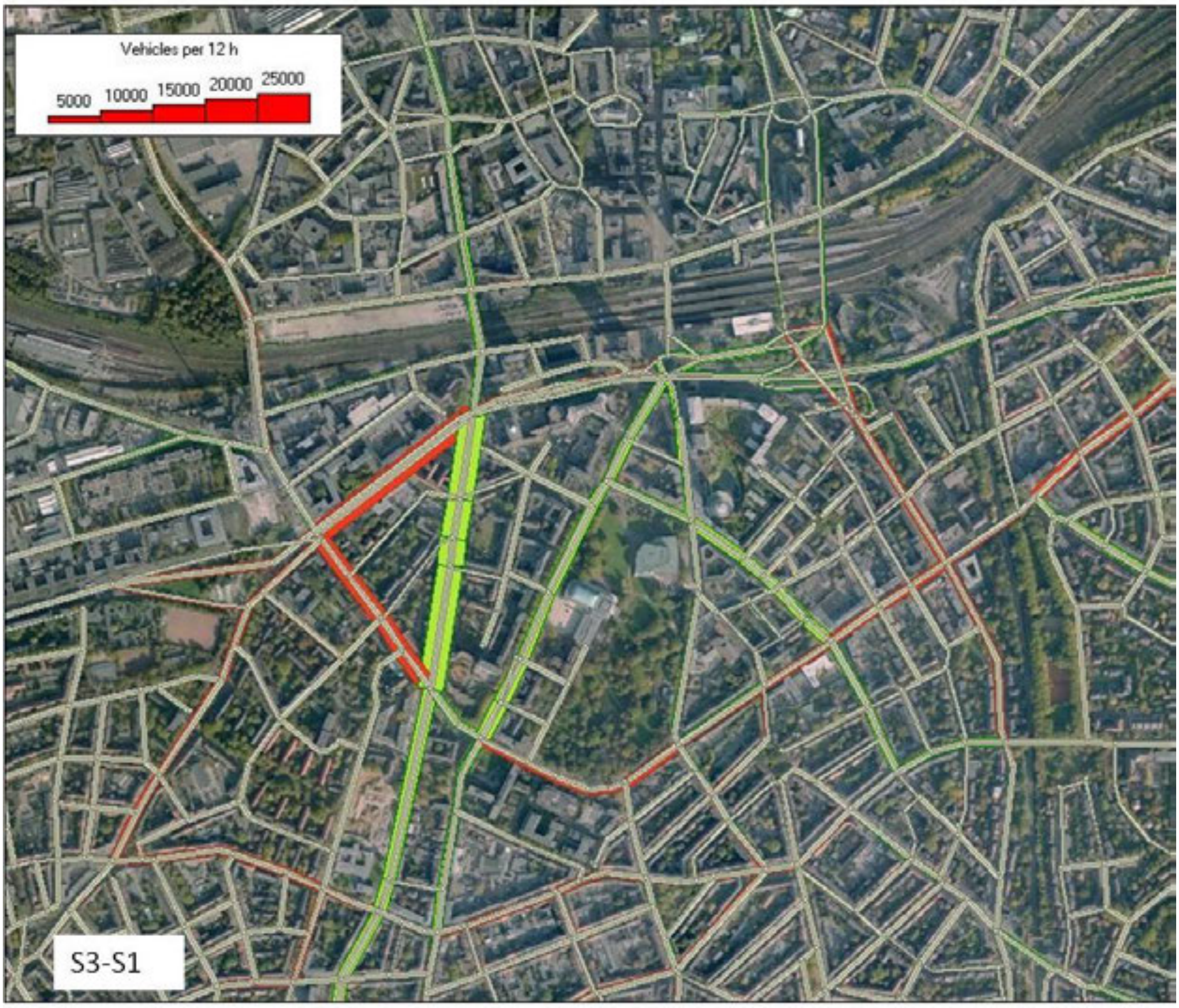

Figure 2.3.3 Scenario 3 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

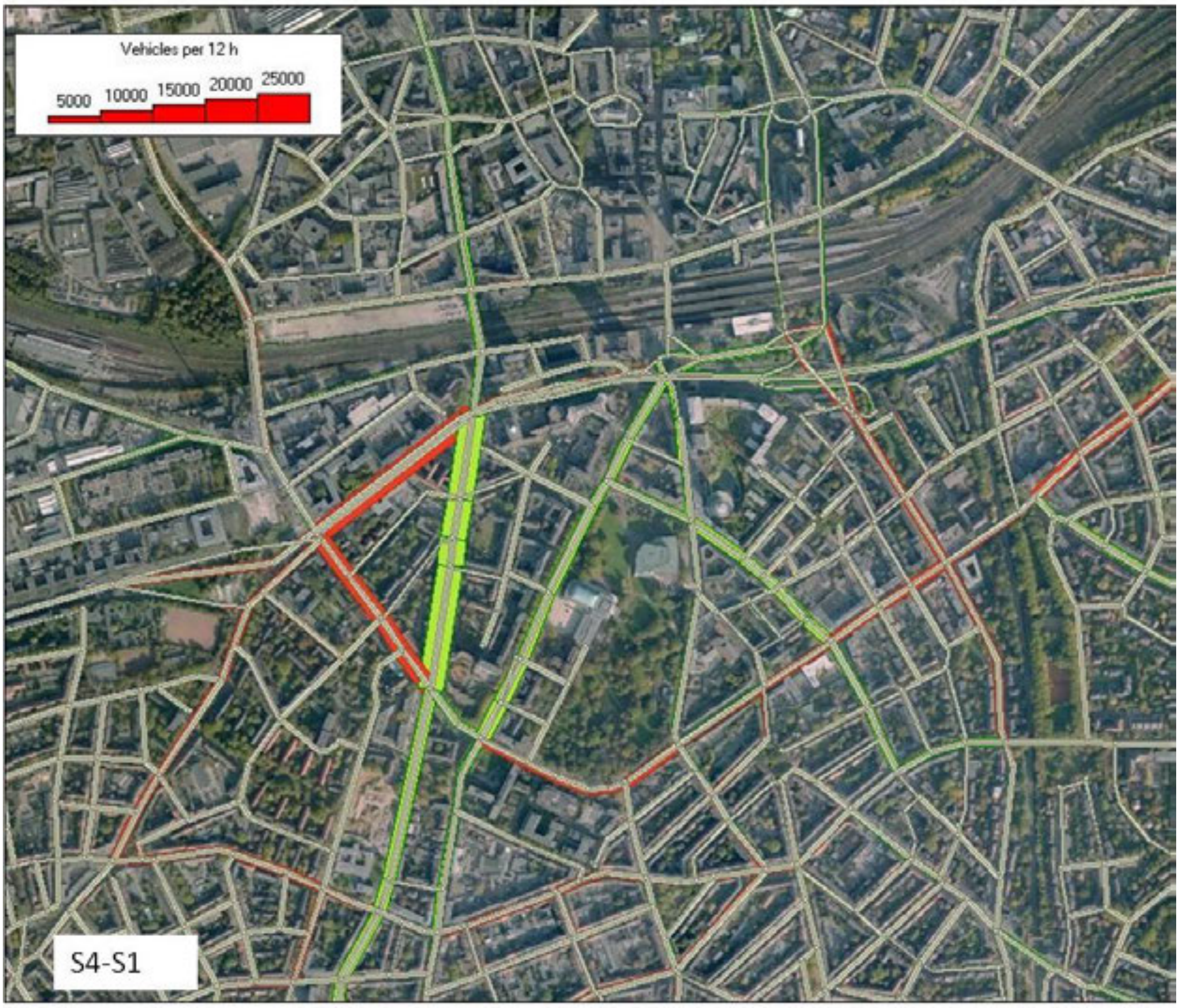

Figure 2.3.4 Scenario 4 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

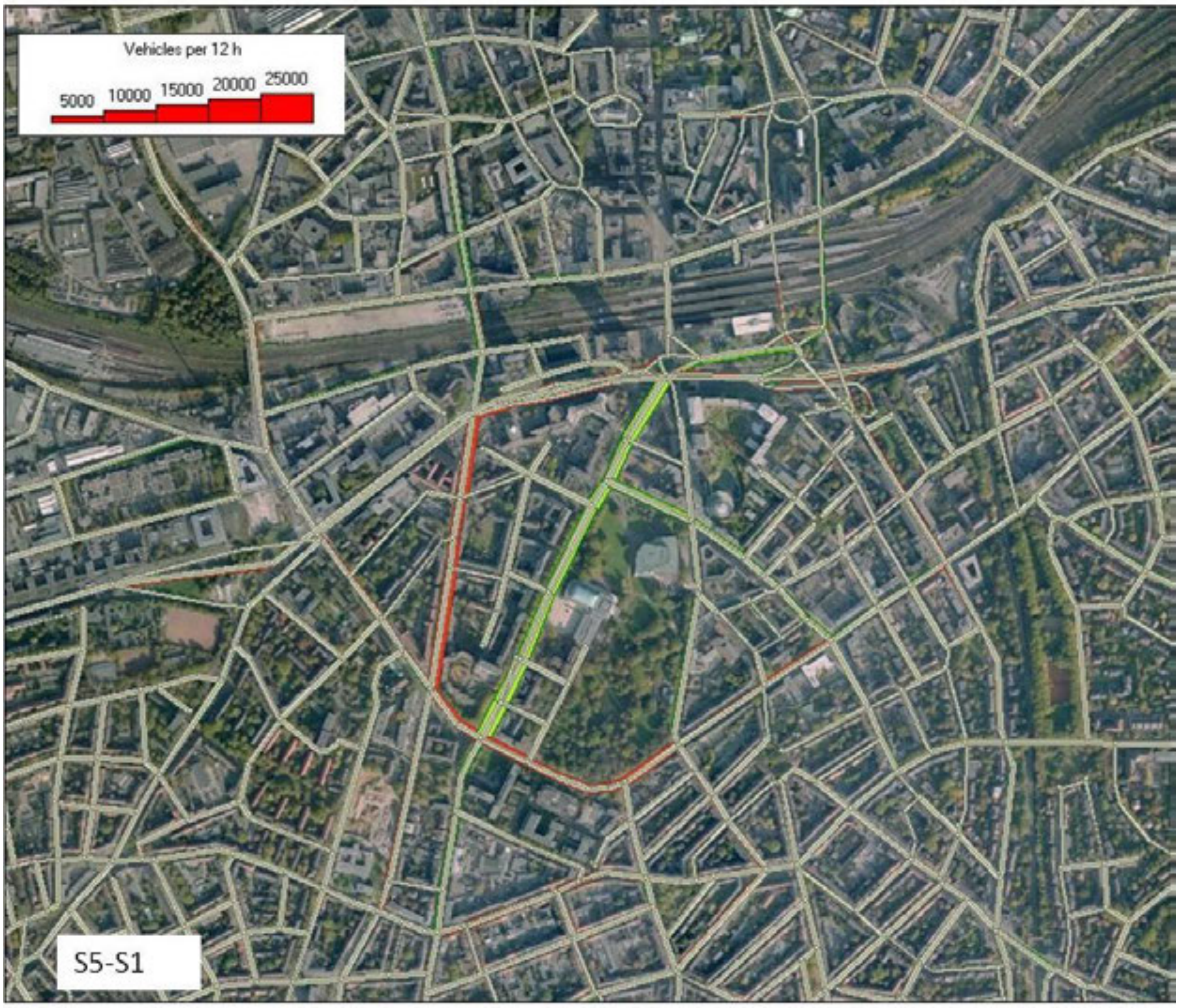

Figure 2.3.5 Scenario 5 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

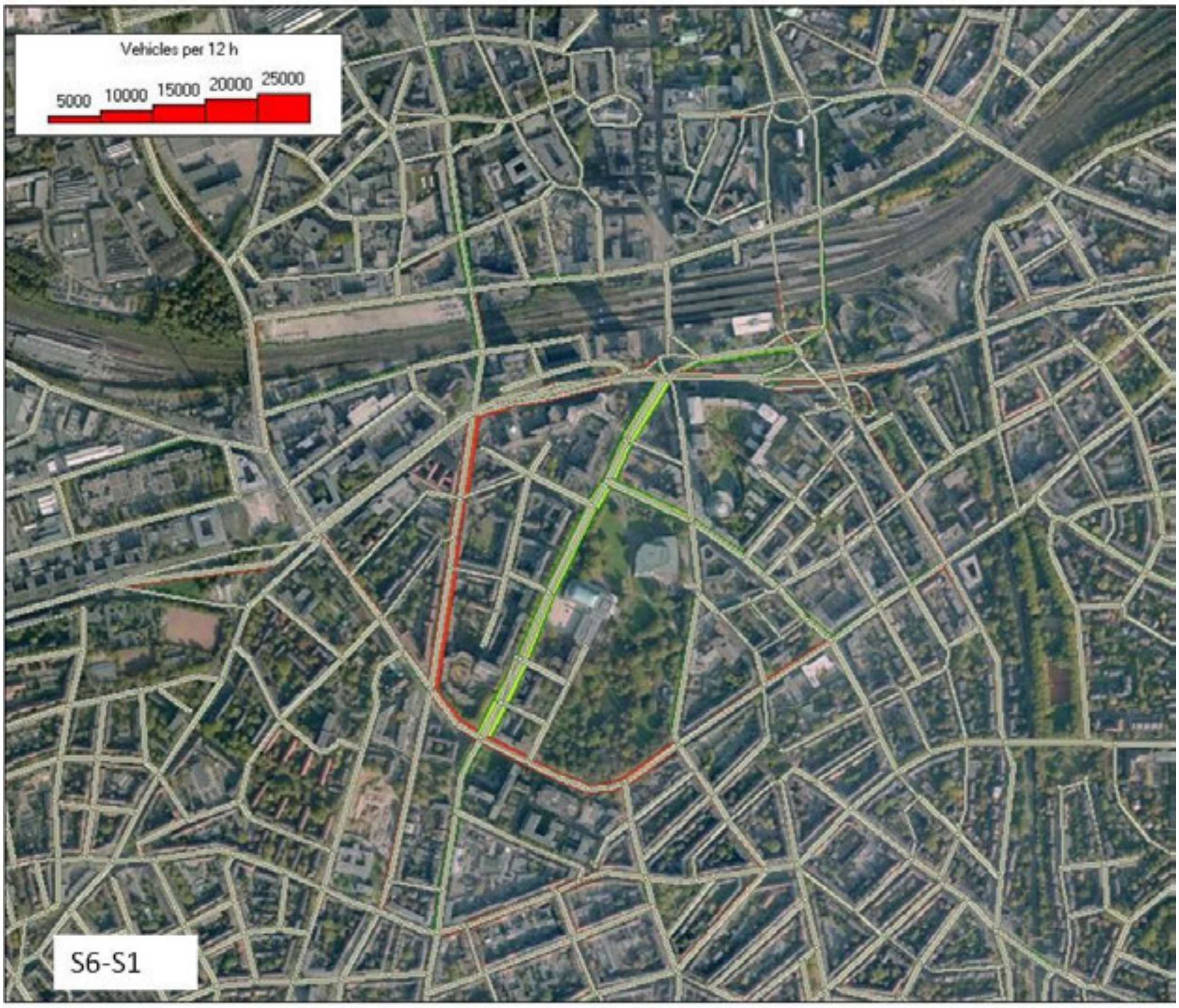

Figure 2.3.6 Scenario 6 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

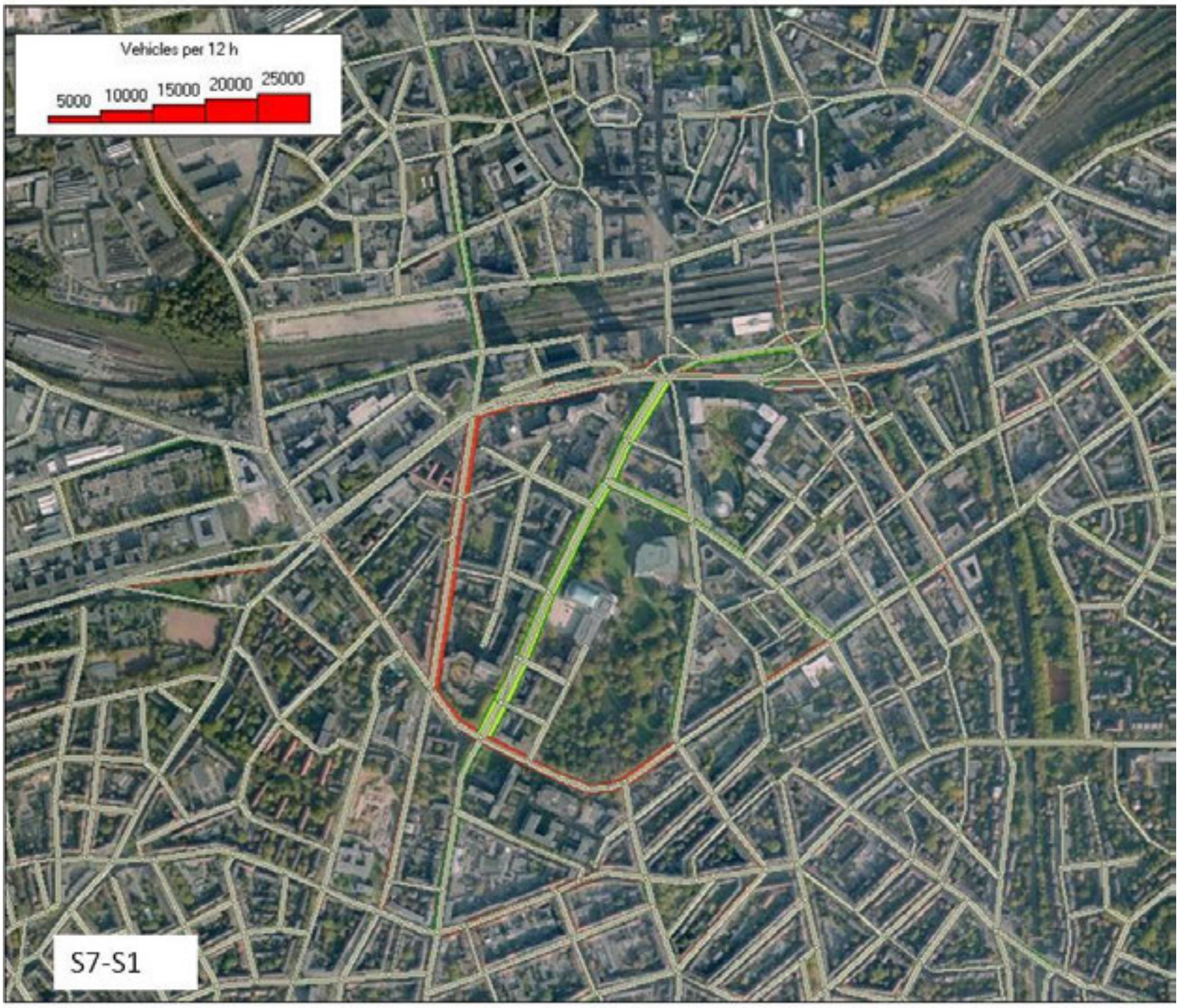

Figure 2.3.7 Scenario 7 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

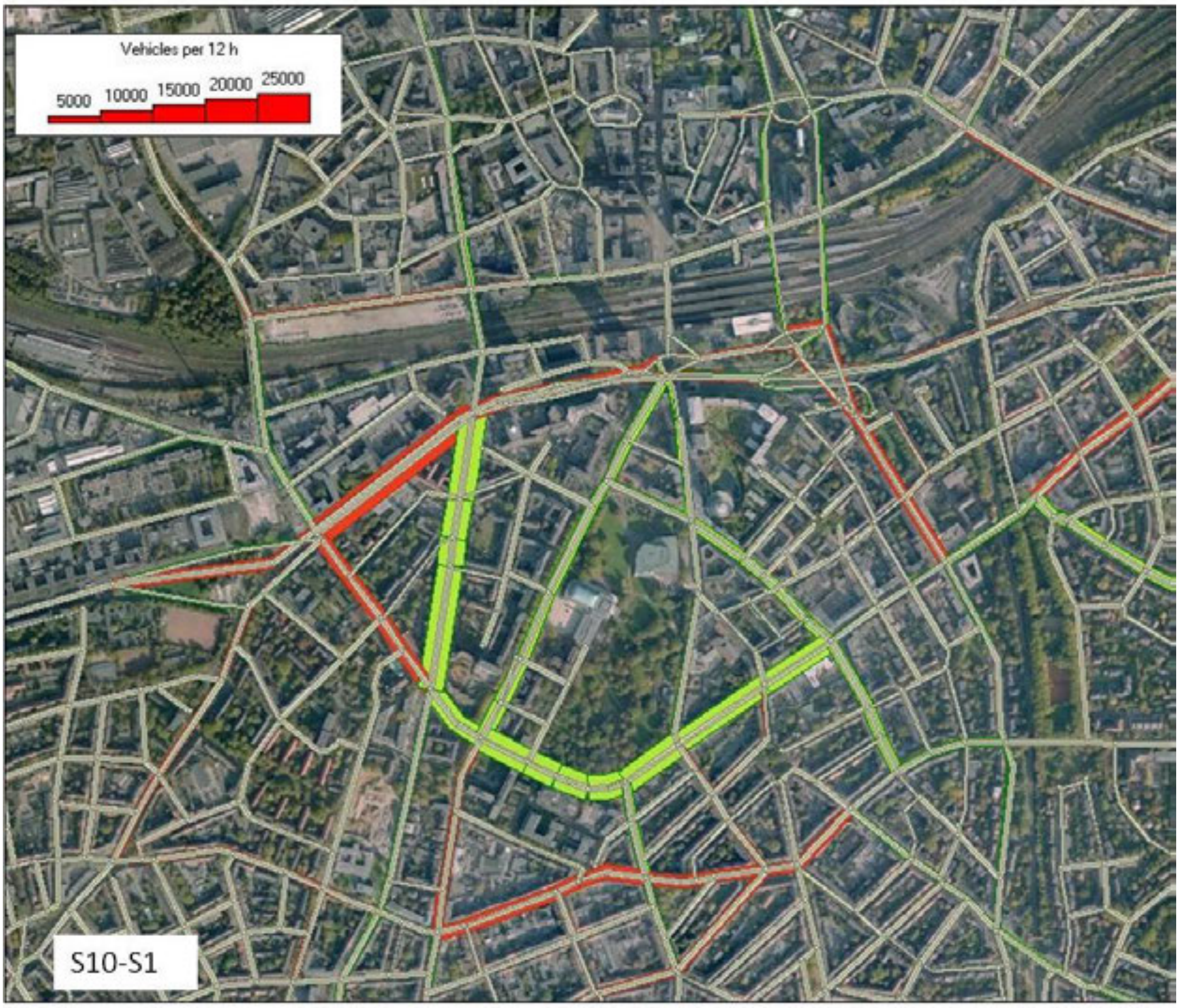

Figure 2.3.8 Scenario 10 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

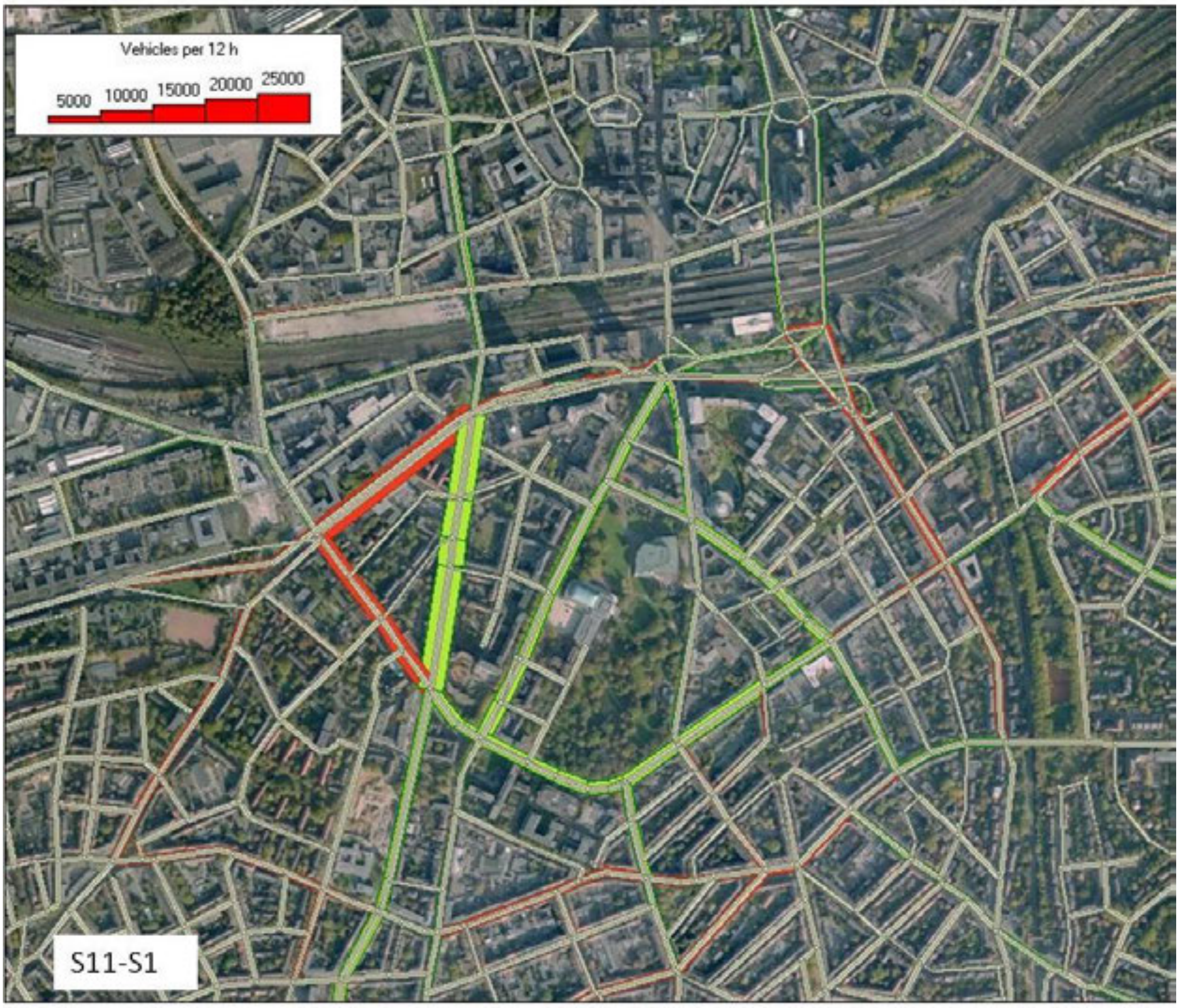

Figure 2.3.9 Scenario 11 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

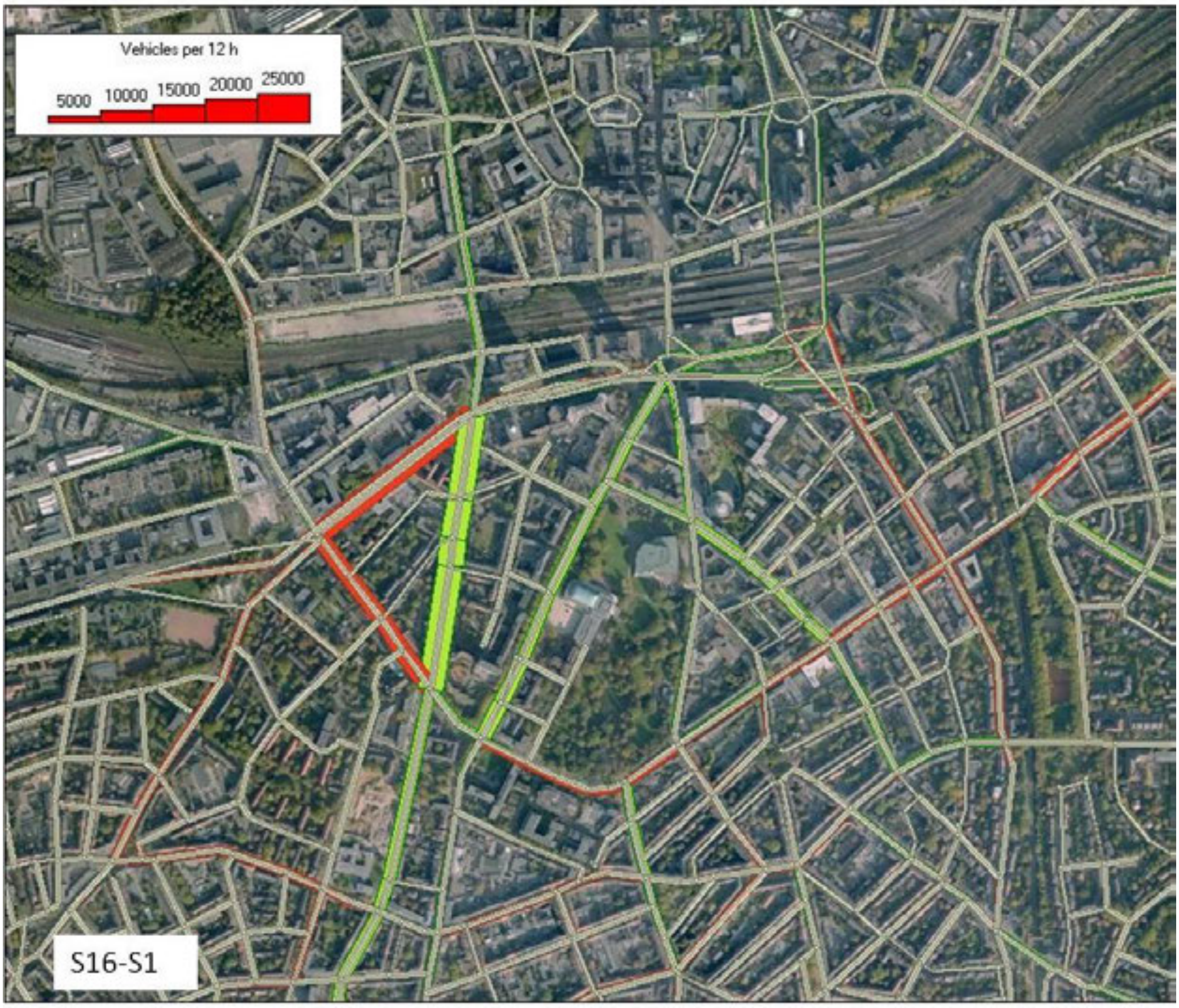

Figure 2.3.10 Scenario 16 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

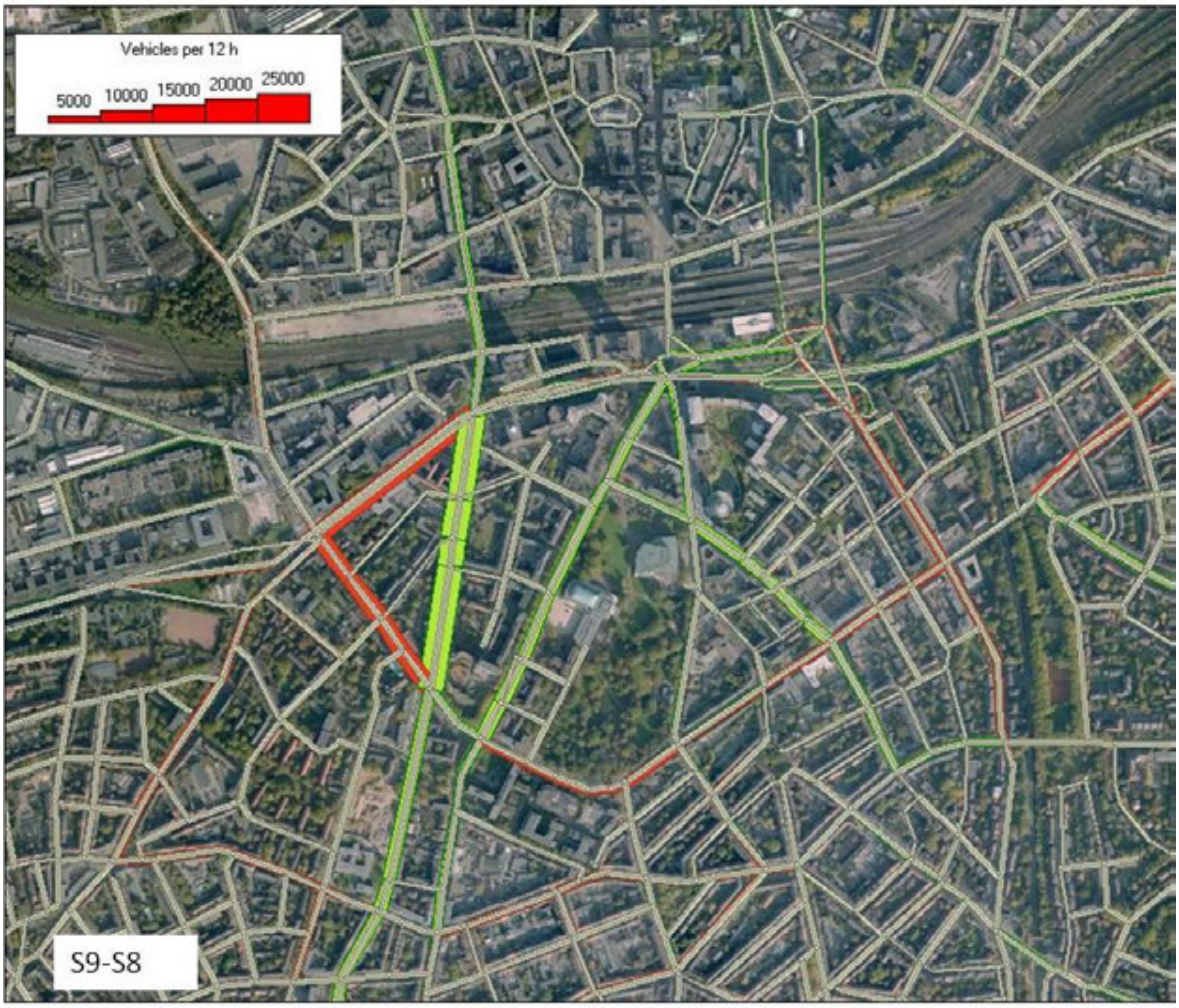

Figure 2.3.11 Scenario 9 difference from Scenario 8 standard vehicle traffic volumes (increase in red, decrease in green)

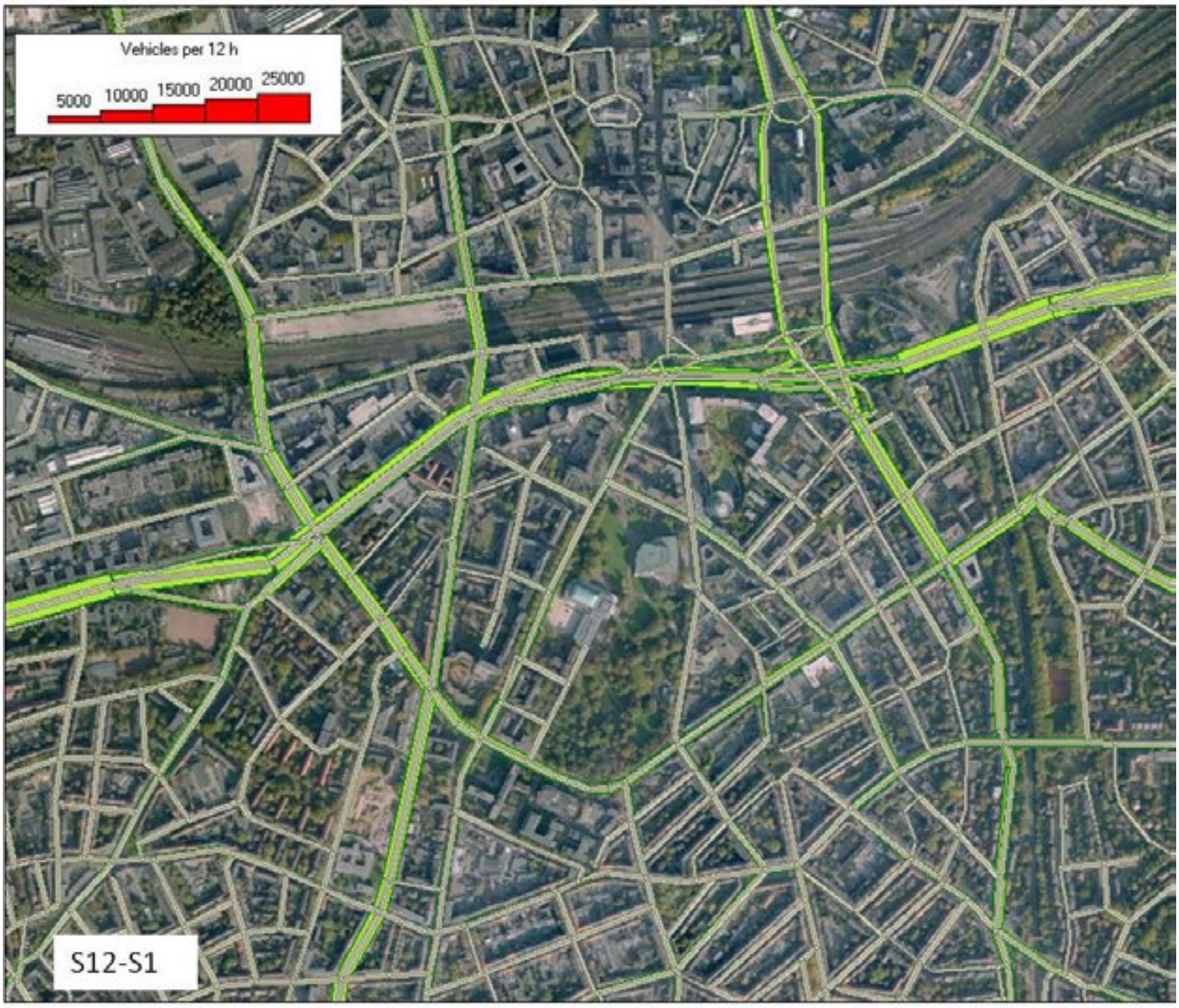

Figure 2.3.12 Scenario 12 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

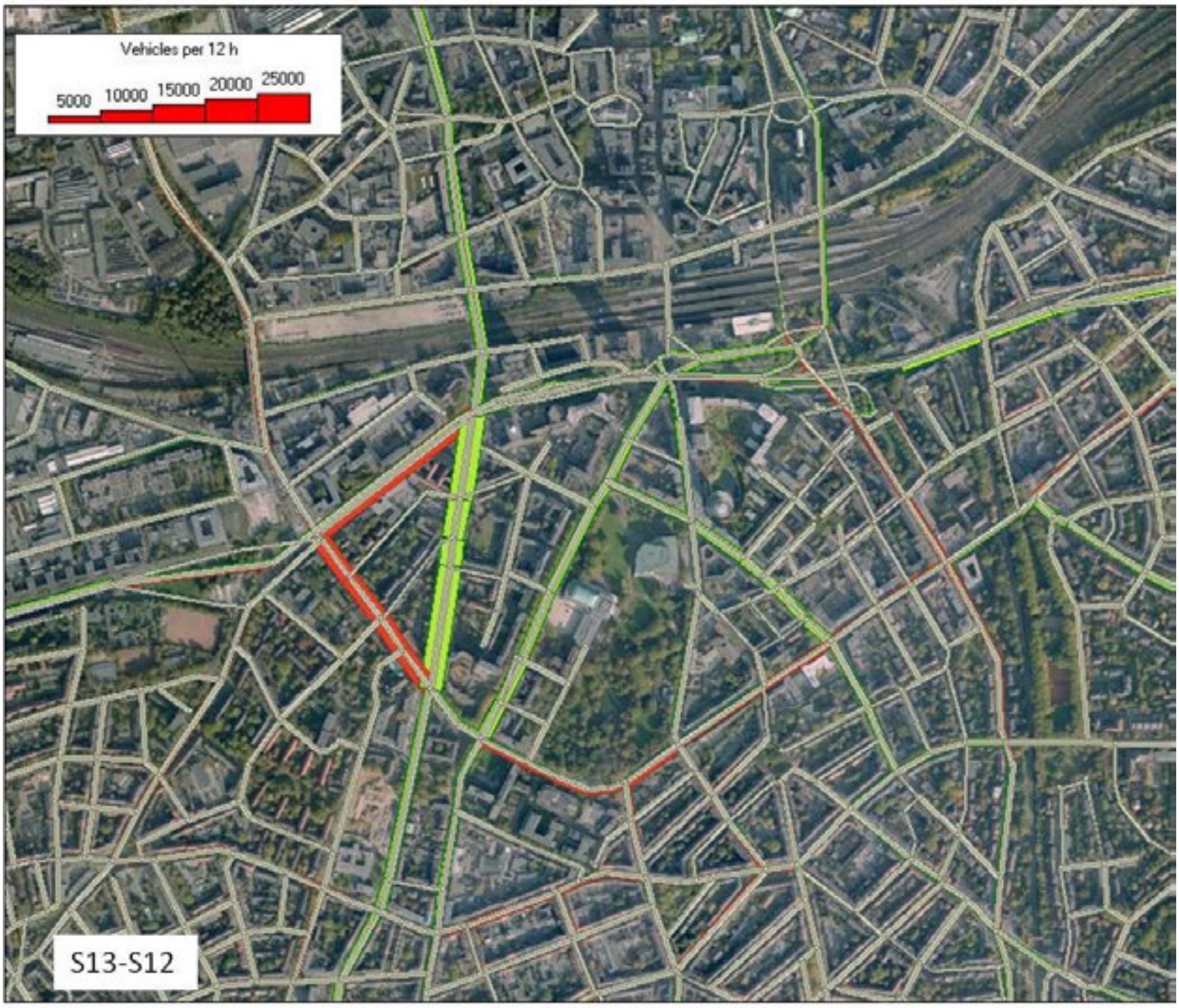

Figure 2.3.13 Scenario 13 difference from Scenario 12 standard vehicle traffic volumes (increase in red, decrease in green)

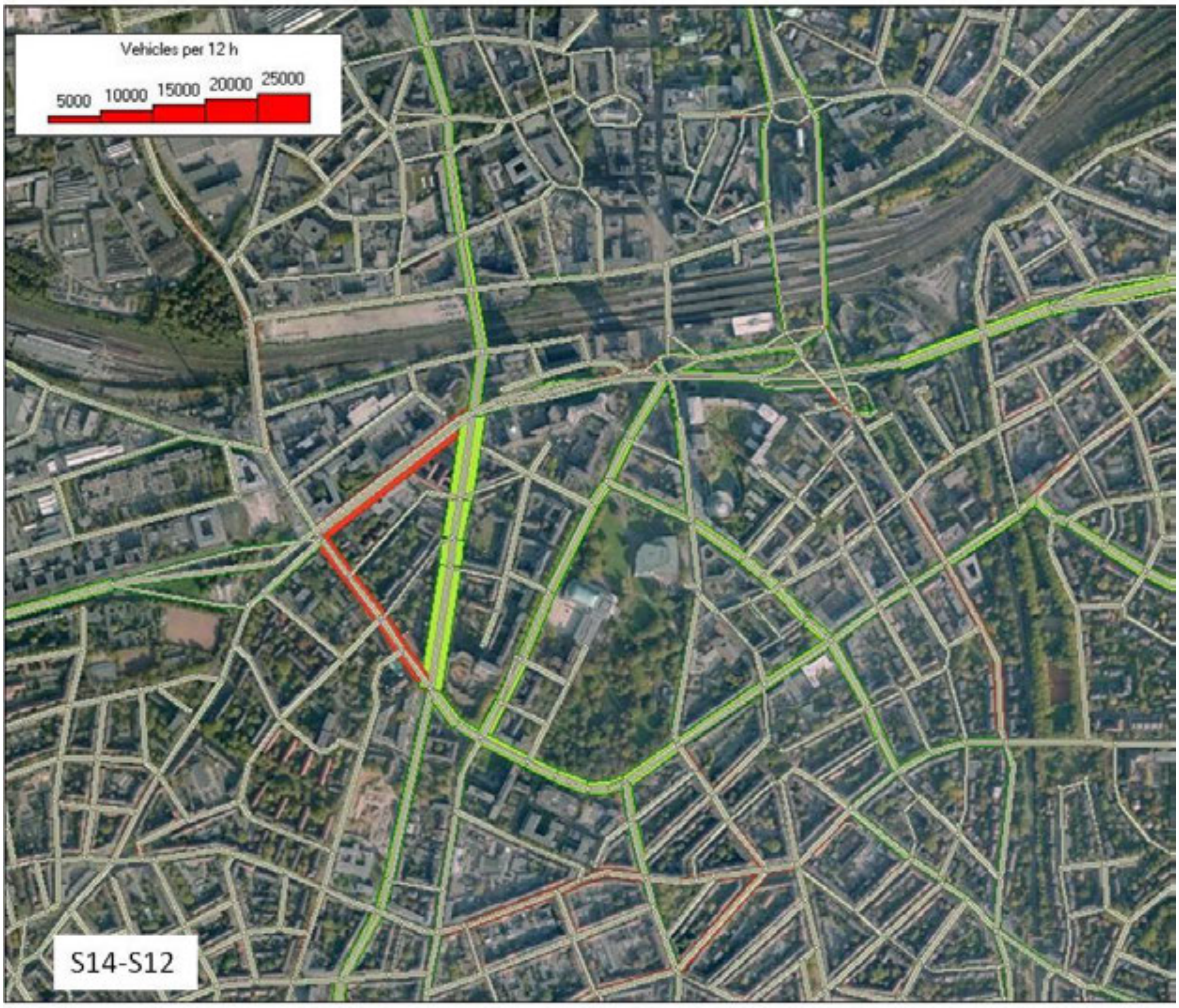

Figure 2.3.14 Scenario 14 difference from Scenario 12 standard vehicle traffic volumes (increase in red, decrease in green)

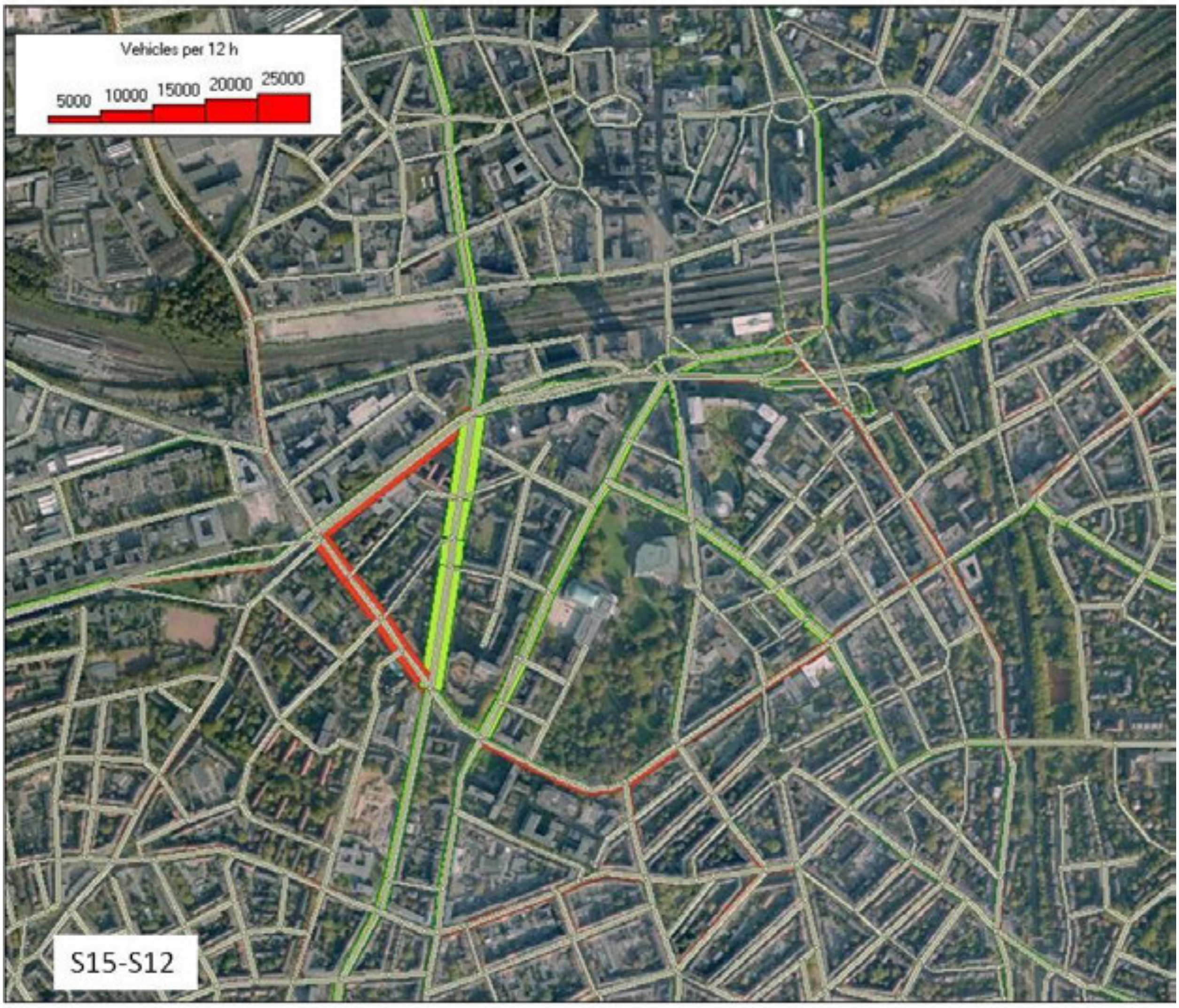

Figure 2.3.15 Scenario 15 difference from Scenario 12 standard vehicle traffic volumes (increase in red, decrease in green)

2.4 GOTHENBURG

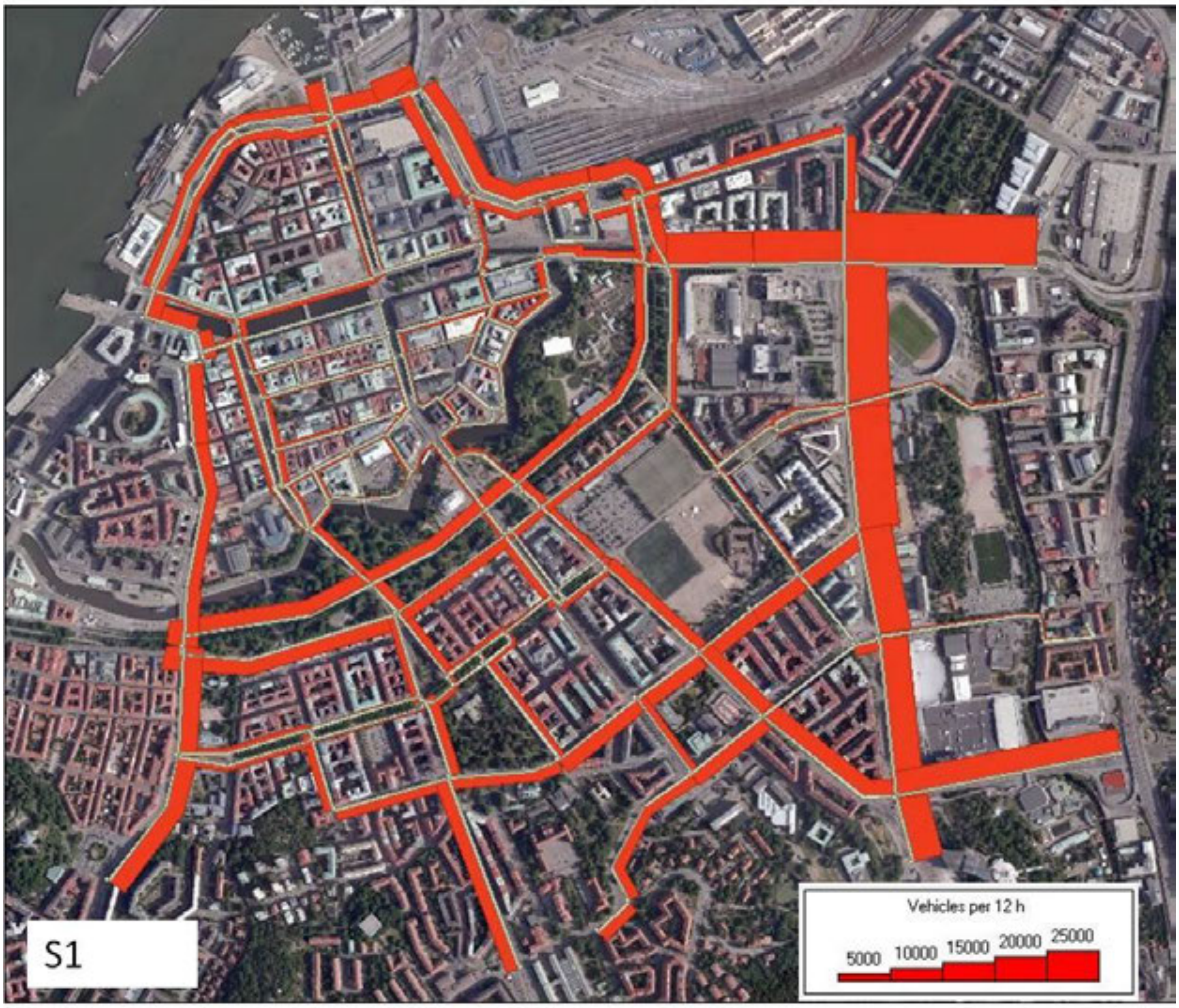

Figure 2.4.1 Base case standard vehicles traffic volumes for Gothenburg

In figure 2.4.1, standard vehicle (99 percent of all vehicles) traffic volumes are presented as bands along the road links, the bandwidth being proportional to traffic volumes as is shown on the scale. In the following figures, differences from the Base Case are shown for the different scenarios. In these figures, traffic volume reductions are visualized using green colour, and increased volumes are visualized using green colour.

Figure 2.4.2 Scenario 3 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

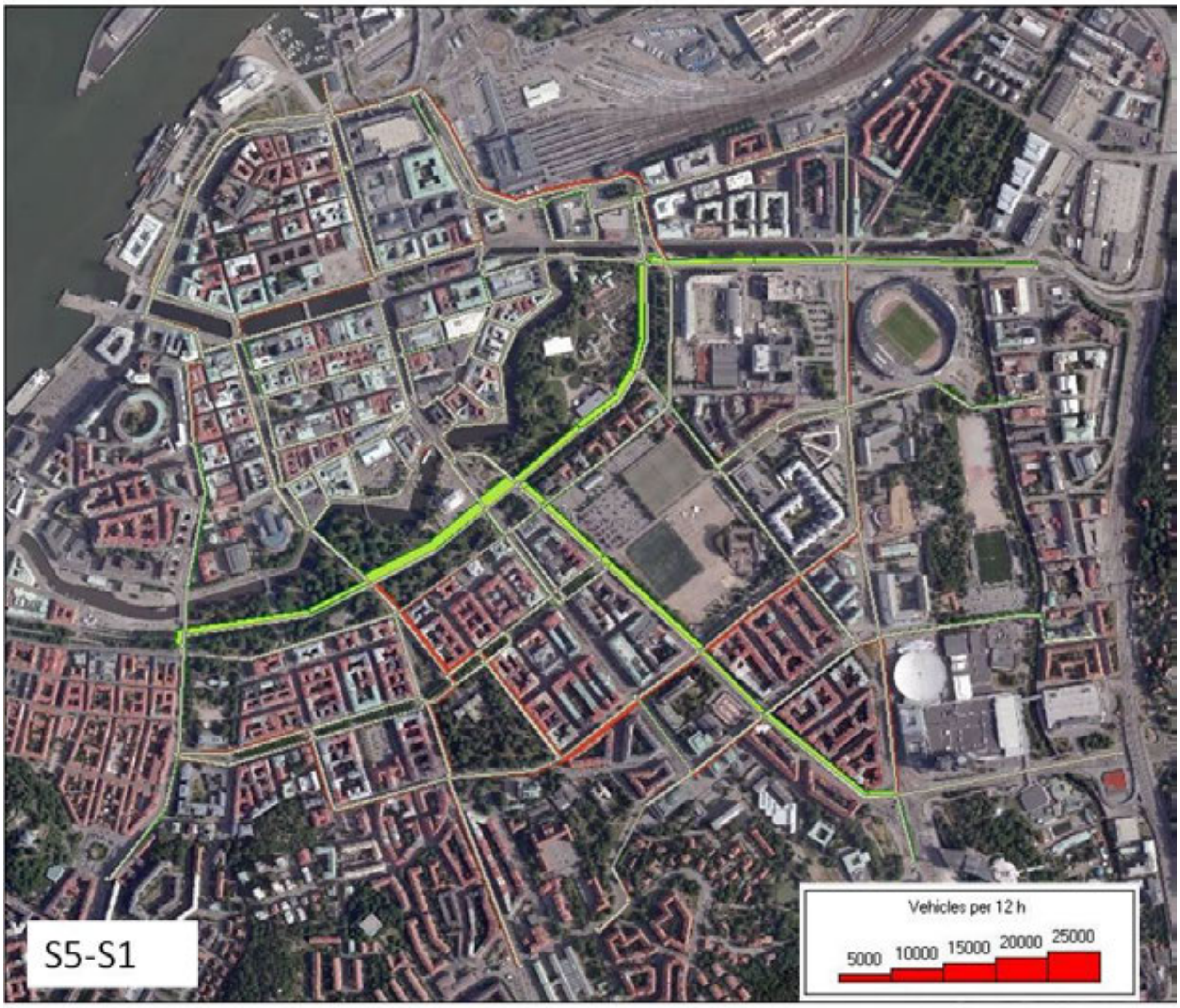

Figure 2.4.3 Scenario 5 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

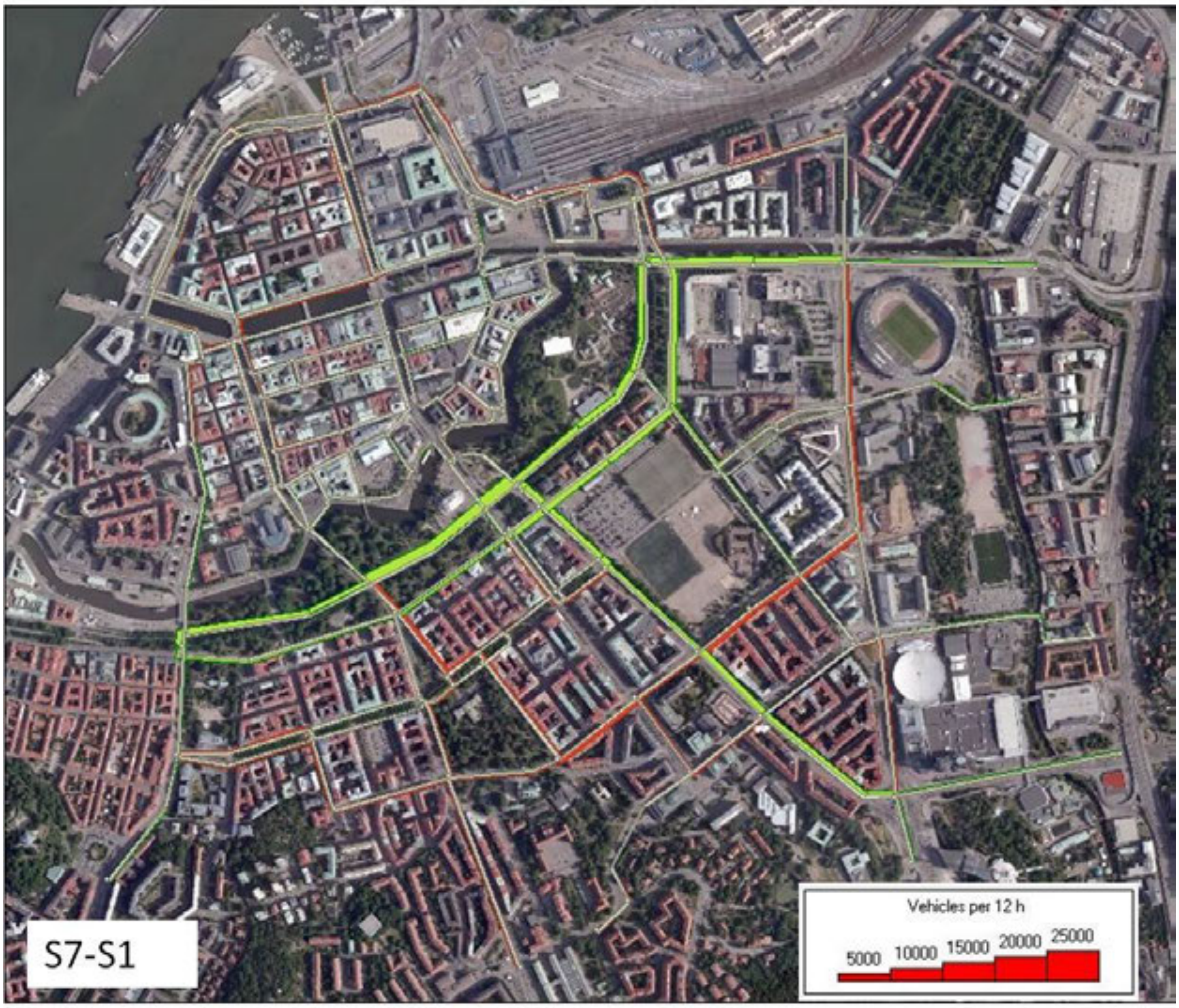

Figure 2.4.4 Scenario 7 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

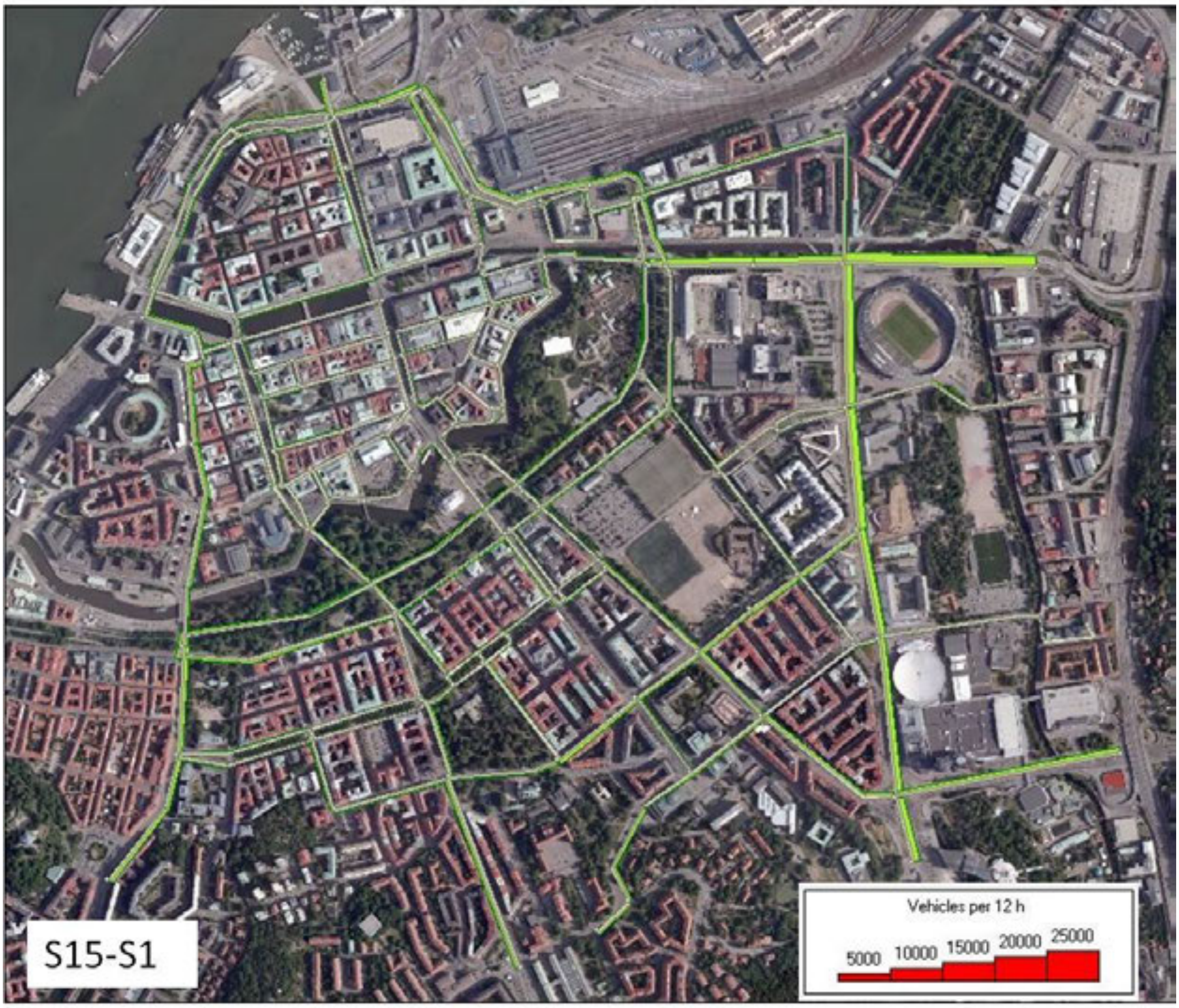

Figure 2.4.5 Scenario 15 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

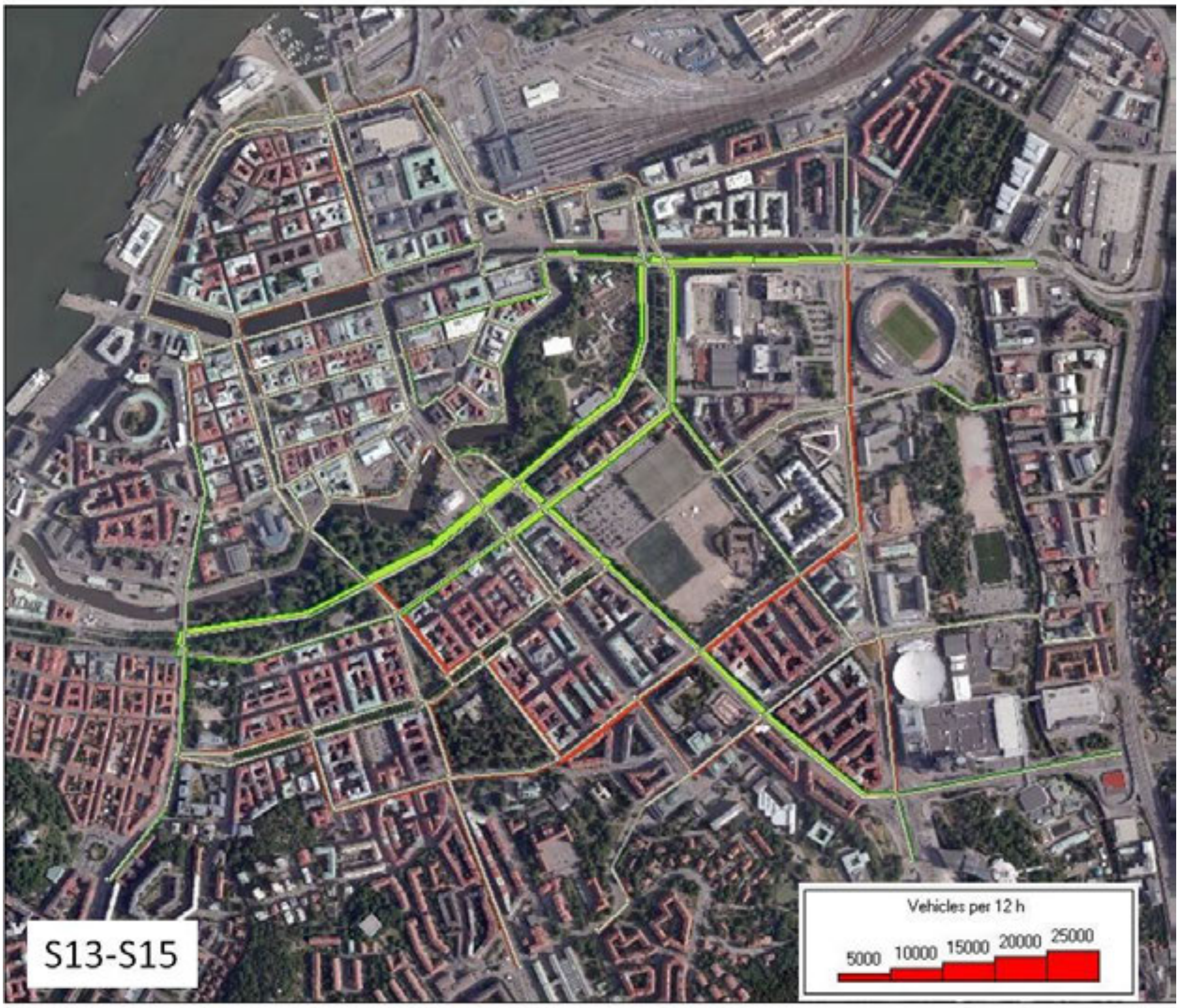

Figure 2.4.6 Scenario 13 difference from Scenario 15 standard vehicle traffic volumes (increase in red, decrease in green)

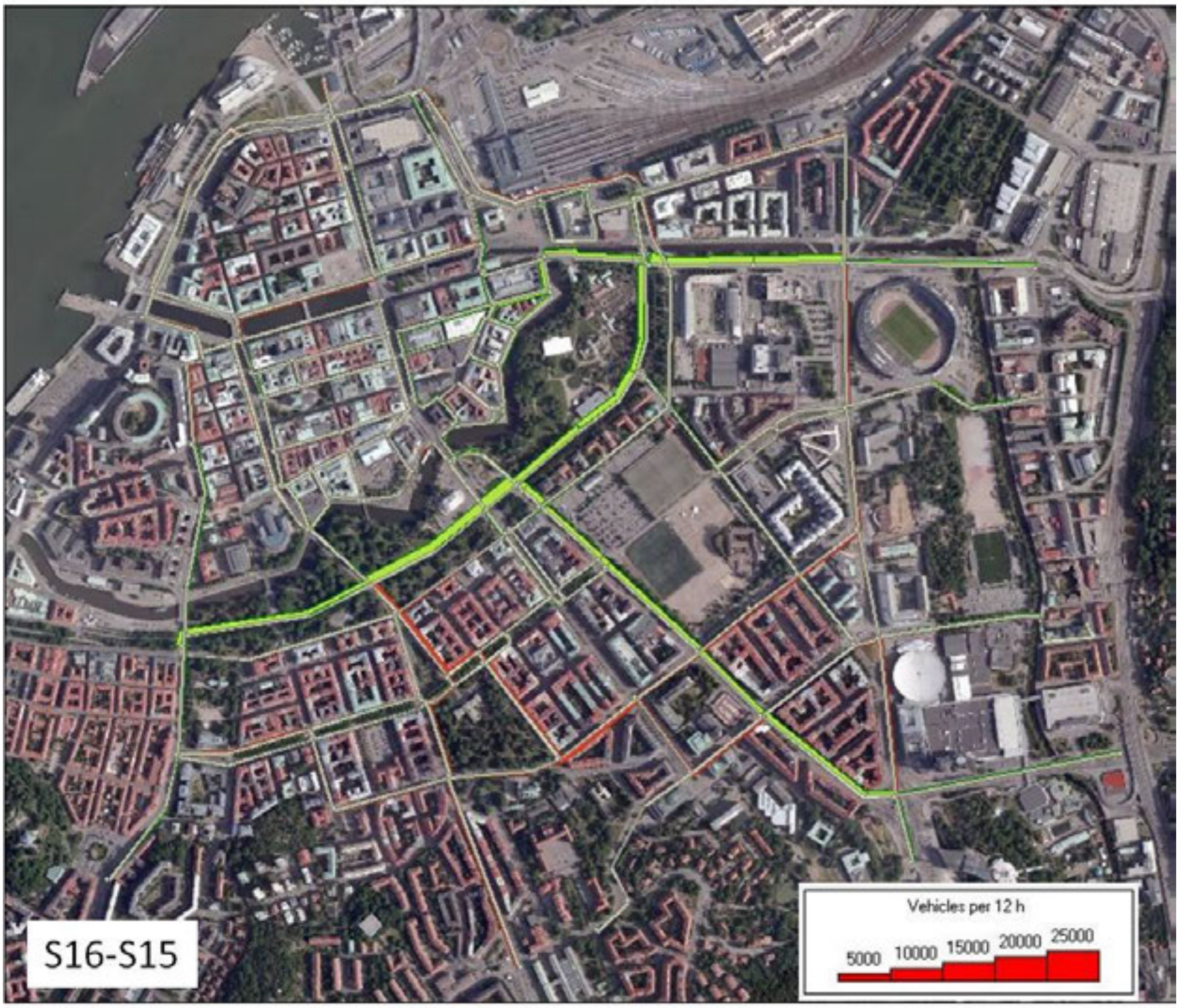

Figure 2.4.7 Scenario 16 difference from Scenario 15 standard vehicle traffic volumes (increase in red, decrease in green)

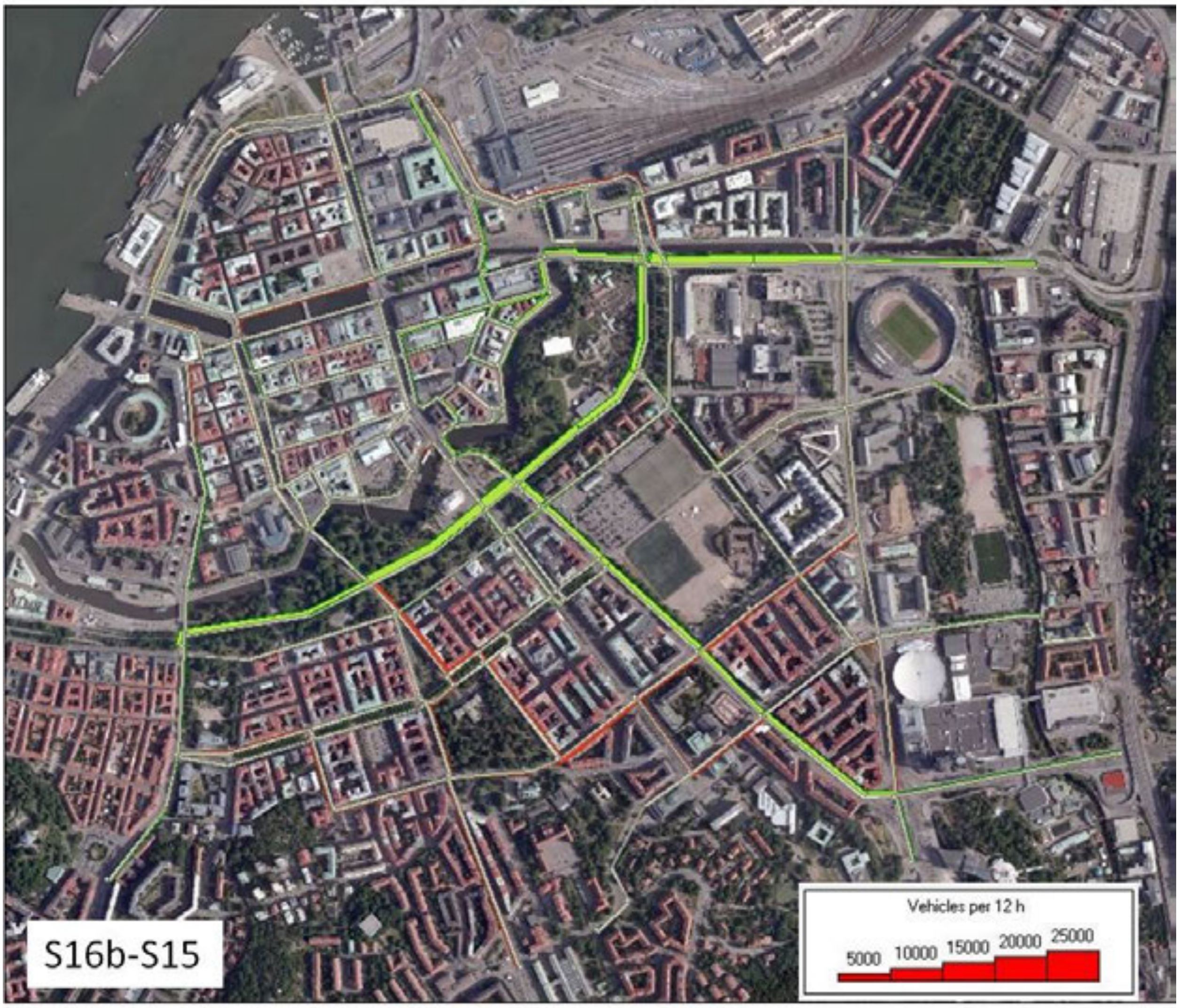

Figure 2.4.8 Scenario 16b difference from Scenario 15 standard vehicle traffic volumes (increase in red, decrease in green)

2.5 STOCKHOLM

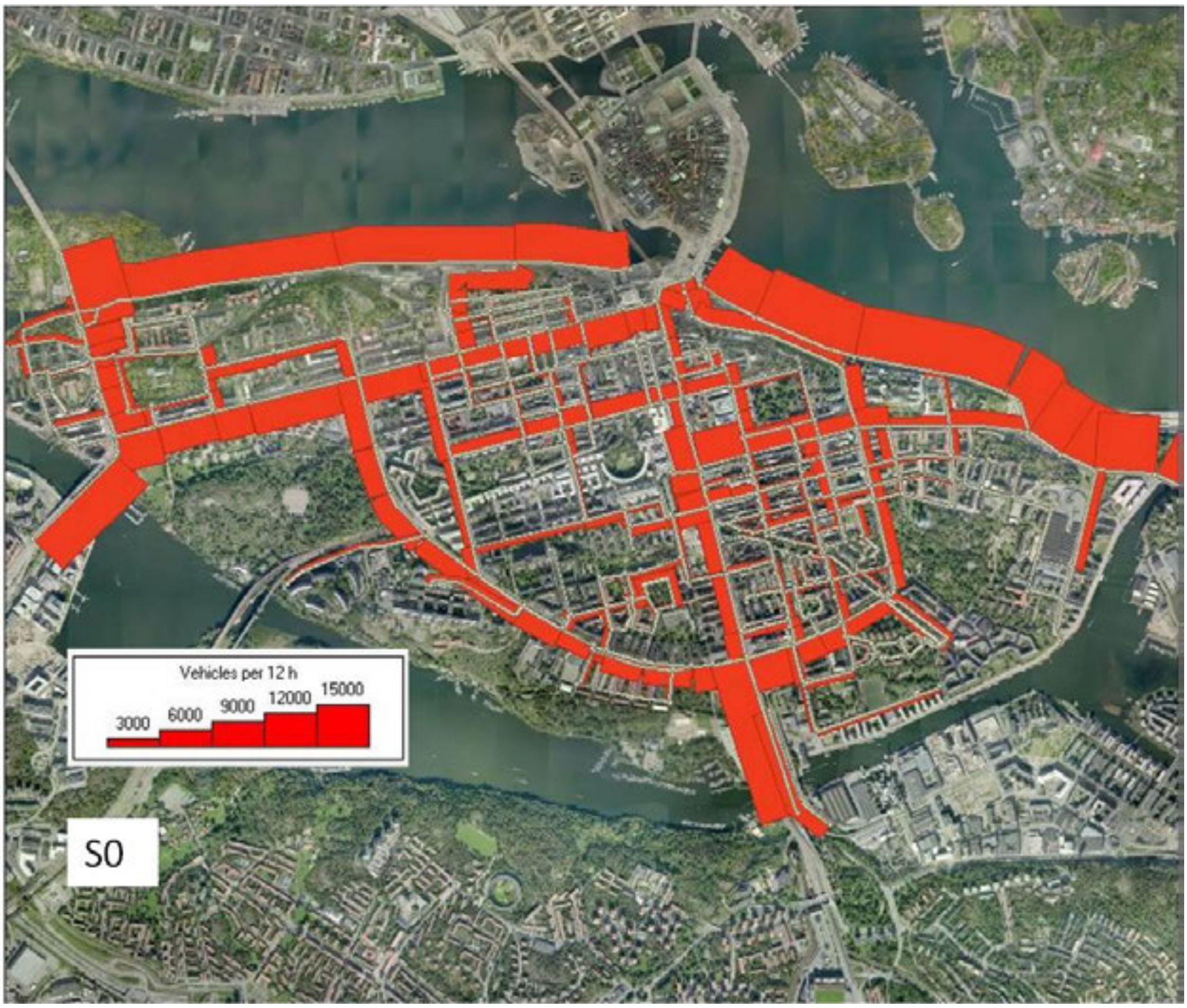

Figure 2.5.1 Base case standard vehicles traffic volumes for Stockholm

In figure 2.5.1, standard vehicle (99 percent of all vehicles) traffic volumes are presented as bands along the road links, the bandwidth being proportional to traffic volumes as is shown on the scale. In the following figures, differences from the Base Case are shown for the different scenarios. In these figures, traffic volume reductions are visualized using green colour, and increased volumes are visualized using green colour.

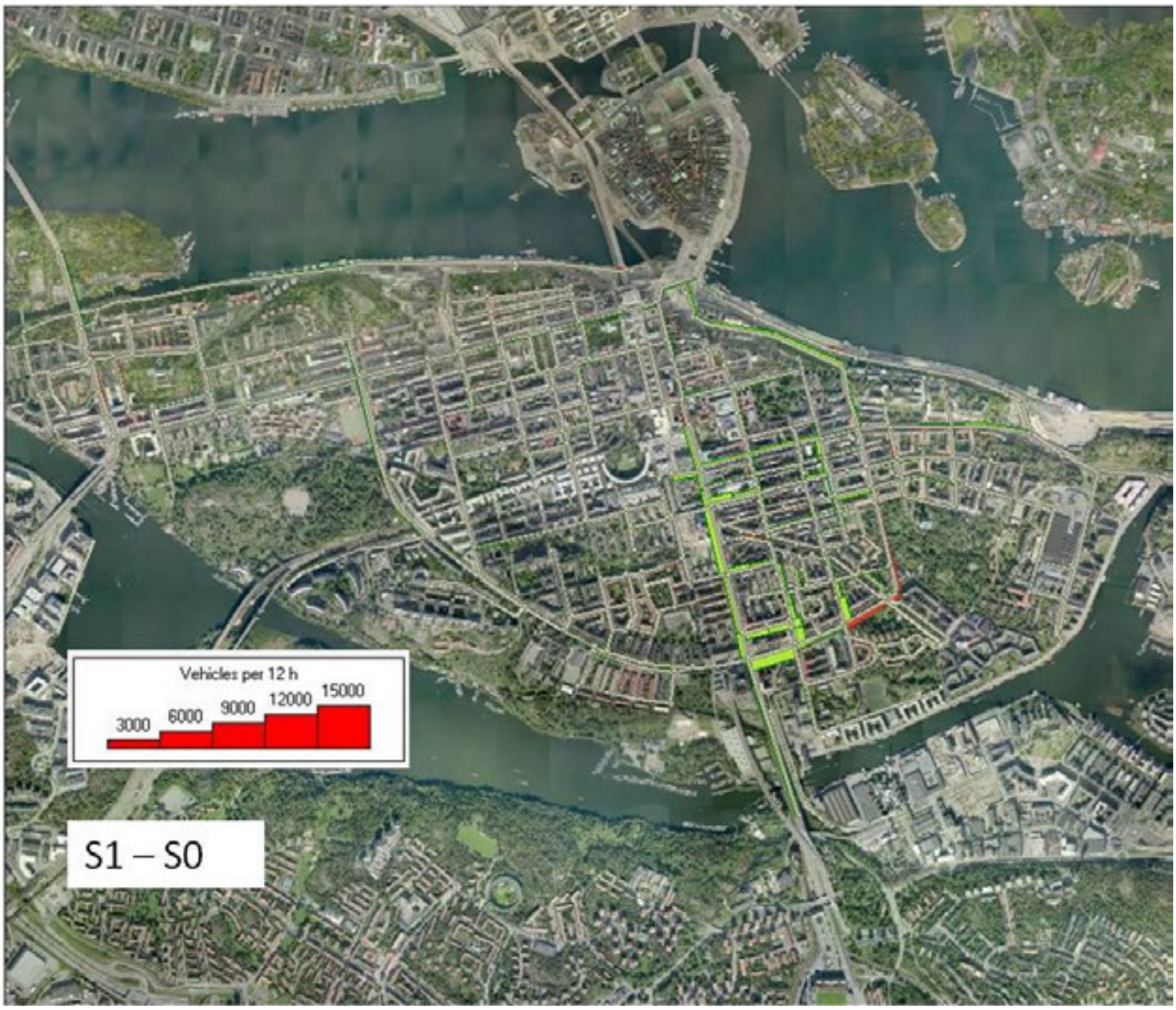

Figure 2.5.2 Scenario 1 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

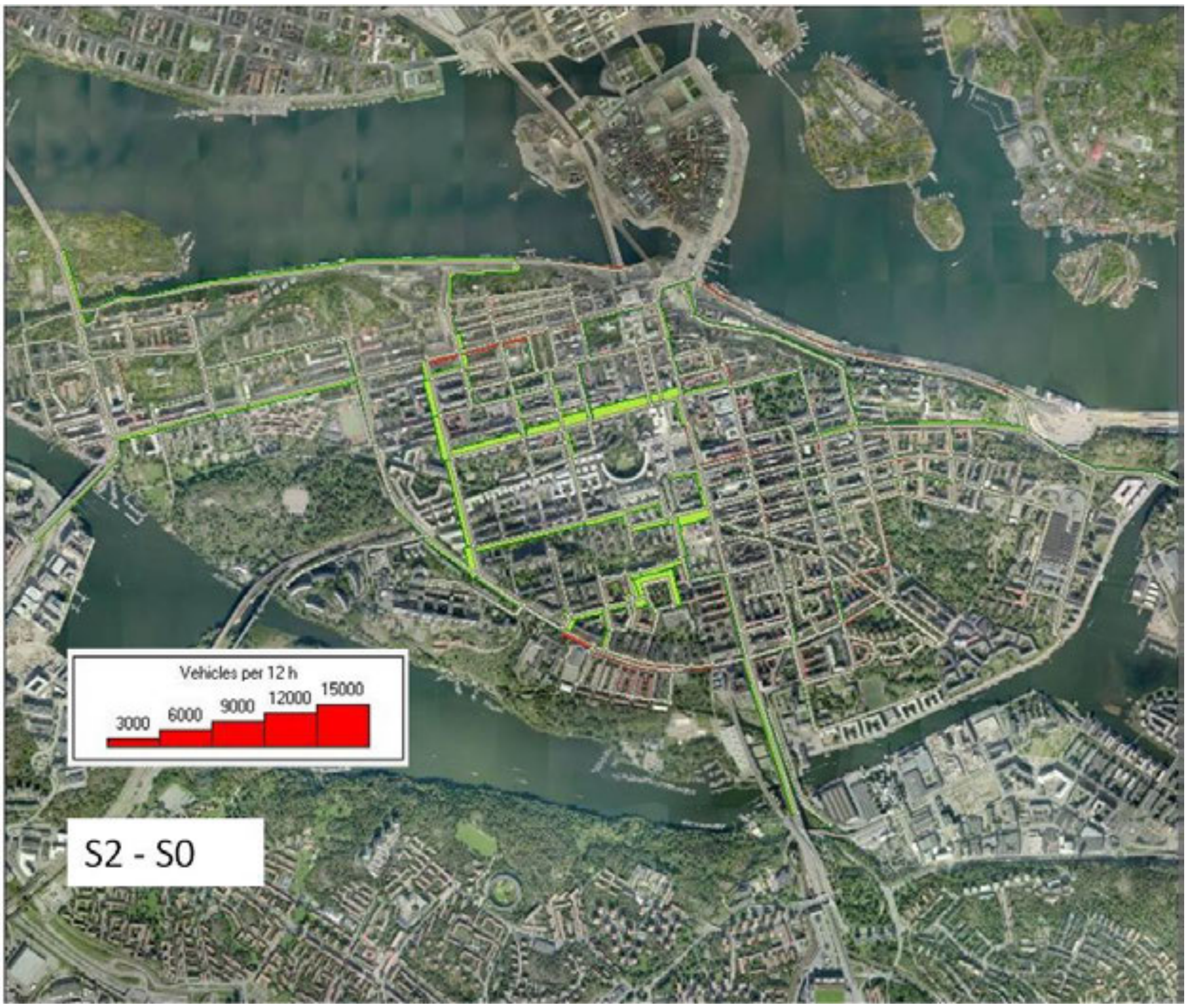

Figure 2.5.3 Scenario 1 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

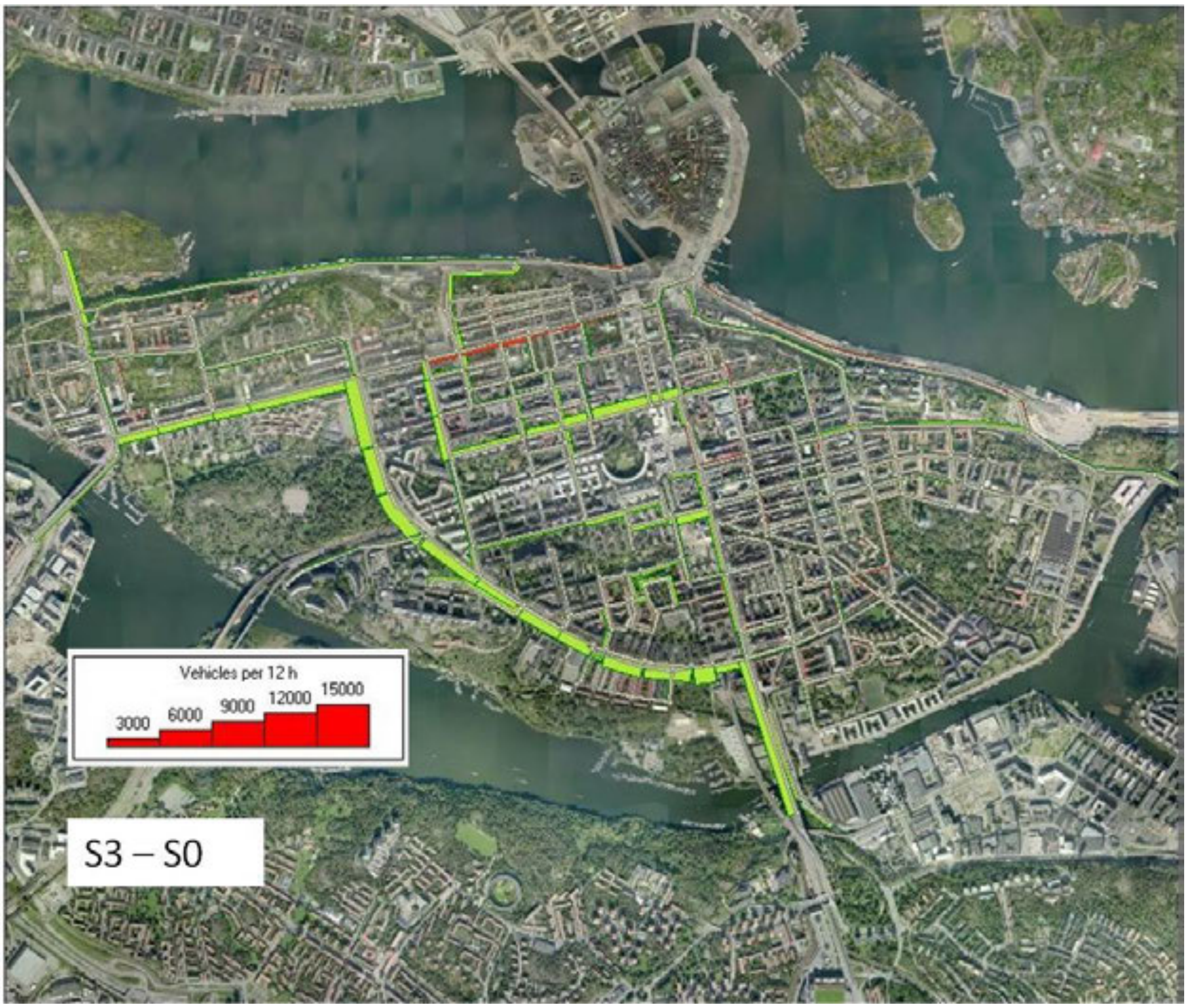

Figure 2.5.4 Scenario 3 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

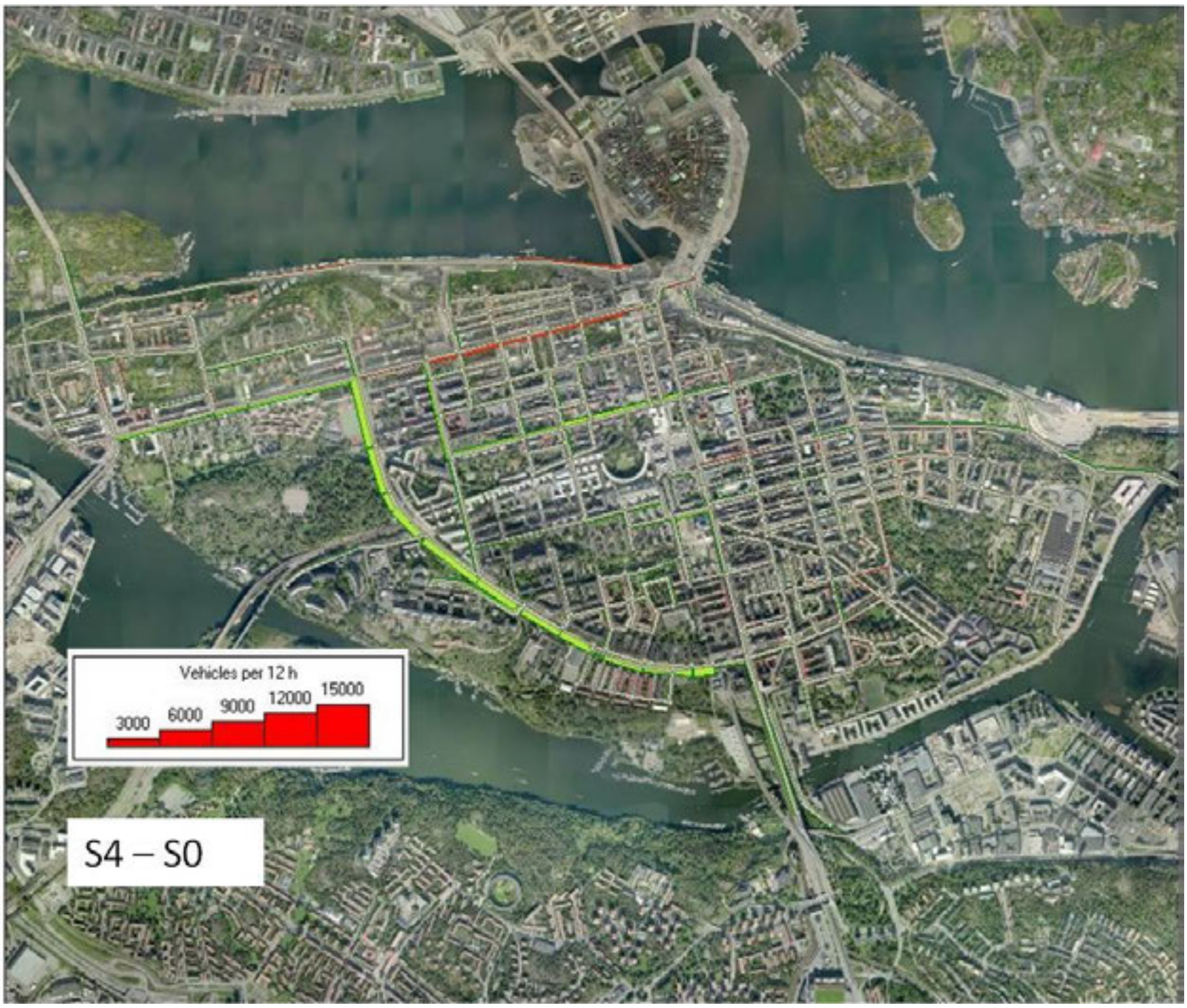

Figure 2.5.5 Scenario 4 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

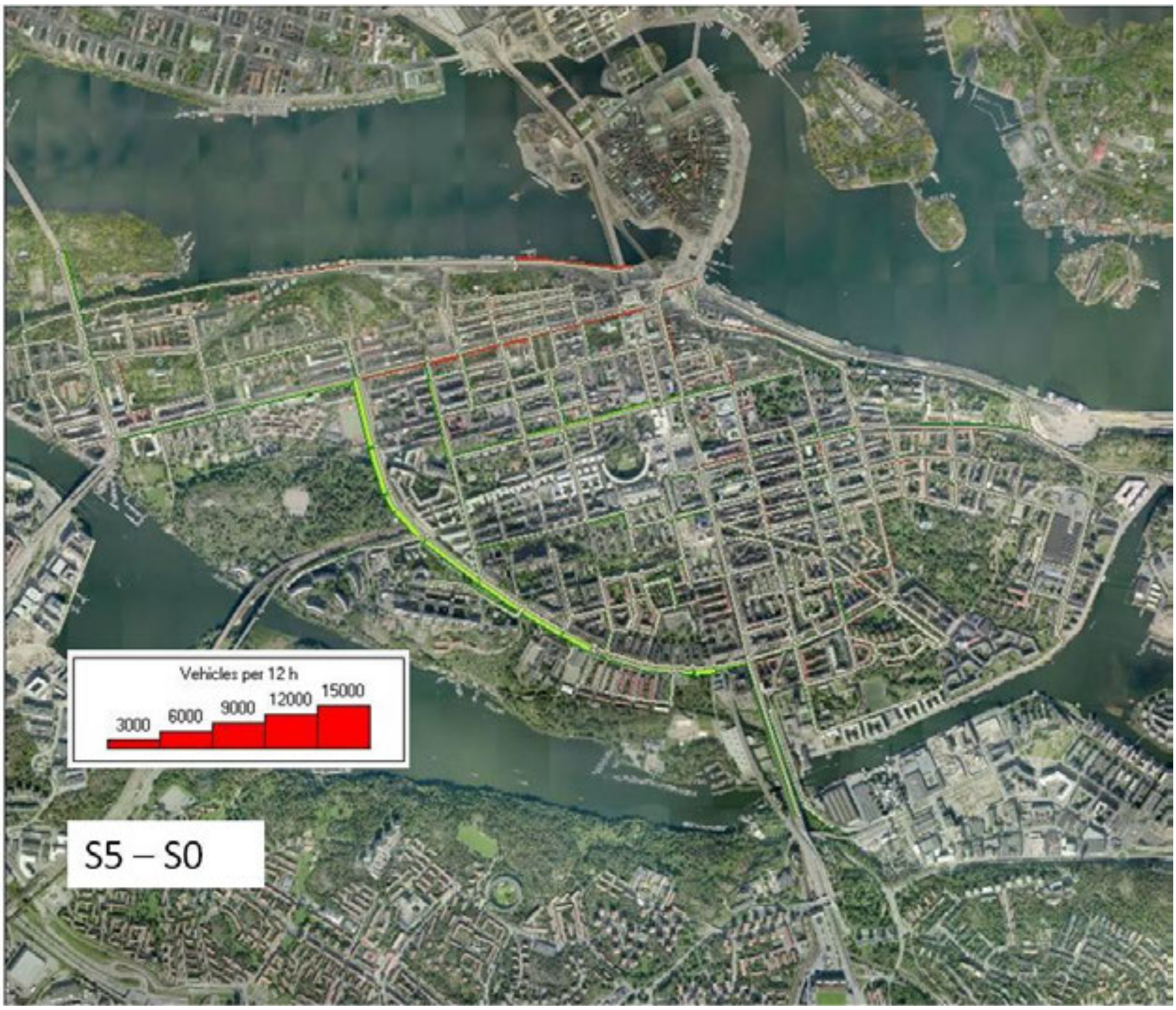

Figure 2.5.6 Scenario 5 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

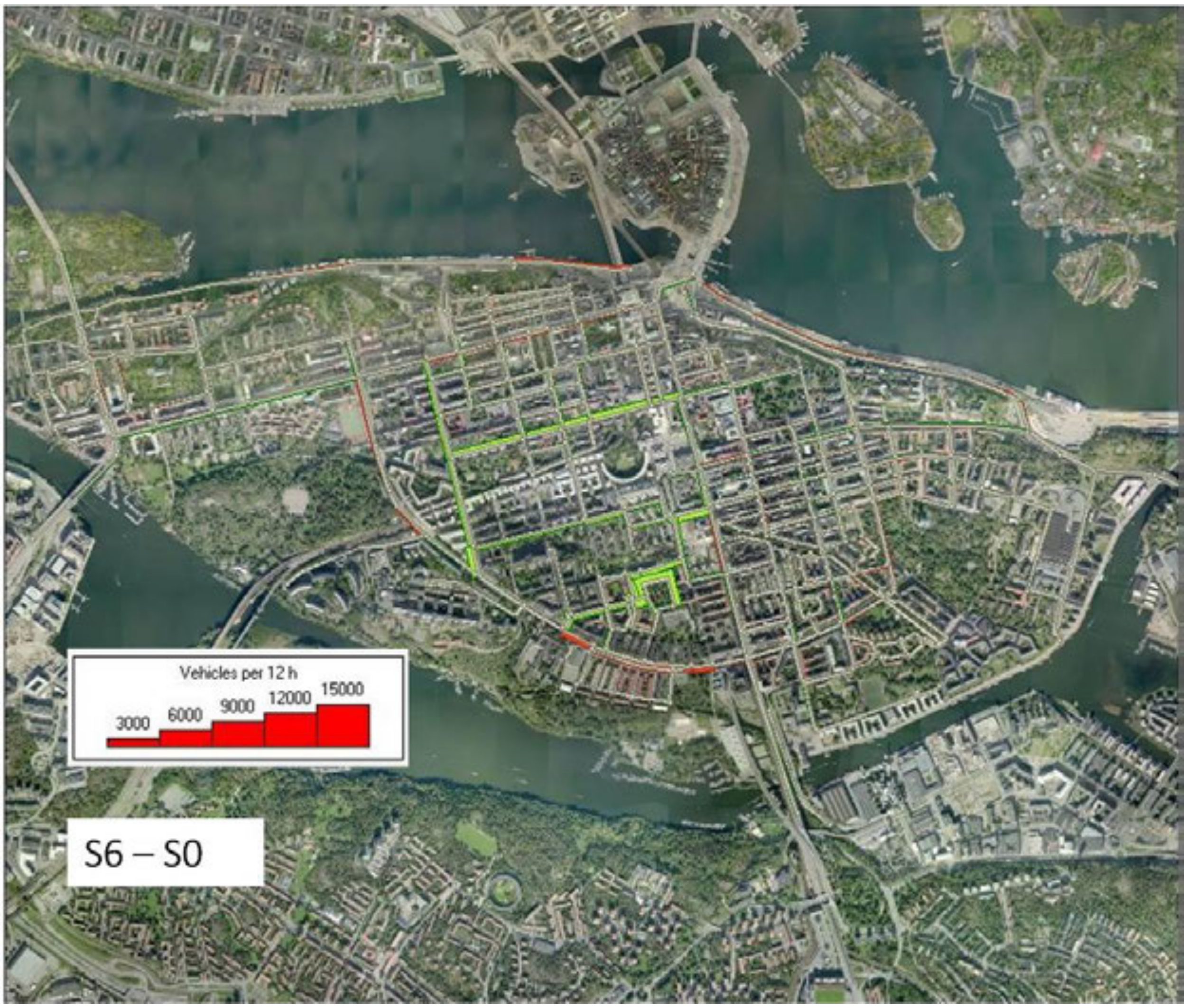

Figure 2.5.7 Scenario 6 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

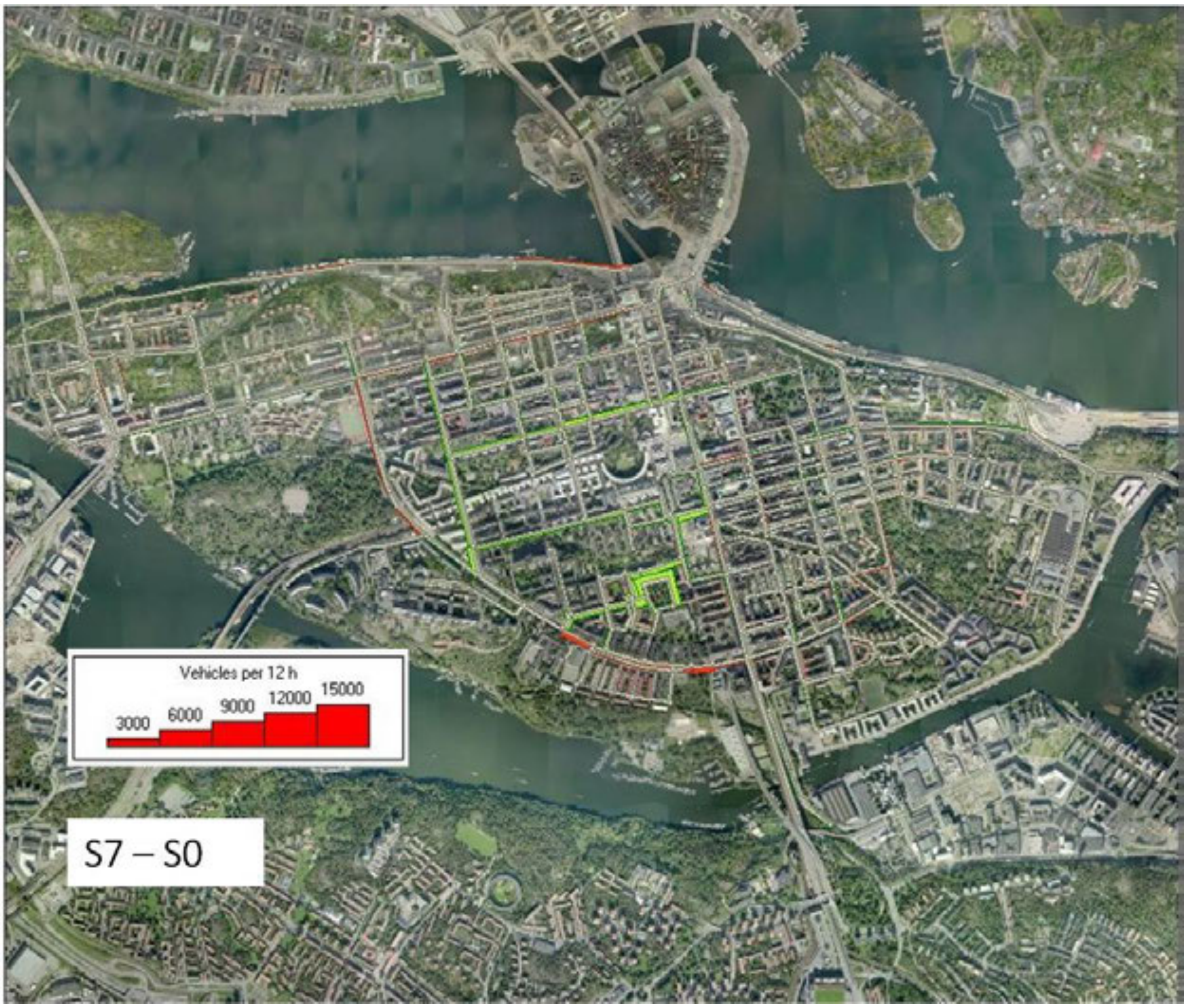

Figure 2.5.8 Scenario 7 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

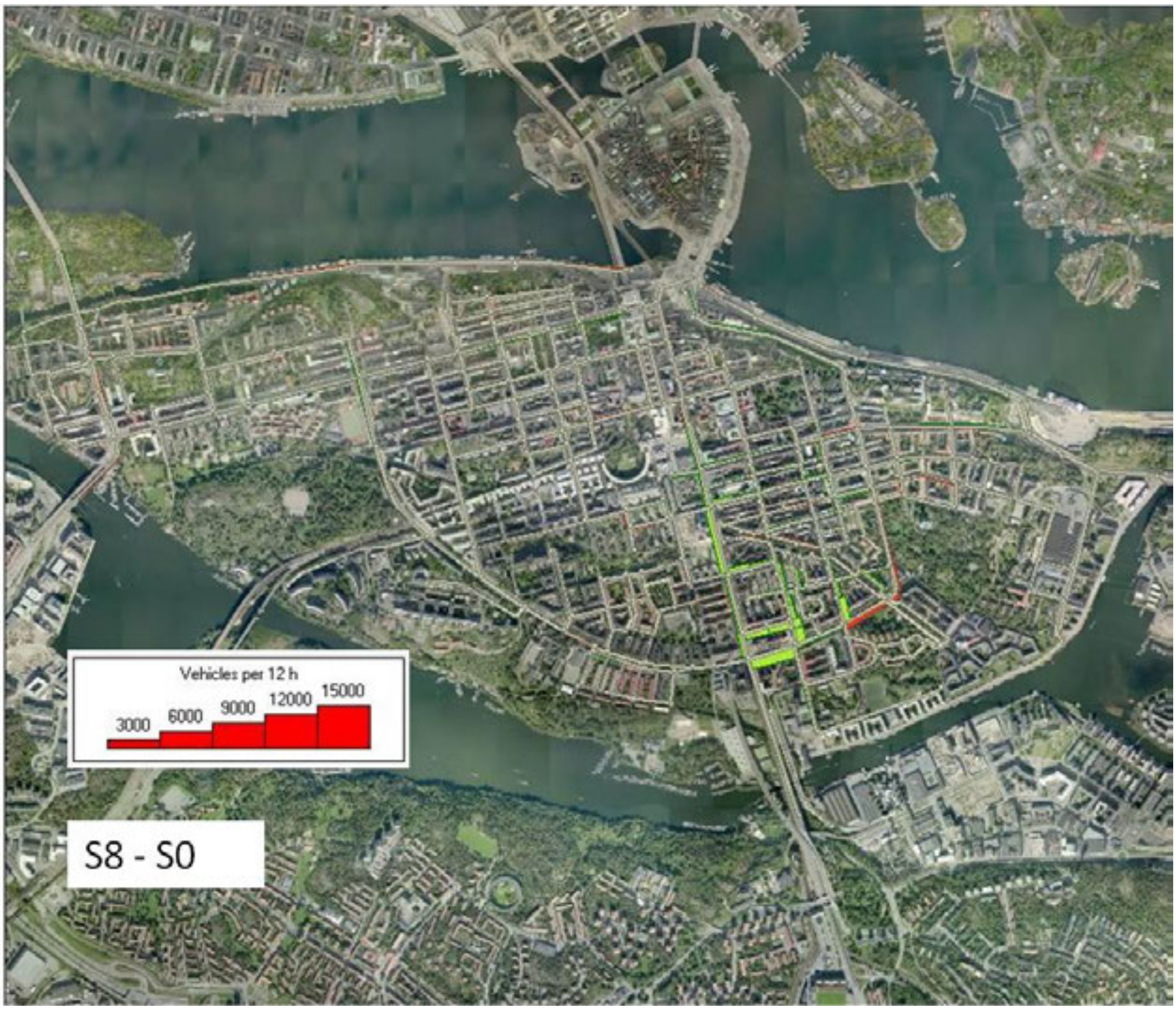

Figure 2.5.9 Scenario 8 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

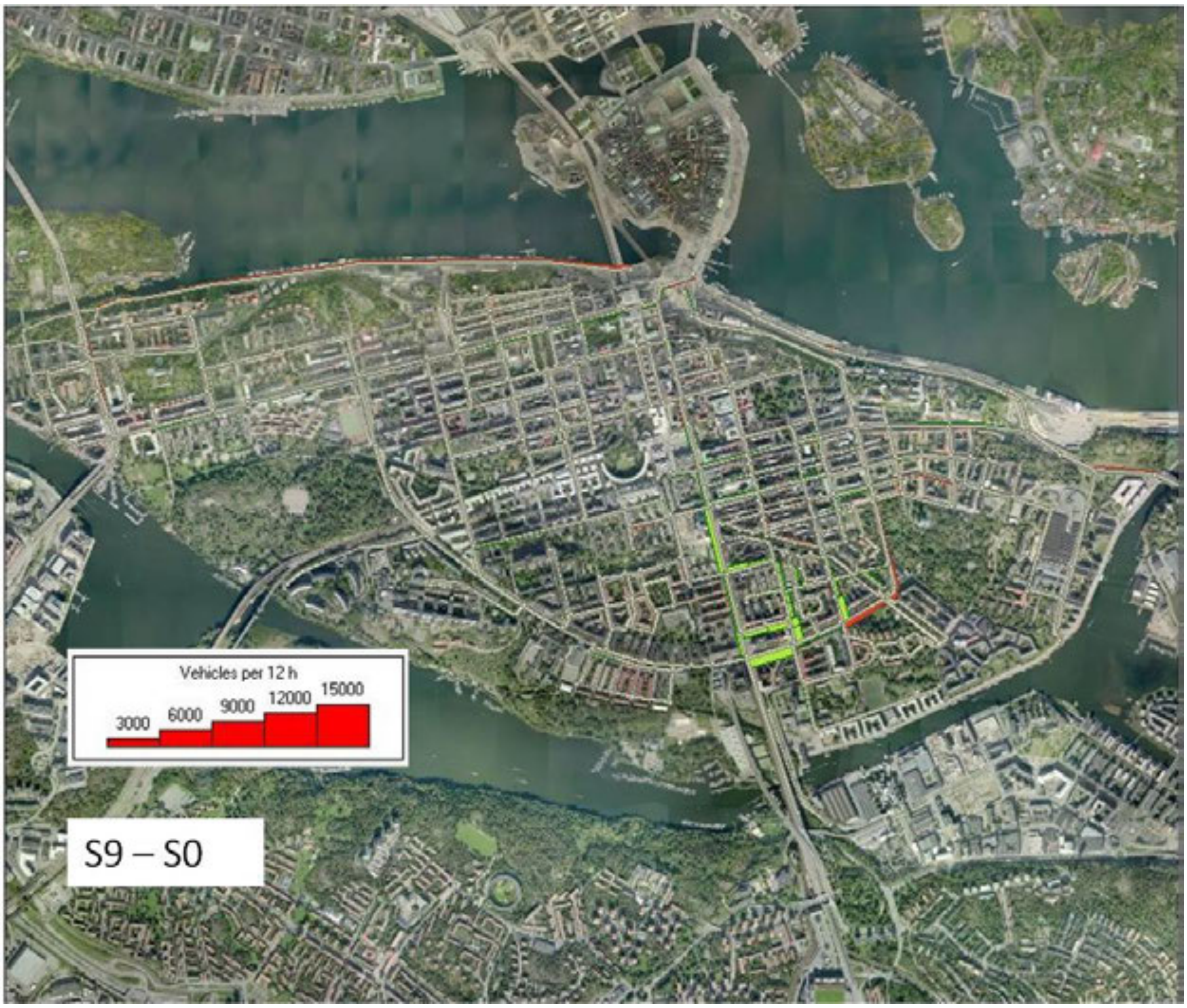

Figure 2.5.10 Scenario 9 difference from Base case standard vehicle traffic volumes (increase in red, decrease in green)

Figure 2.5.11 Scenario 10 difference from Scenario 14 standard vehicle traffic volumes (increase in red, decrease in green)

Figure 2.5.12 Scenario 11 difference from Scenario 14 standard vehicle traffic volumes (increase in red, decrease in green)

Figure 2.5.13 Scenario 15 difference from Base Case standard vehicle traffic volumes (increase in red, decrease in green)

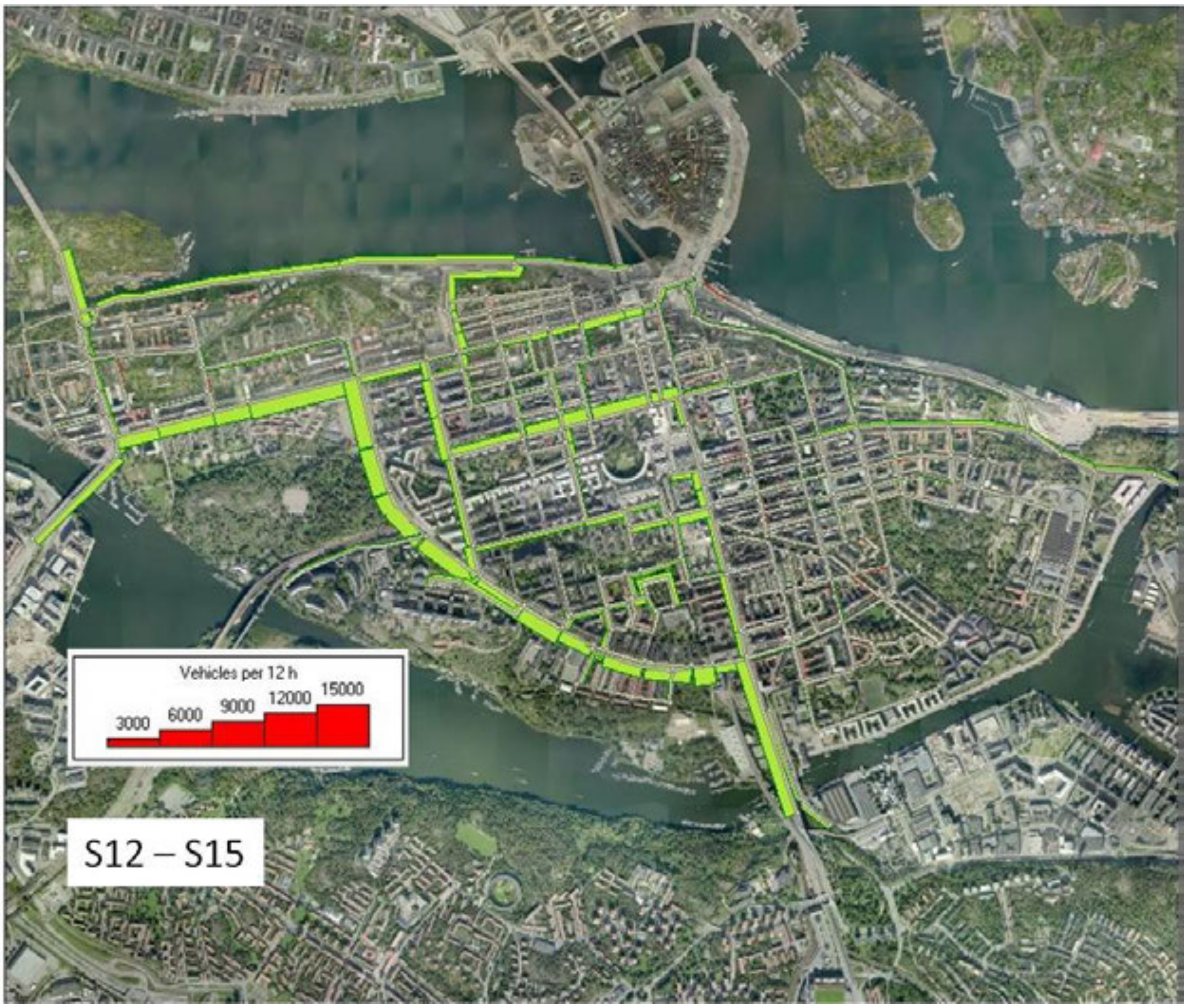

Figure 2.5.14 Scenario 12 difference from Scenario 15 standard vehicle traffic volumes (increase in red, decrease in green)

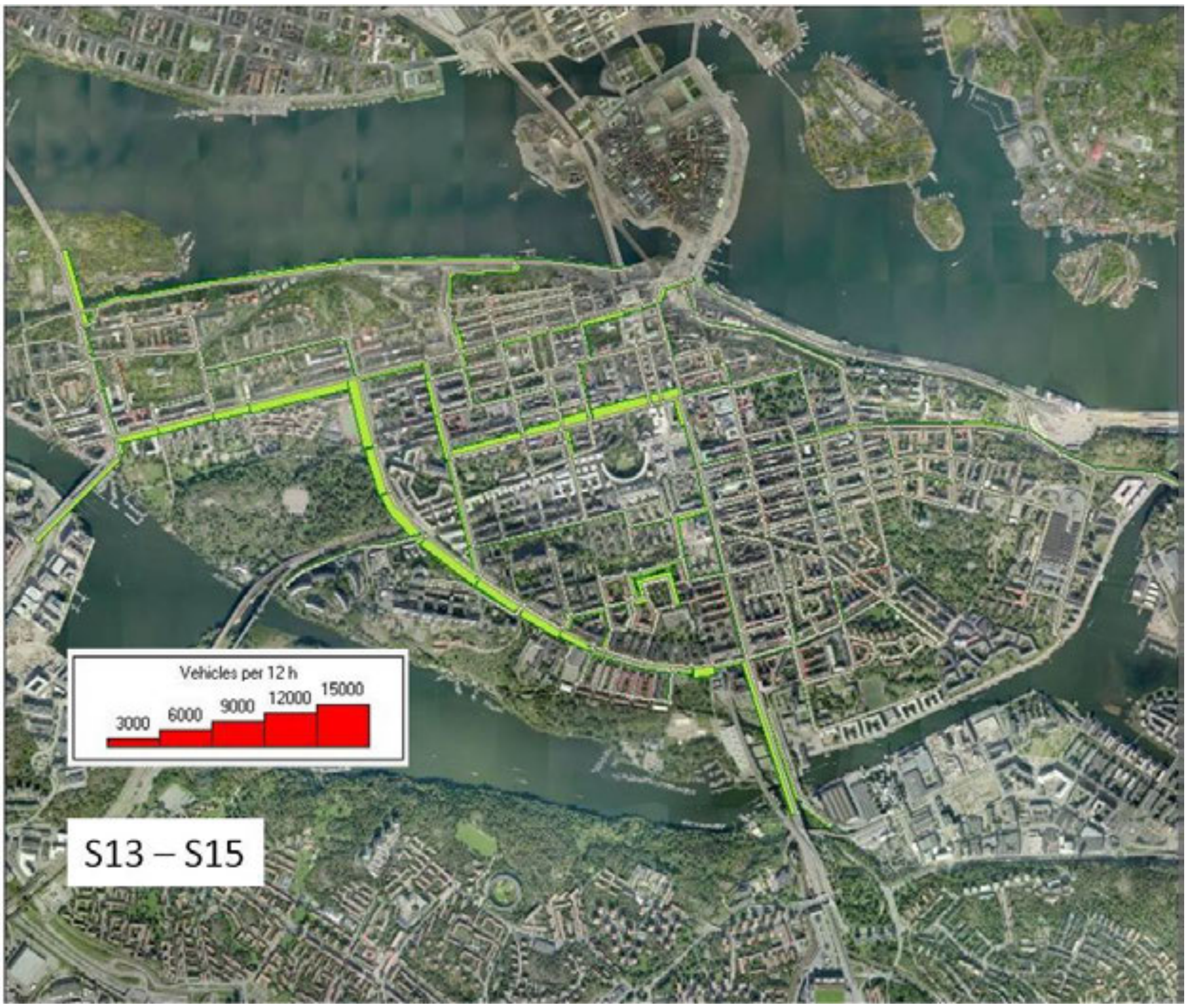

Figure 2.5.15 Scenario 13 difference from Scenario 15 standard vehicle traffic volumes (increase in red, decrease in green)

Figure 2.5.16 Scenario 16 difference from Scenario 15 standard vehicle traffic volumes (increase in red, decrease in green)

3 ADDITIONAL NOISE MAPPING RESULTS

In this chapter, noise maps from all scenarios will be presented for each site. The figures represent noise levels as well as differences from the base case.

3.1 BRATISLAVA

To provide a better overview we included the definition of the scenarios once again at this point. For Bratislava, the following set of traffic scenarios was simulated:

Scenario nr	Zone	Fee, Euros/passage	Inside LNVO percentage	External LNVO percentage
1	none	none	1	1
2	large	ban	1	1
3	large	1	1	1
4	large	2	1	1
5	small	ban	1	1
6	small	1	1	1
7	small	2	1	1
8	none	none	5	5
9	large	ban	20	5
10	large	1	20	5
11	large	2	20	5
12	none	none	20	20
13	large	ban	100	20
14	large	1	100	20
15	large	2	100	20

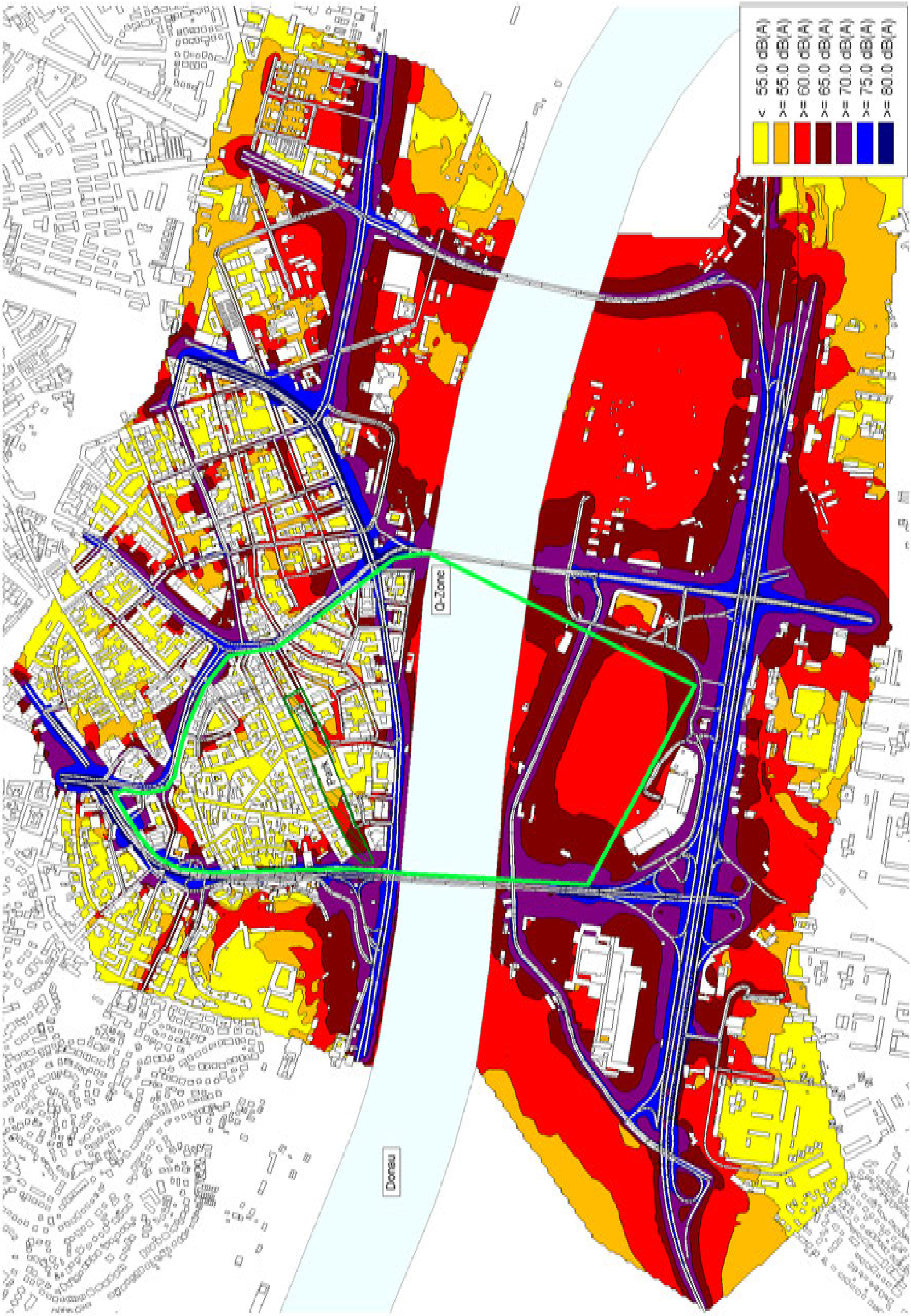

Figure 3.1.1: Bratislava Scenario 1 (S16) - L_{den}

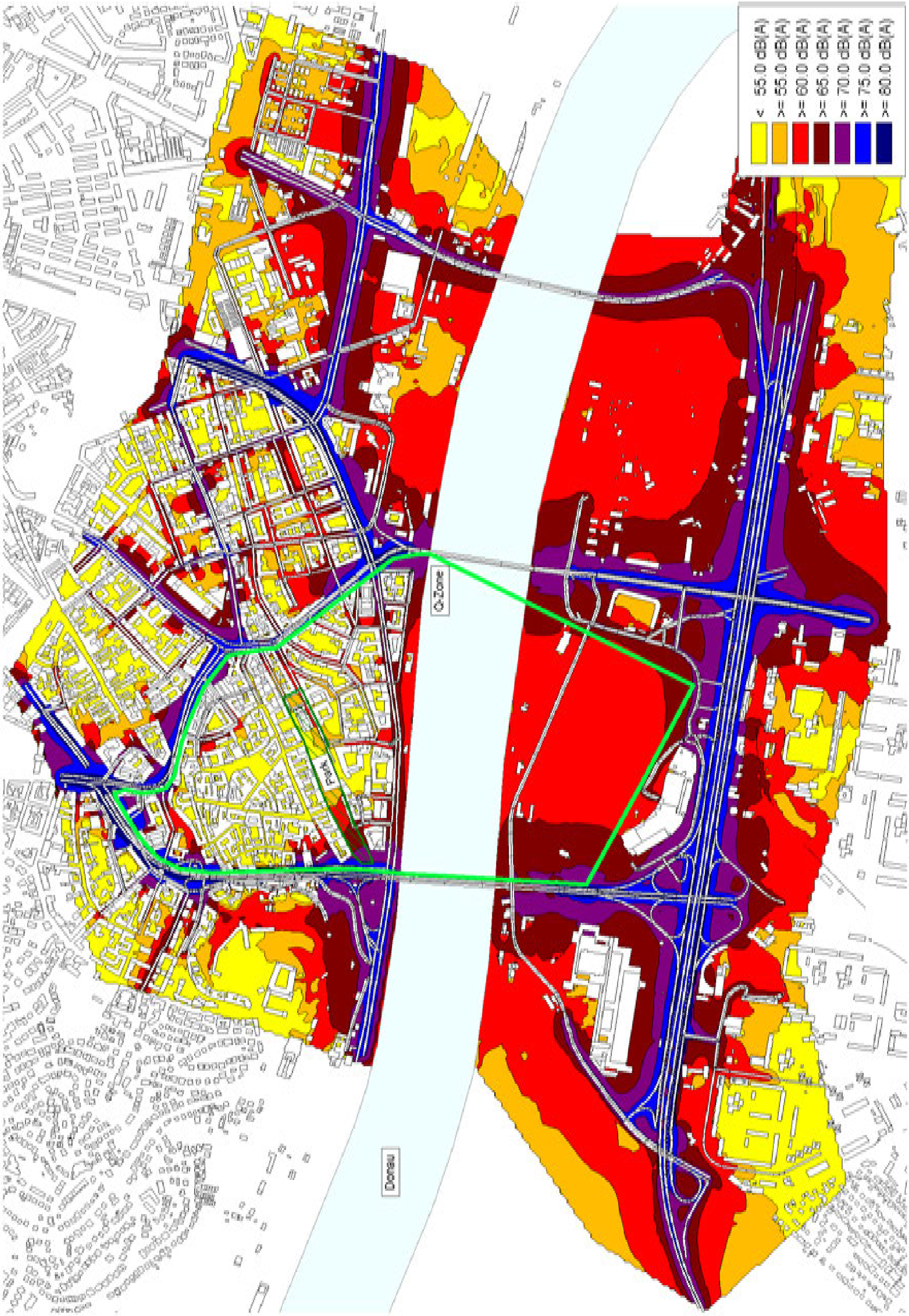

Figure 3.1.2: Bratislava Scenario 2 (S17) - L_{den}

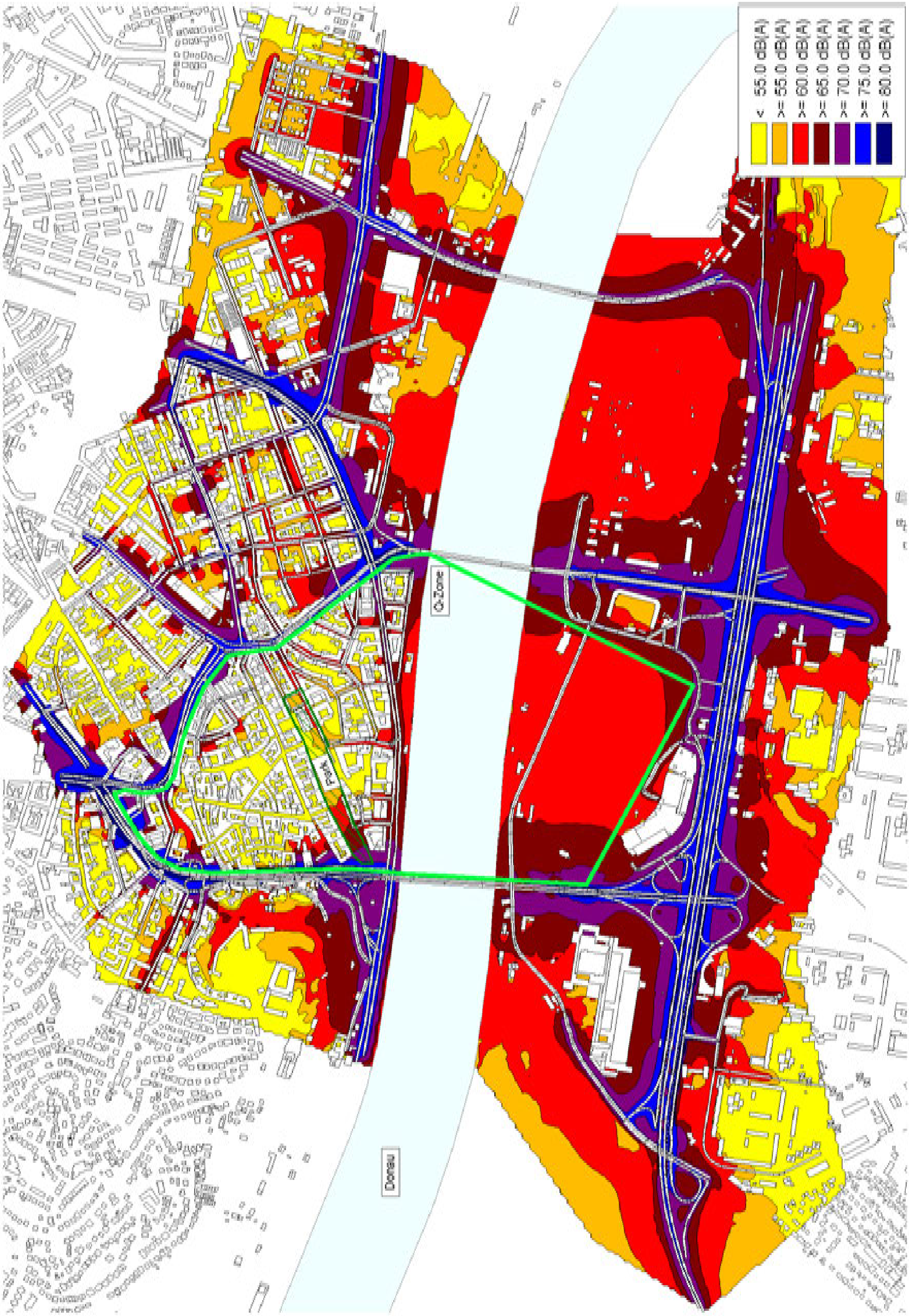

Figure 3.1.3: Bratislava Scenario 3 (S18) - L_{den}

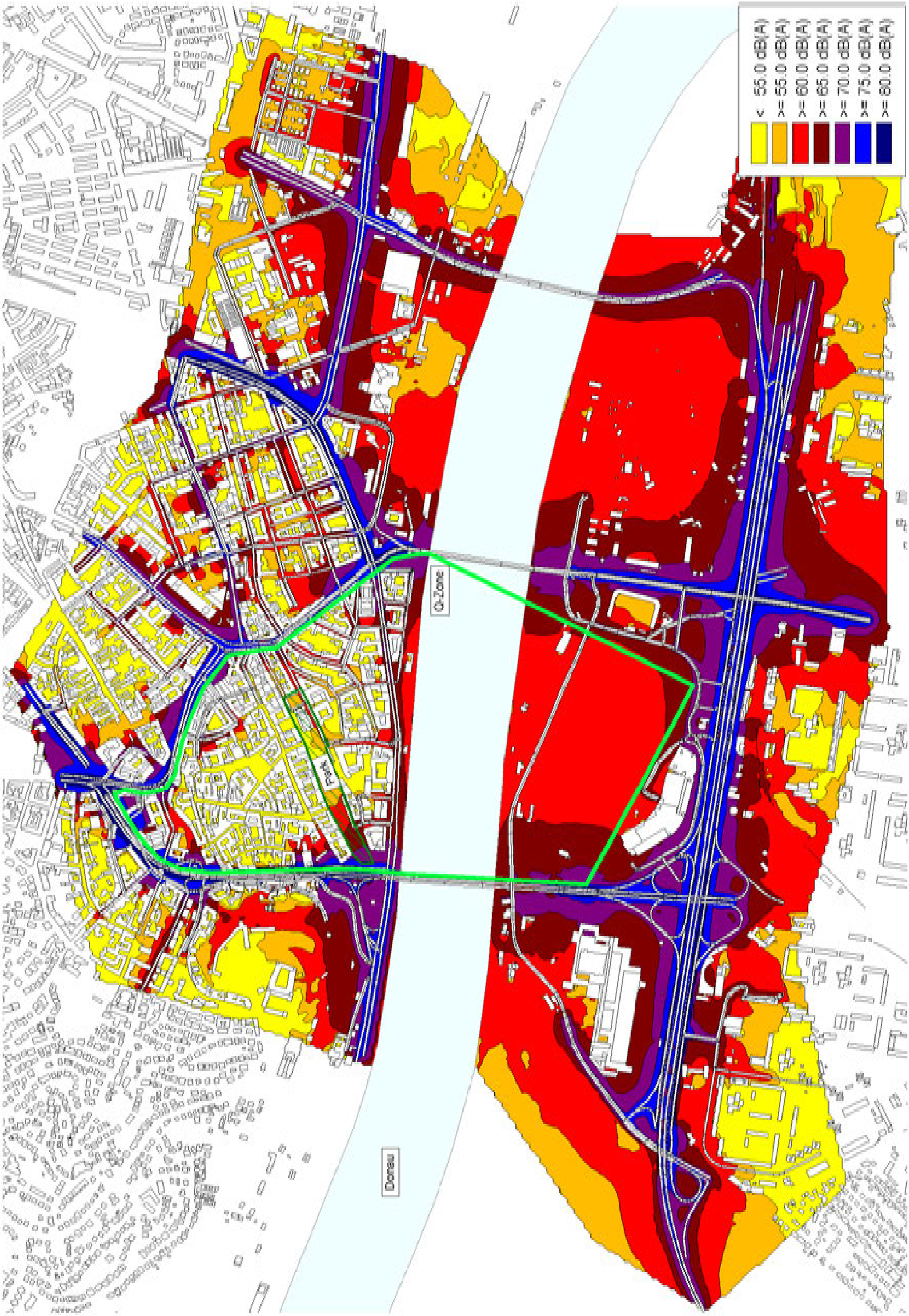

Figure 3.1.4: Bratislava Scenario 4 (S19) – L_{den}

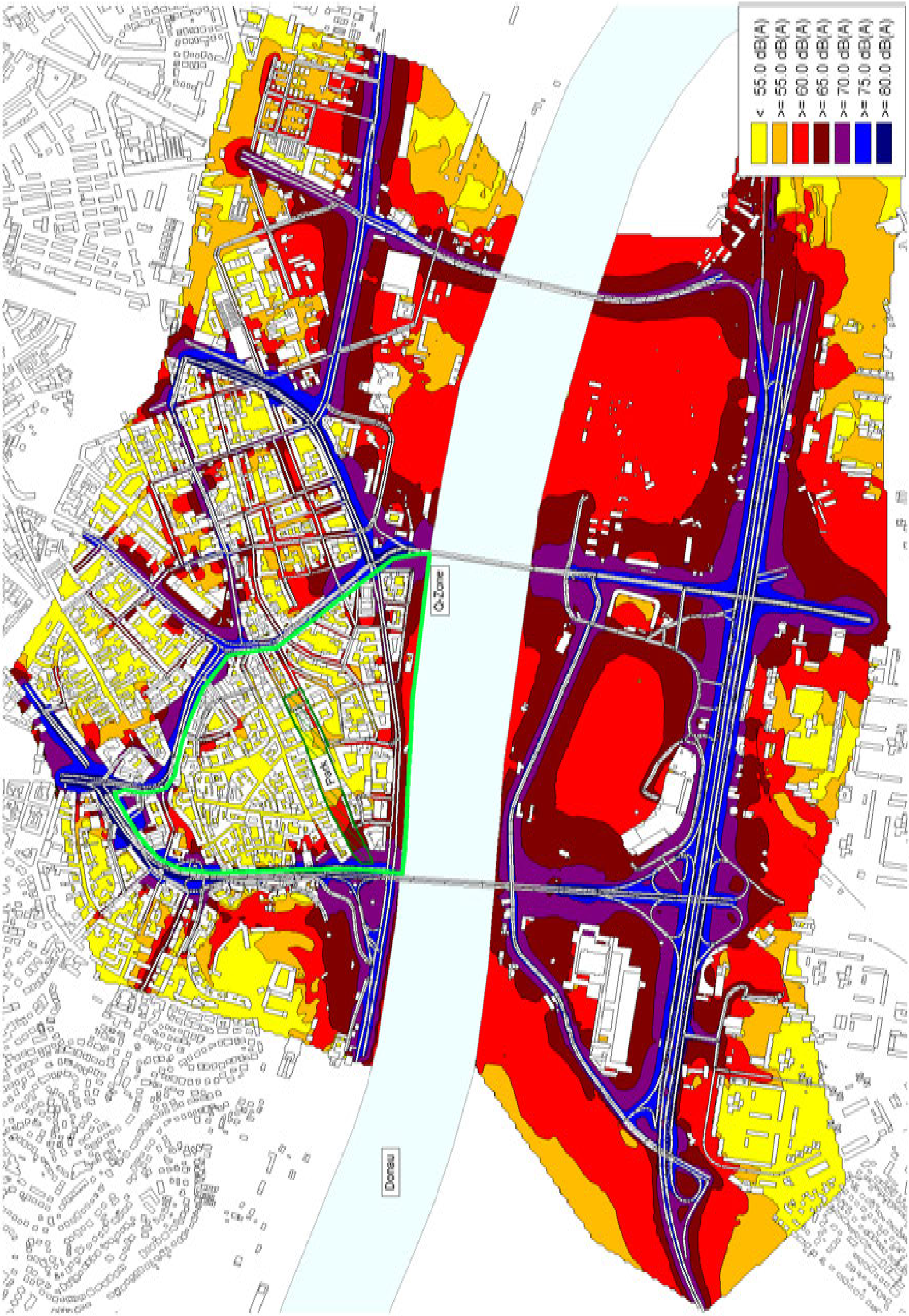

Figure 3.1.5: Bratislava Scenario 5 (S20) – L_{den}

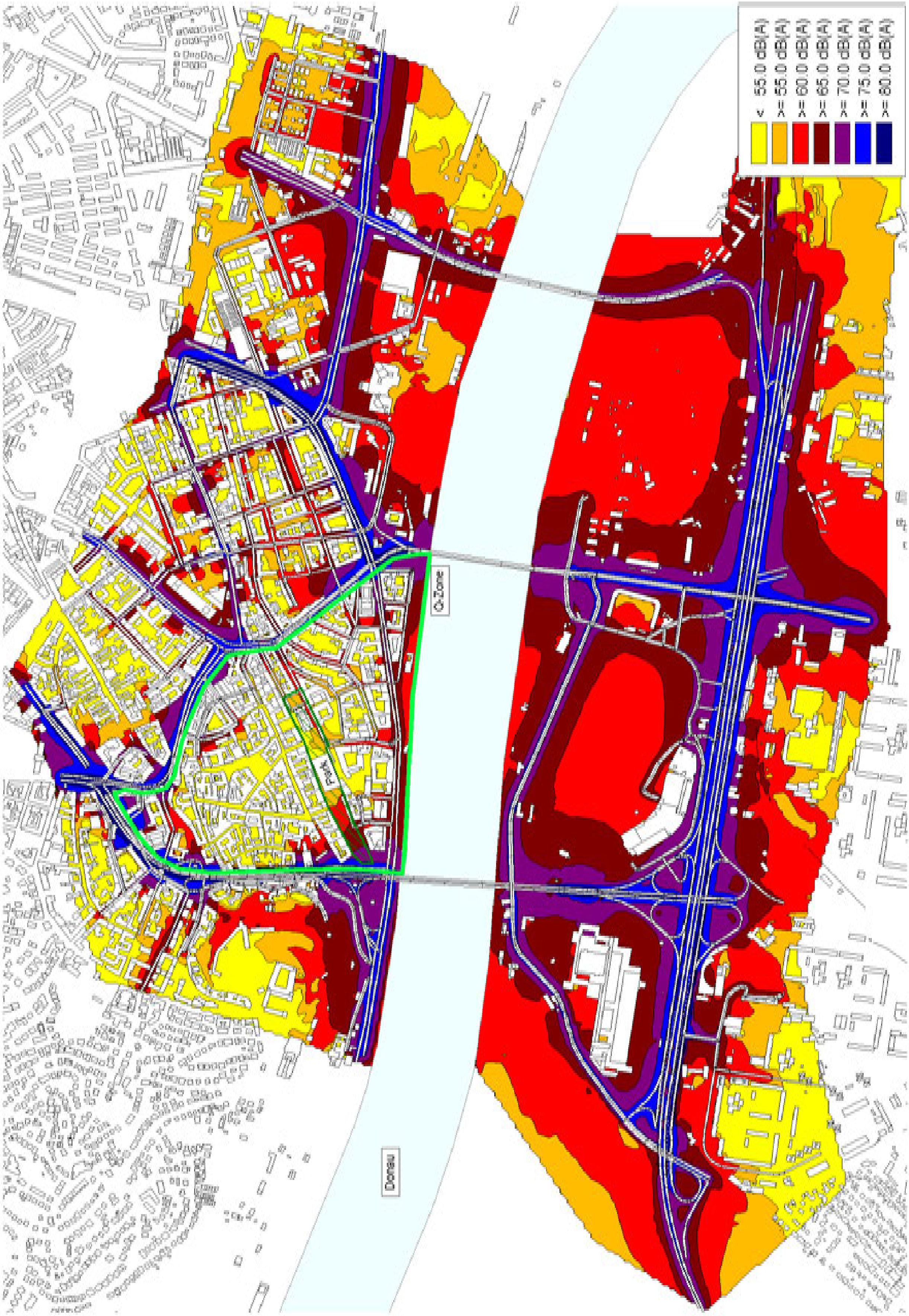

Figure 3.1.6: Bratislava Scenario 6 (S21) – L_{den}

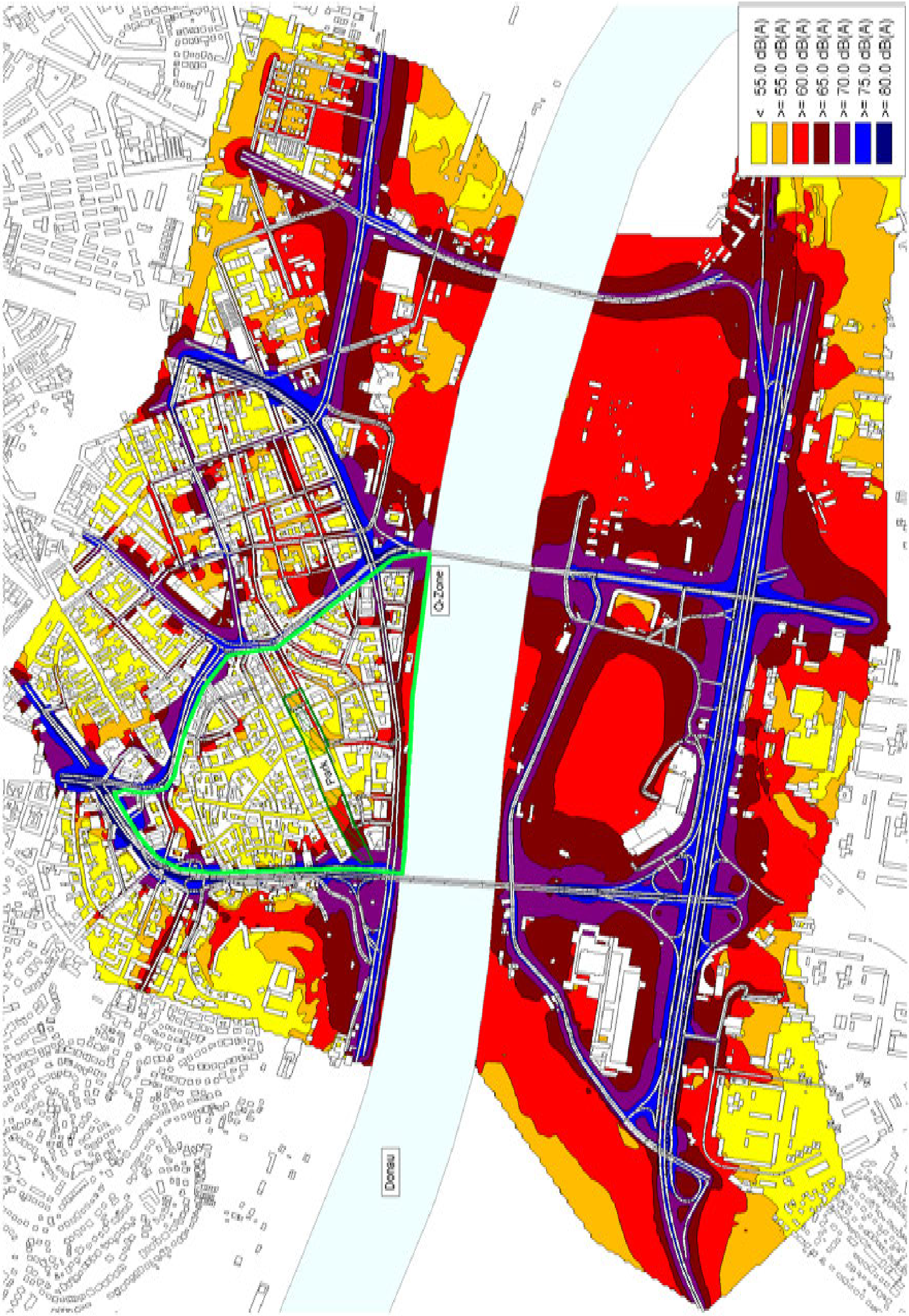

Figure 3.1.7: Bratislava Scenario 7 (S22) – L_{den}

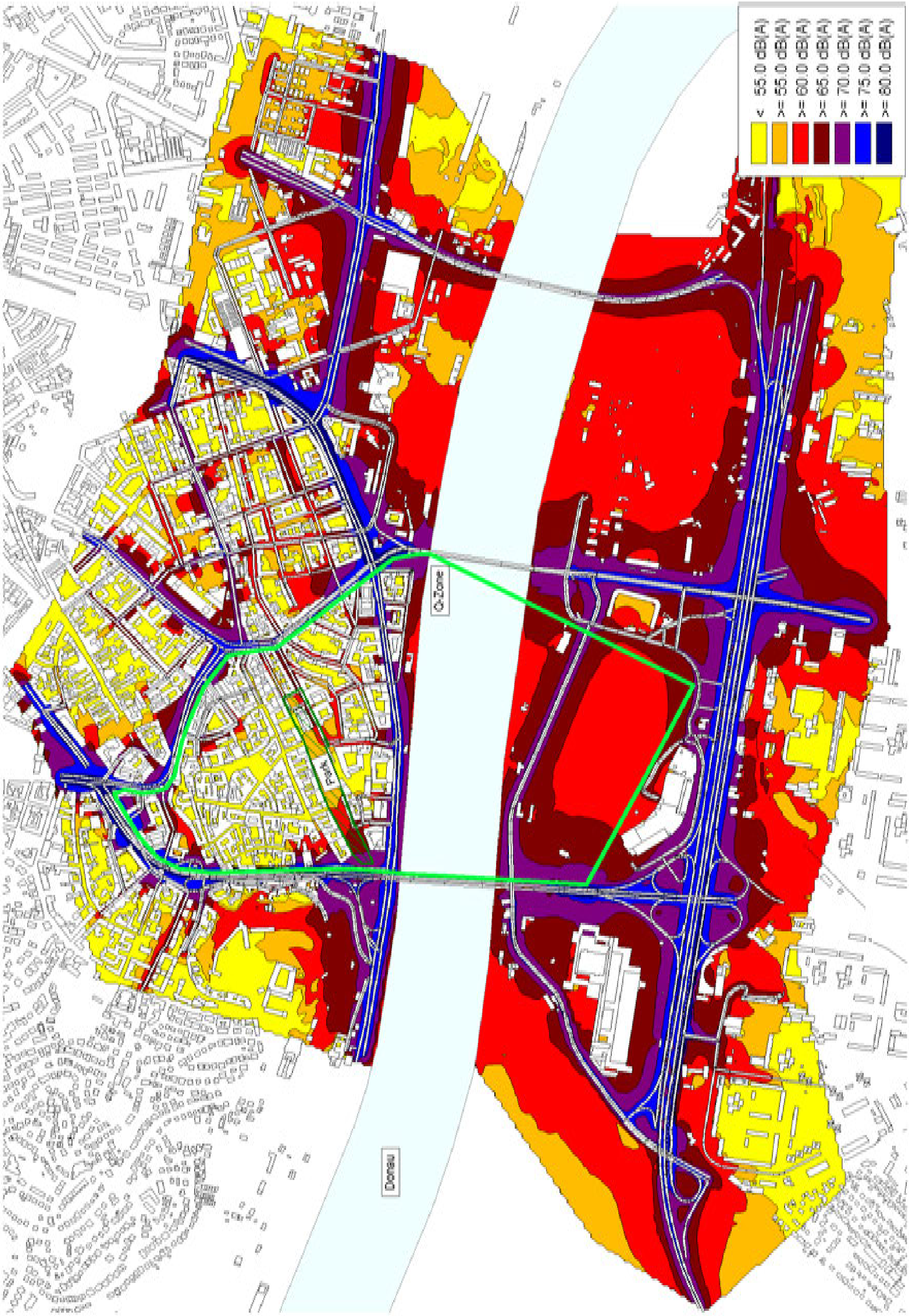

Figure 3.1.8: Bratislava Scenario 8 (S23) - L_{den}

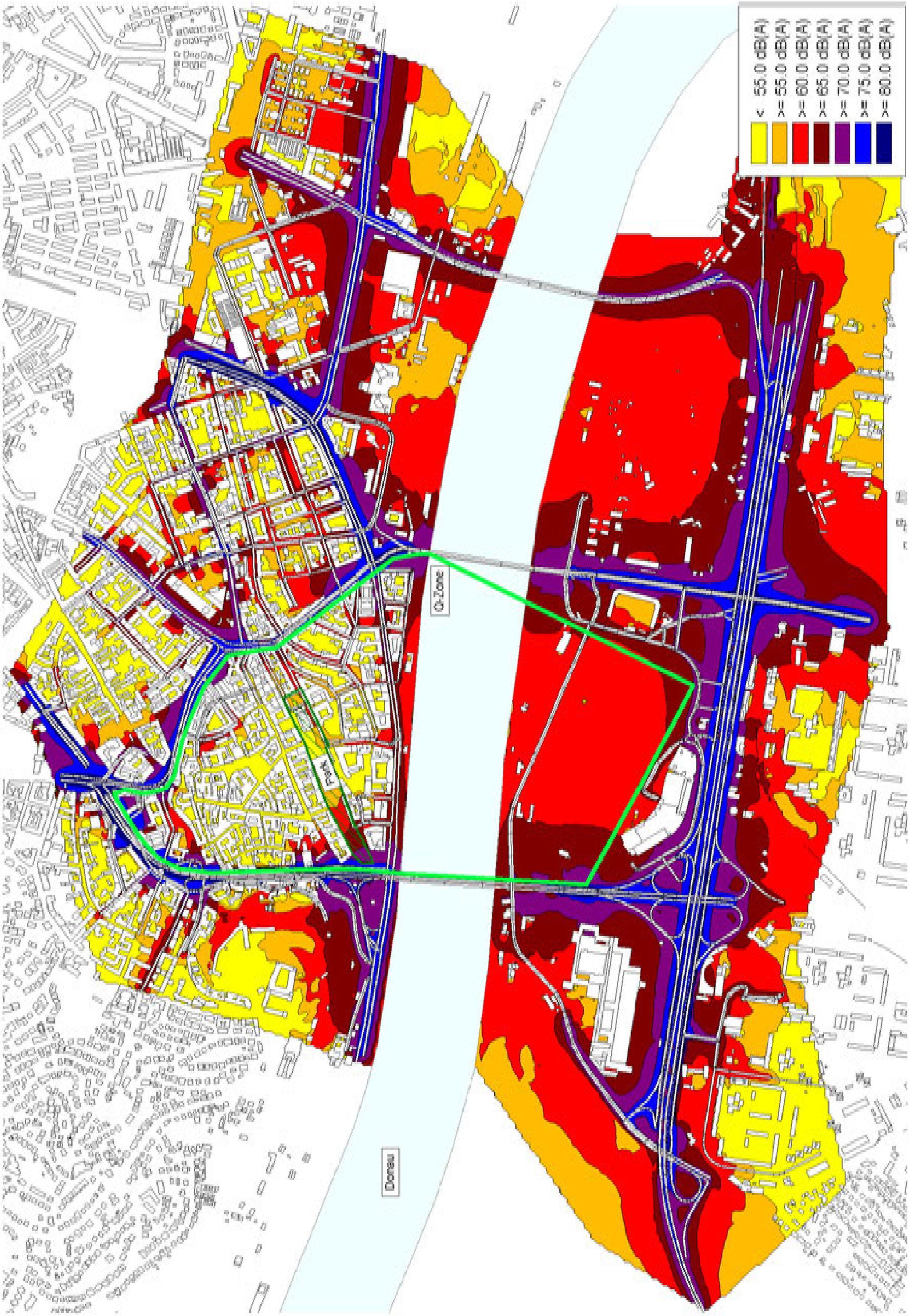

Figure 3.1.9: Bratislava Scenario 9 (S24) - L_{den}

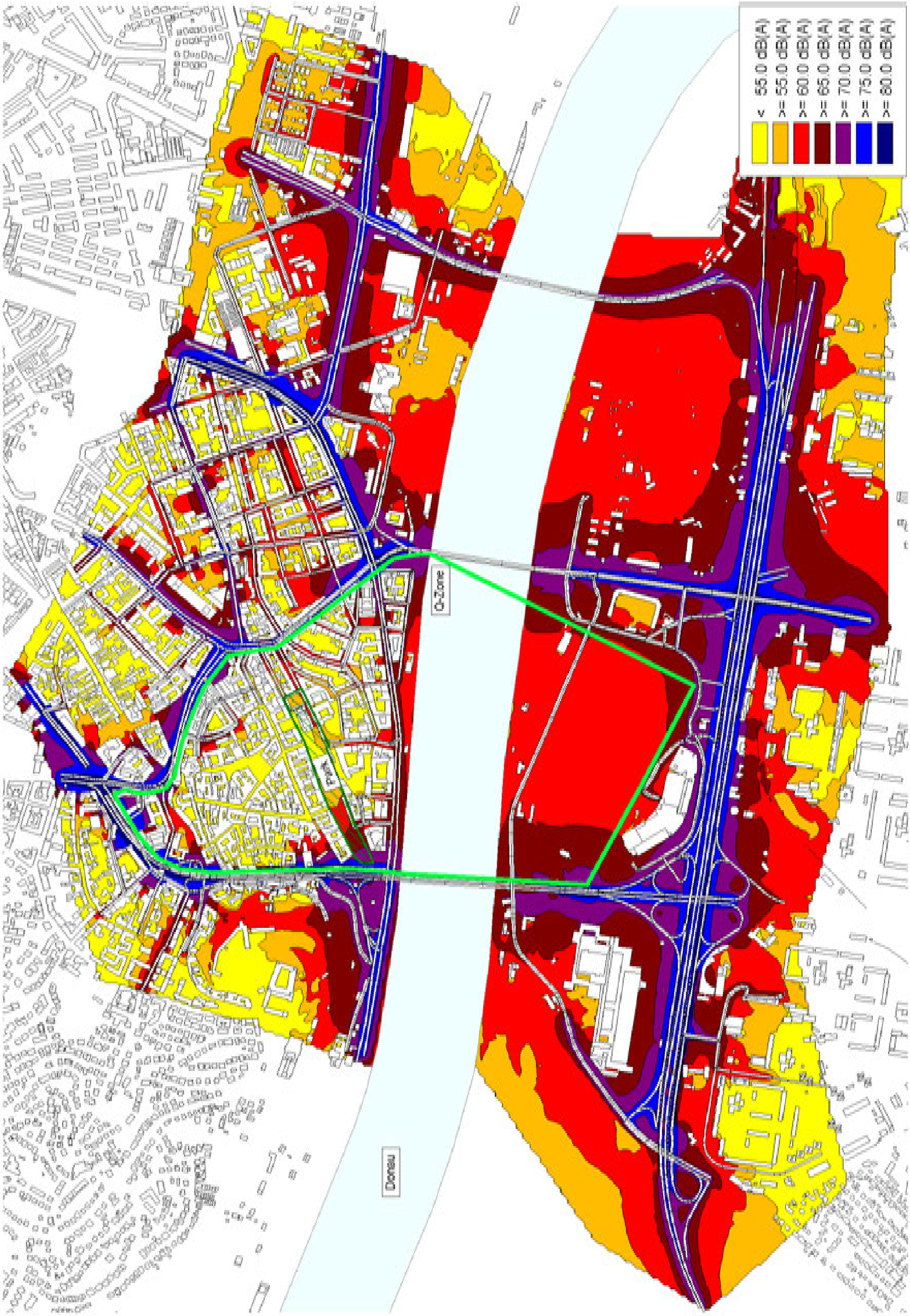

Figure 3.1.10: Bratislava Scenario 10 (S25) - L_{den}

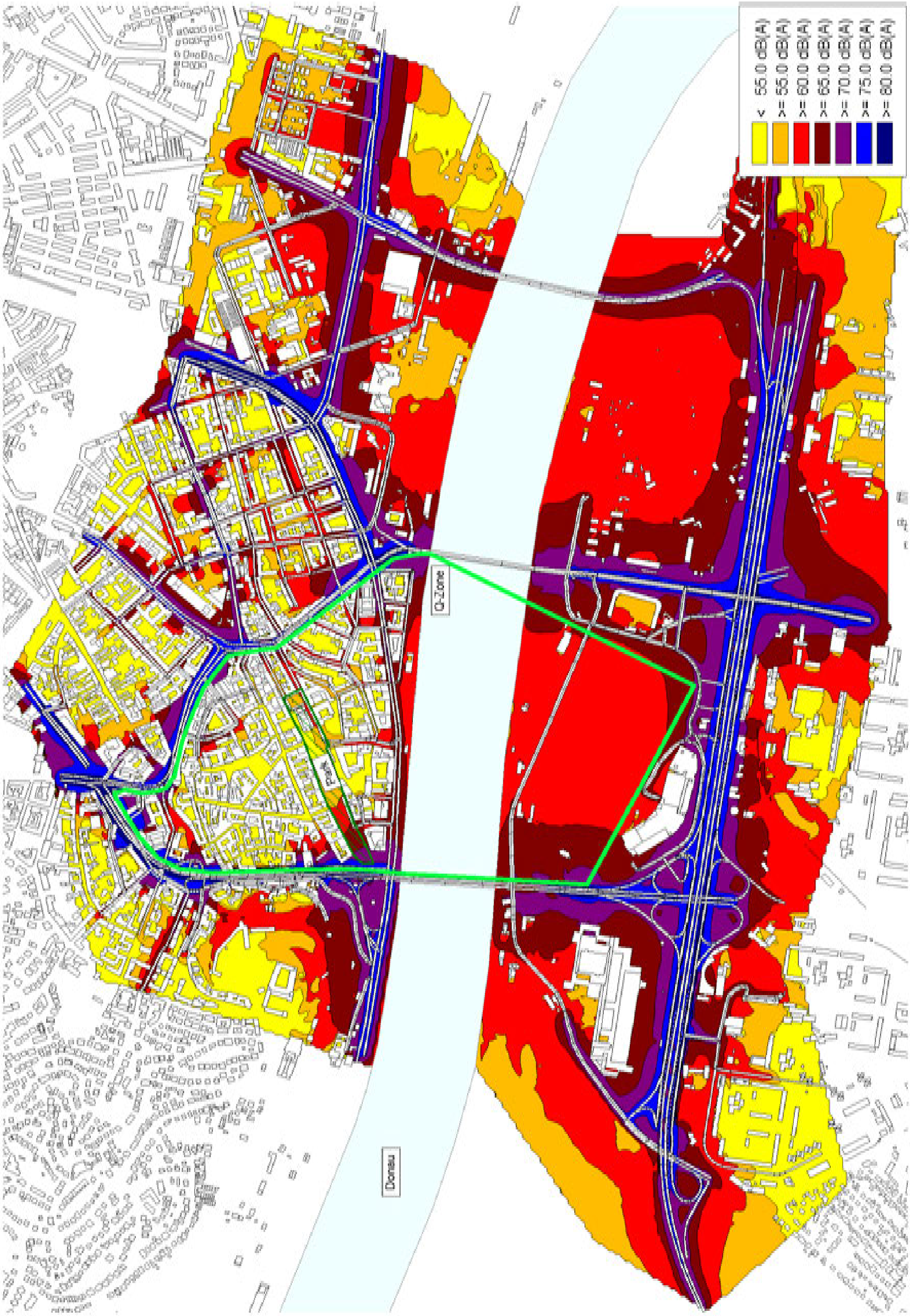

Figure 3.1.11: Bratislava Scenario 11 (S26) - L_{den}

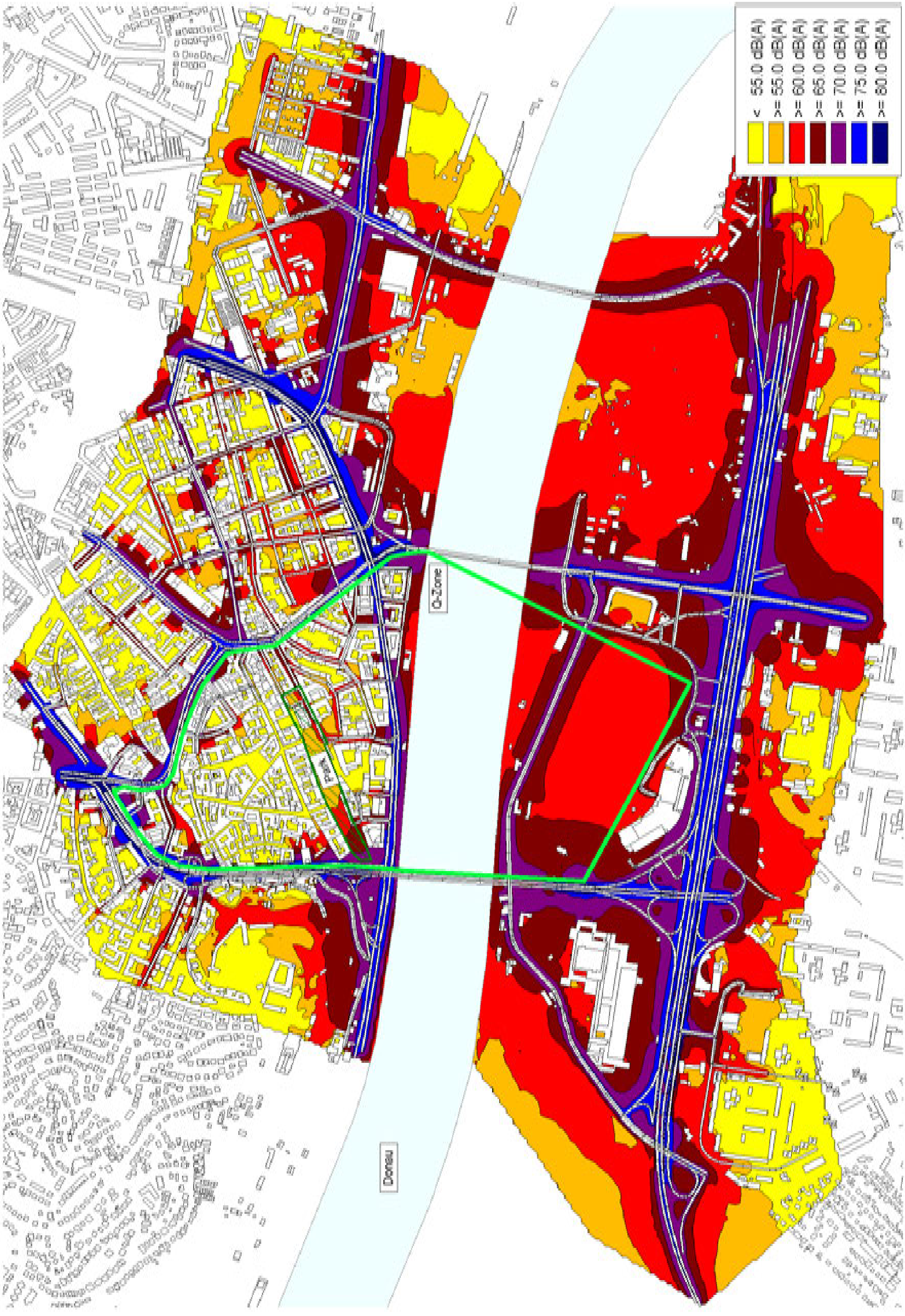

Figure 3.1.12: Bratislava Scenario 12 (S27) – L_{den}

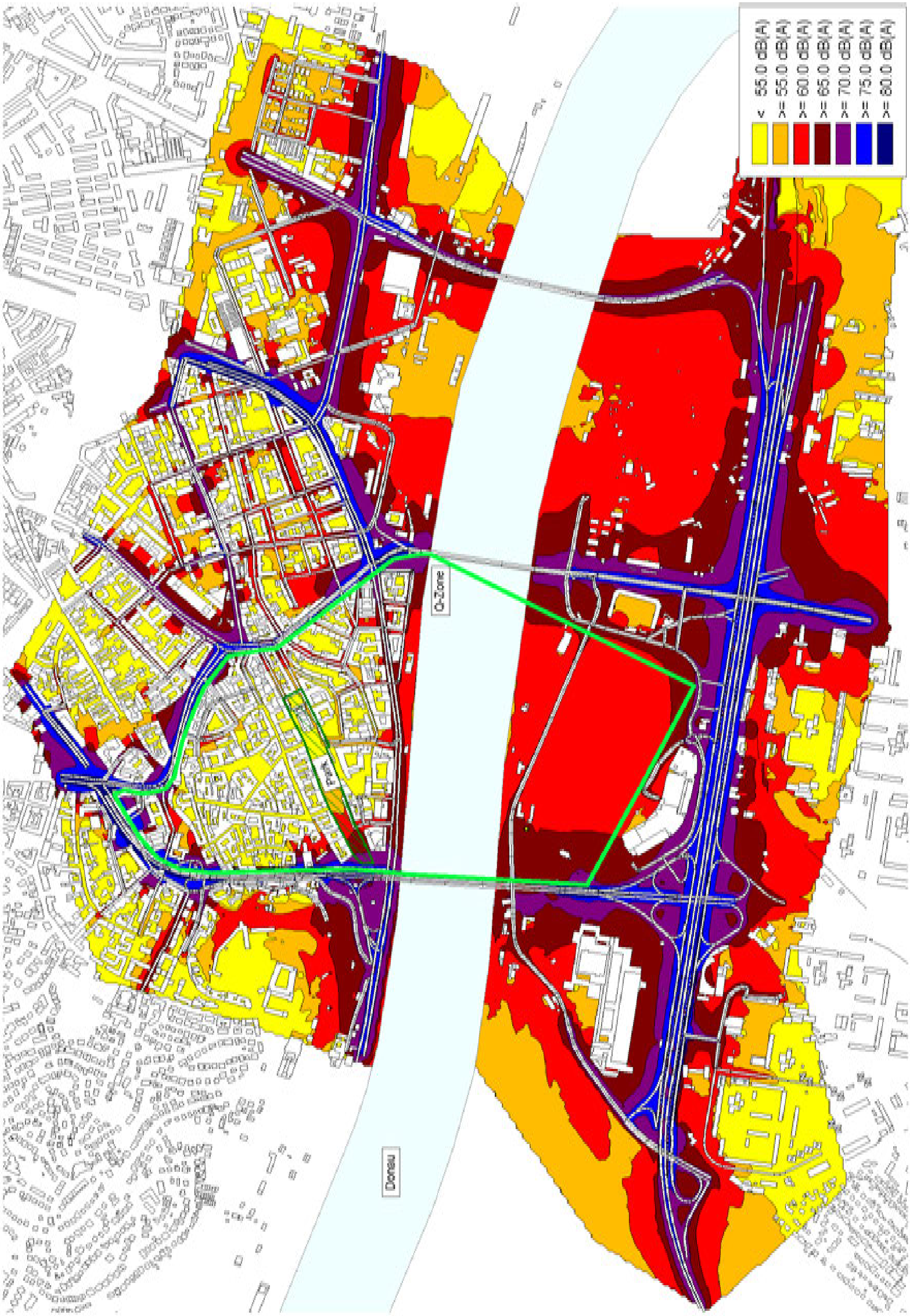

Figure 3.1.13: Bratislava Scenario 13 (S28) - L_{den}

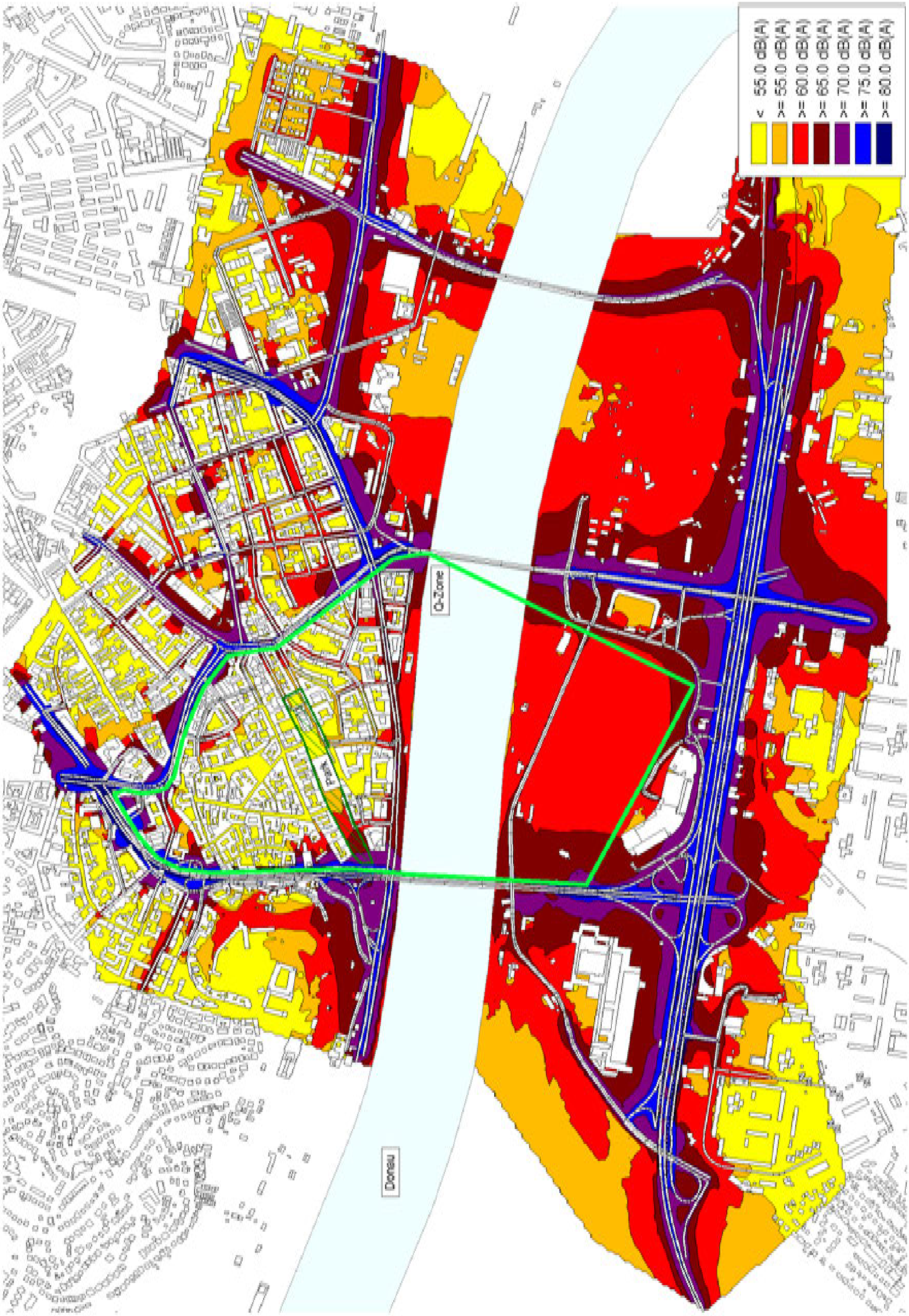

Figure 3.1.14: Bratislava Scenario 14 (S29) - L_{den}

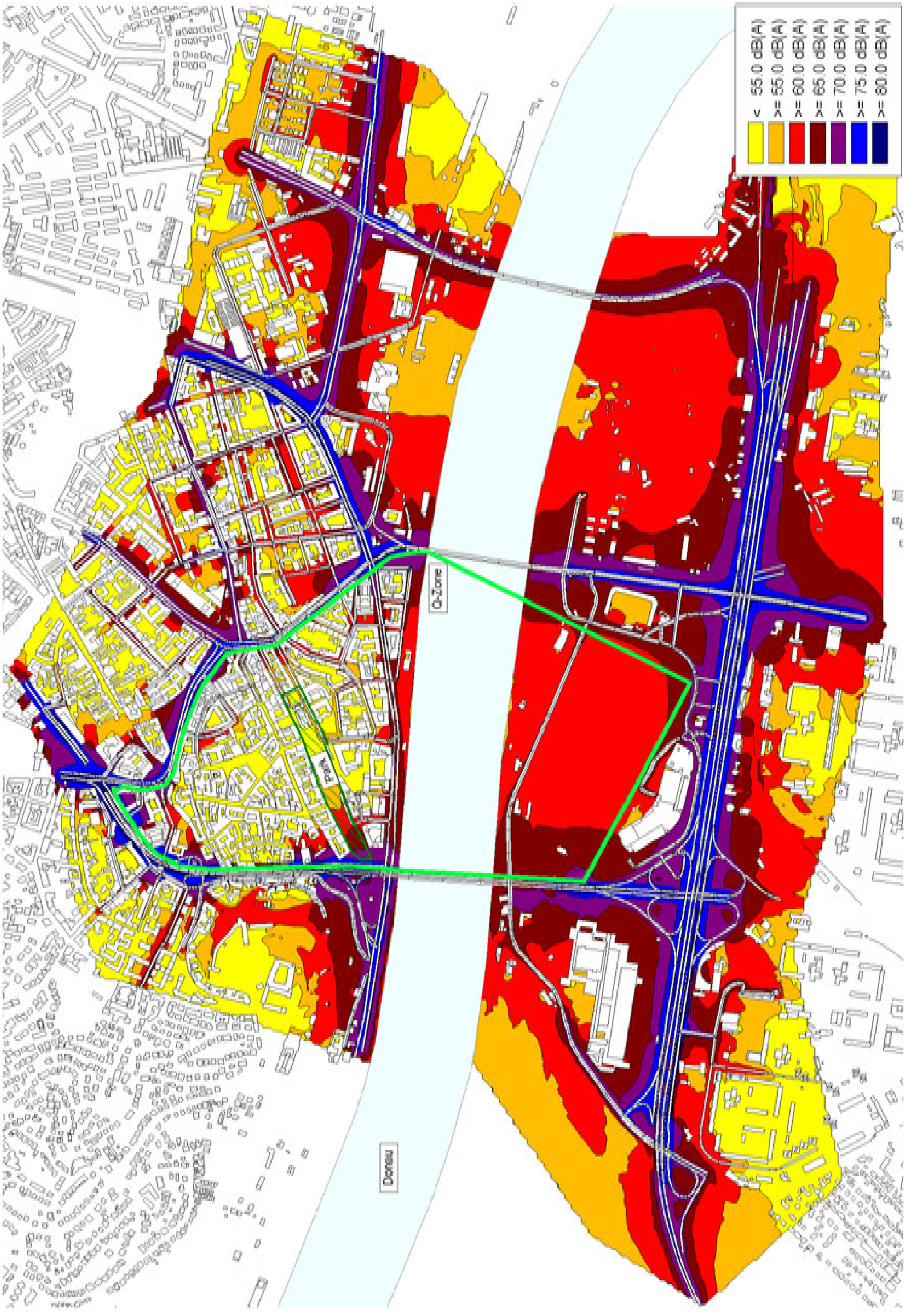

Figure 3.1.15: Bratislava Scenario 15 (S30) - L_{den}

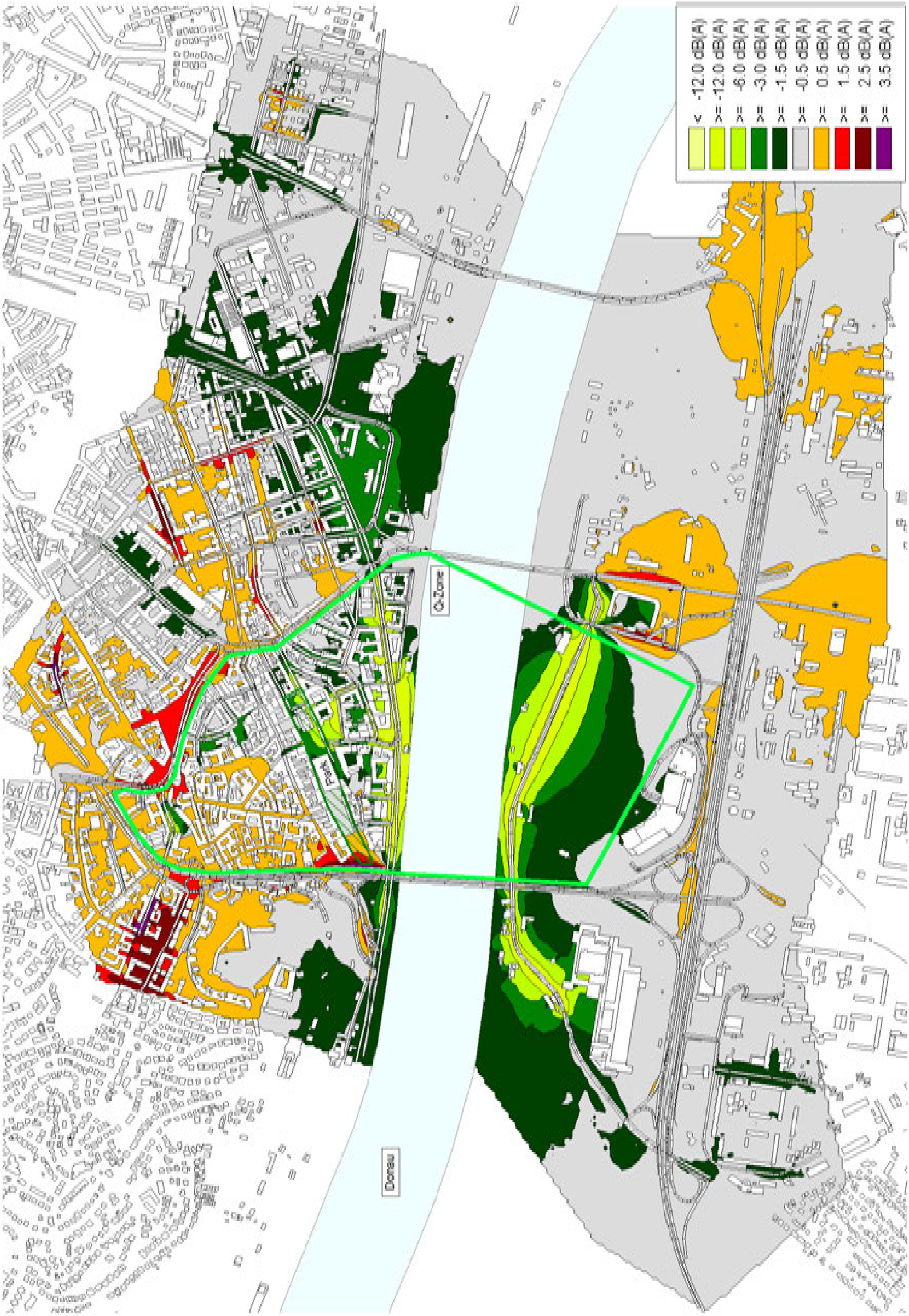

Figure 3.1.16: Bratislava Scenario 2 (S17) – difference to base case – L_{den}

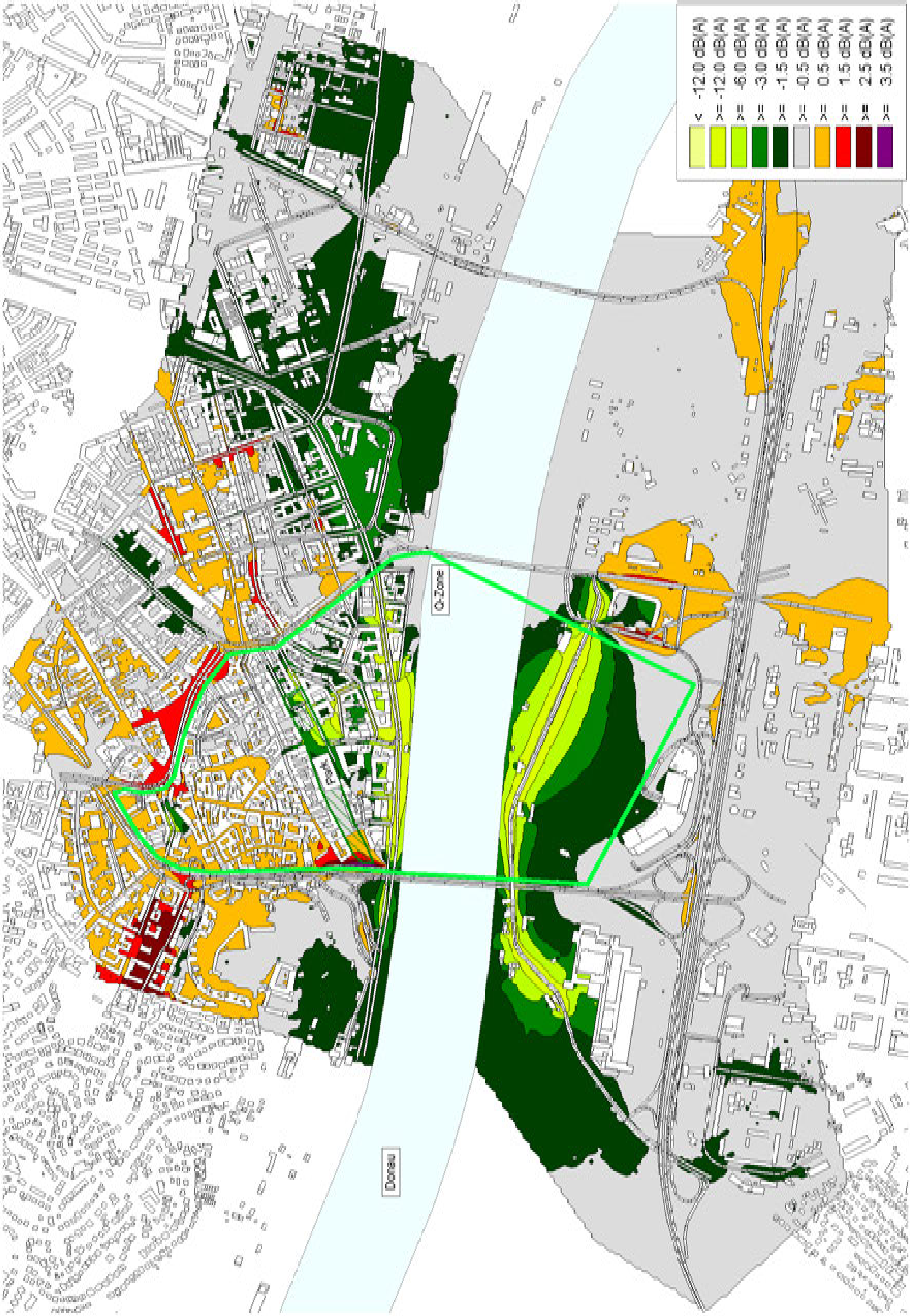

Figure 3.1.17: Bratislava Scenario 3 (S18) – difference to base case- L_{den}

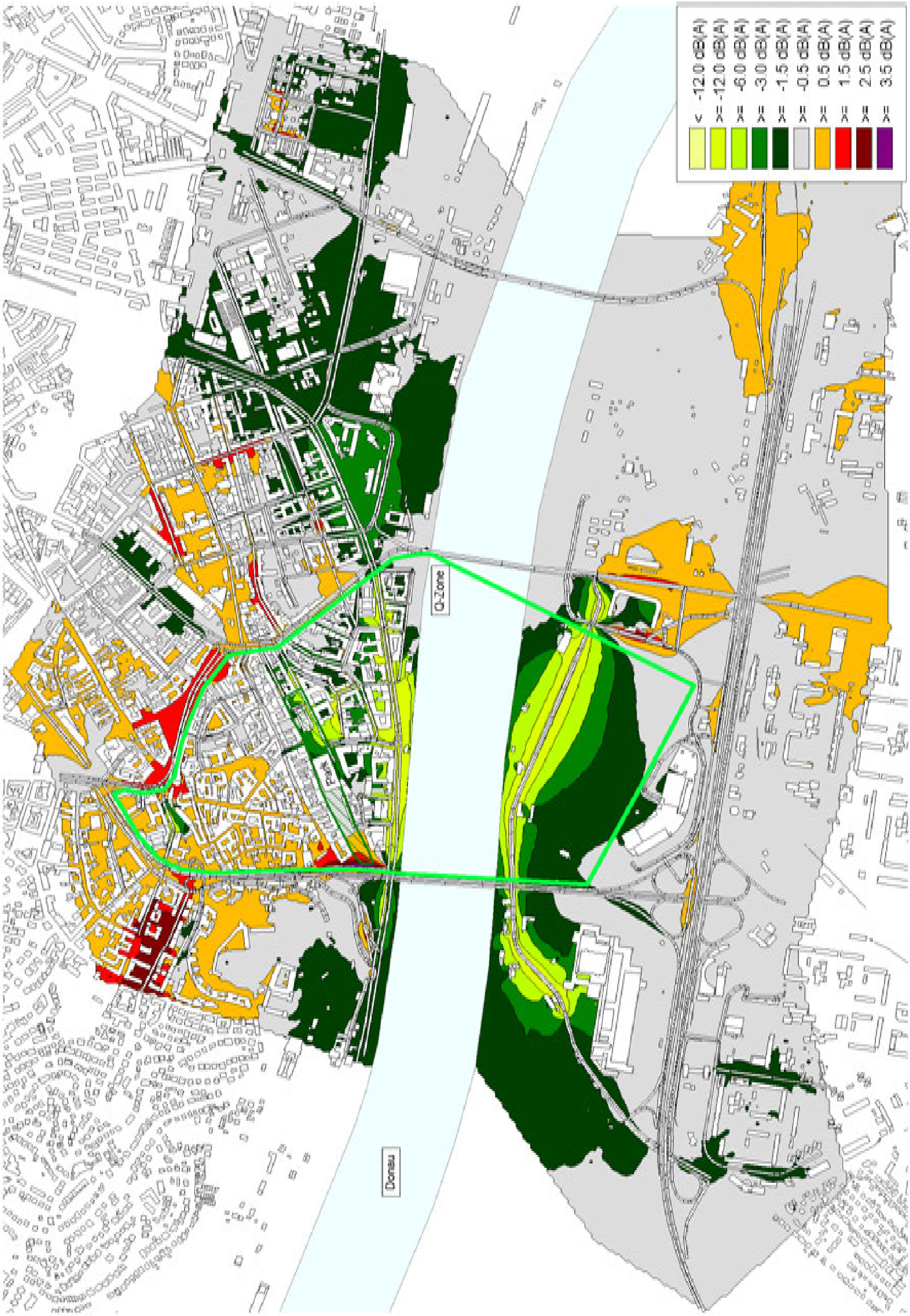

Figure 3.1.18: Bratislava Scenario 4 (S19) - difference to base case – L_{den}

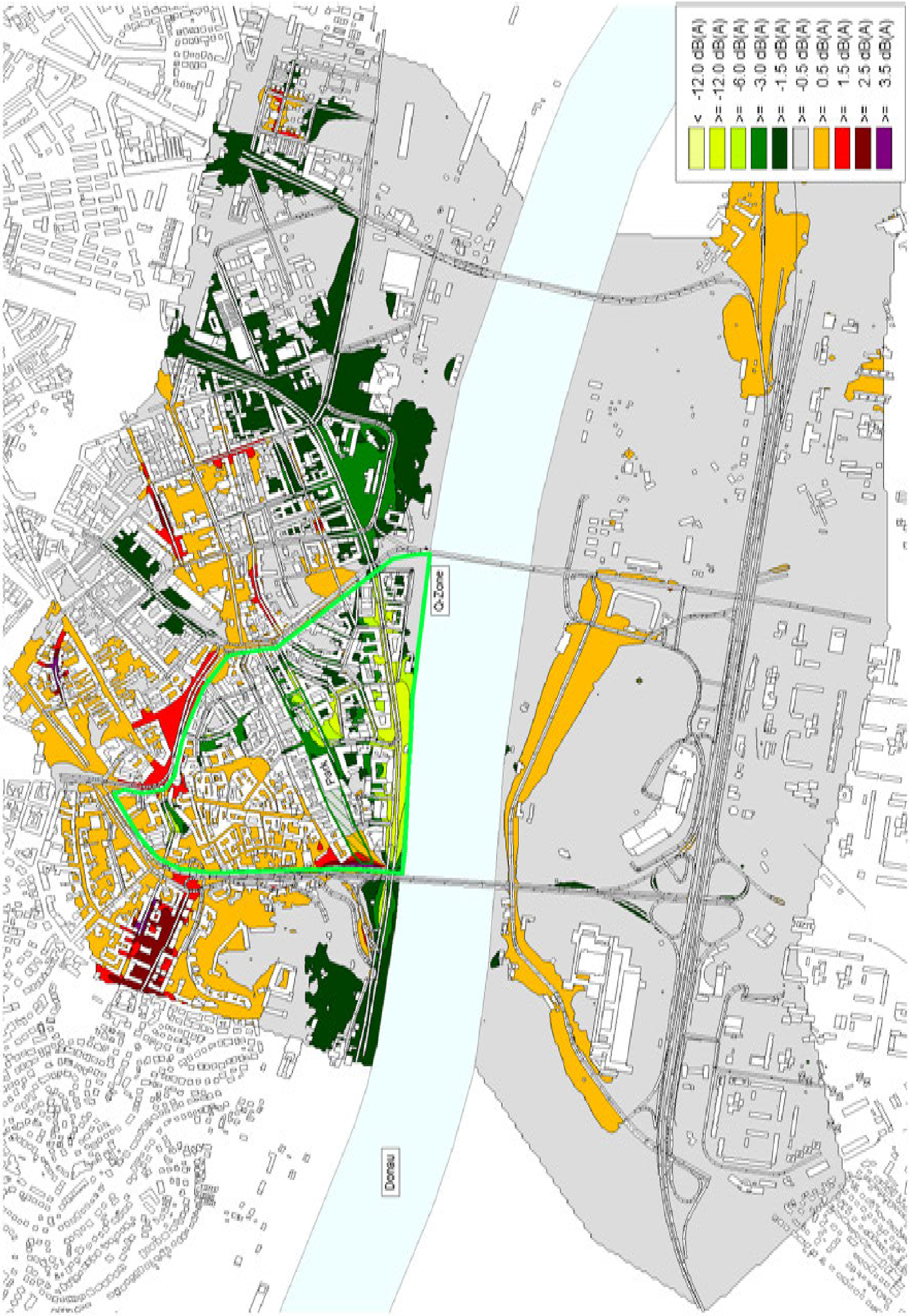

Figure 3.1.19: Bratislava Scenario 5 (S20) - difference to base case - L_{den}

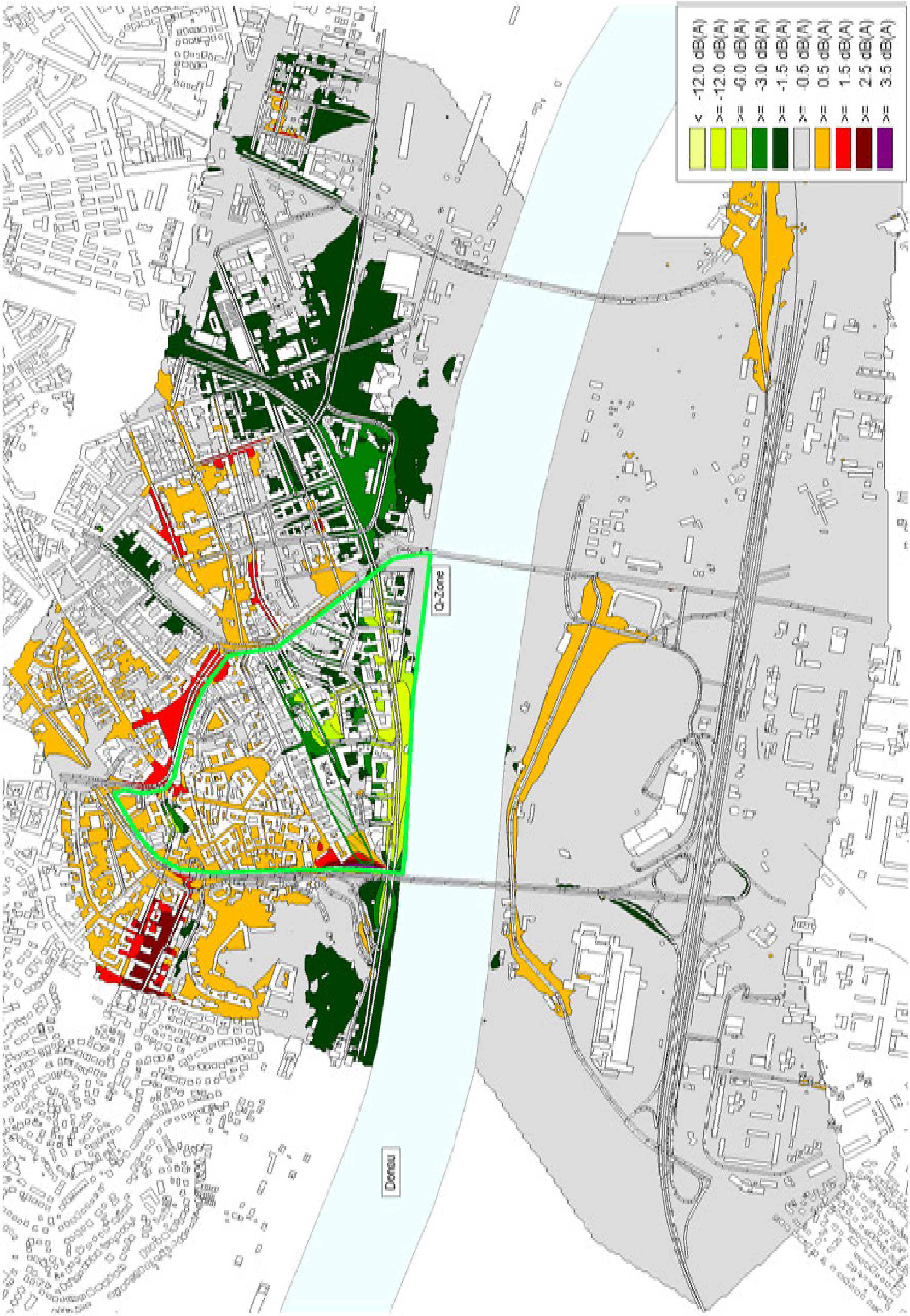

Figure 3.1.20: Bratislava Scenario 6 (S21) - difference to base case – L_{den}

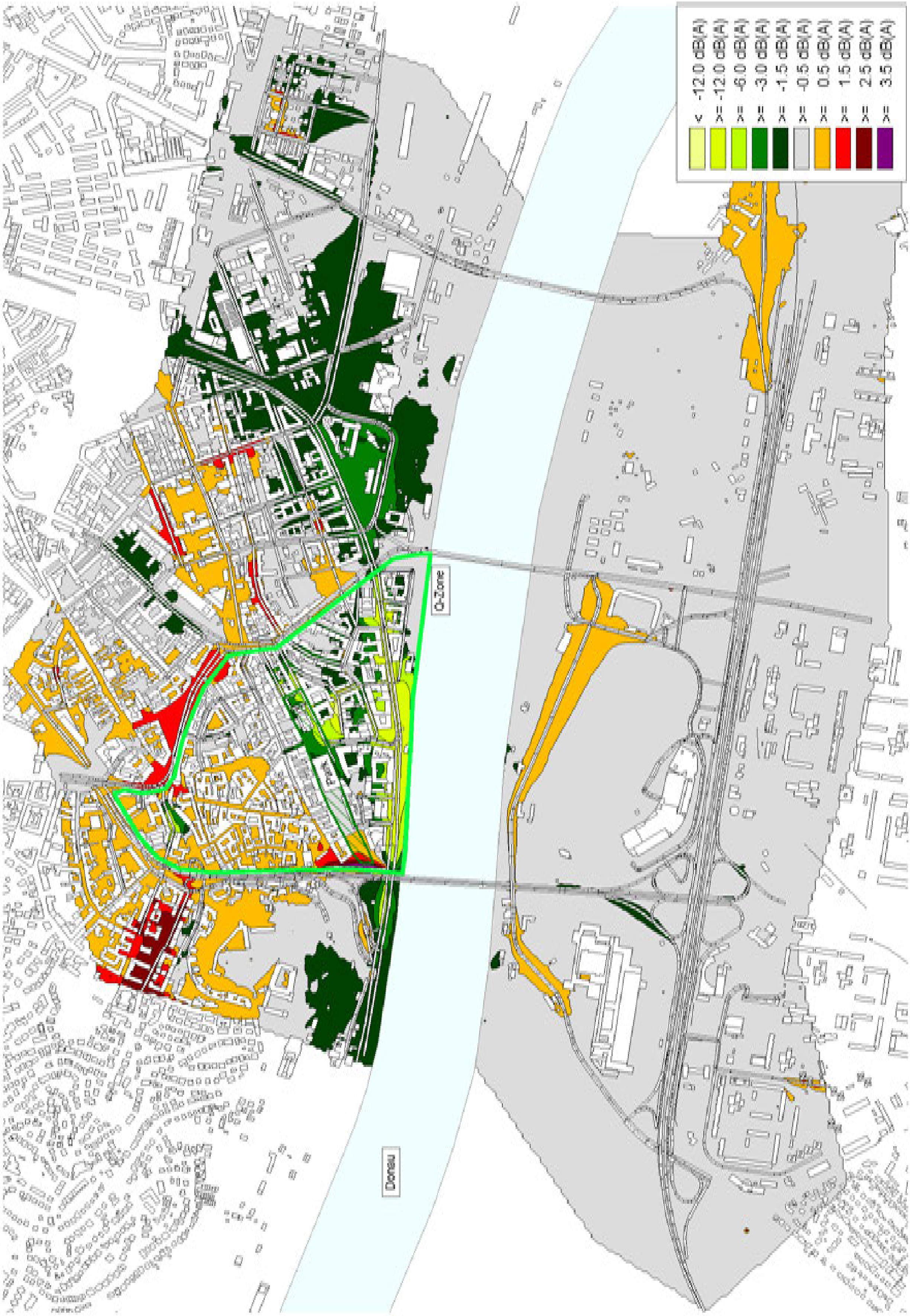

Figure 3.1.21: Bratislava Scenario 7 (S22) - difference to base case – L_{den}

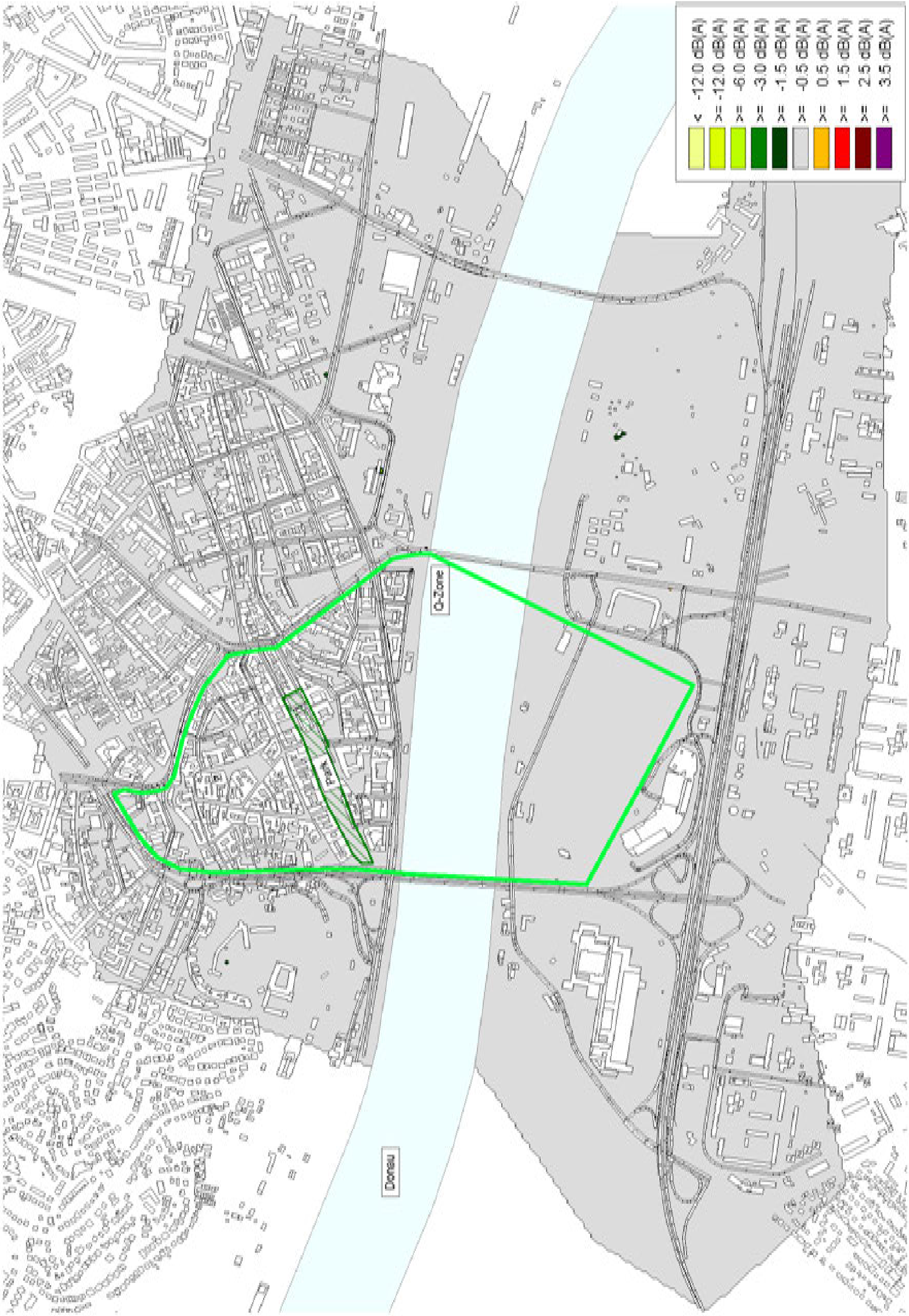

Figure **3.1.**22: Bratislava Scenario 8 (S23) – difference to base case – L_{den}

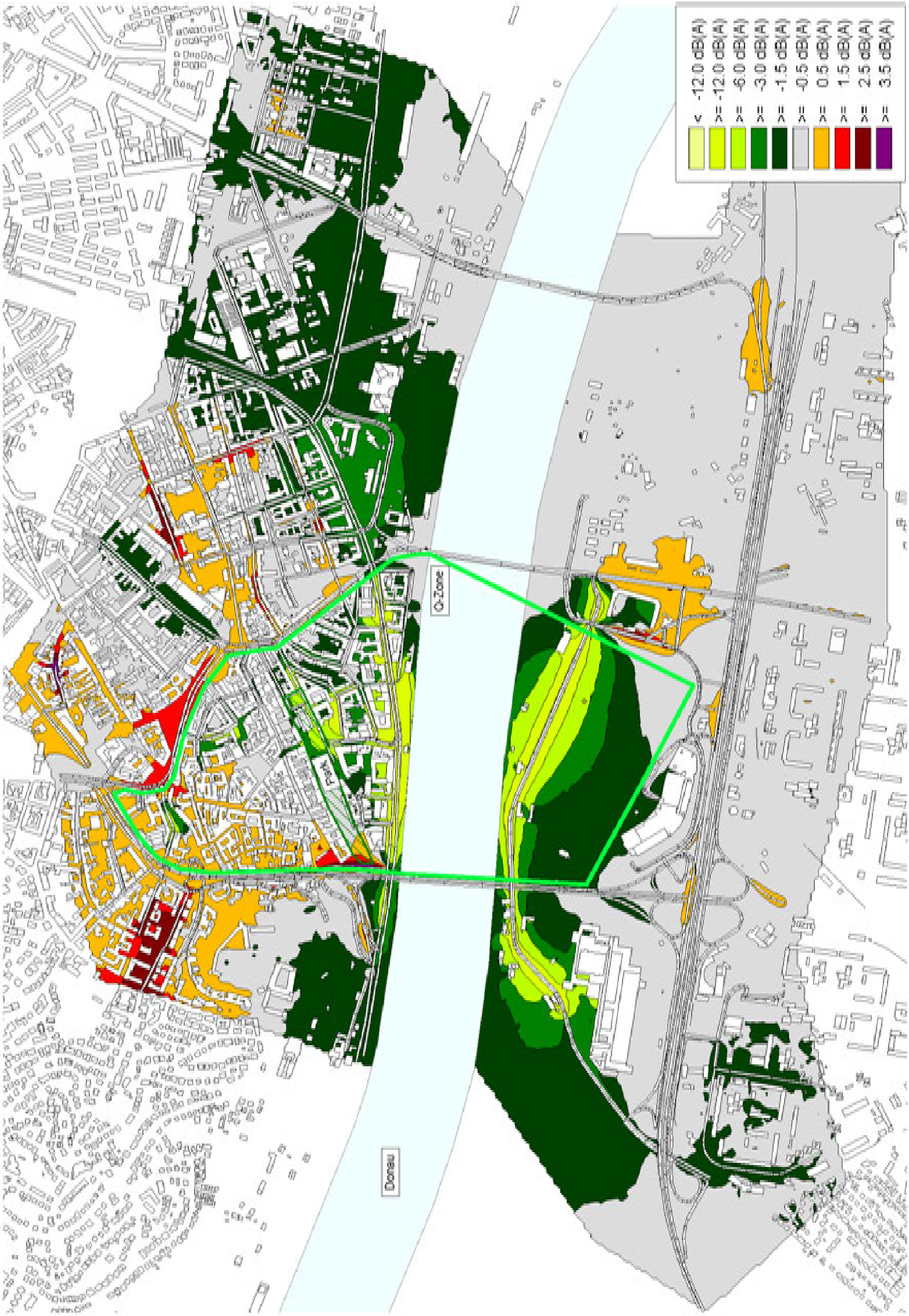

Figure 3.1.23: Bratislava Scenario 9 (S24) – difference to base case – L_{den}

Figure 3.1.24: Bratislava Scenario 10 (S25) – difference to base case – L_{den}

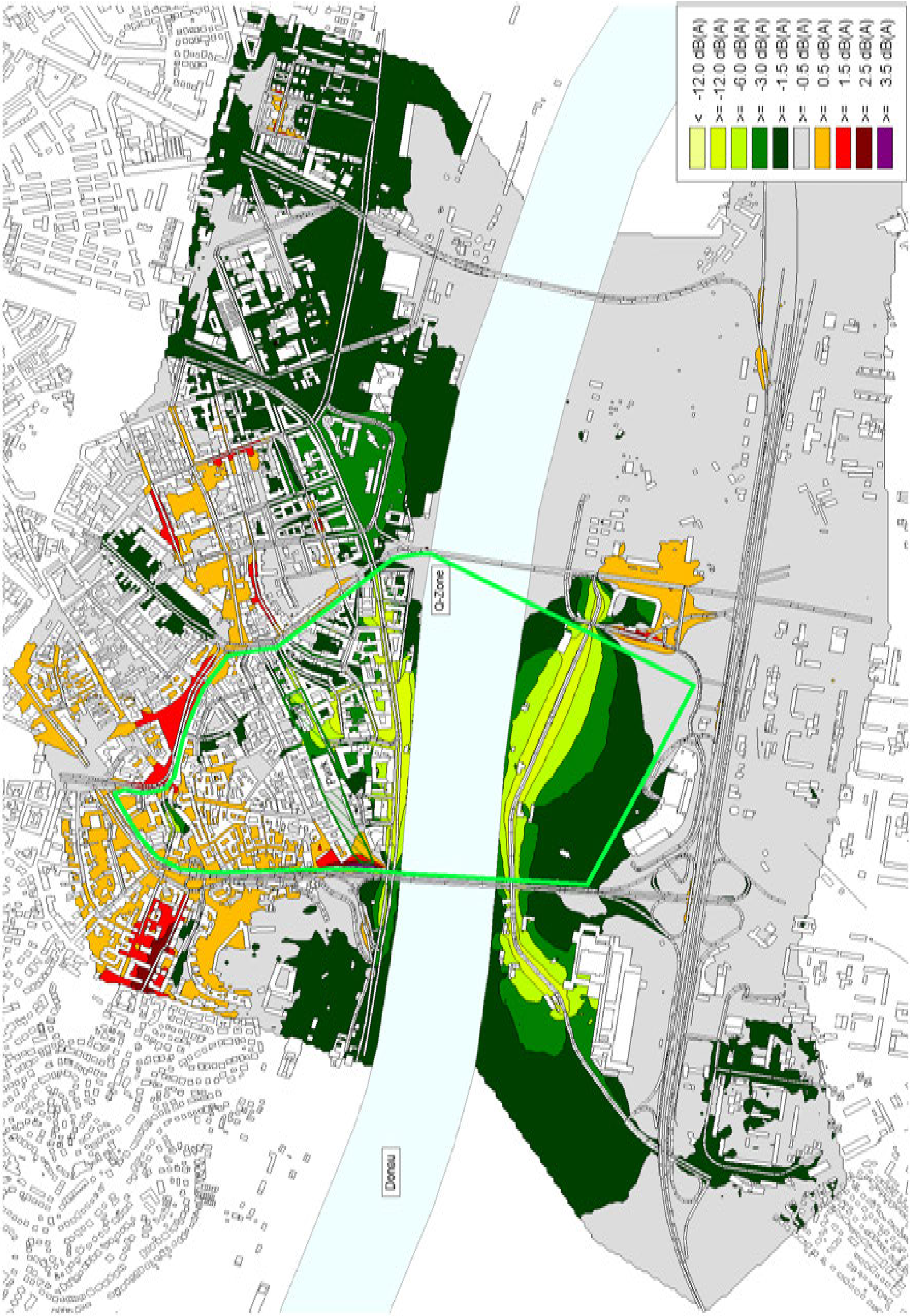

Figure 3.1.25: Bratislava Scenario 11 (S26) – difference to base case – L_{den}

Figure **3.1.**26: Bratislava Scenario 12 (S27) – difference to base case – L_{den}

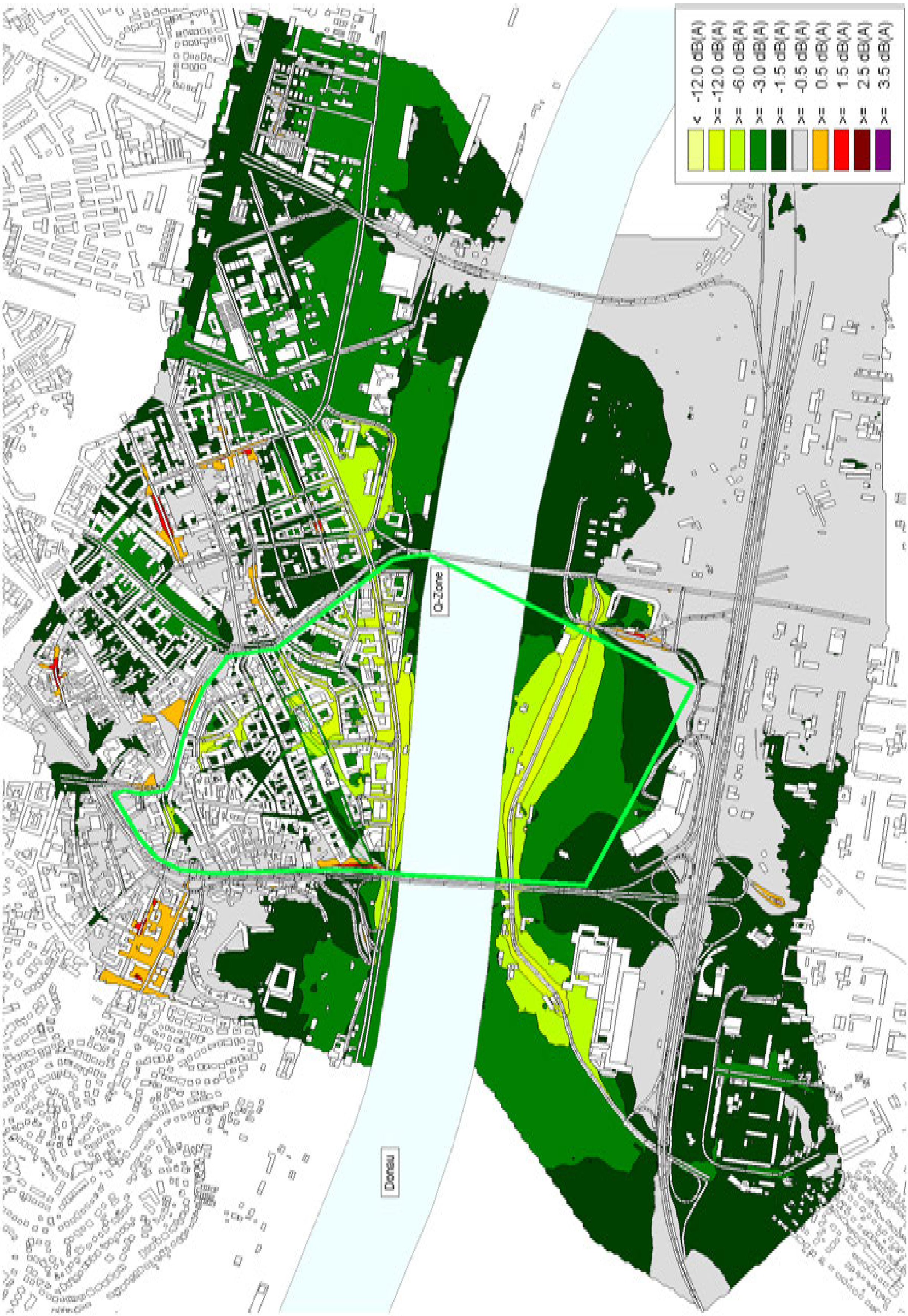

Figure **3.1.**27: Bratislava Scenario 13 (S28) – difference to base case – L_{den}

Figure **3.1.**28: Bratislava Scenario 14 (S29) – difference to base case – L_{den}

Figure **3.1.**29: Bratislava Scenario 15 (S30) – difference to base case - L_{den}

3.2 BRISTOL

To provide a better overview we included the definition of the scenarios once again at this point. For Bristol, the following set of traffic scenarios was simulated:

Scenario nr	Zone	Fee, Euros/passage	Inside LNVO percentage	External LNVO percentage
1	none	none	1	1
2	QZ	ban	1	1
3	QZ	1	1	1
4	QZ	0.5	1	1
8	none	none	5	5
9	QZ	Ban	20	5
10	QZ	1	20	5
11	QZ	0.5	20	5
12	none	none	20	20
13	QZ	ban	100	20
14	QZ	0.5	100	20
15	QZ	1	100	20

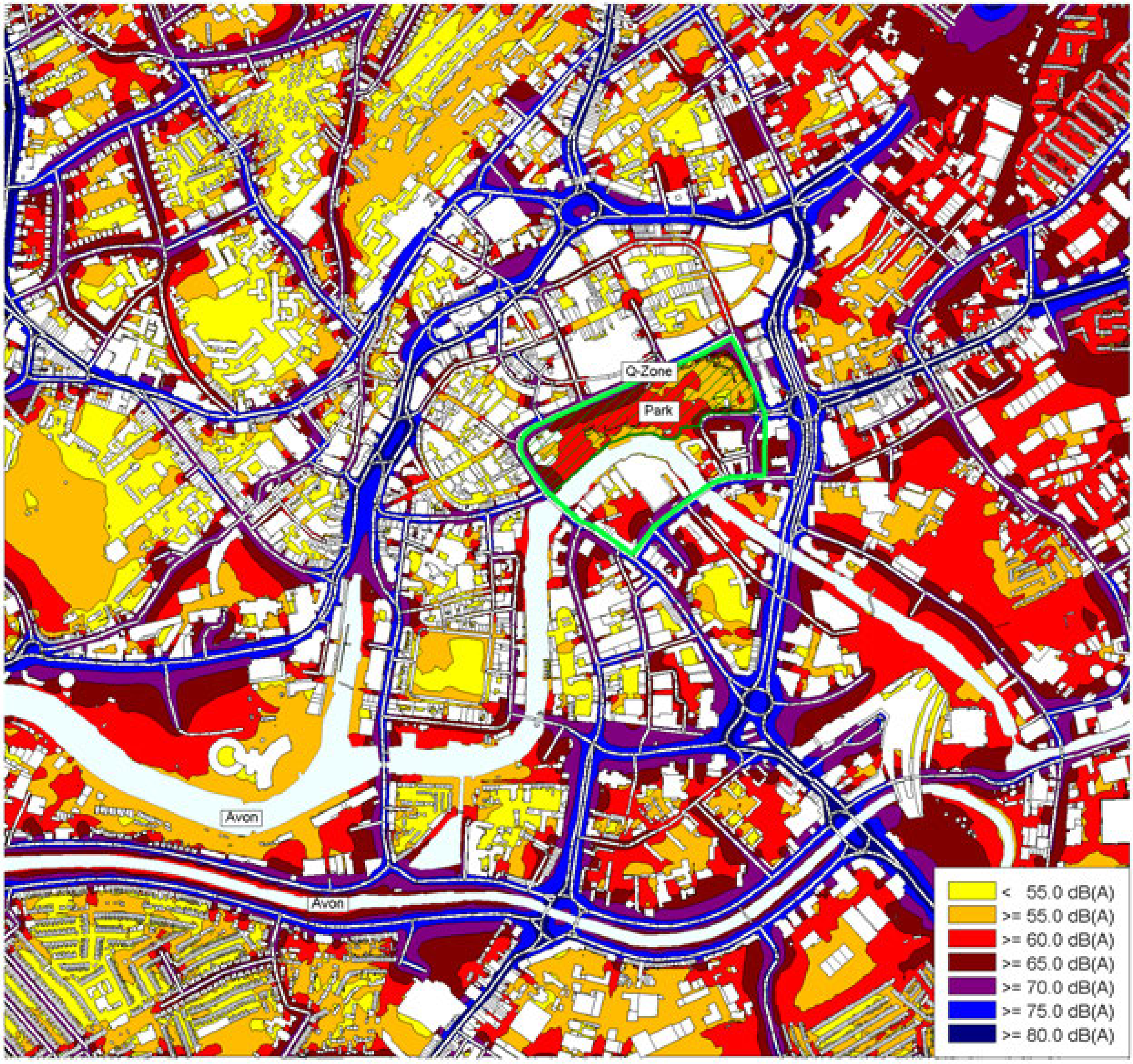

Figure 3.2.1: Bristol Scenario 1 (Base Case) - L_{den}

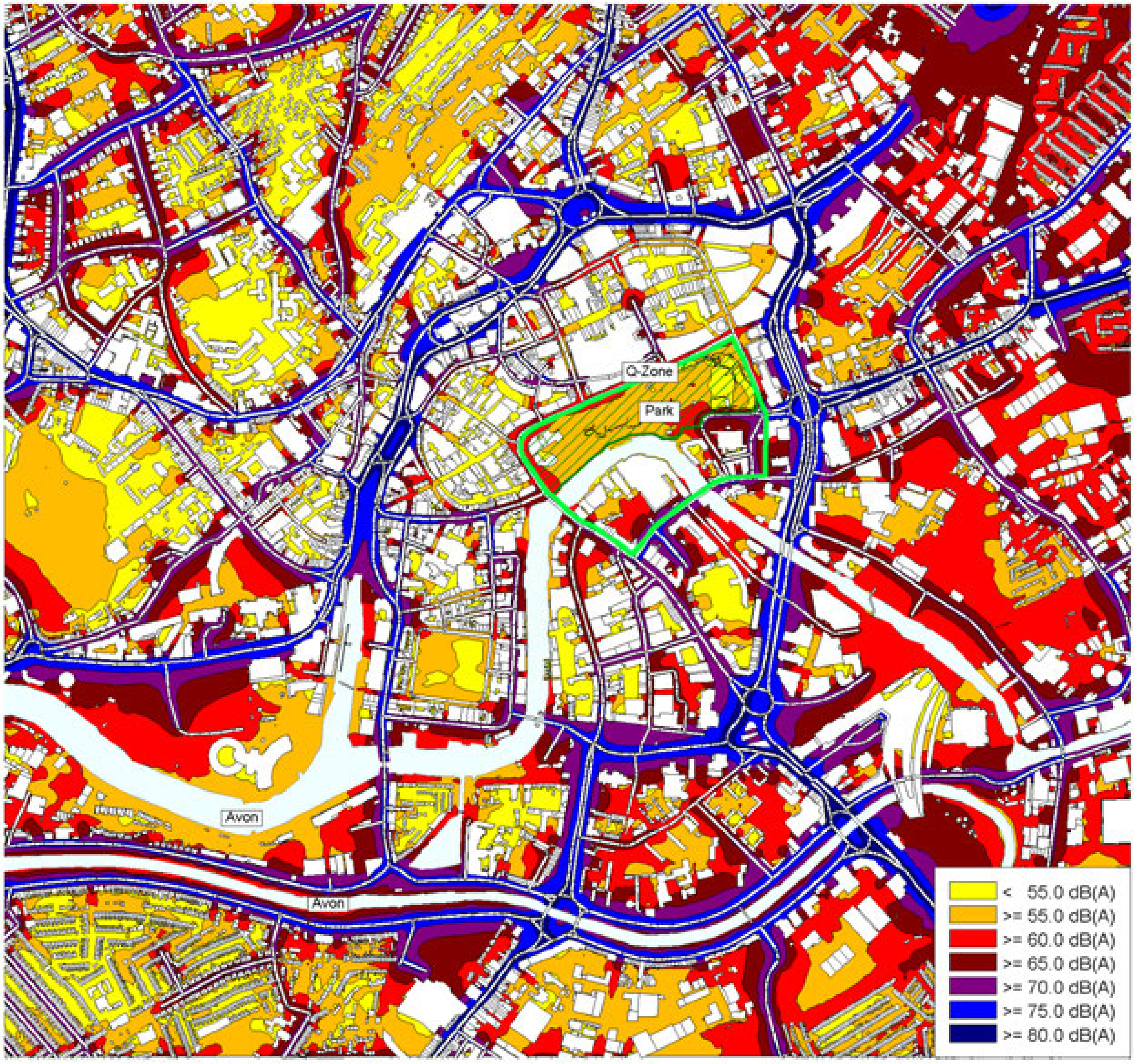

Figure 3.2.2: Bristol Scenario 2 - L_{den}

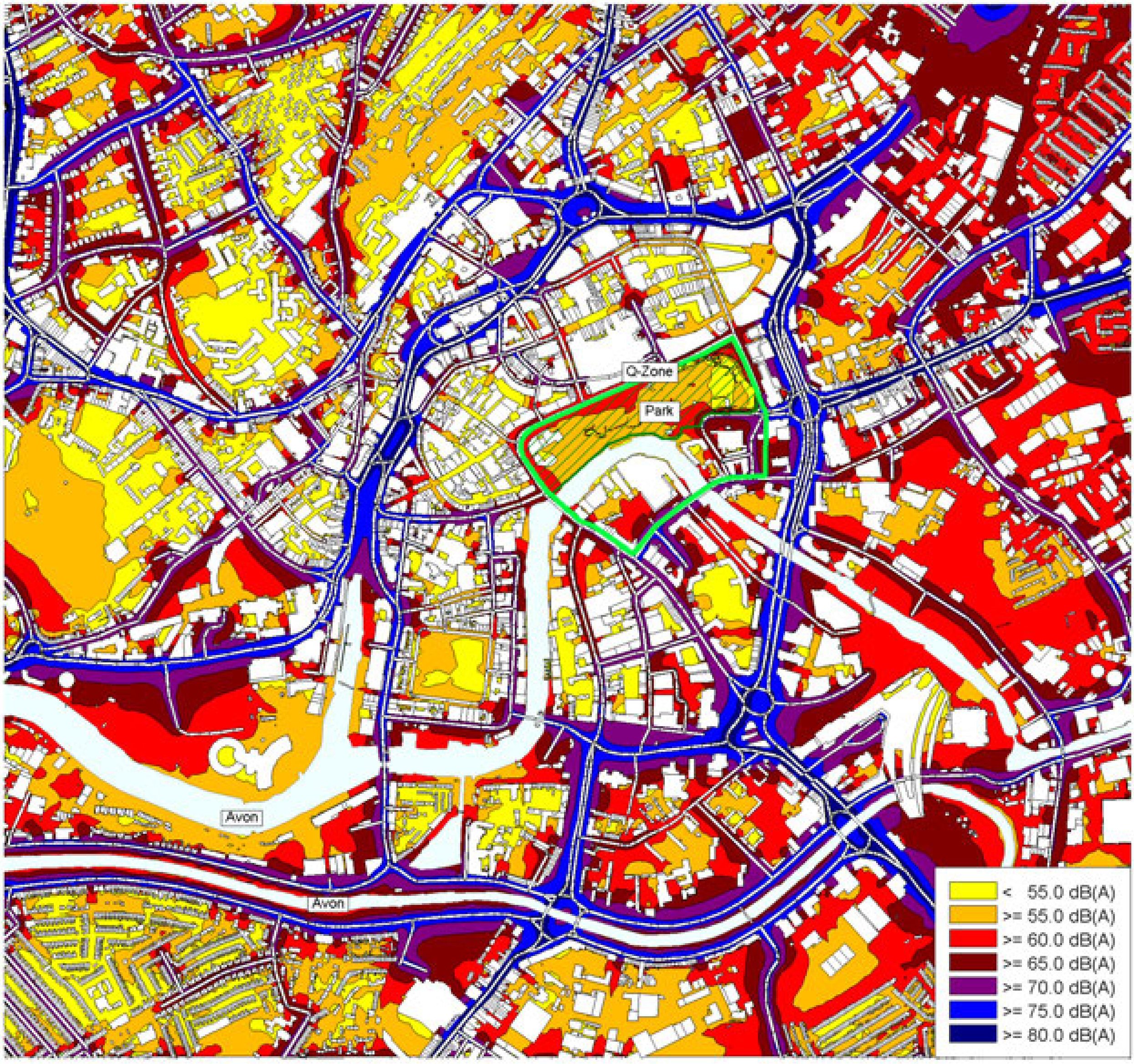

Figure 3.2.3: Bristol Scenario 3 - L_{den}

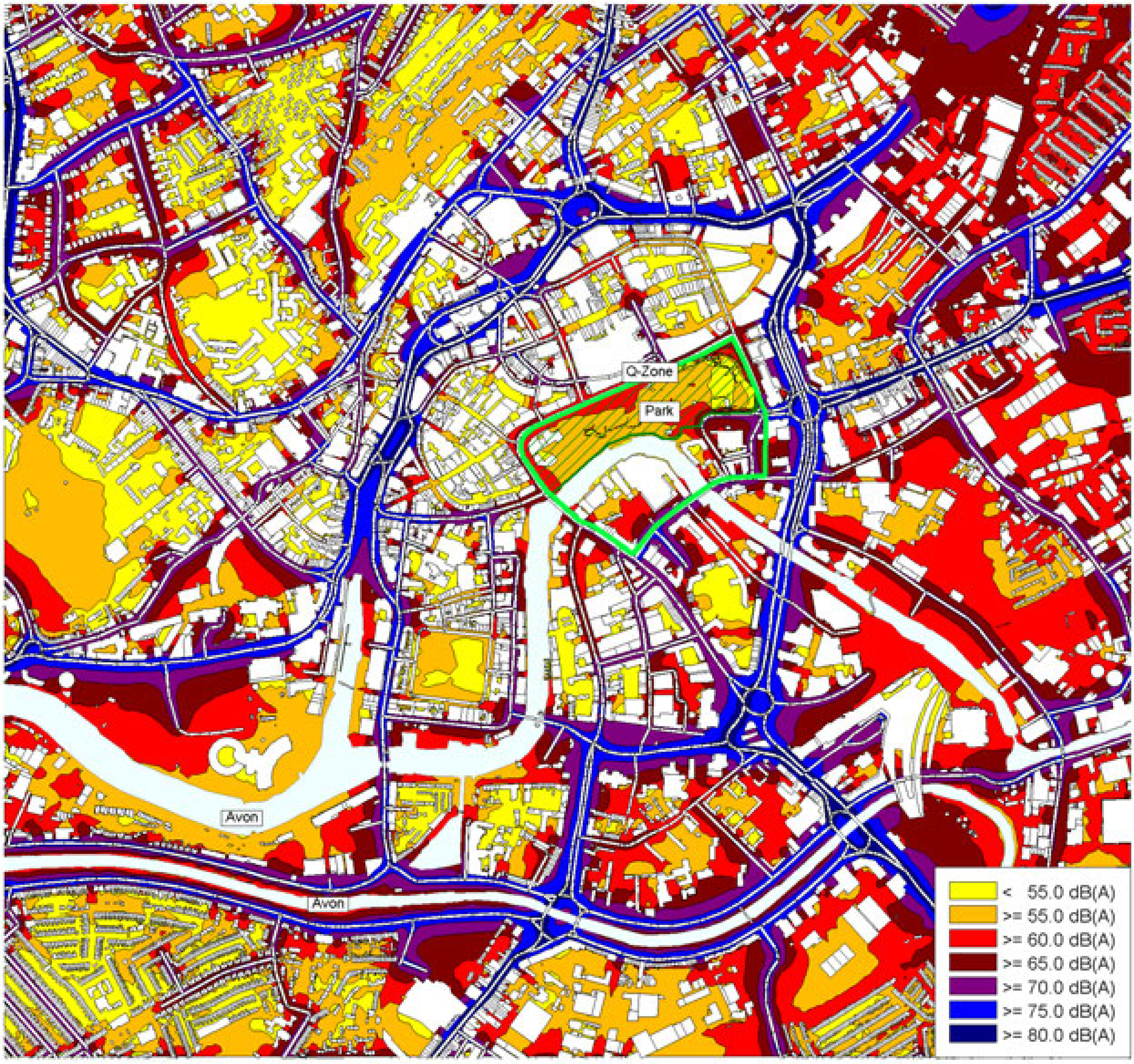

Figure 3.2.4: Bristol Scenario 4 - L_{den}

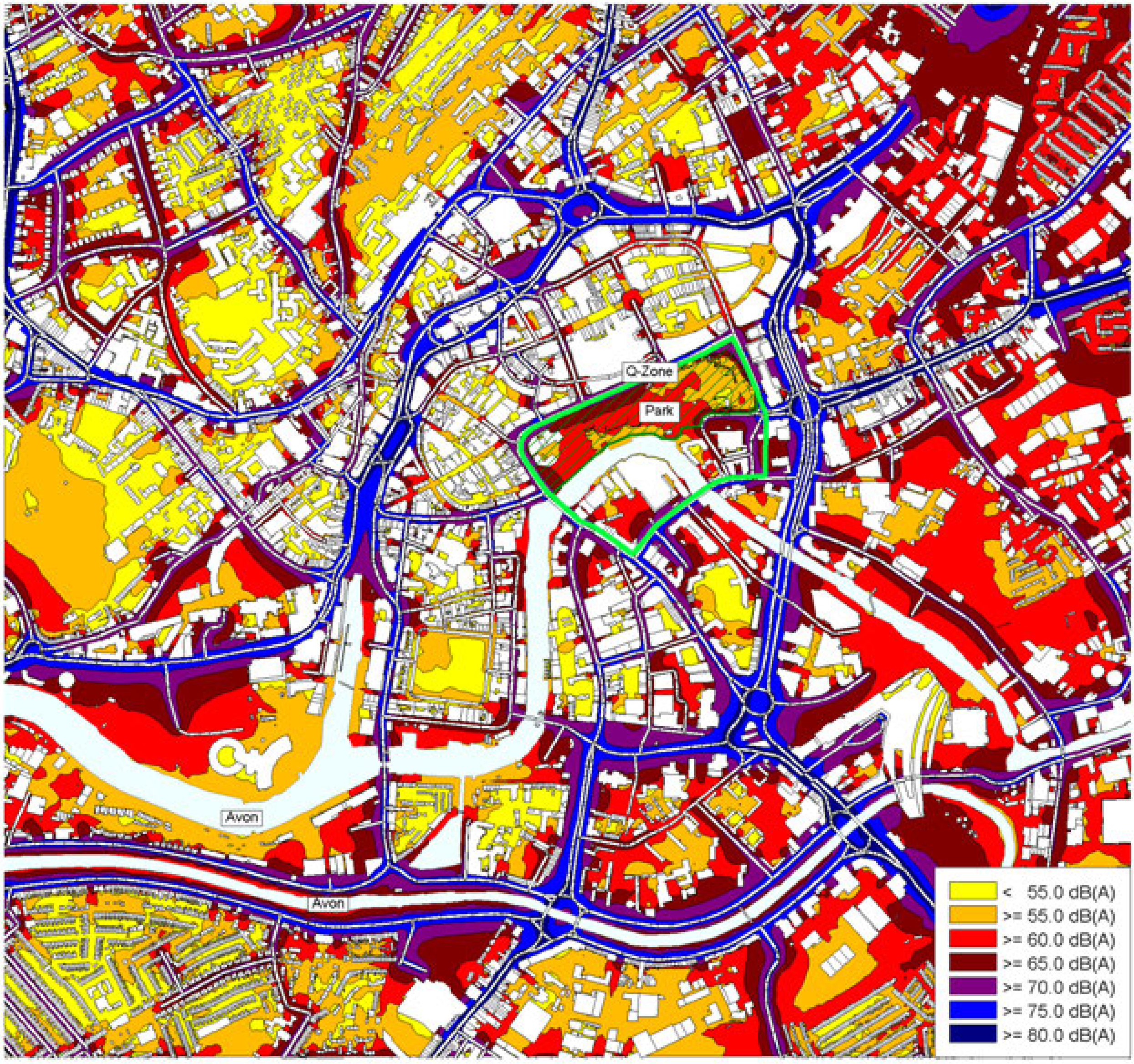

Figure 3.2.5: Bristol Scenario 8 - L_{den}

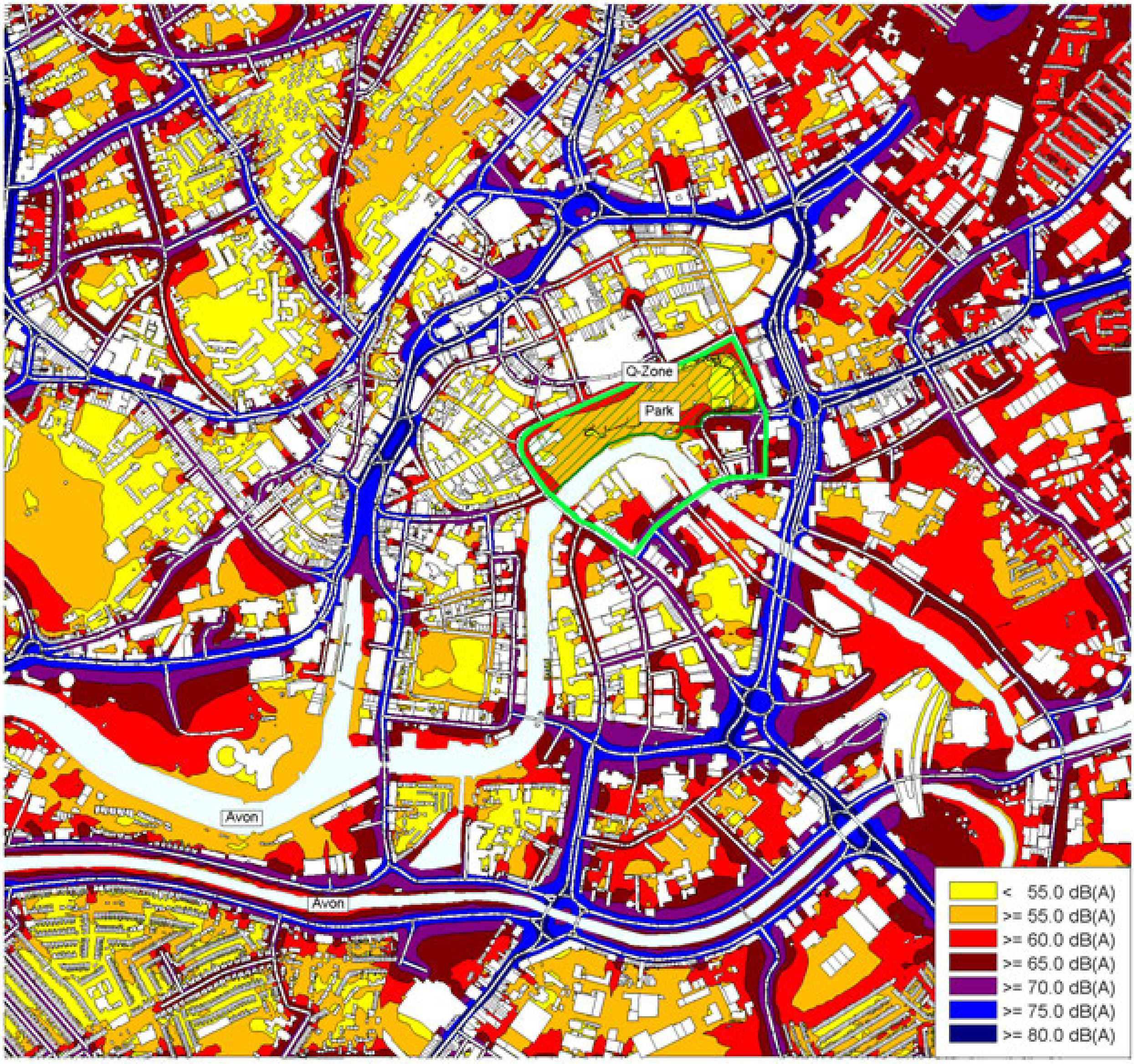

Figure 3.2.6: Bristol Scenario 9 - L_{den}

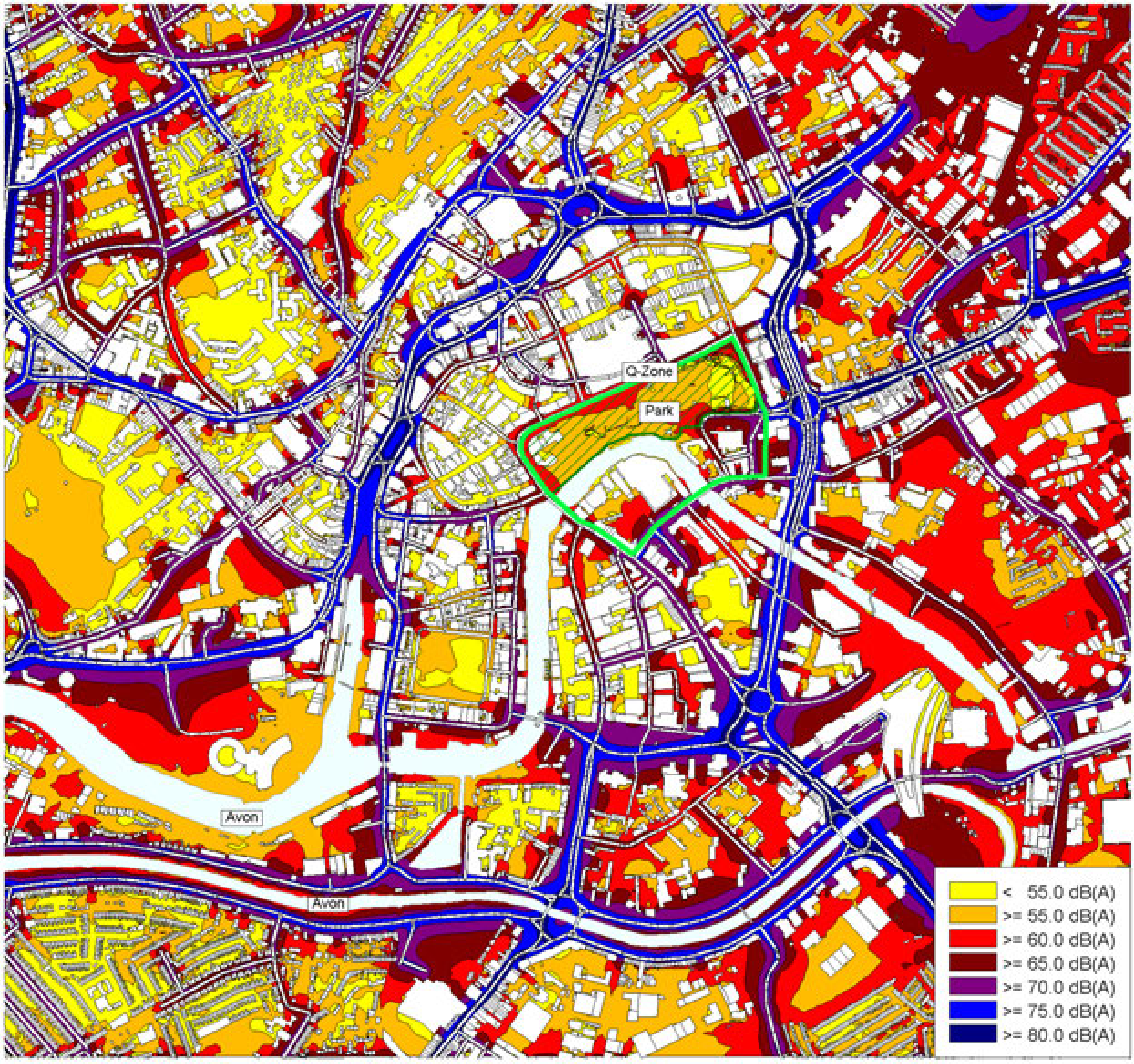

Figure 3.2.7: Bristol Scenario 10 - L_{den}

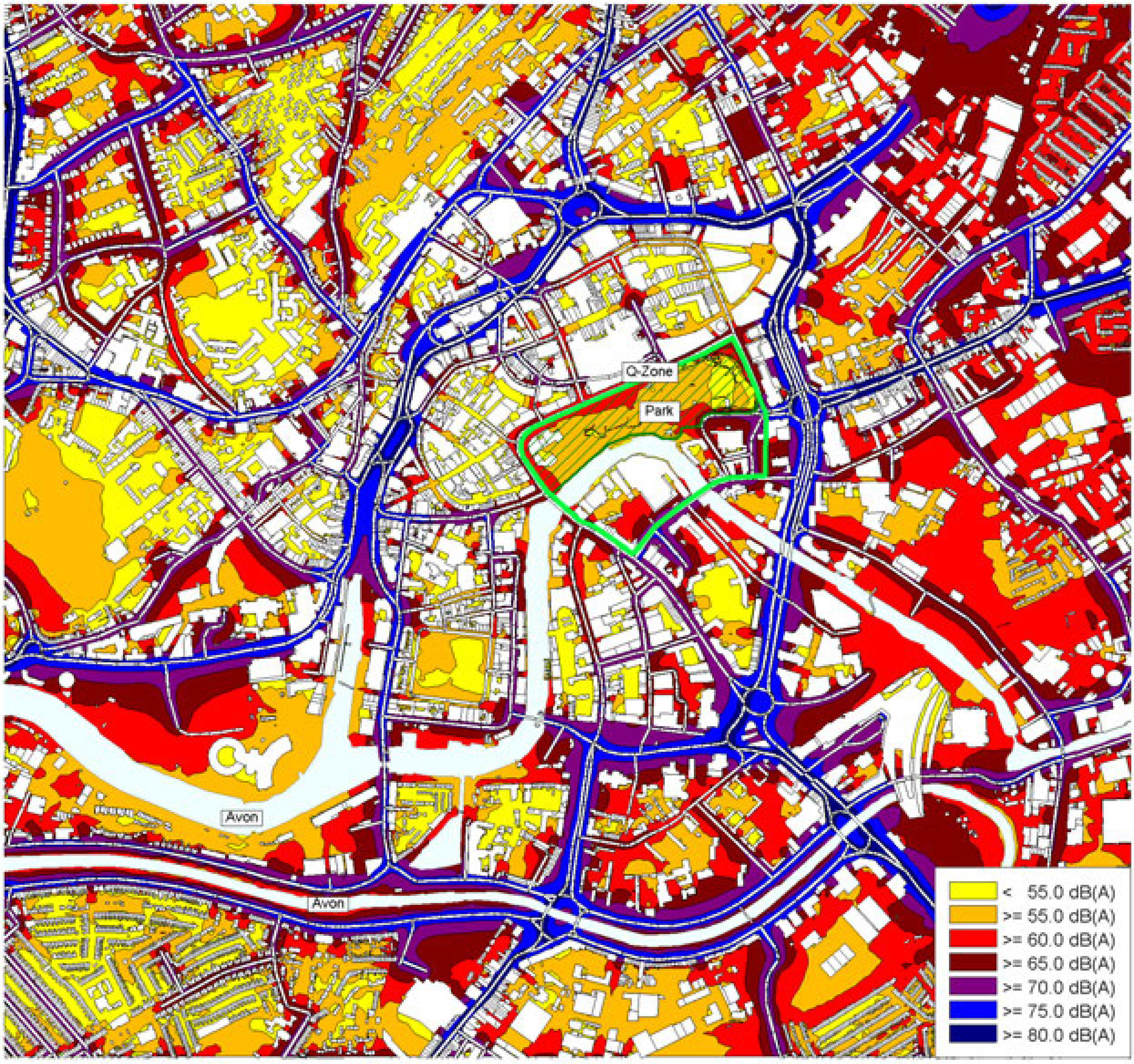

Figure 30: Bristol Scenario 11 - L_{den}

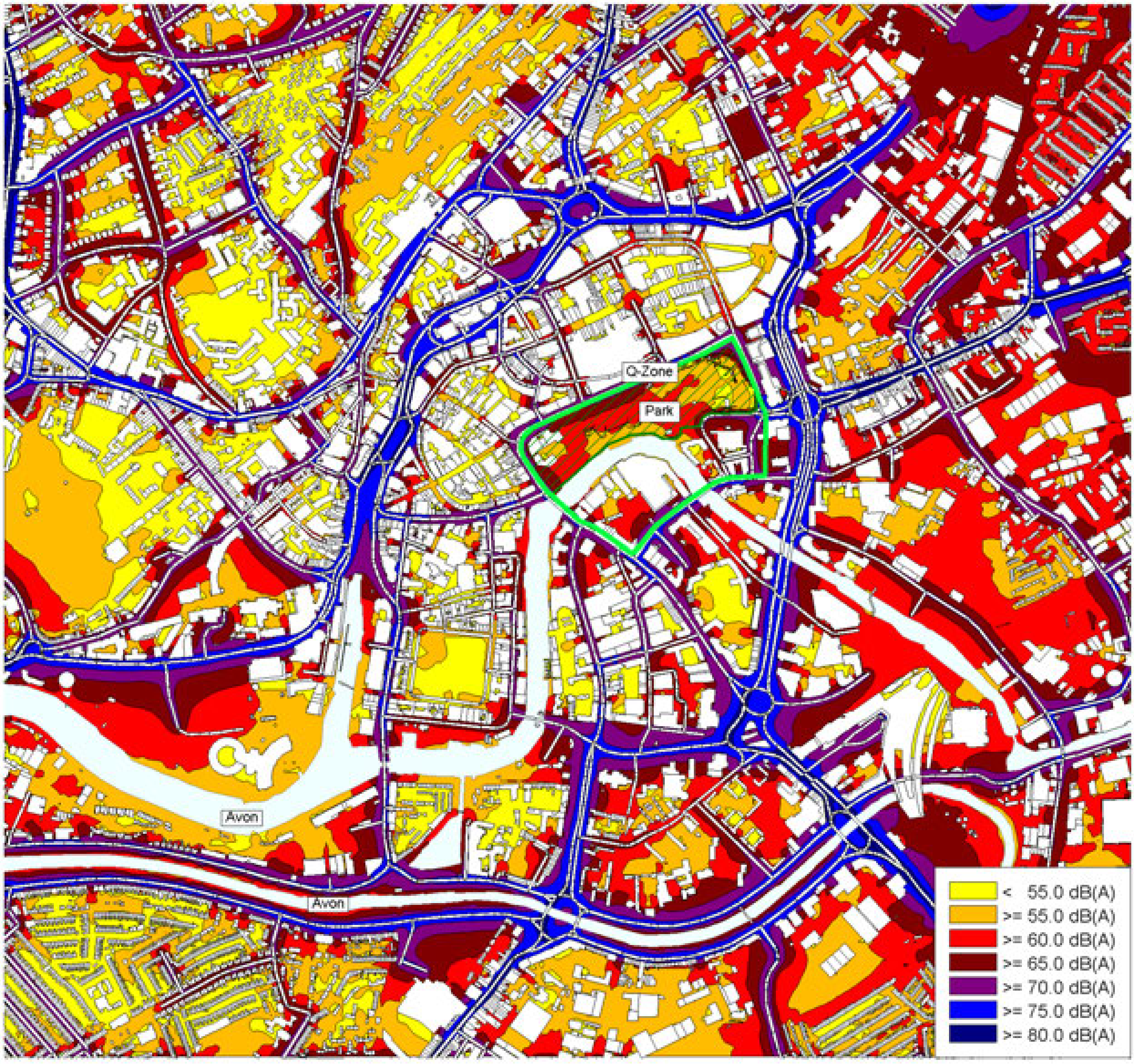

Figure 3.2.9: Bristol Scenario 12 - L_{den}

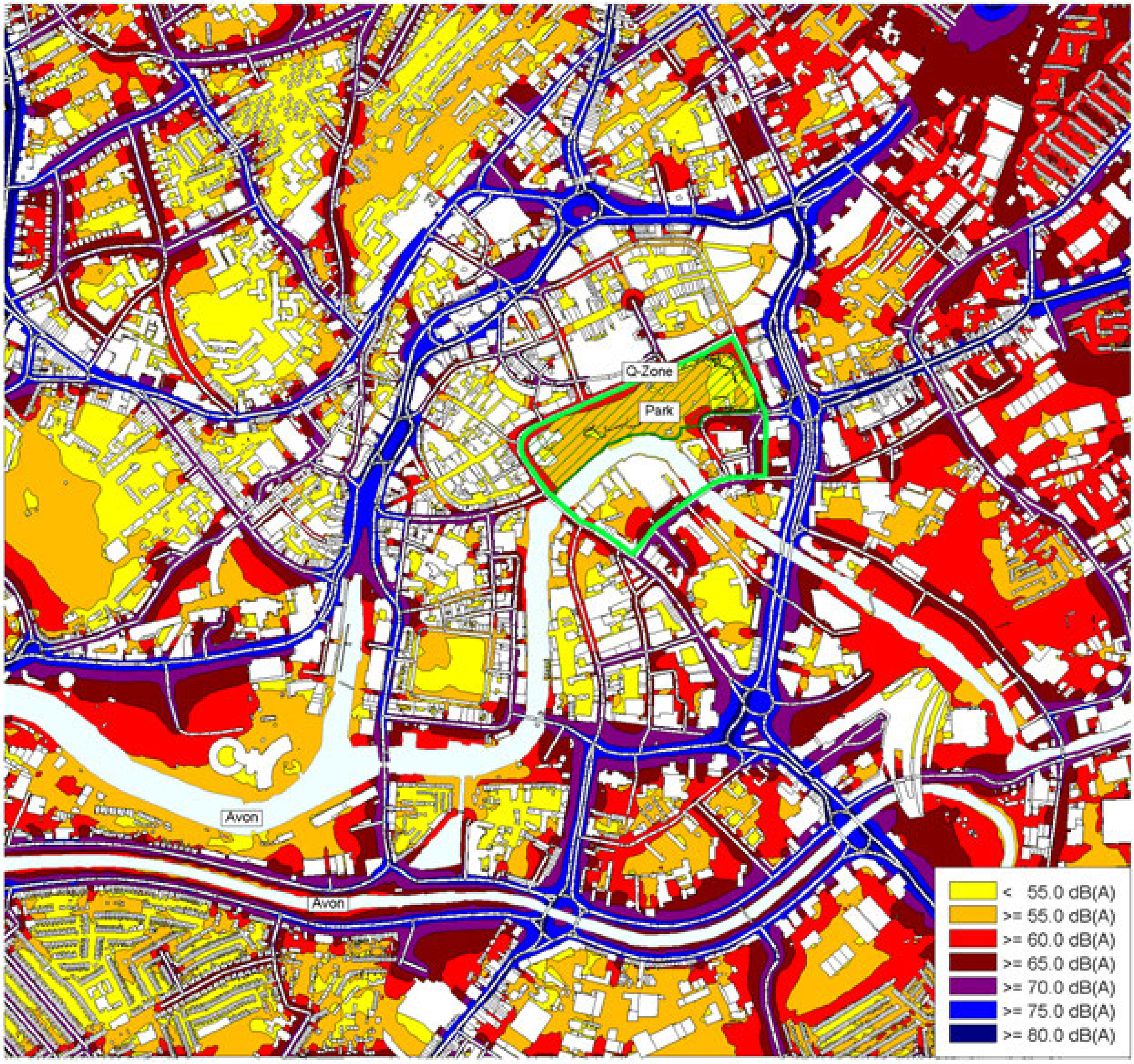

Figure 3.2.10: Bristol Scenario 13 - L_{den}

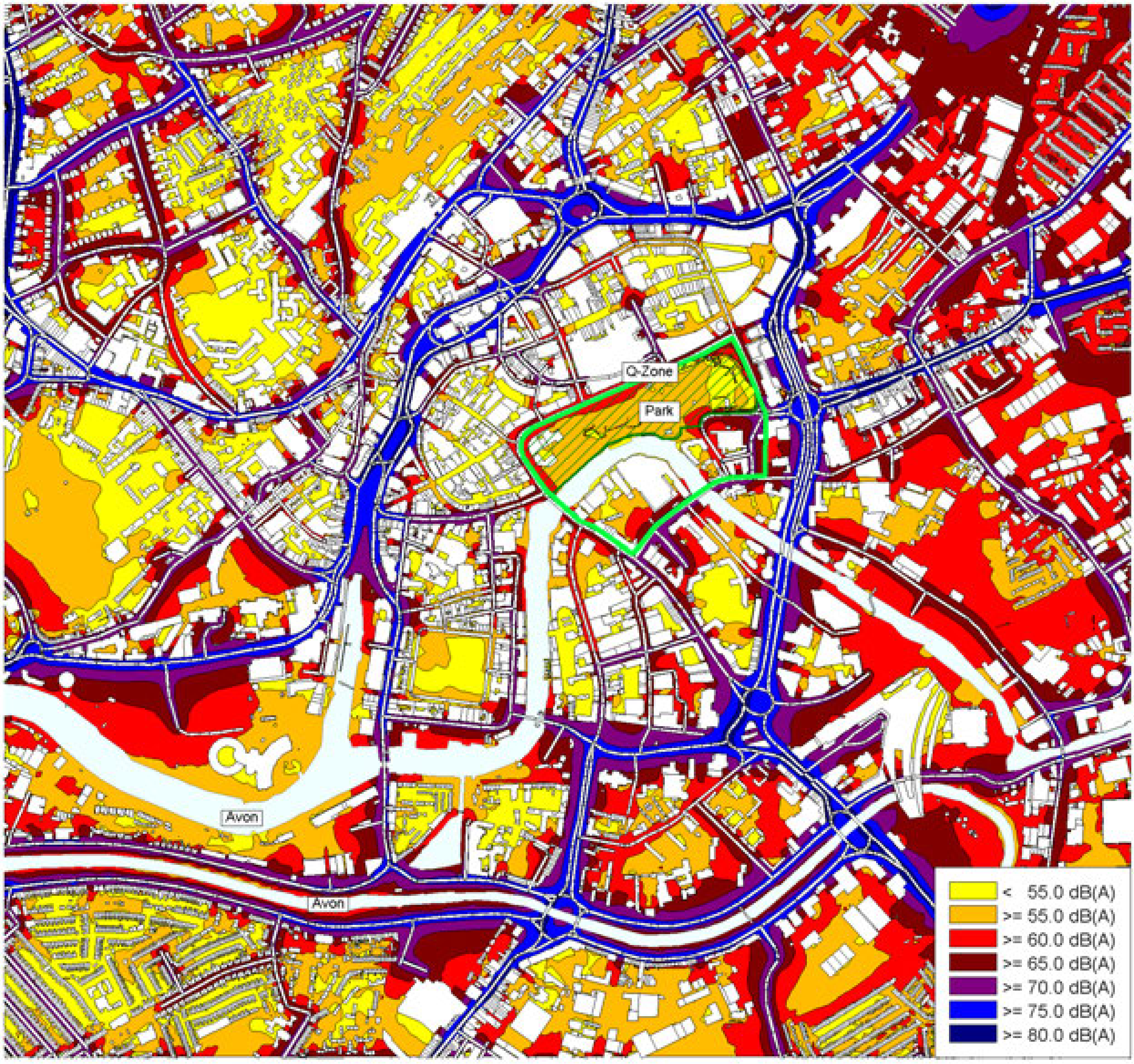

Figure 3.2.11: Bristol Scenario 14 - L_{den}

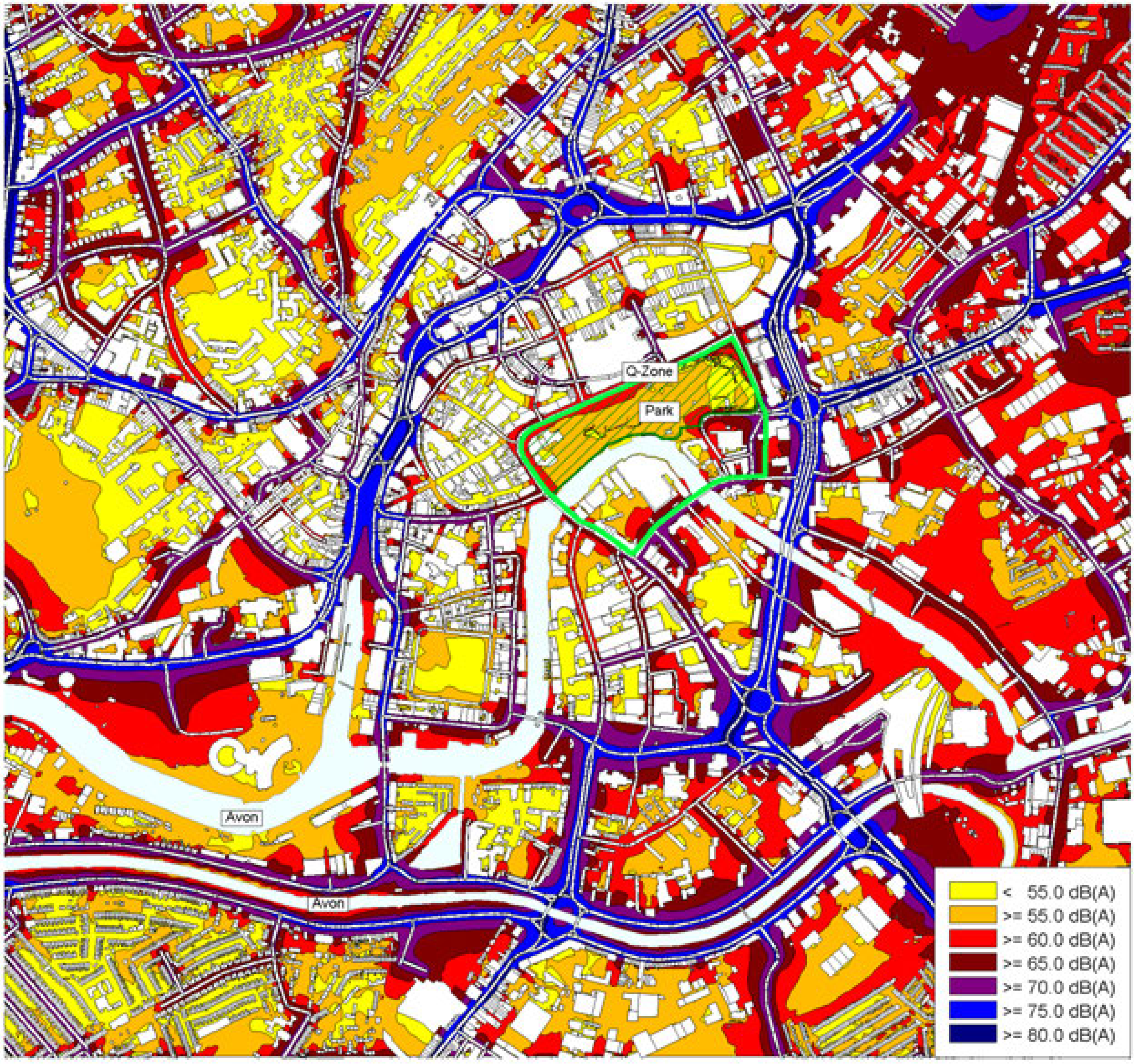

Figure 312: Bristol Scenario 15 L_{den}

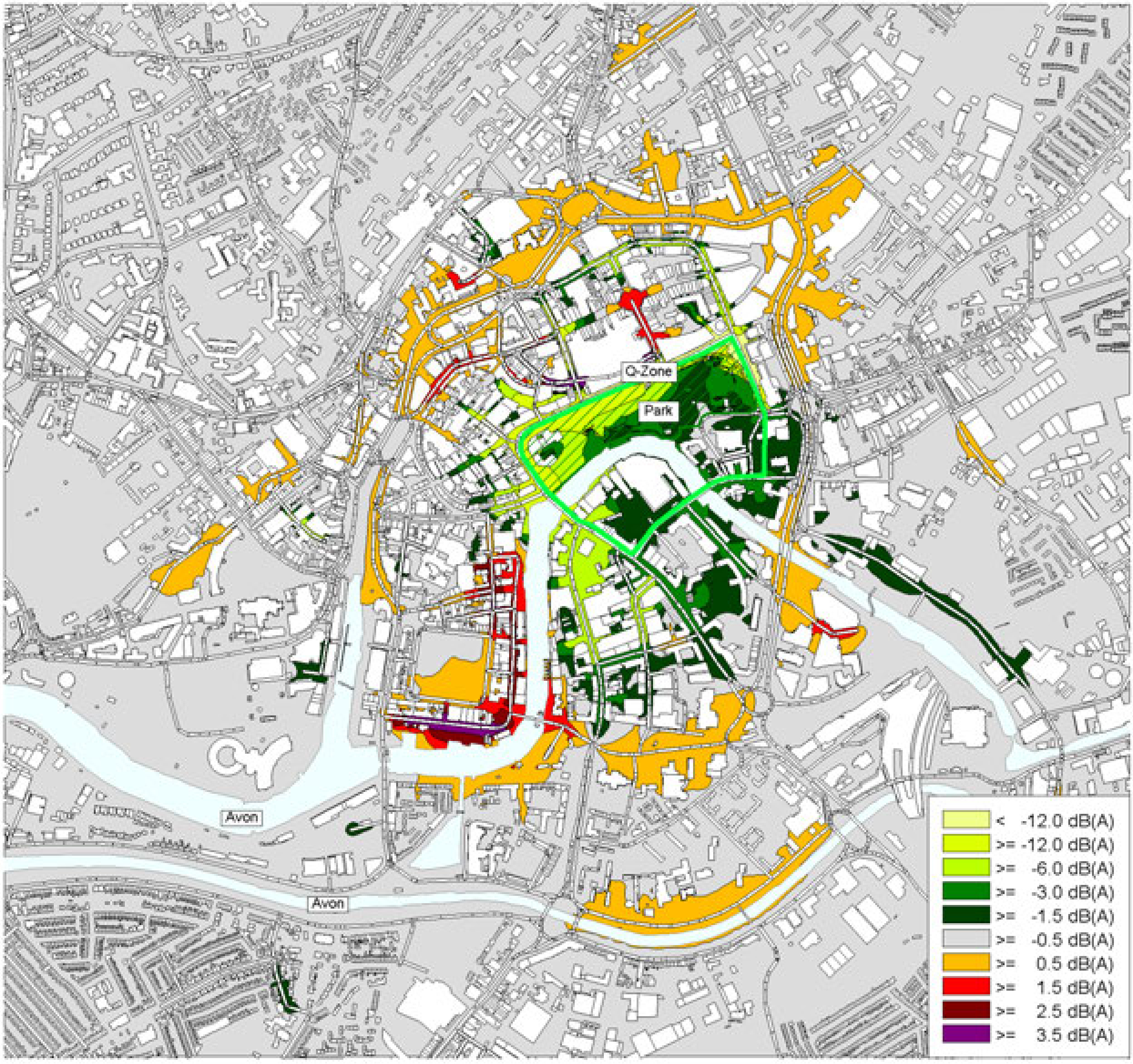

Figure 3.2.13: Bristol Scenario 2 – difference to base case - L_{den}

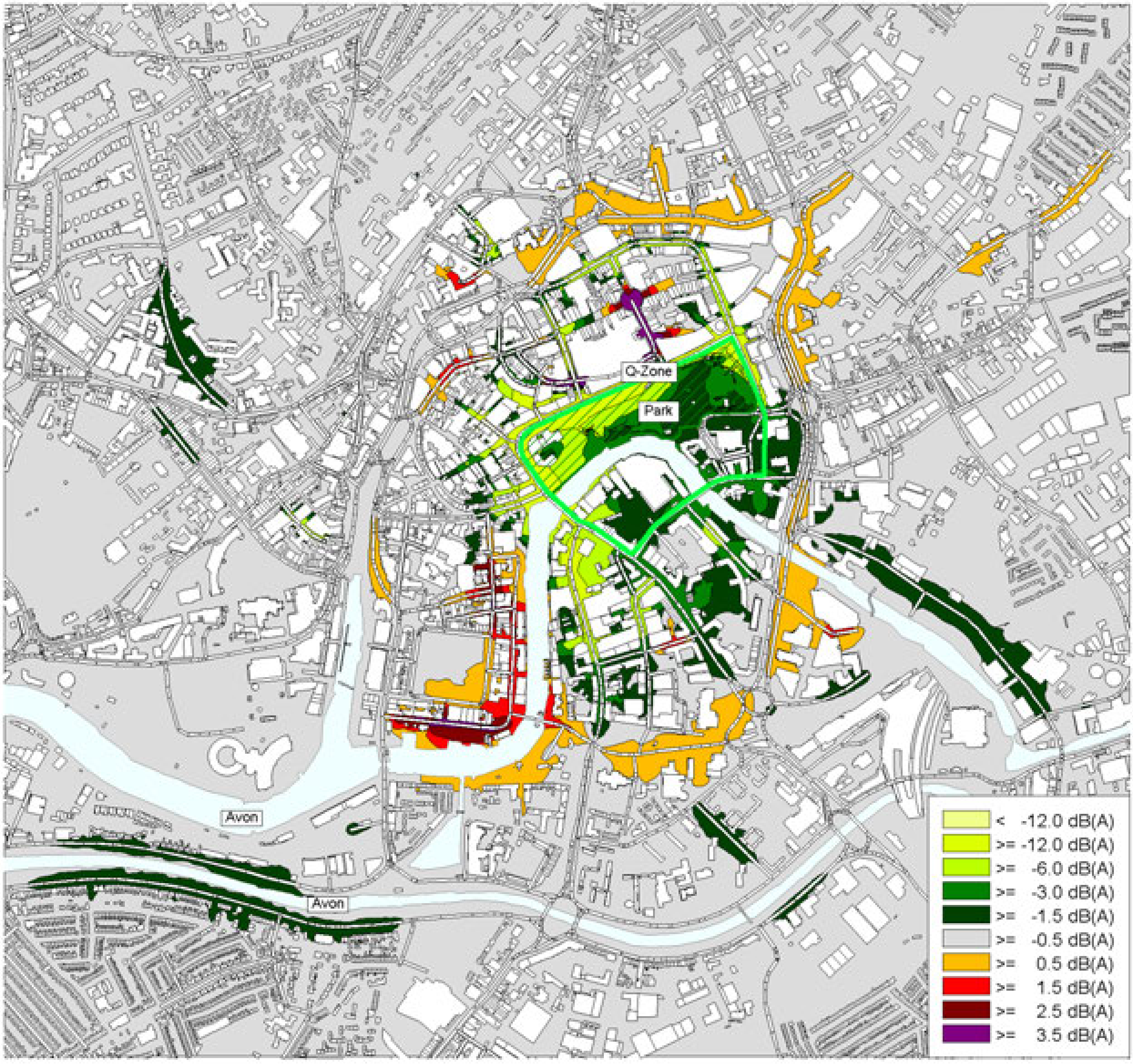

Figure 3.2.14: Bristol Scenario 3 – difference to base case - L_{den}

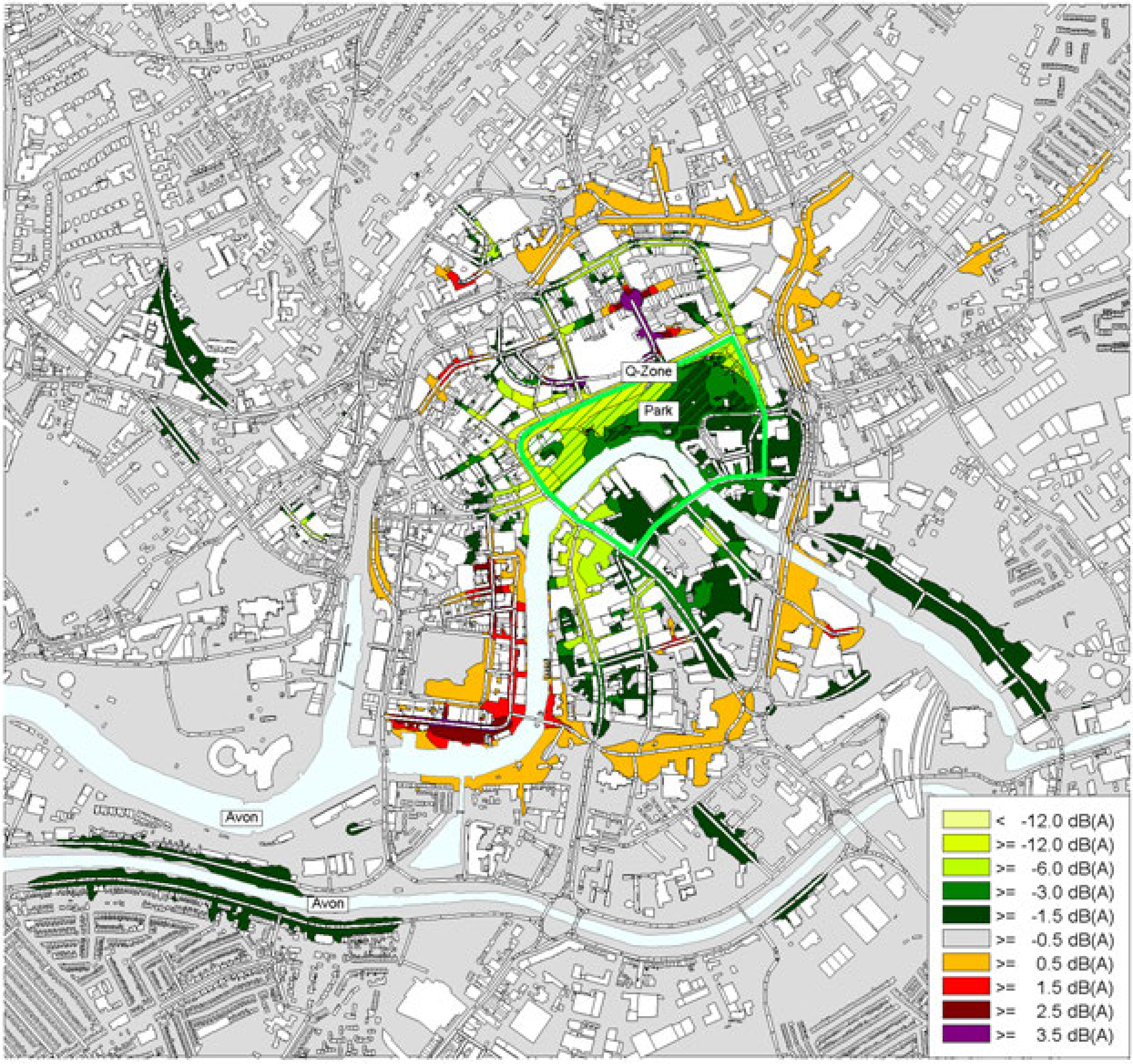

Figure 3.2.15: Bristol Scenario 4 – difference to base case - L_{den}

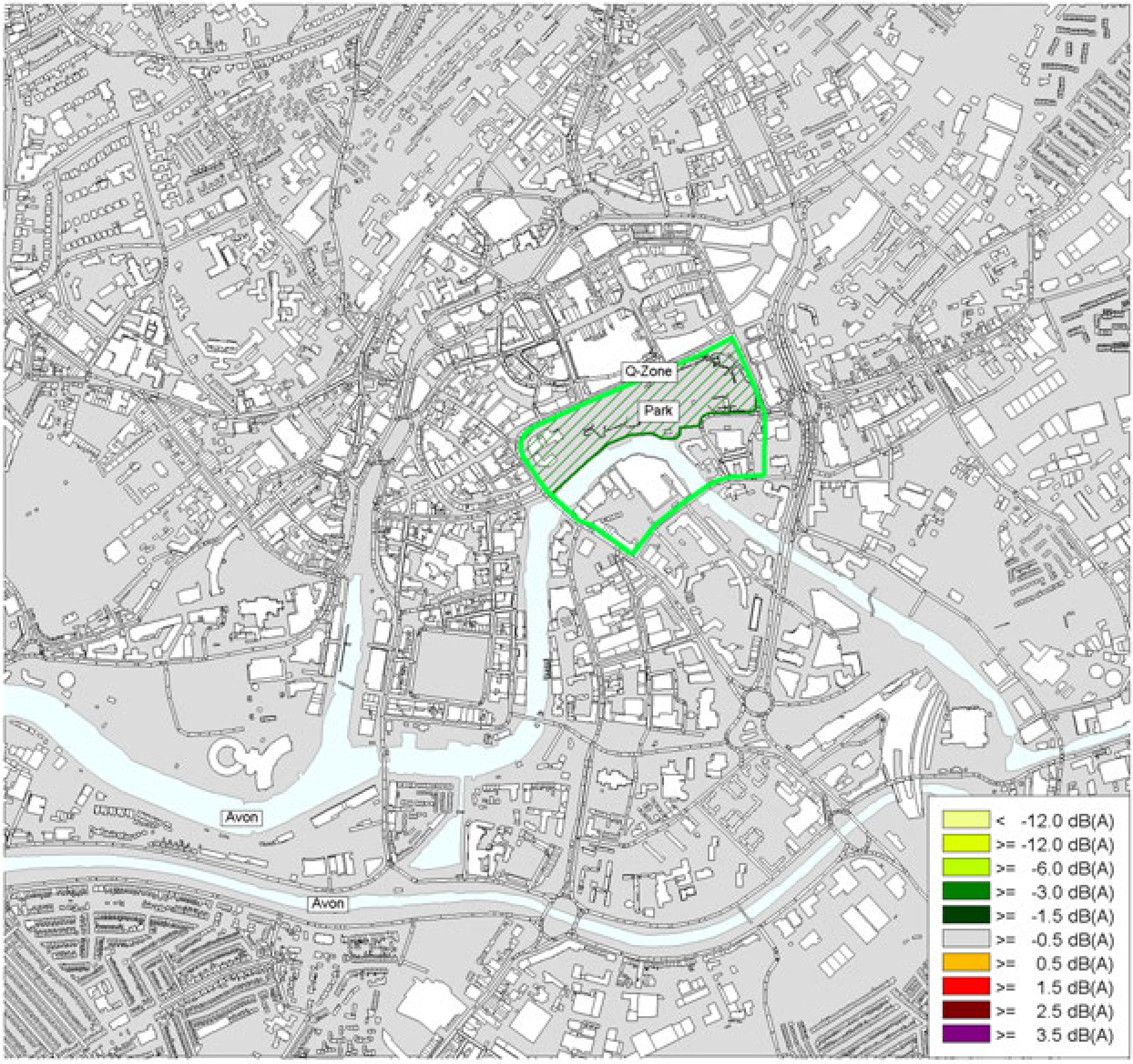

Figure 3.2.16: Bristol Scenario 8 – difference to base case - L_{den}

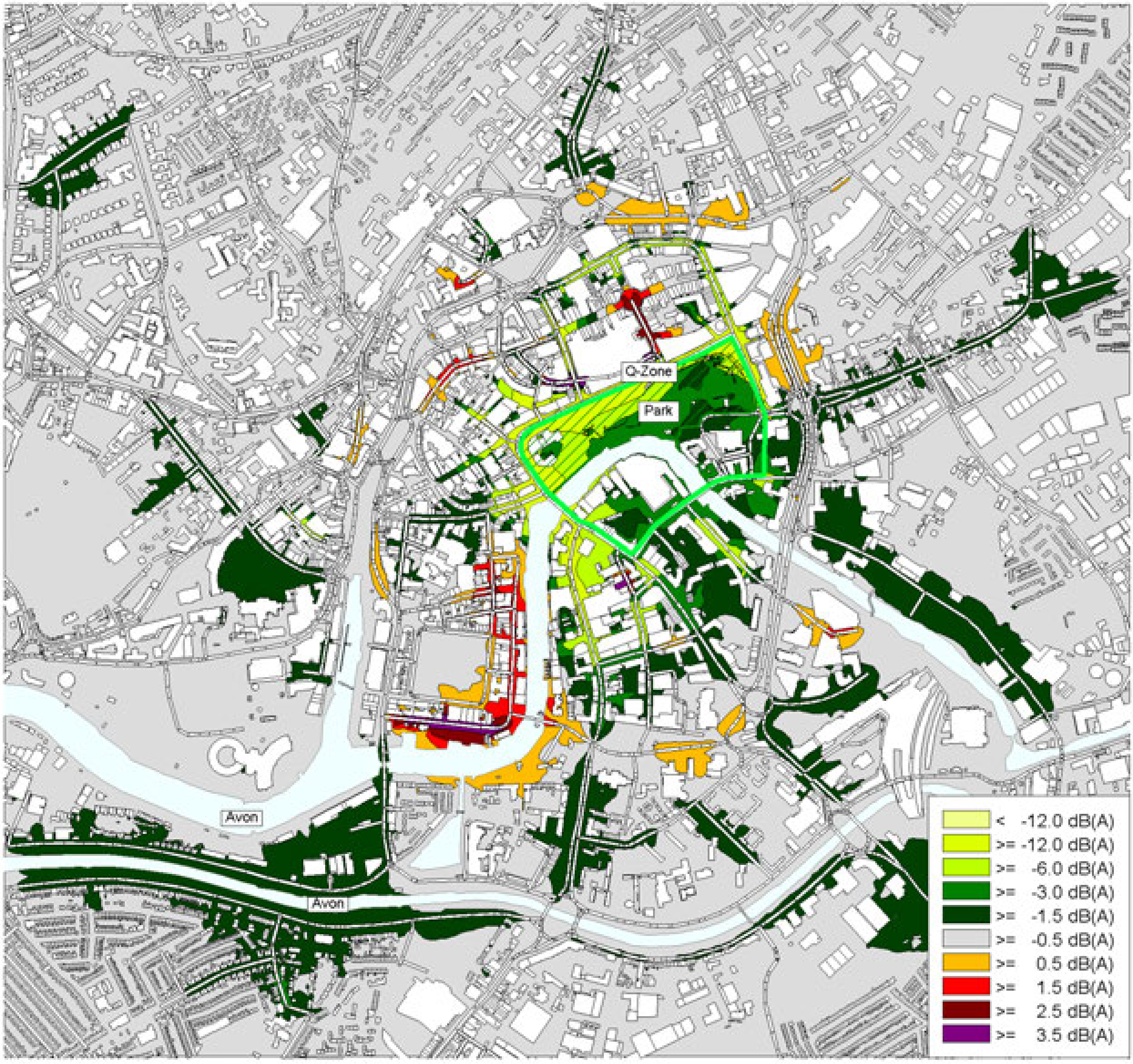

Figure 3.2.17: Bristol Scenario 9 – difference to base case - L_{den}

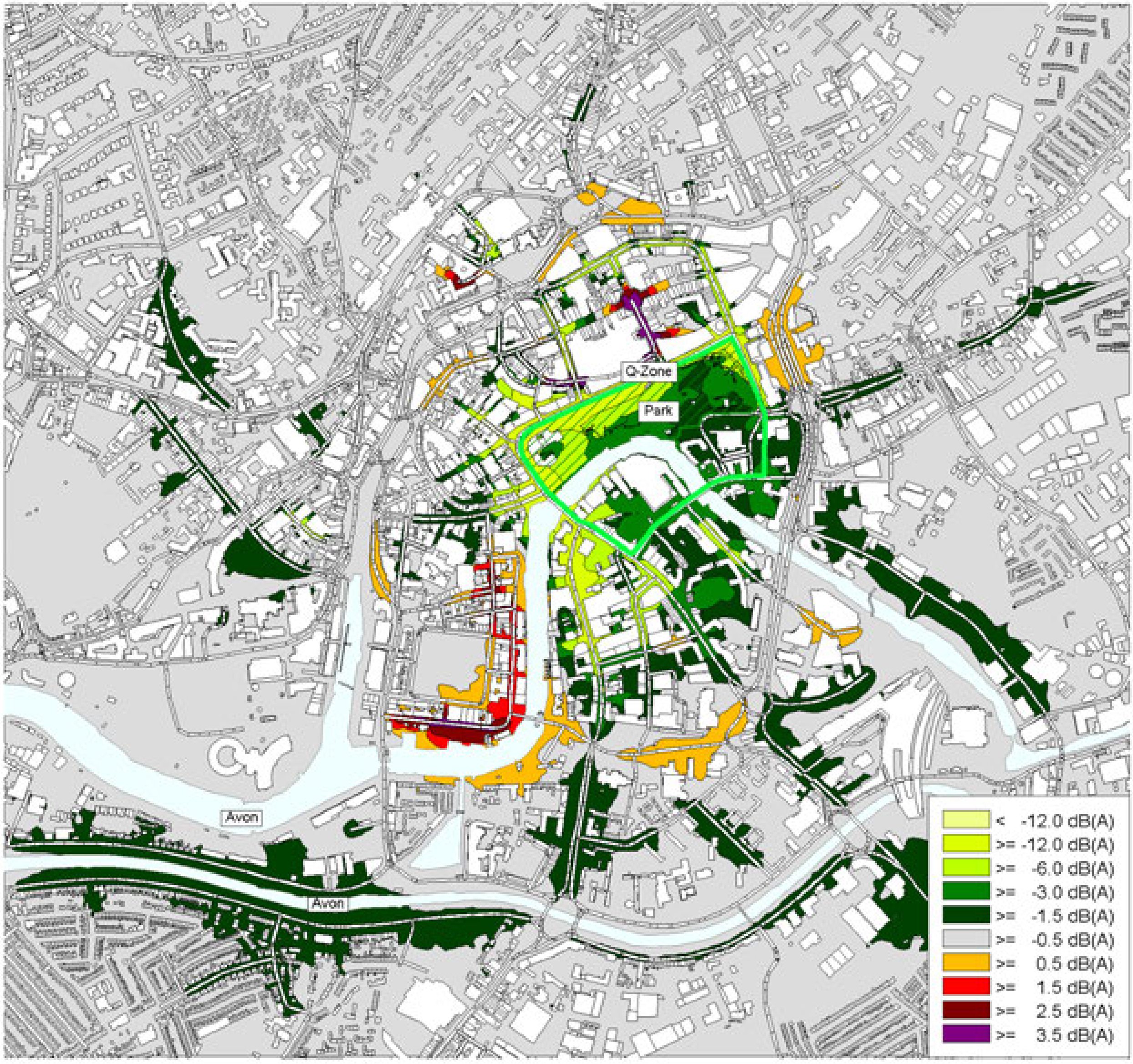

Figure 3.2.18: Bristol Scenario 10 – difference to base case - L_{den}

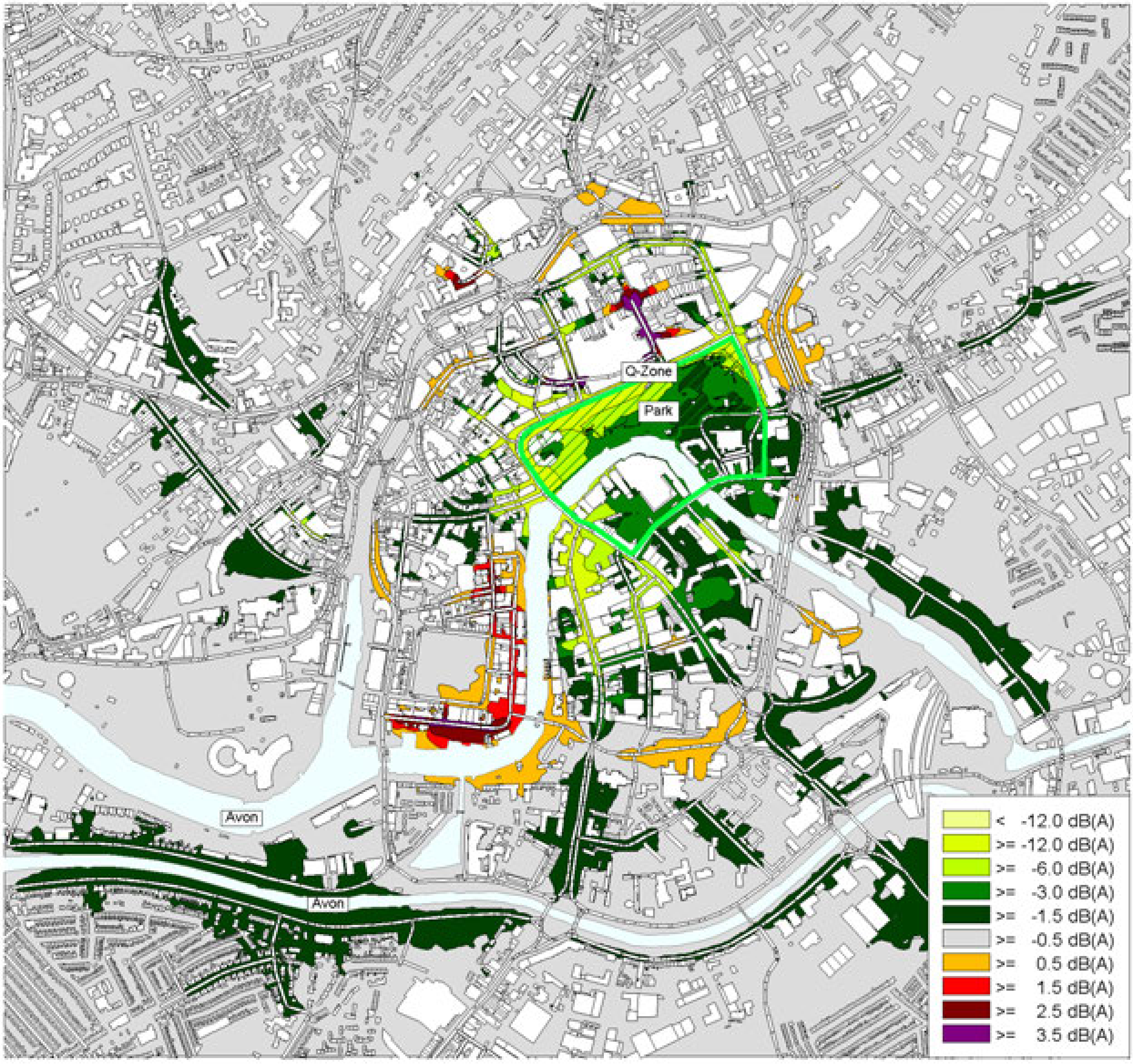

Figure 3.2.19: Bristol Scenario 11 – difference to base case - L_{den}

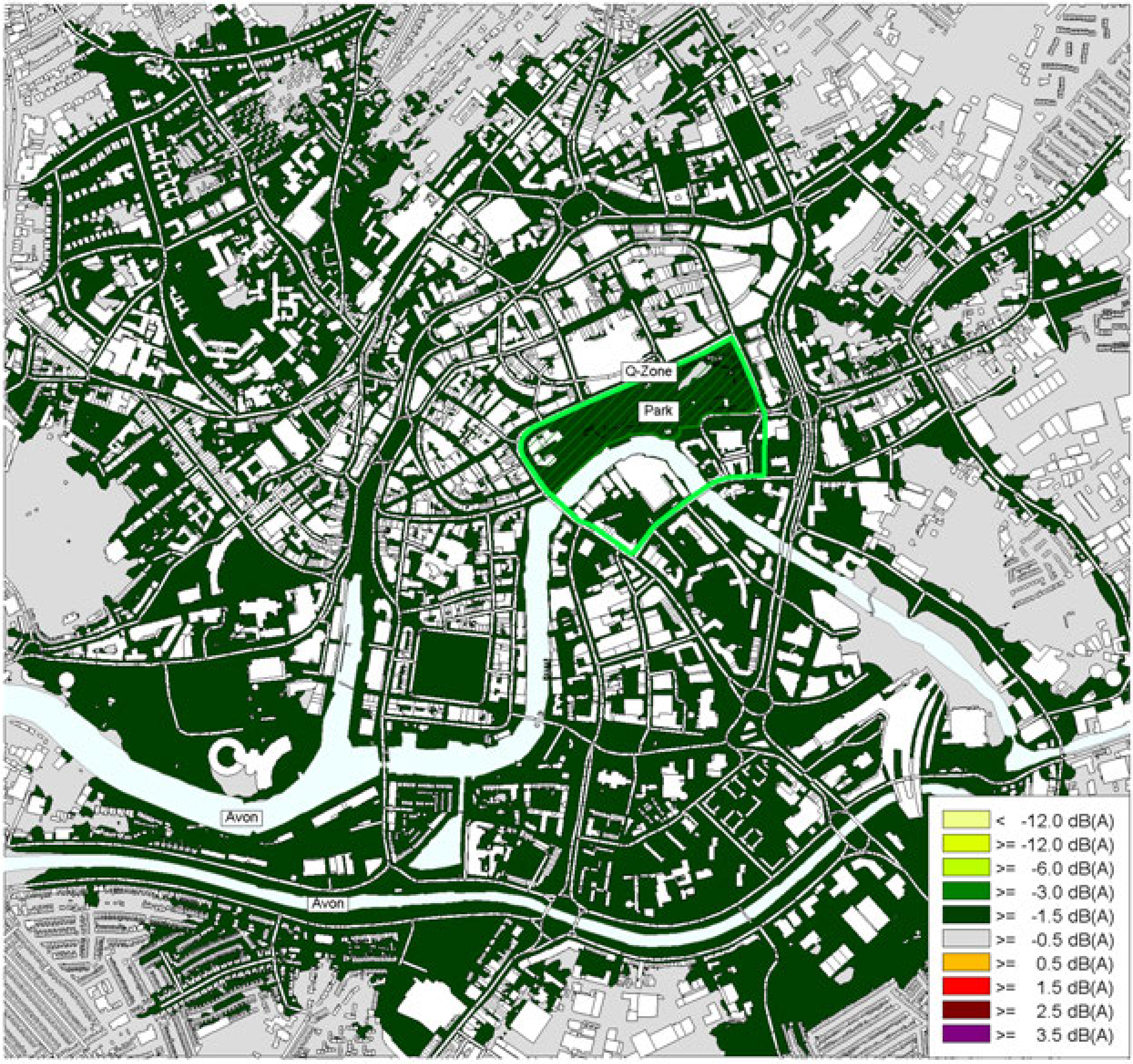

Figure 3.2.20: Bristol Scenario 12 – difference to base case - L_{den}

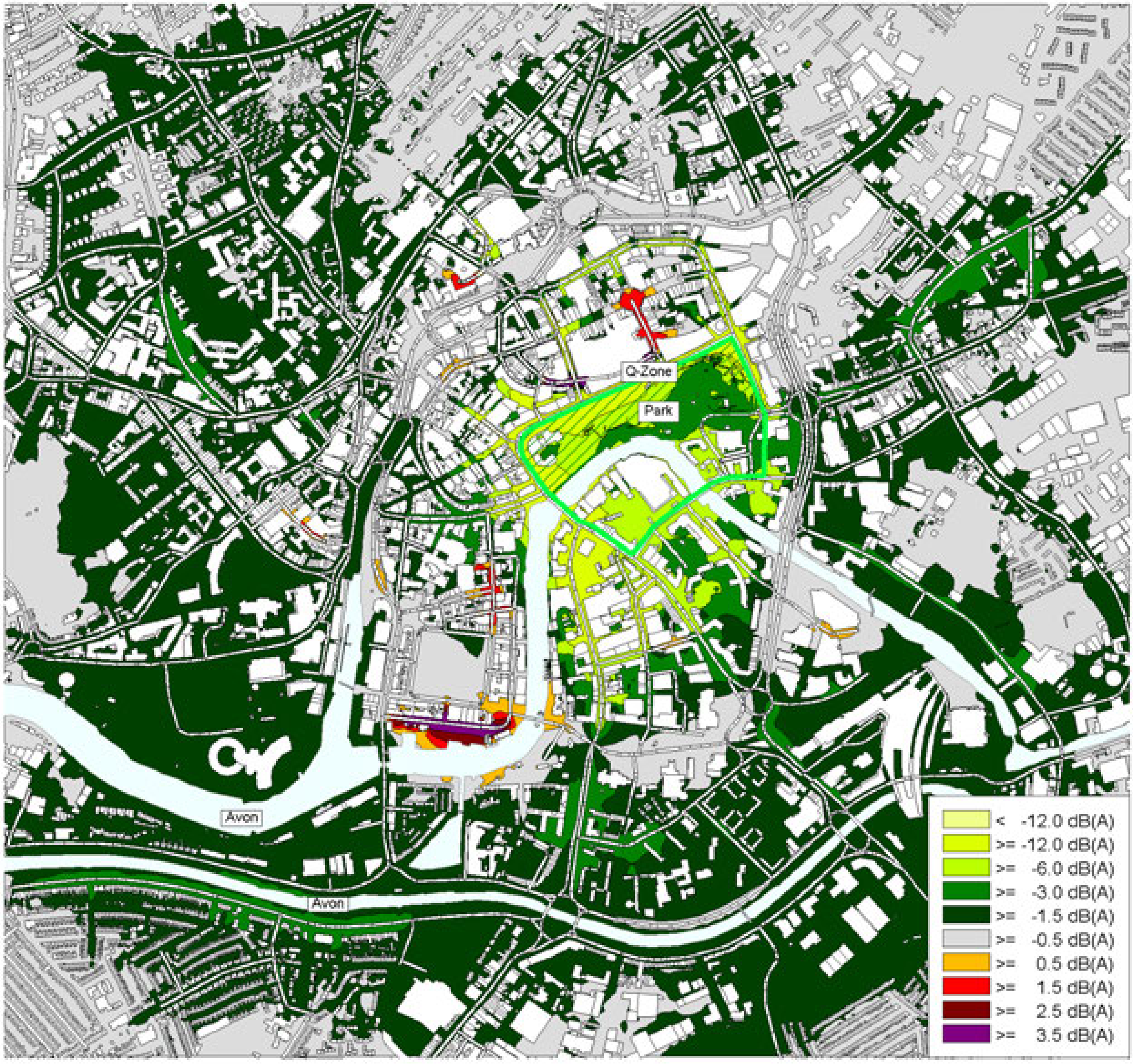

Figure 3.2.21: Bristol Scenario 13 – difference to base case - L_{den}

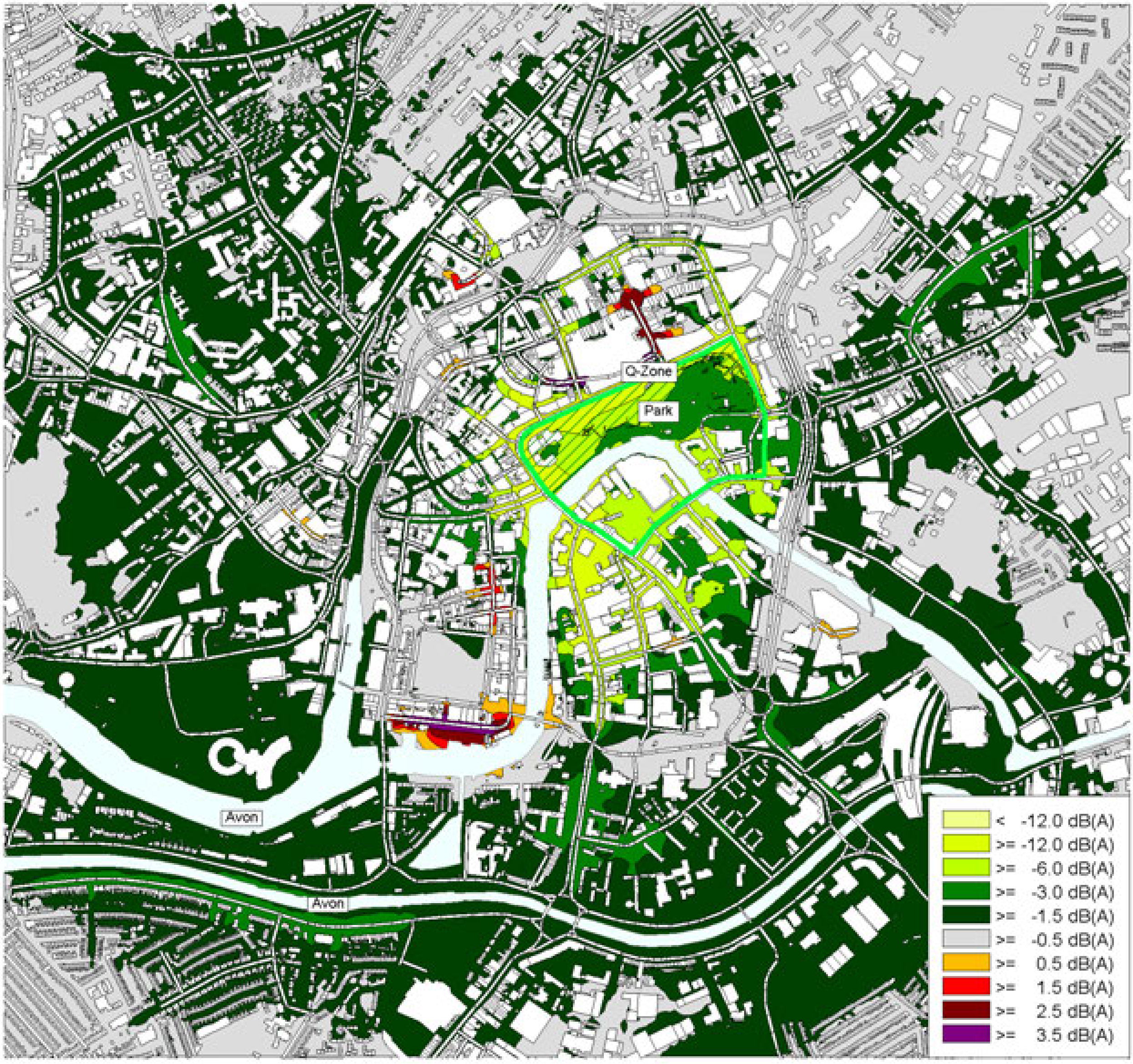

Figure 3.2.22: Bristol Scenario 14 – difference to base case - L_{den}

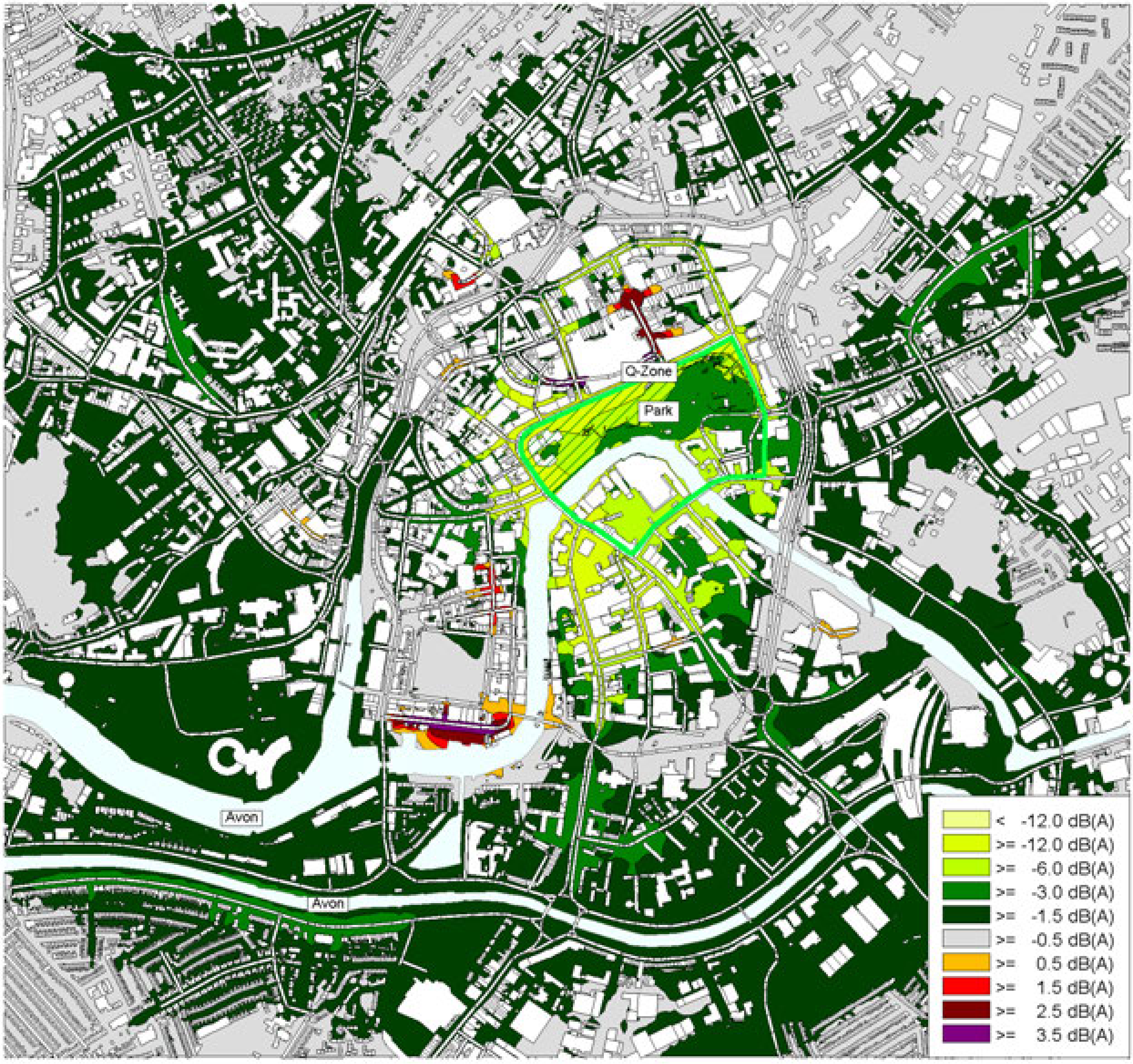

Figure 3.2.23: Bristol Scenario 15 – difference to base case - L_{den}

3.3 ESSEN

To provide a better overview we included the definition of the scenarios once again at this point. For Essen, the following set of traffic scenarios was simulated:

Scenario nr	Zone	Fee, Euros/passage	Inside LNVO percentage	External LNVO percentage
1	none	none	1	1
2	large	ban	1	1
3	large	1	1	1
4	large	0.5	1	1
5	small	ban	1	1
6	small	1	1	1
7	small	0.5	1	1
8	none	none	5	5
9	large	ban	20	5
10	XL	ban	1	1
11	XXL	ban	1	1
12	none	none	20	20
13	large	ban	100	20
14	XXL	ban	100	20
15	large	0.5	100	20

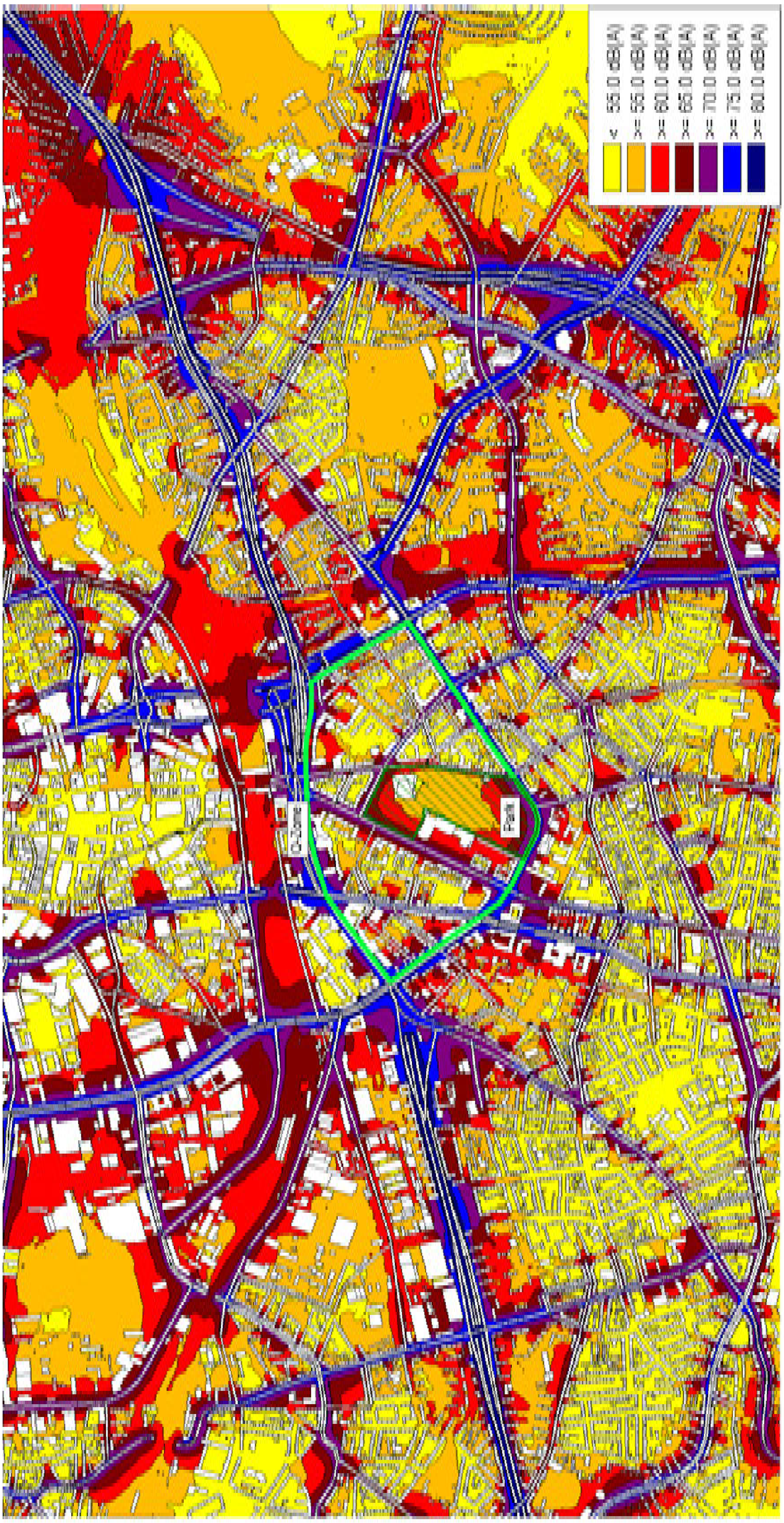

Figure 3.3.1: Essen Scenario 1 (Base Case) - L_{den}

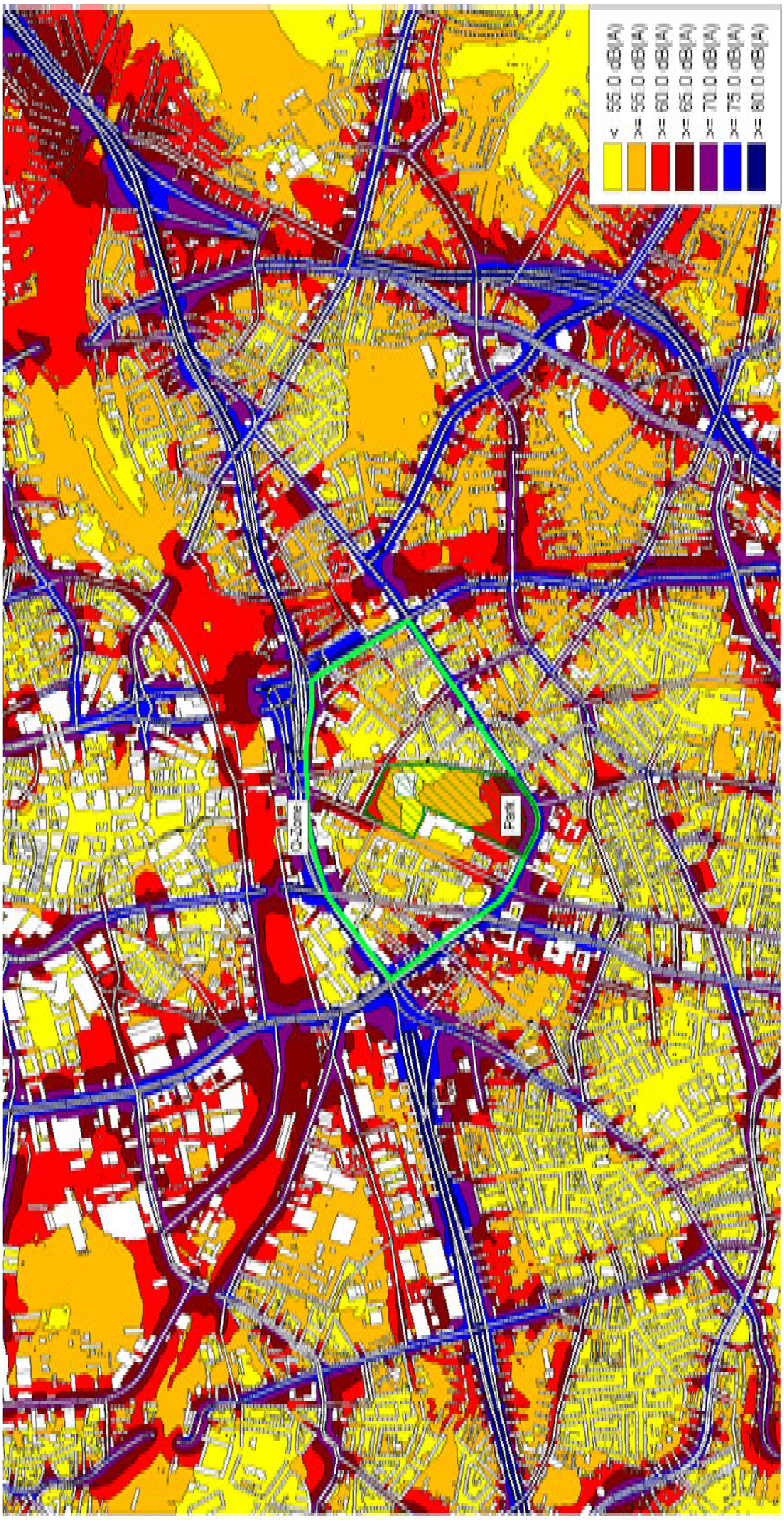

Figure 3.3.2: Essen Scenario 2 - L_{den}

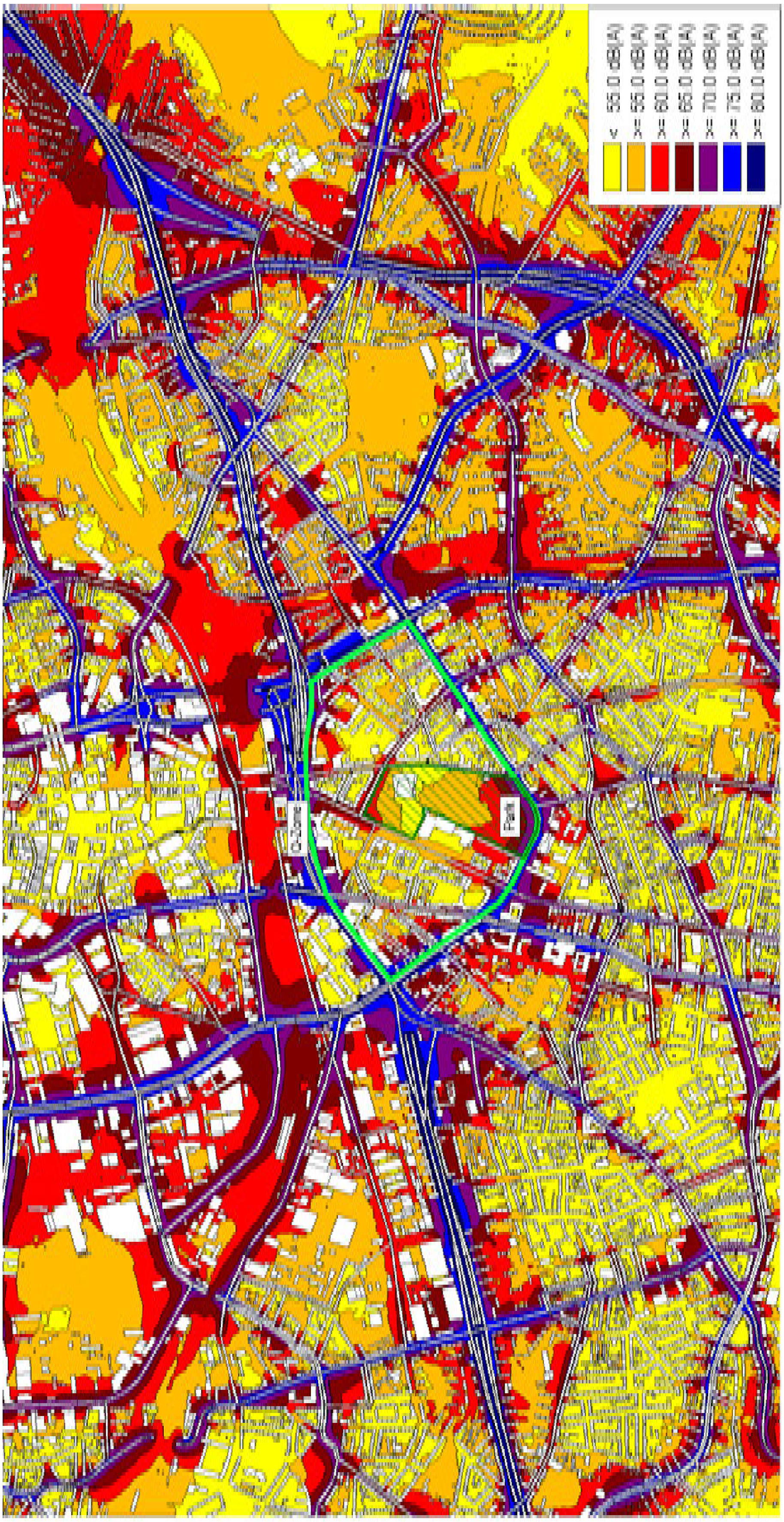

Figure 3.3.3: Essen Scenario 3 - L_{den}

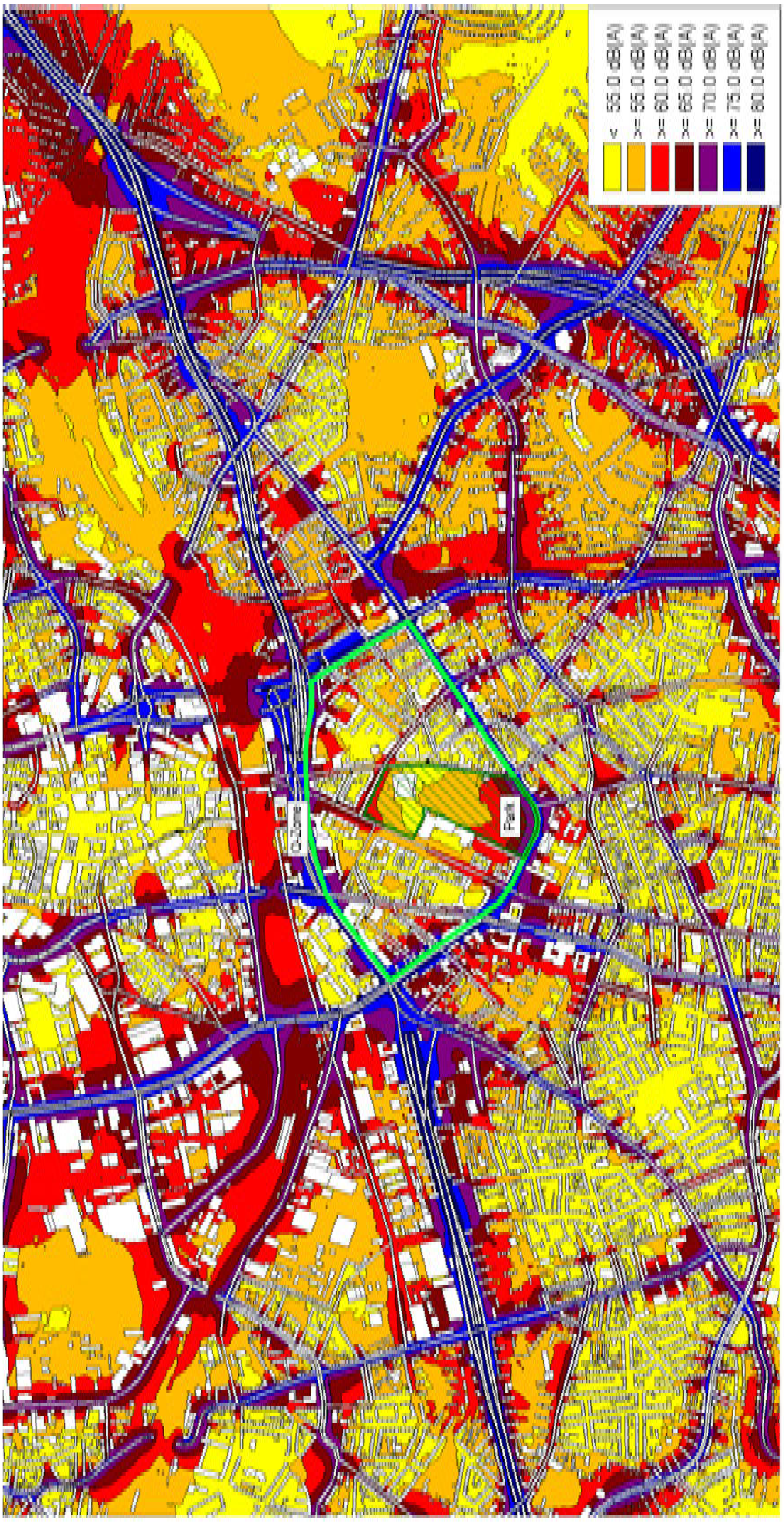

Figure 3.3.4: Essen Scenario 4 - L_{den}

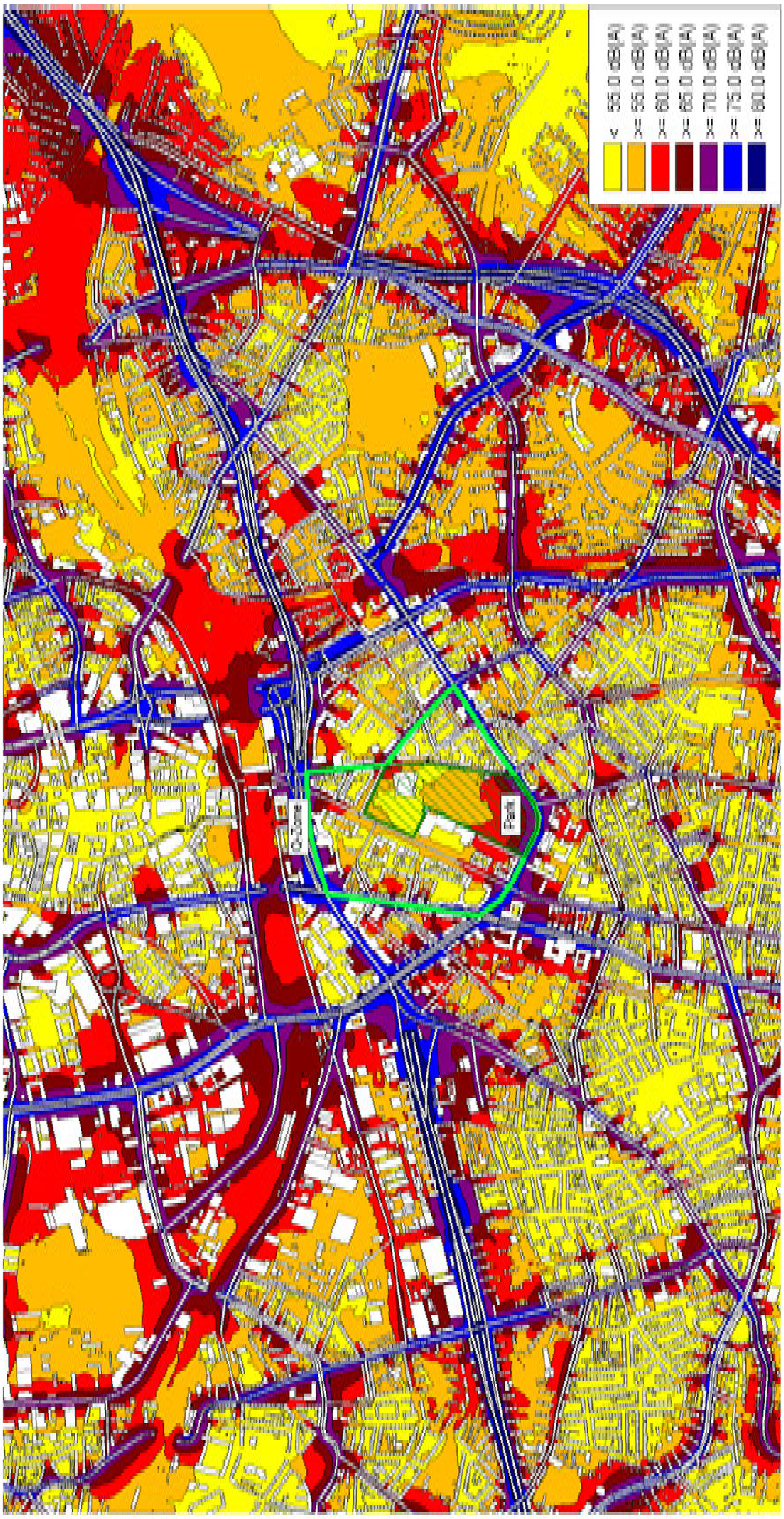

Figure 3.3.5: Essen Scenario 5 - L_{den}

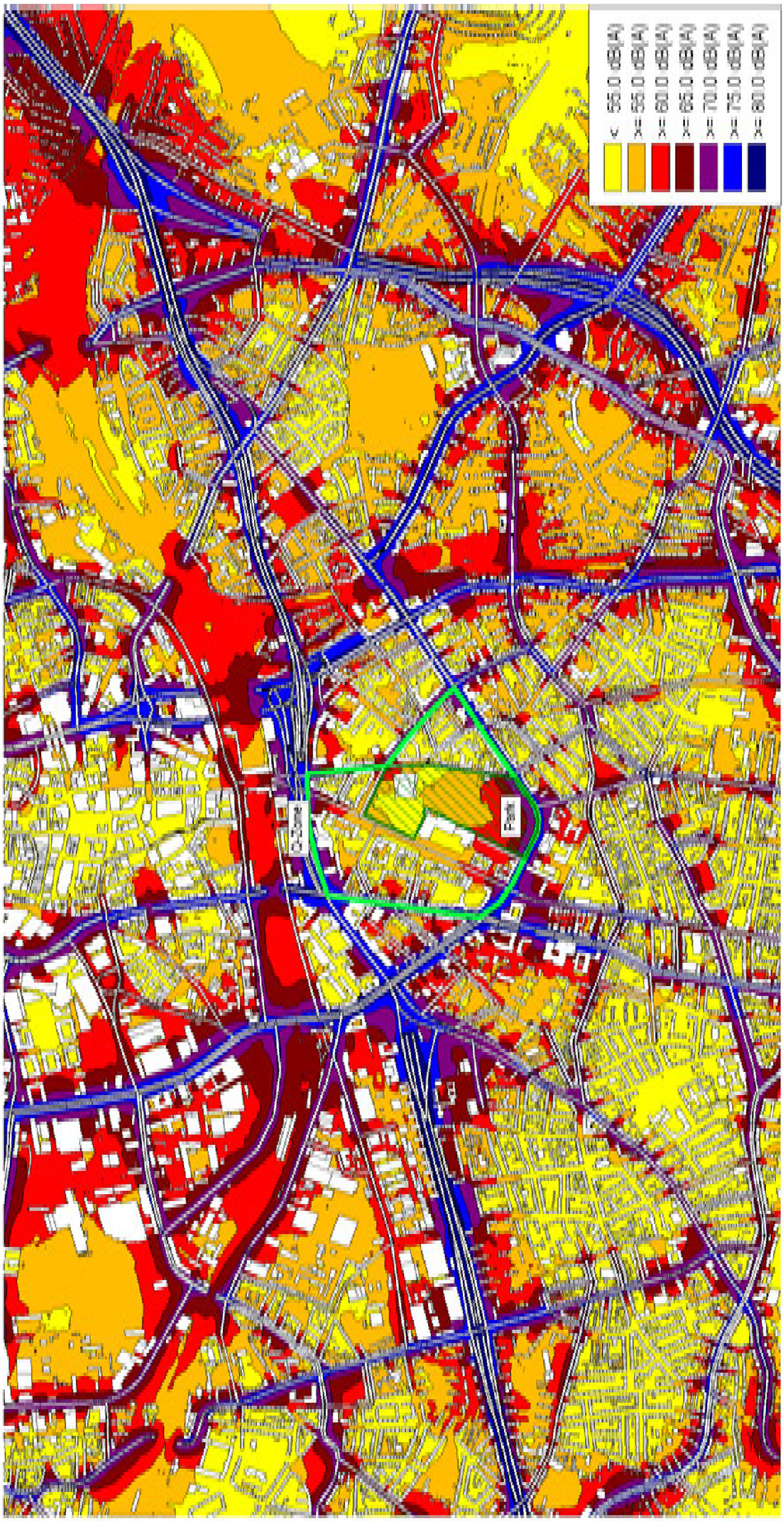

Figure 3.3.6: Essen Scenario 6 - L_{den}

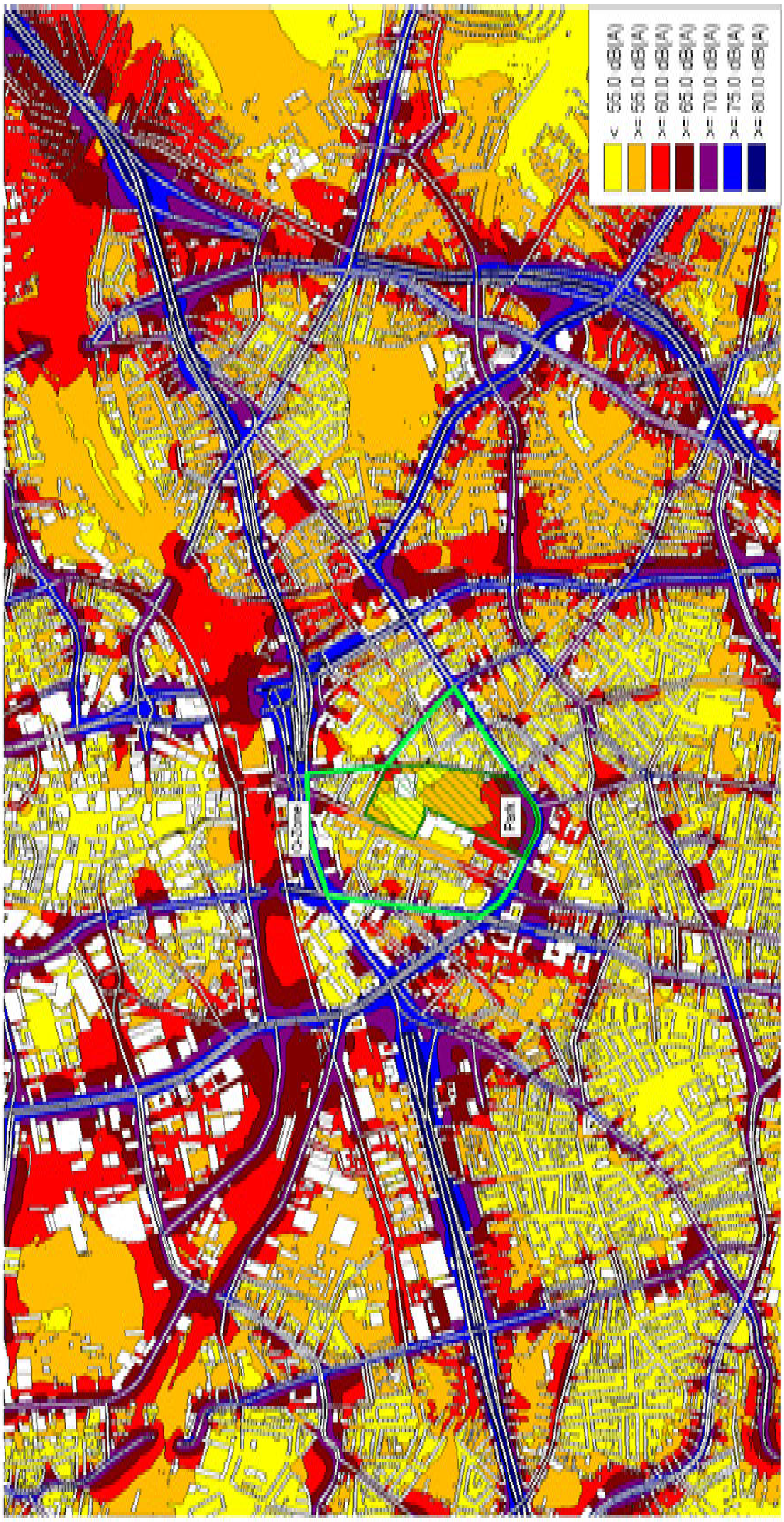

Figure 3.3.7: Essen Scenario 7 - L_{den}

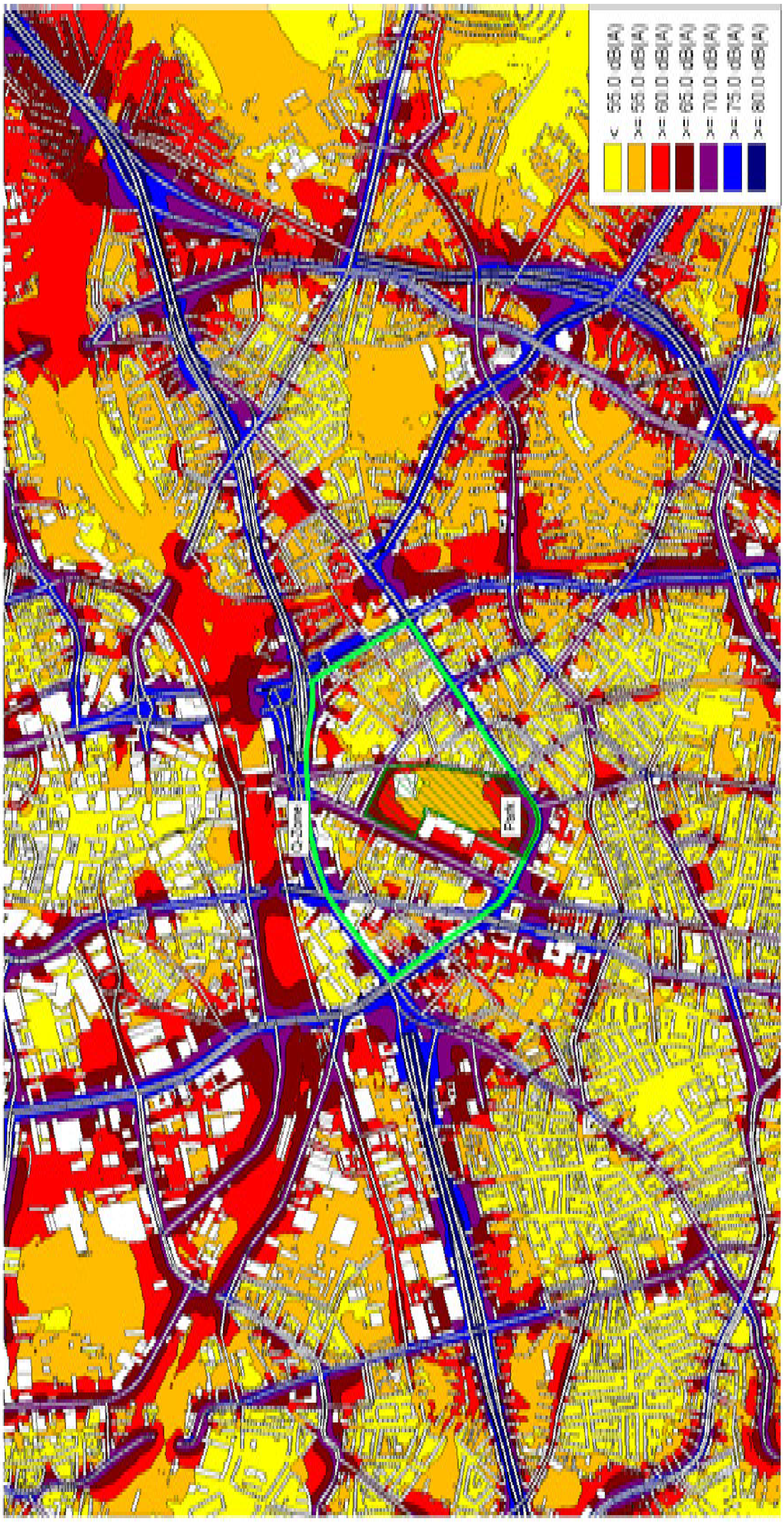

Figure 3.3.8: Essen Scenario 8 - L_{den}

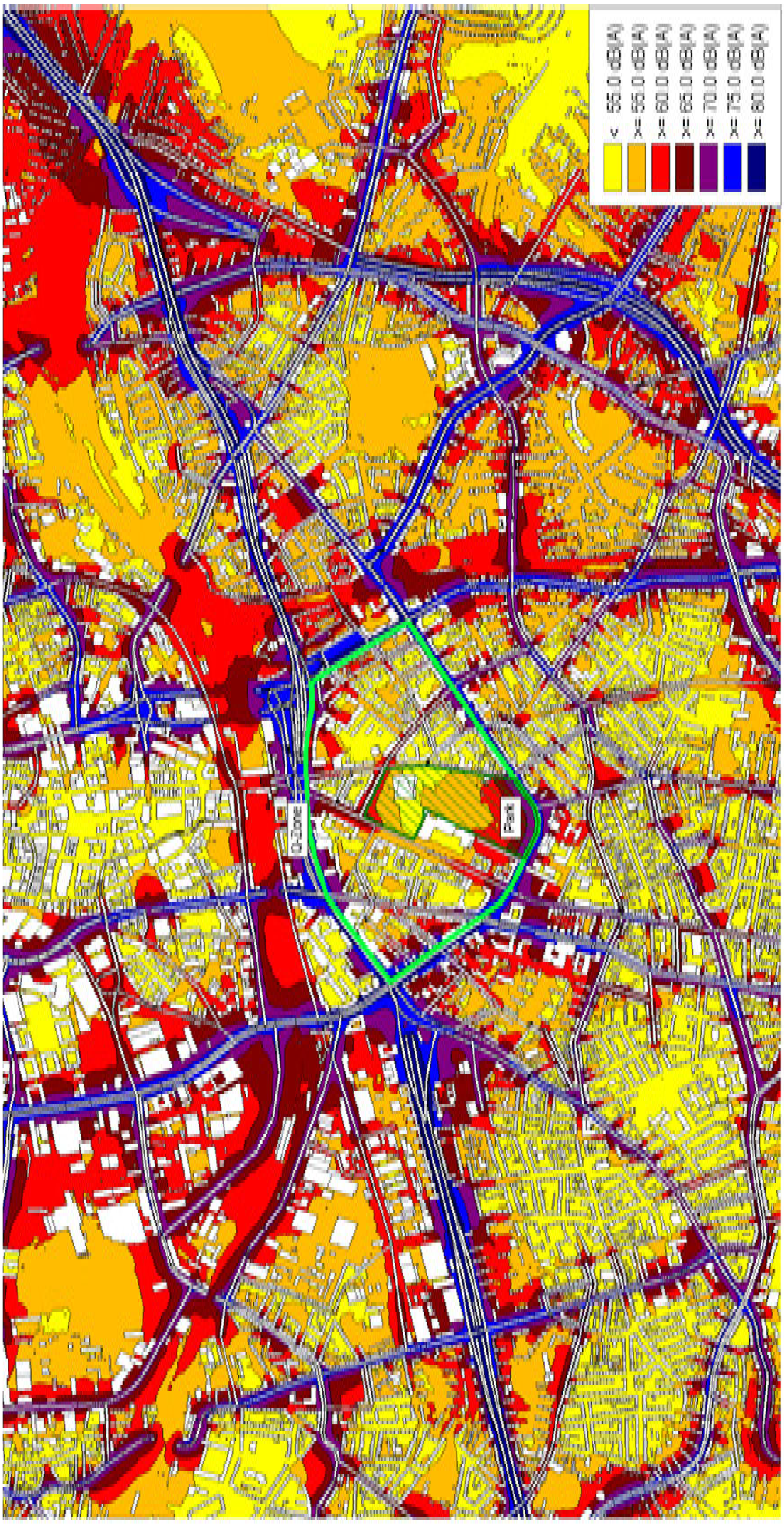

Figure 3.3.9: Essen Scenario 9 - L_{den}

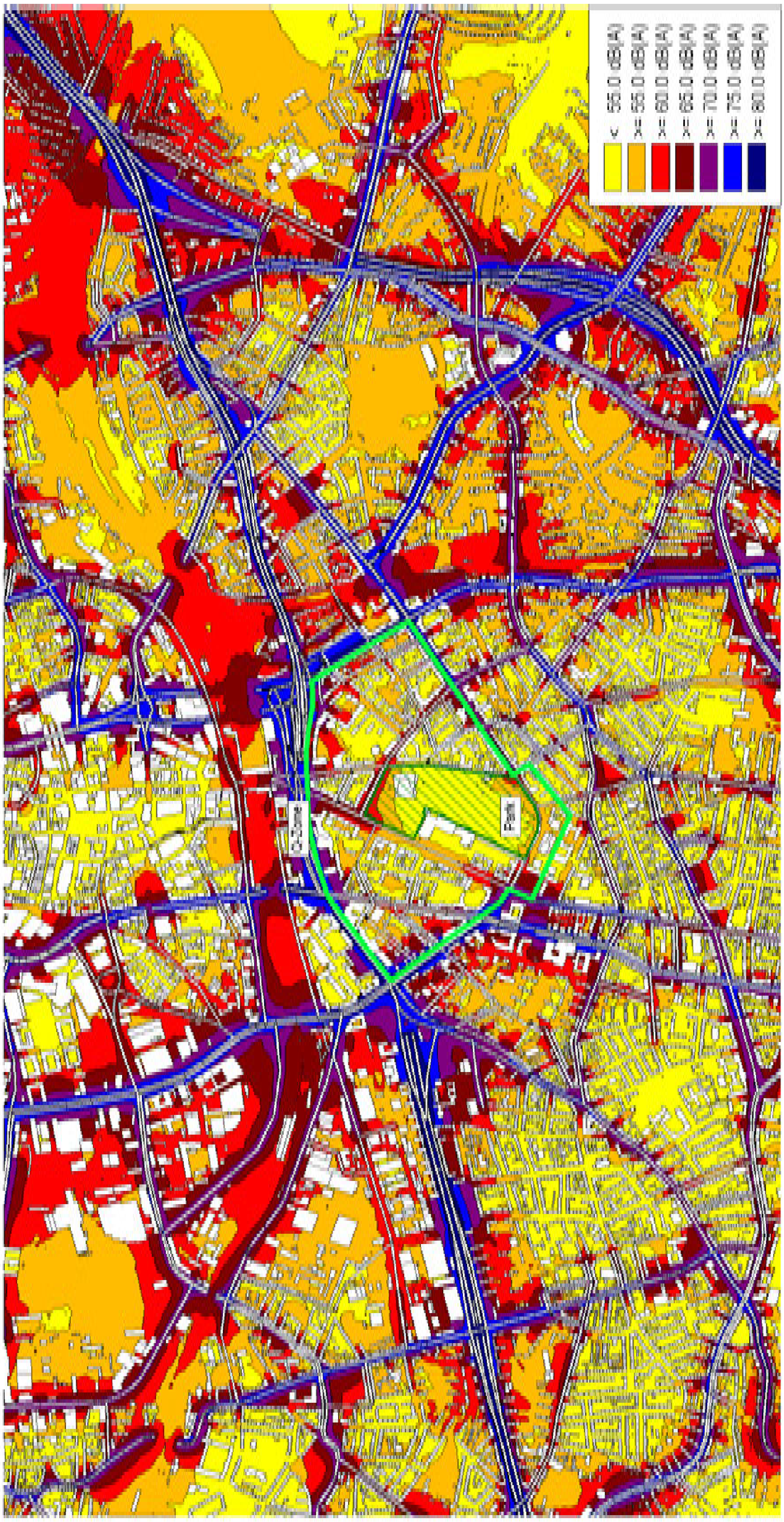

Figure 3.3.10: Essen Scenario 10 - L_{den}

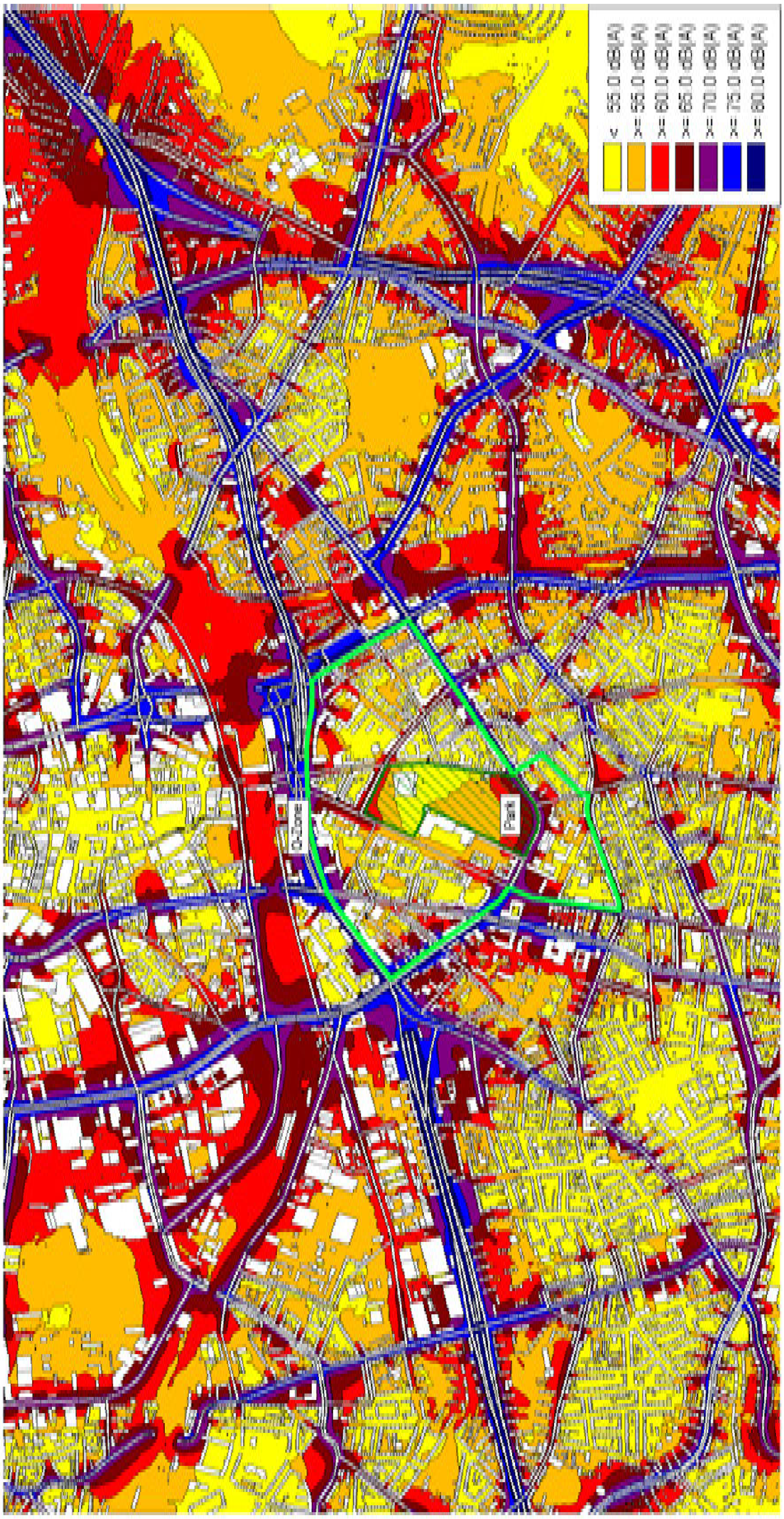

Figure 3.3.11: Essen Scenario 11 - L_{den}

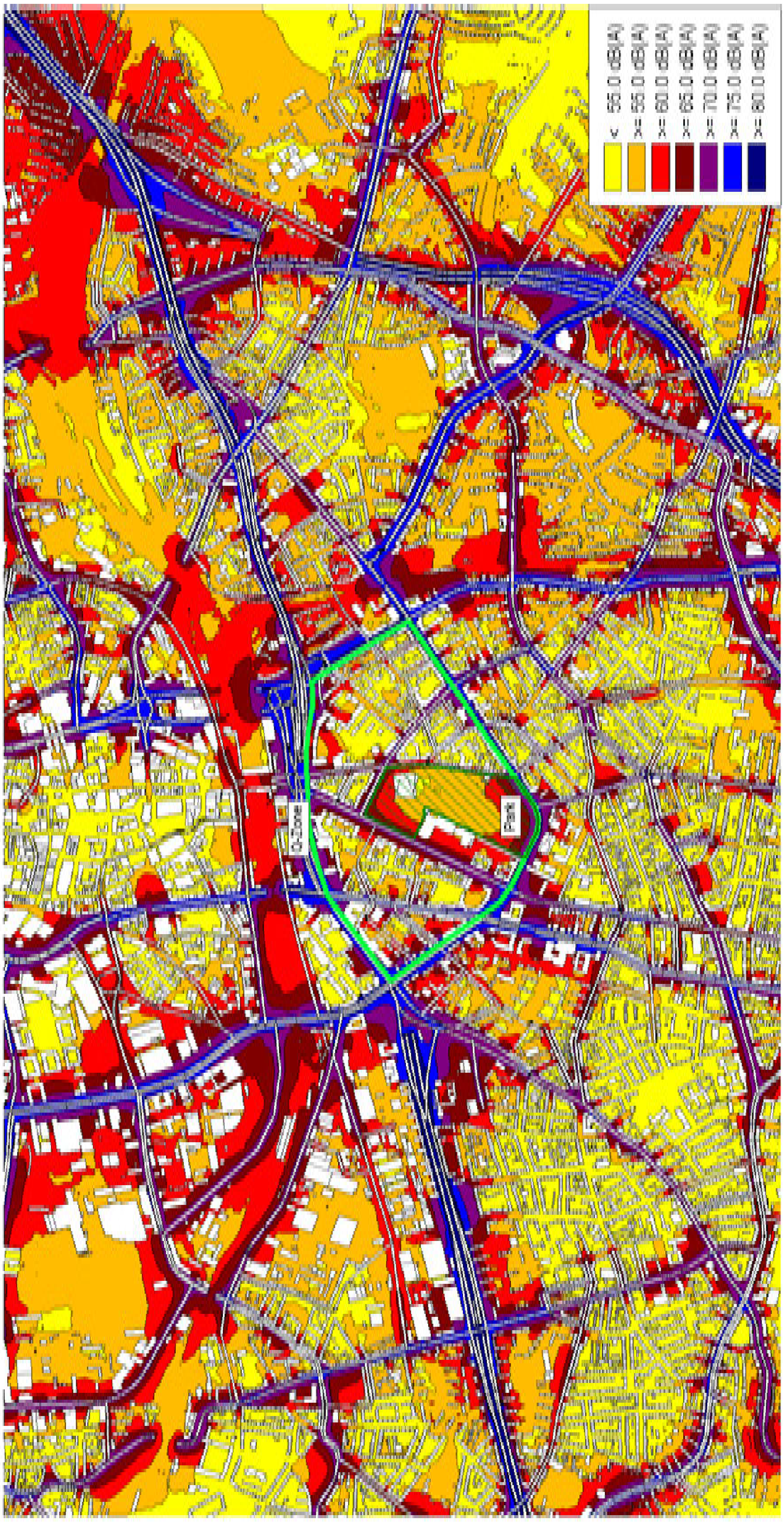

Figure 3.3.12: Essen Scenario 12 - L_{den}

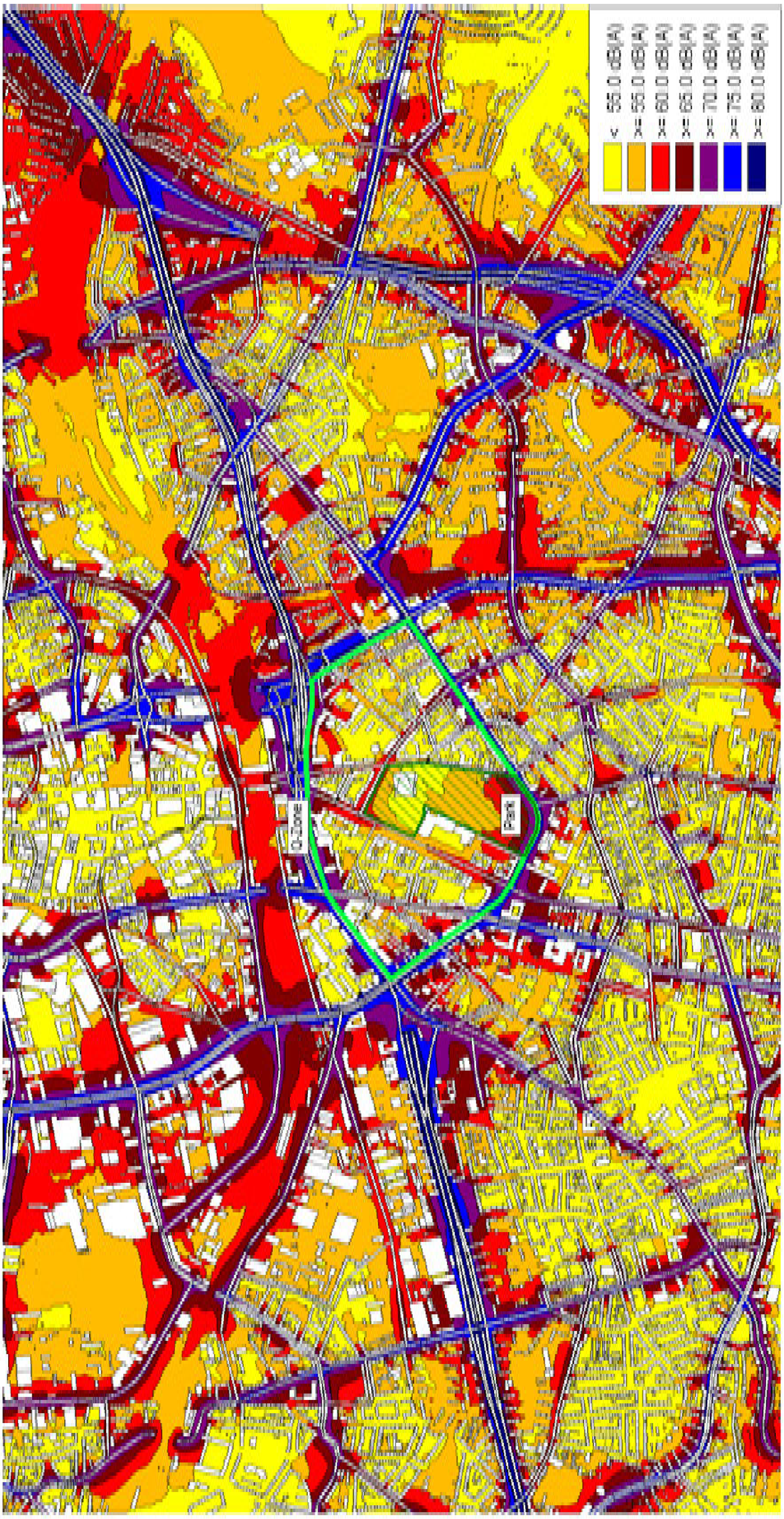

Figure 3.3.13: Essen Scenario 13 - L_{den}

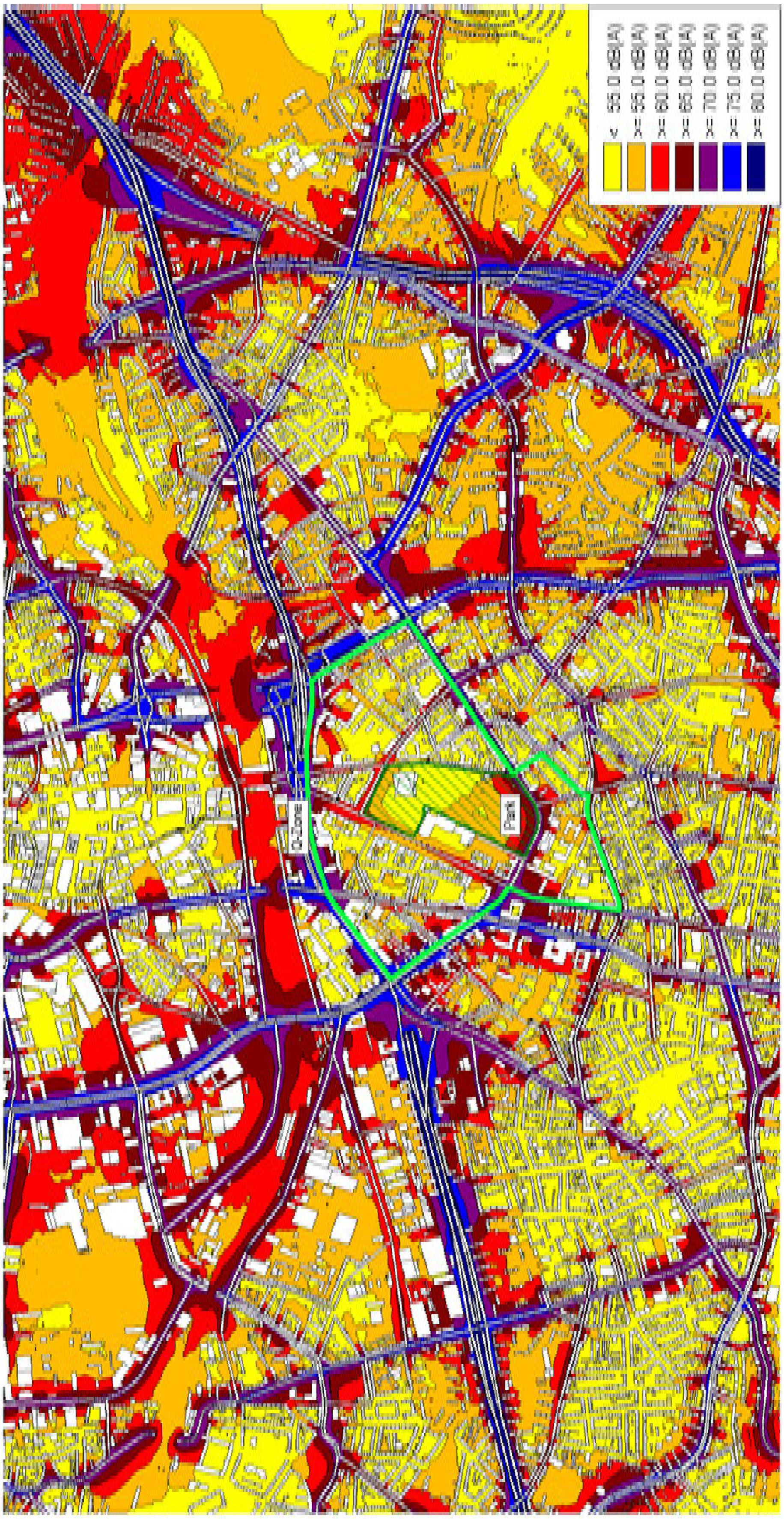

Figure 3.3.14: Essen Scenario 14 - L_{den}

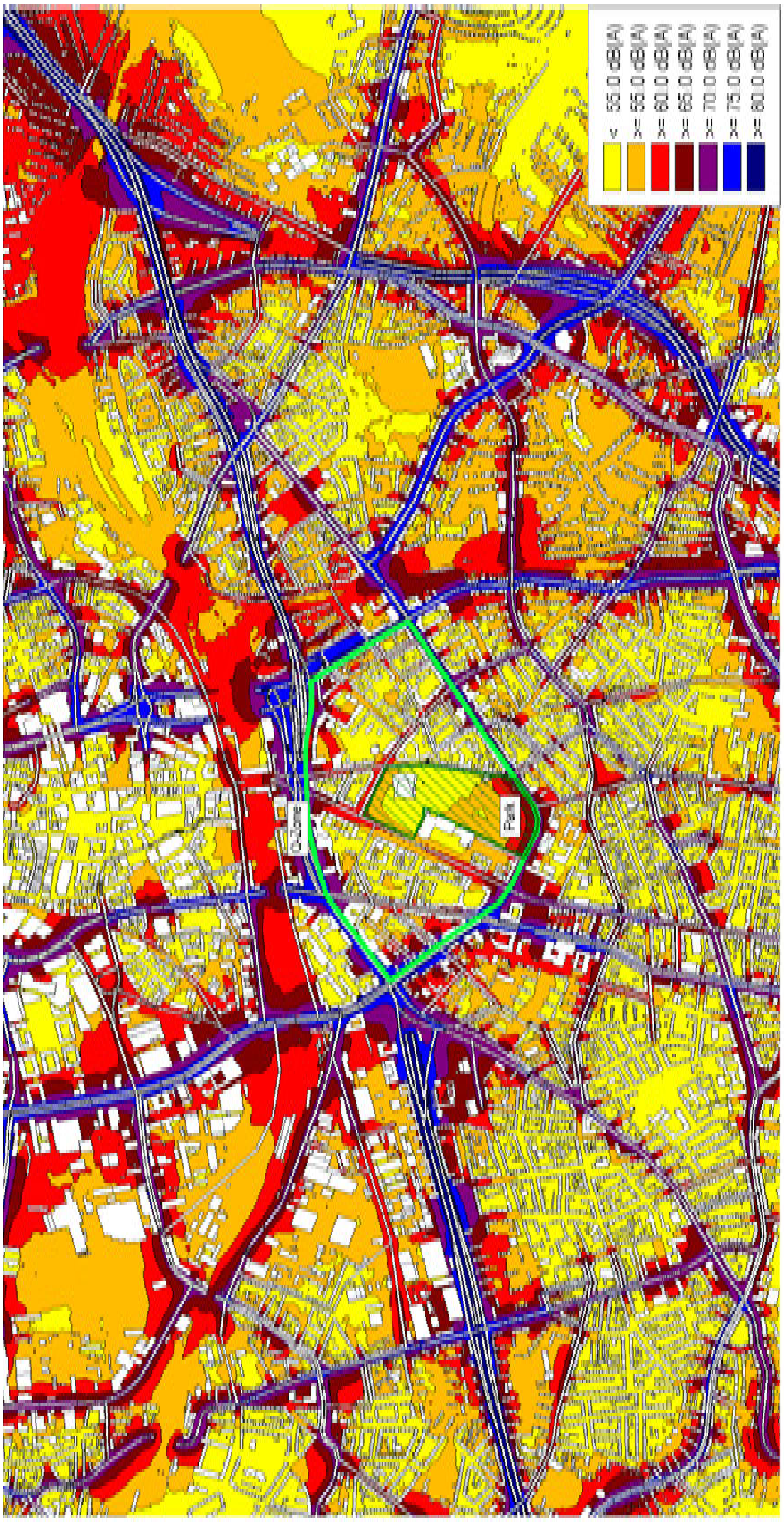

Figure 3.3.15: Essen Scenario 15 - L_{den}

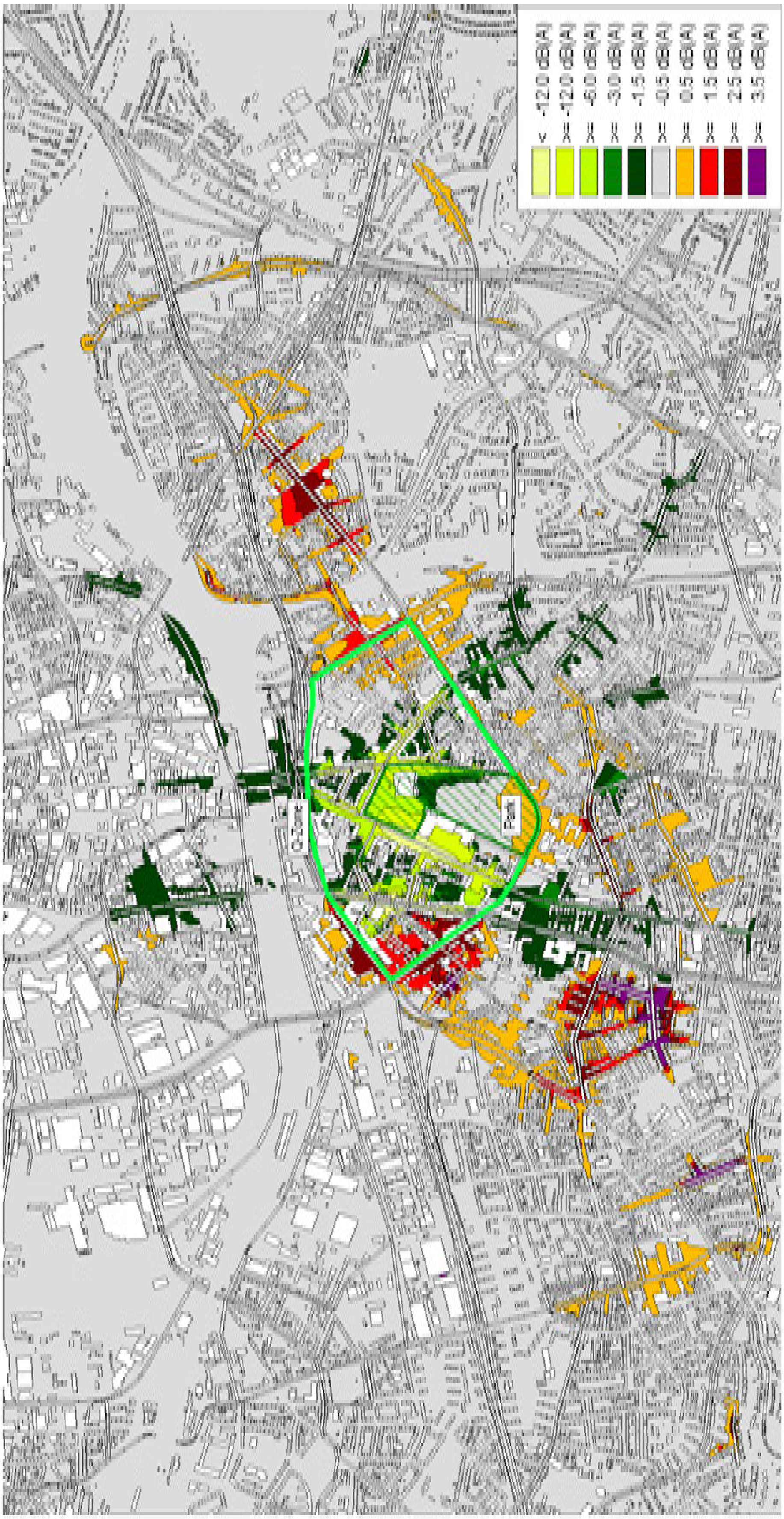

Figure 3.3.16: Essen Scenario 2 - difference to base case - L_{den}

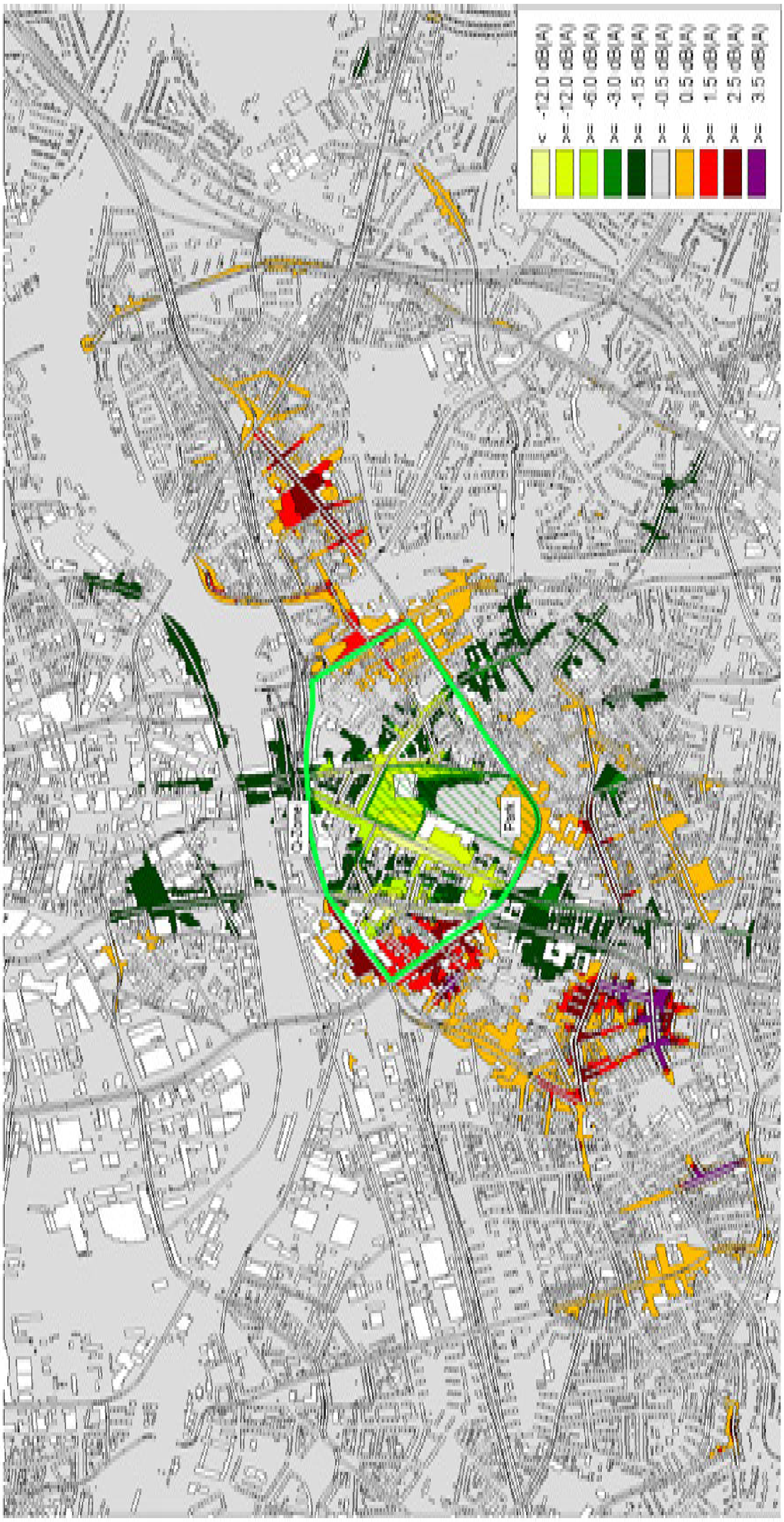

Figure 3.3.17: Essen Scenario 3 - difference to base case - L_{den}

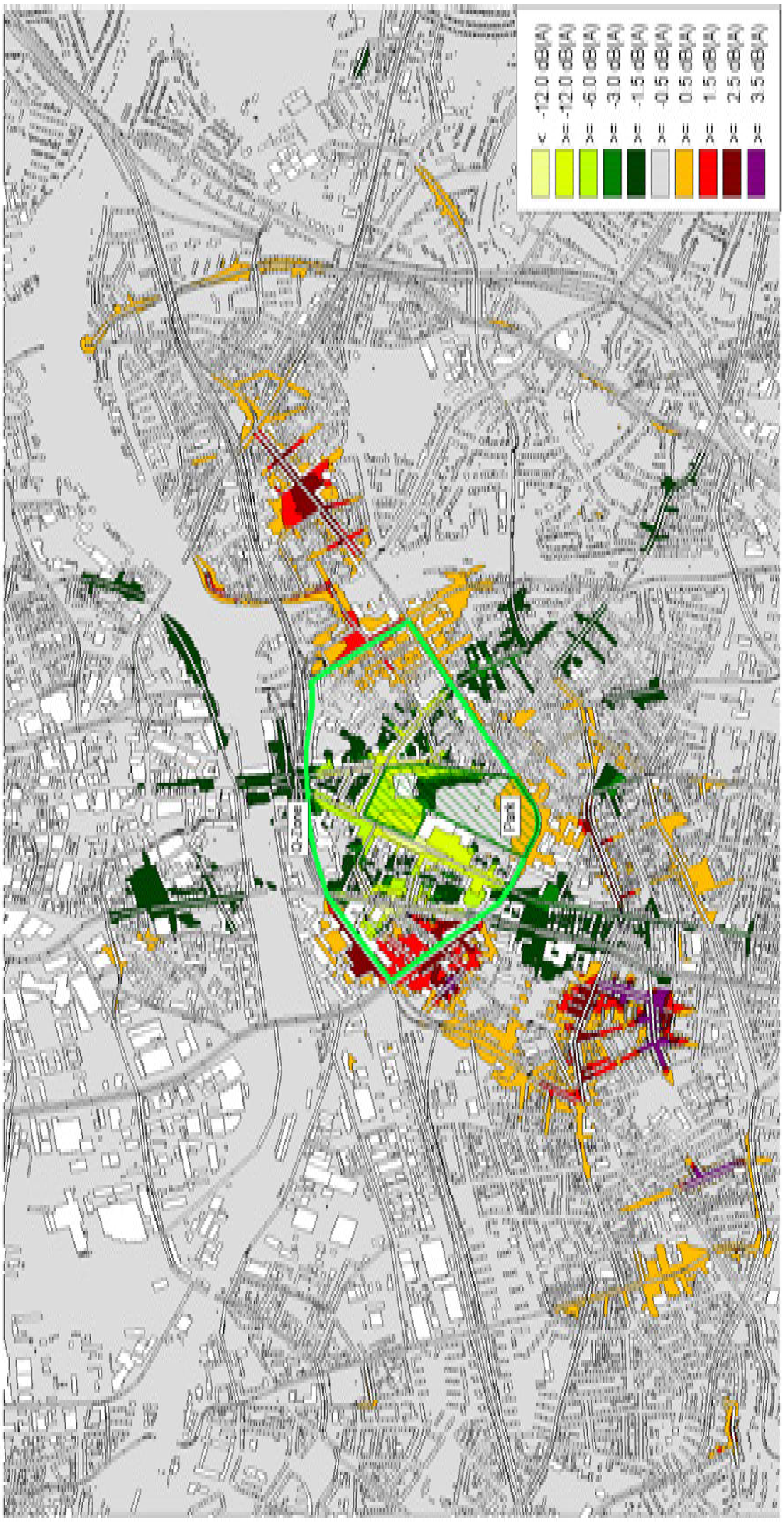

Figure 3.3.18: Essen Scenario 4 - difference to base case - L_{den}

Figure 3.3.19: Essen Scenario 5 - difference to base case - L_{den}

Figure 3.3.20: Essen Scenario 6 - difference to base case - L_{den}

Figure 3.3.21: Essen Scenario 7 - difference to base case - L_{den}

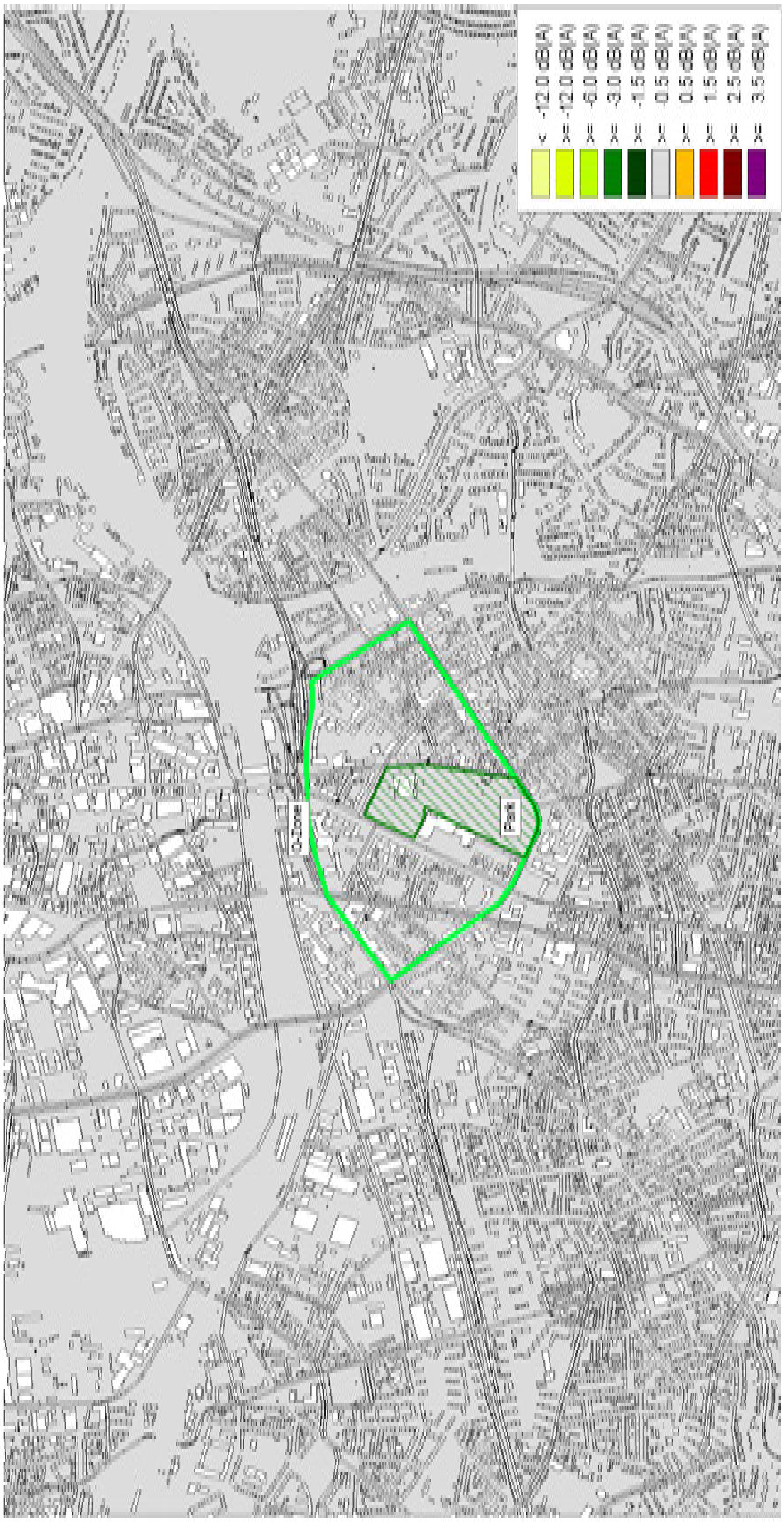

Figure 3.3.22: Essen Scenario 8 - difference to base case - L_{den}

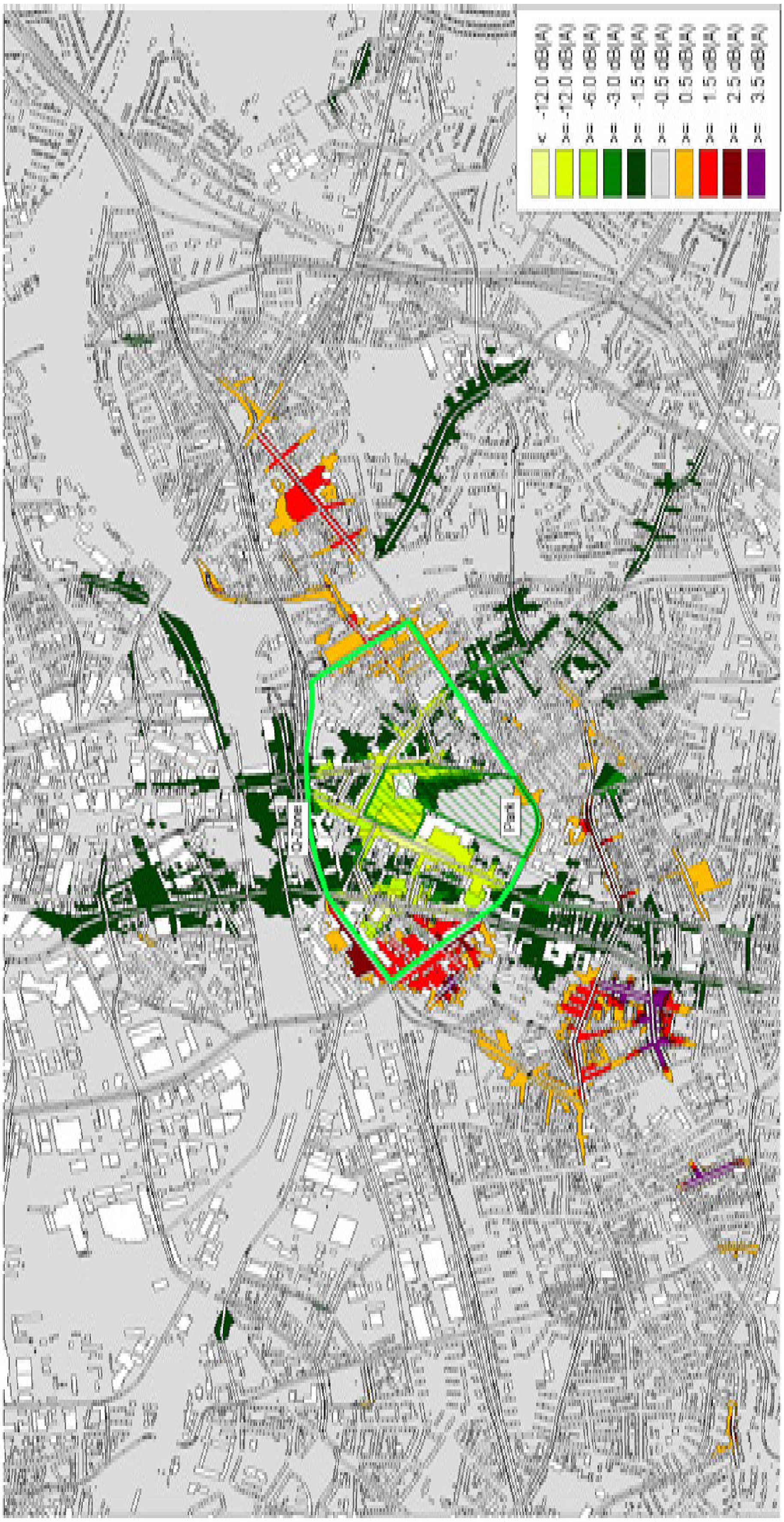

Figure 3.3.23: Essen Scenario 9 - difference to base case - L_{den}

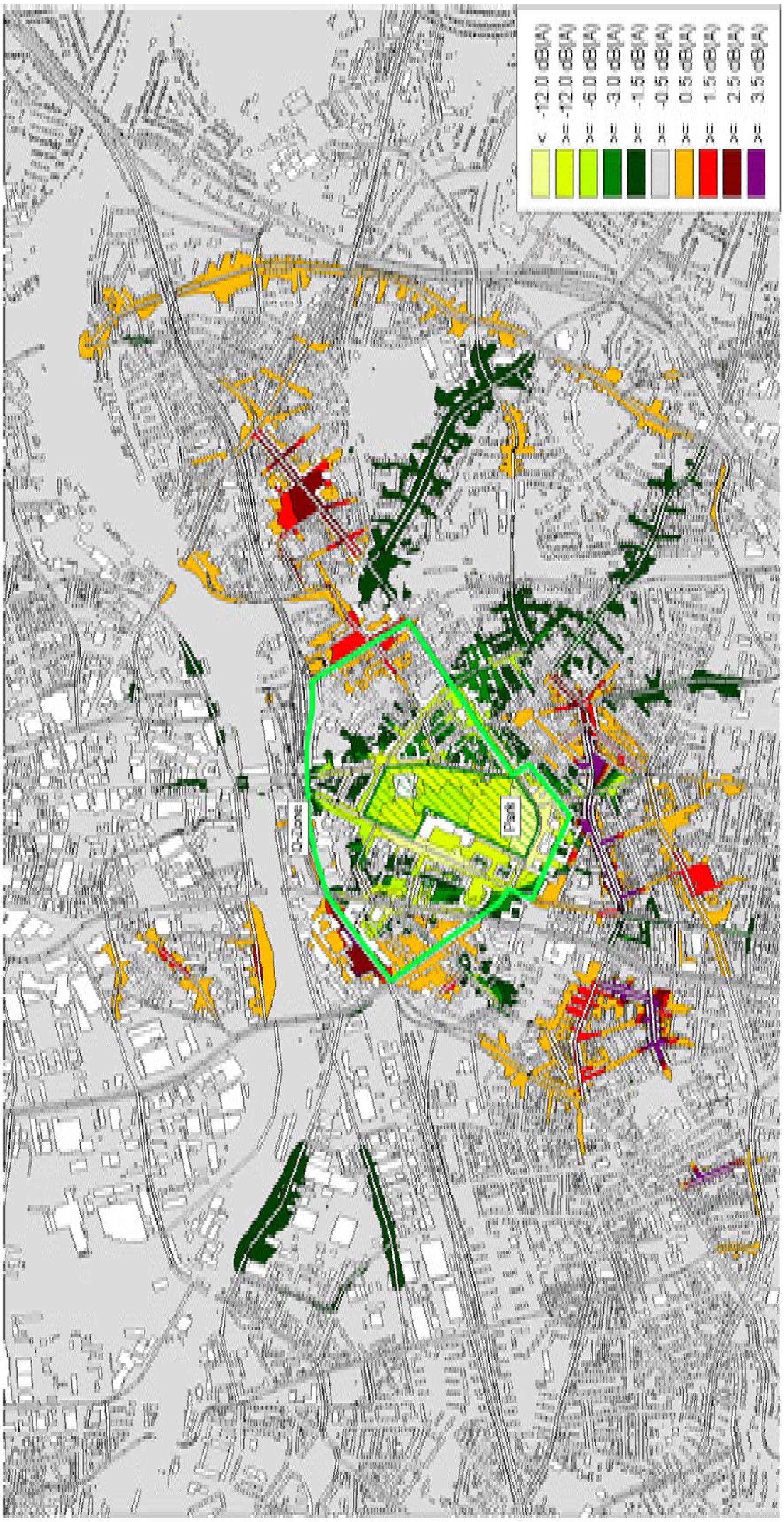

Figure 3.3.24: Essen Scenario 10 - difference to base case - L_{den}

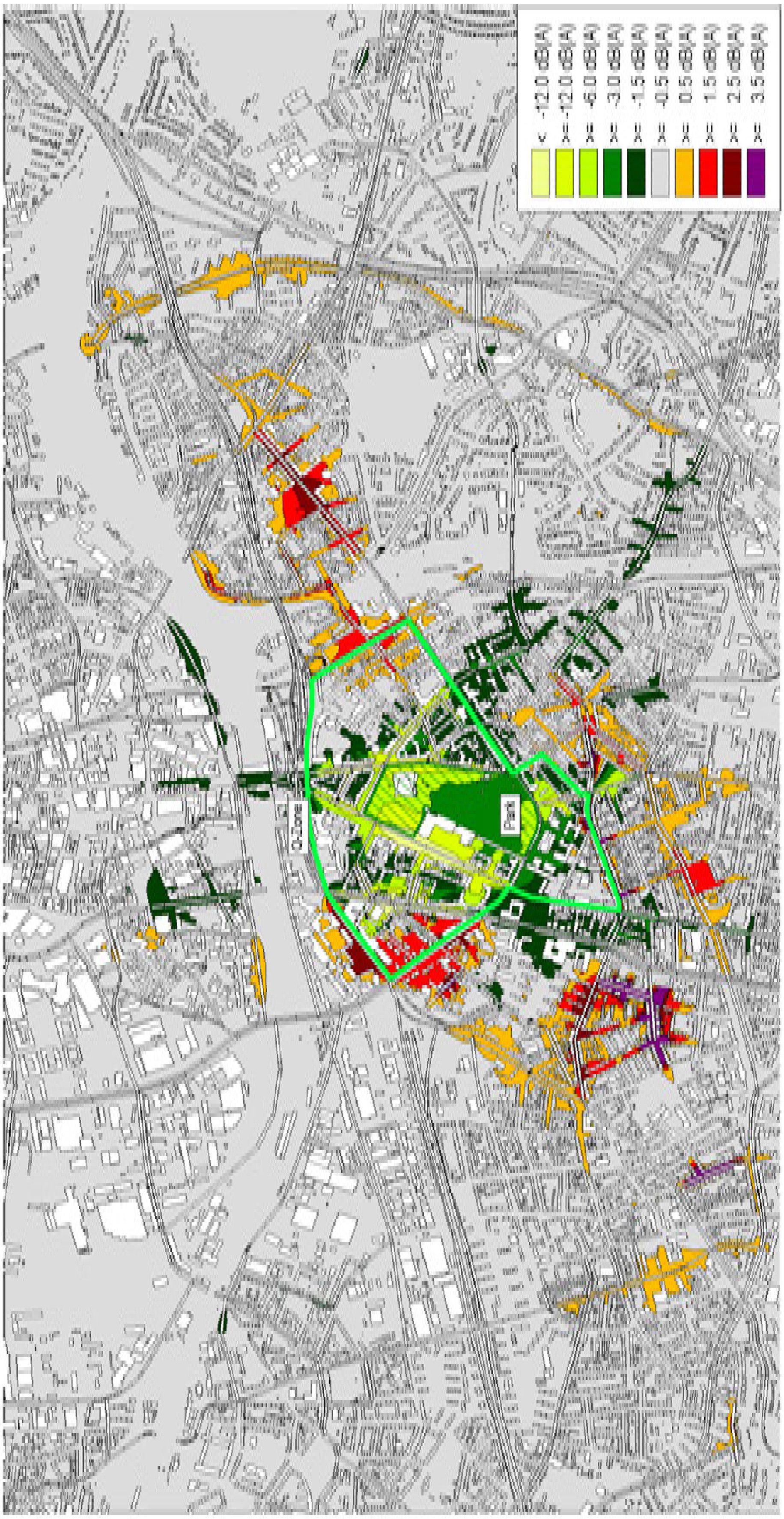

Figure 3.3.25: Essen Scenario 11 - difference to base case - L_{den}

Figure 3.3.26: Essen Scenario 12 - difference to base case - L_{den}

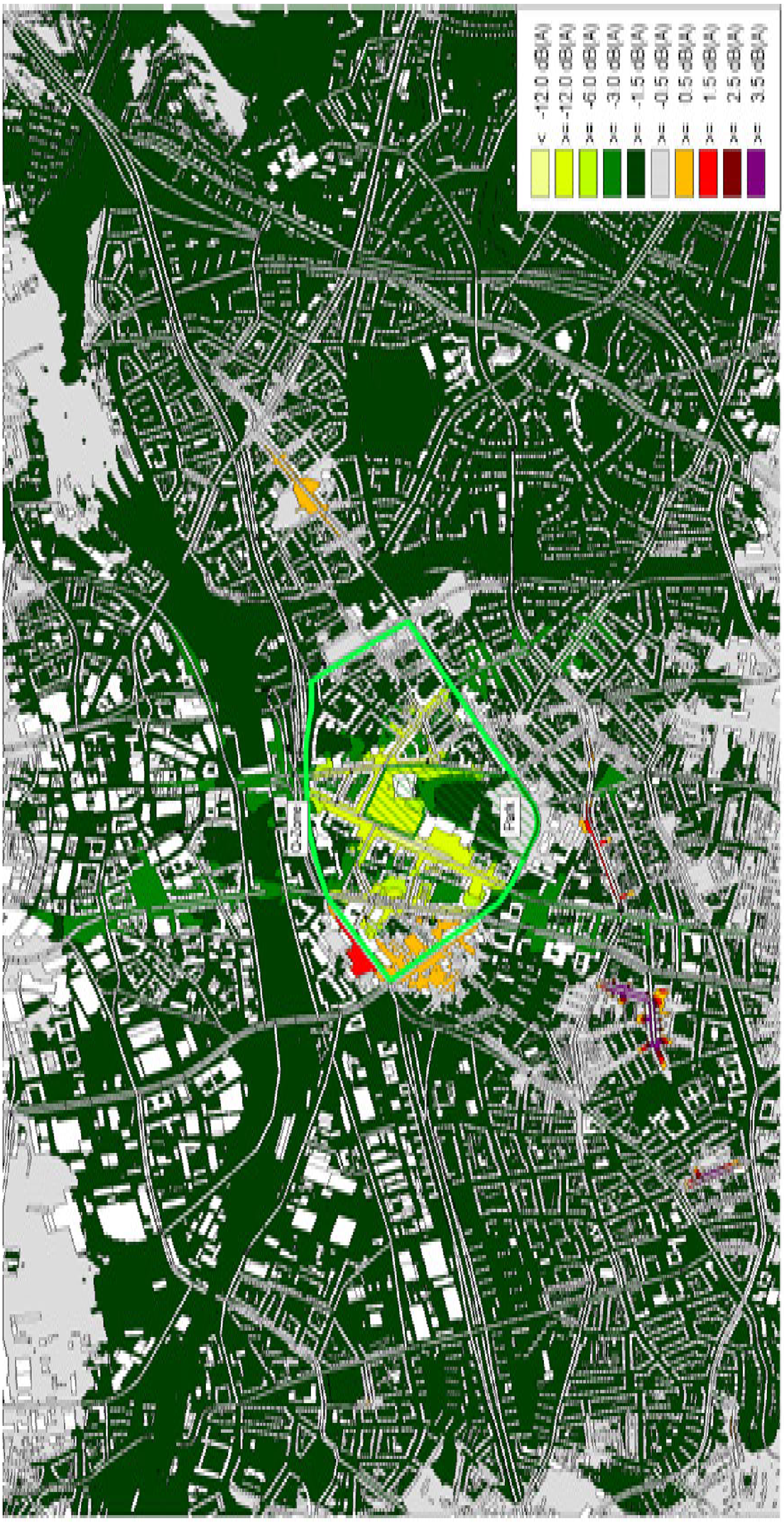

Figure 3.3.27: Essen Scenario 13 - difference to base case - L_{den}

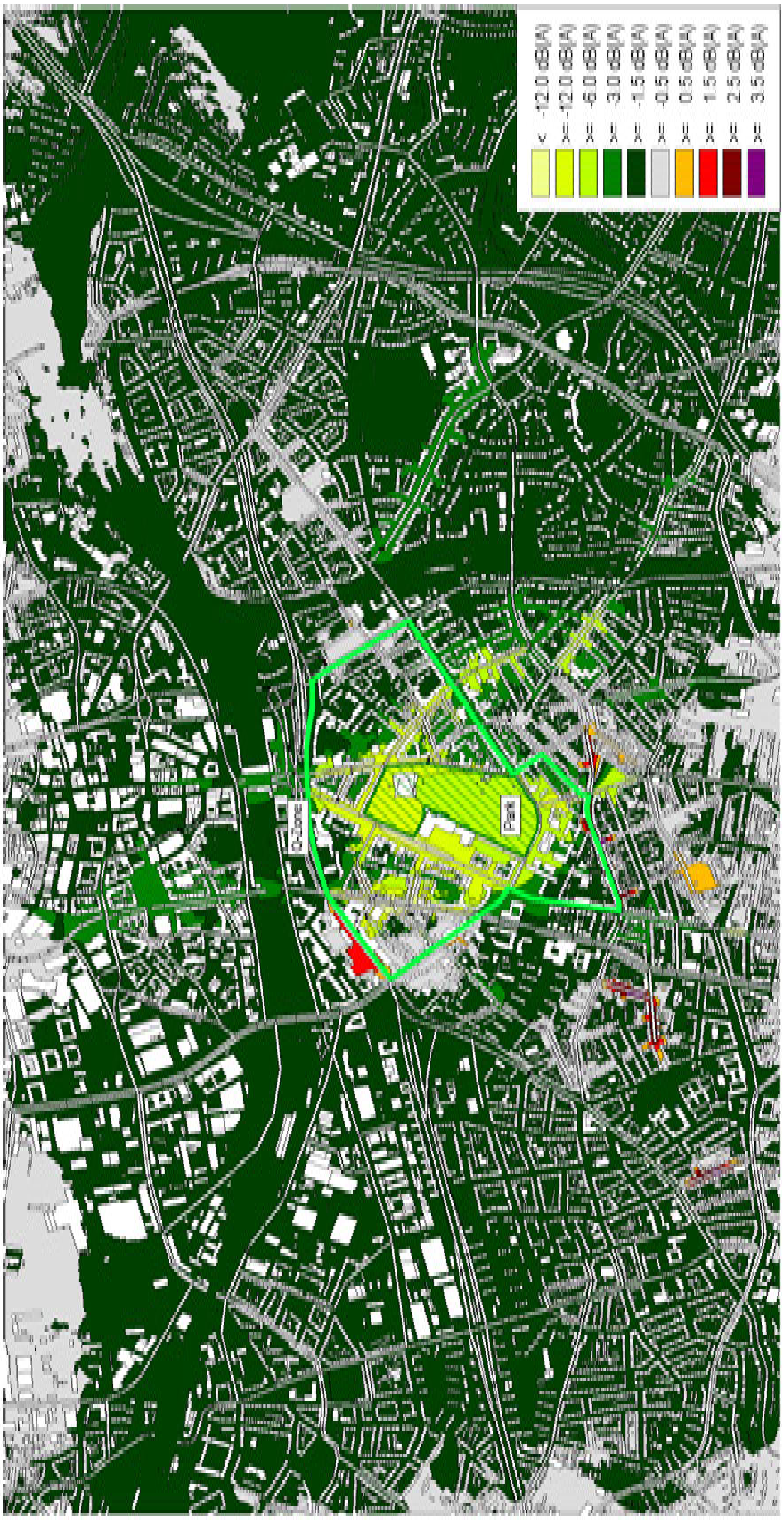

Figure 3.3.28: Essen Scenario 14 - difference to base case - L_{den}

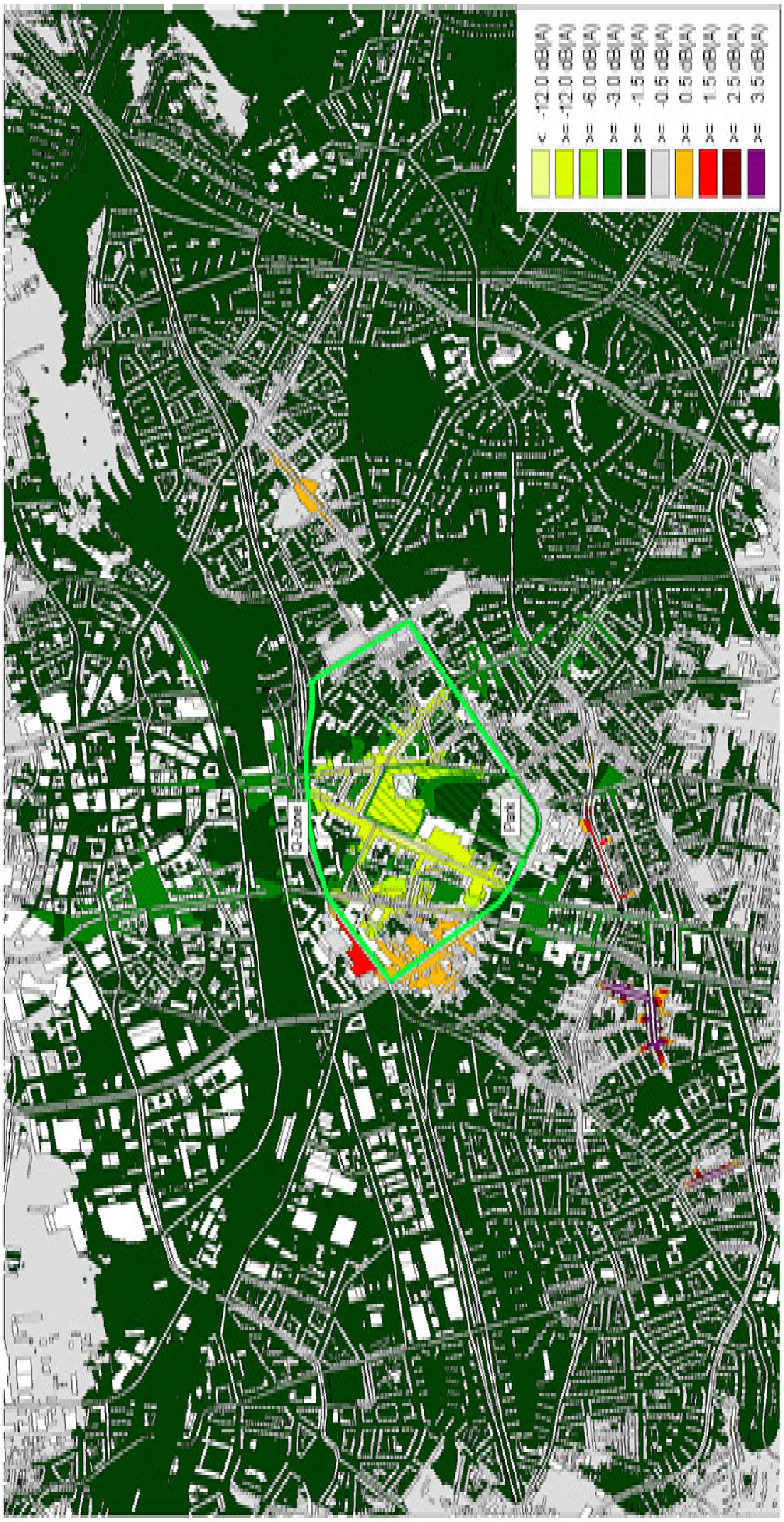

Figure 3.3.29: Essen Scenario 15 - difference to base case - L_{den}

3.4 GOTHENBURG

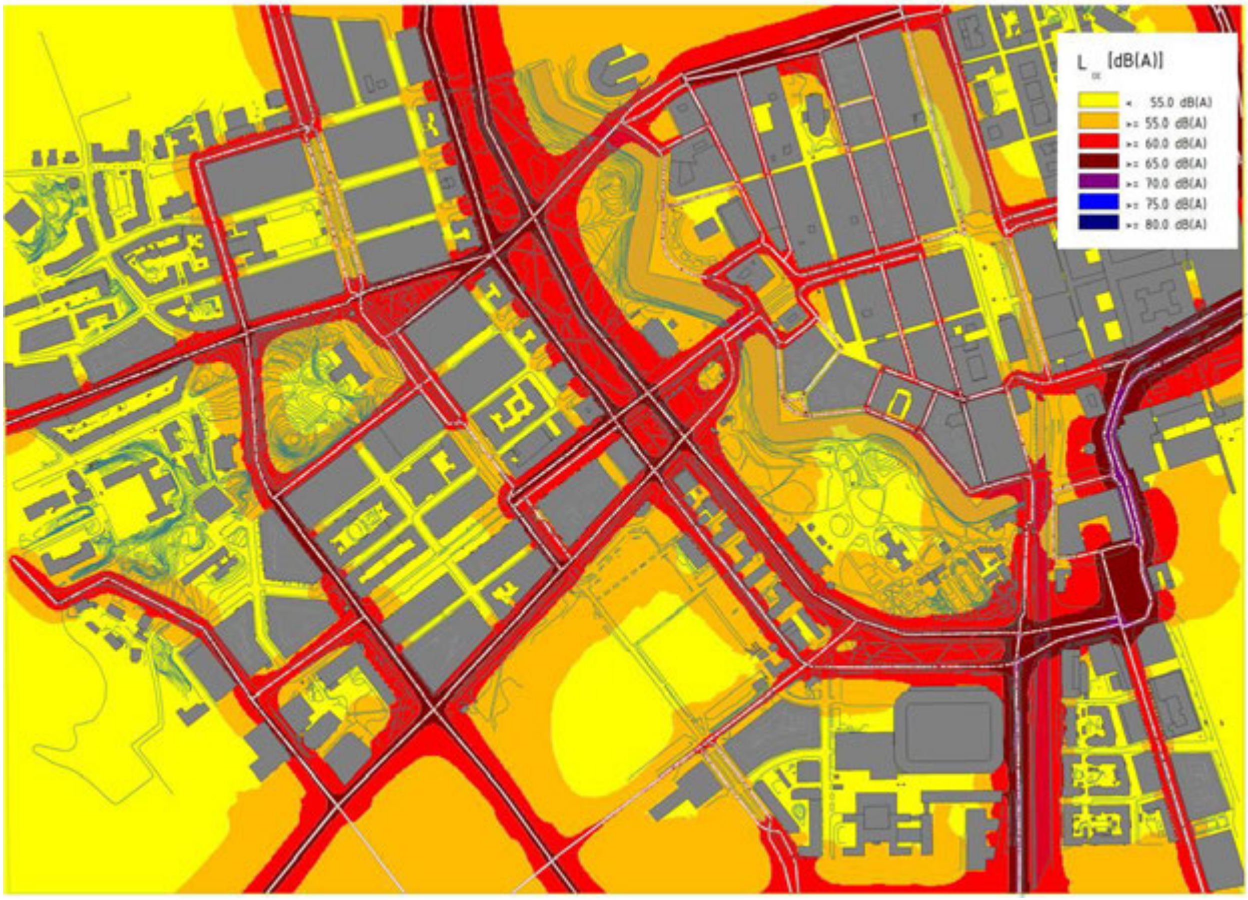

Figure 3.4.1 Lde for Base case for Gothenburg

Figure 3.4.2 Scenario 1 Lde difference from Base case

Figure 3.1.3 Scenario 3 Lde difference from Base case

Figure 3.1.4 Scenario 5 Lde difference from Base case

Figure 3.1.5 Scenario 7 Lde difference from Base case

Figure 3.1.6 Scenario 13 Lde difference from Base case

Figure 3.1.7 Scenario 15 Lde difference from Base case

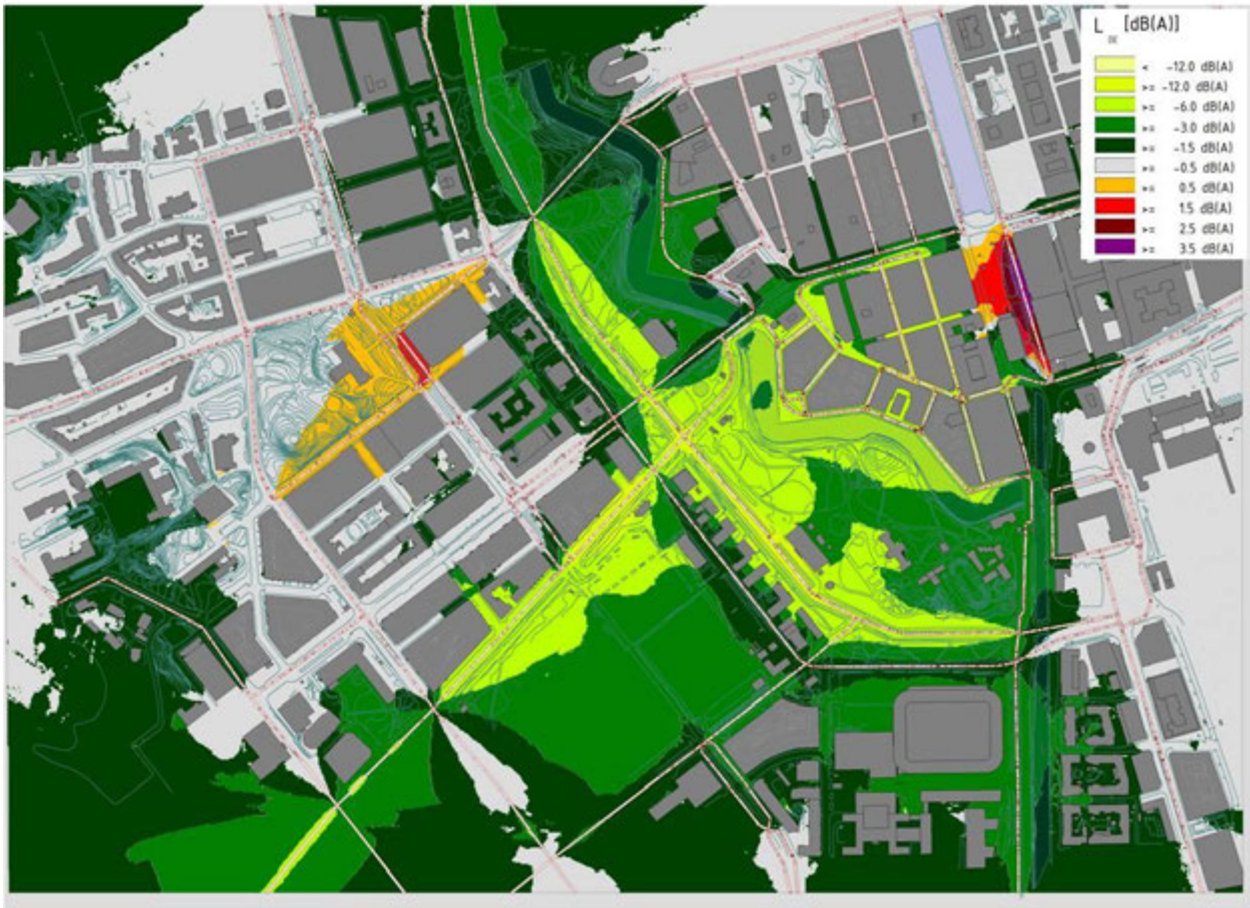

Figure 3.1.8 Scenario 16 Lde difference from Base case

3.5 STOCKHOLM

Figure 3.5.1 Lde for Base case for Stockholm

Figure 3.5.2 Scenario 1 Lde difference from Base case

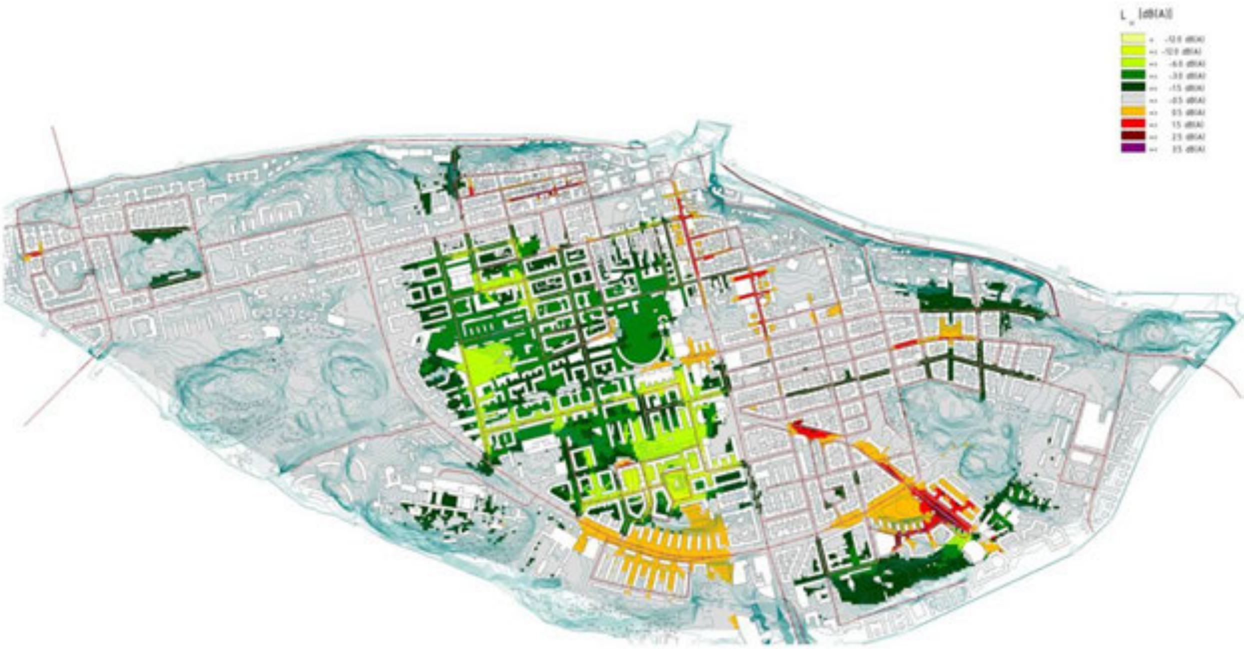

Figure 3.5.3 Scenario 2 Lde difference from Base case

Figure 3.5.4 Scenario 3 Lde difference from Base case

Figure 3.5.5 Scenario 4 Lde difference from Base case

Figure 3.5.6 Scenario 5 Lde difference from Base case

Figure 3.5.7 Scenario 6 Lde difference from Base case

Figure 3.5.8 Scenario 7 Lde difference from Base case

Figure 3.5.9 Scenario 8 Lde difference from Base case

Figure 3.5.10 Scenario 9 Lde difference from Base case

Figure 3.5.11 Scenario 10 Lde difference from Base case

Figure 3.5.12 Scenario 11 Lde difference from Base case

Figure 3.5.13 Scenario 12 Lde difference from Base case

Figure 3.5.14 Scenario 13 Lde difference from Base case

Figure 3.5.15 Scenario 14 Lde difference from Base case

Figure 3.5.16 Scenario 15 Lde difference from Base case

Figure 3.5.17 Scenario 16 Lde difference from Base case