

Lower Tweed and Pacific Highway Traffic Master Plan



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Lower Tweed and Pacific Highway Traffic Master Planning Report

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Tweed Shire Council
and
NSW Roads and Traffic Authority




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Executive summary

The Tweed Shire Council (TSC) and NSW Roads & Traffic Authority (RTA) have recognised the concerns of the community and stakeholders regarding local traffic conditions and the road hierarchy in the greater Tweed Heads area. These concerns had heightened in reaction to the proposed Tugun bypass and the reactivation of the planning process for the Banora Point upgrade, which had been on-hold since the mid 1990s.

With both state and local government projects earmarked for the area, it is apparent that an integrated solution is required to effectively address the future traffic demands on the Tweed road network. To meet this requirement the TSC and the RTA have jointly engaged in the development of a master plan for the highway between Chinderah and the Tugun bypass.

The Lower Tweed and Pacific Highway traffic master plan considers the long term needs of the region in terms of both highway and local network functionality. In particular, the study focuses upon the form and functionality of the Banora Point upgrade and Kirkwood Road interchange, and the influence of the imminent Tugun bypass.

Numerous network scenarios were developed combining various arrangements of the Banora Point upgrade northern interchange, Kirkwood Road interchange and Terranora Creek service roads.

The options analyses undertaken have concluded that an appropriate balanced ultimate arrangement for the development of both the Pacific Highway and adjoining local road network involves the major elements tabulated below. The table also includes indicative target completion dates for each major element of the master plan. These target dates are indicative only and would be adjusted in response to actual traffic demand. The timing of the Banora Point upgrade could be sooner or later, depending on future Federal/State funding agreements.

Master planning element	Estimated cost** (\$Million)	Funding responsibility	Indicative timing
Kennedy Drive to Tugun bypass service roads	n/a	QDMR/Dotars	Late 2008
Banora Point upgrade	190	RTA	2010 – 2015
Kirkwood Road extension (including modifications to Fraser Drive)	10 - 15	TSC	2015 -2020
Terranora Creek western service road	15 – 20	Joint TSC/RTA	2015 -2020
Kirkwood Road south facing ramps	10 – 15	Joint TSC/RTA	2015 -2020
Terranora Creek eastern service road	15 – 20	Joint TSC/RTA	2025 - 2030
Tweed Heads bypass, widening to 6 lanes*	30 – 45	RTA	2025 - 2030

* estimate for widening of road and bridge. Rehabilitation of existing pavement may be required around same time.

** indicative estimate to be refined with concept design development

There is the potential for staged construction of both the Banora Point upgrade and Kirkwood Road interchange with the deferred introduction of highway ramps and service roads, and interim interchange arrangements.

Construction of each master planning element on its own would benefit the local community through improved accessibility and connectivity and further separation of the local and highway traffic.

1. Introduction

Since late 2000, the TSC and Roads and Traffic Authority (RTA) have been working together to develop and agree on arrangements for the connection of Kirkwood Road to the Pacific Highway (Tweed Heads bypass).

Shortly after Parsons Brinckerhoff (PB) was engaged in 2004 to develop the Banora Point upgrade project, the need to consider the future interaction of the Pacific Highway between the Tweed River and the Queensland border with the local road network was identified.

TSC and RTA agreed to jointly develop a master plan for the future Pacific Highway and PB was engaged to assess the broader traffic operations and the role of the Pacific Highway.

The future operation of the Tweed Heads road network was considered on two levels: the project level (Banora Point upgrade, Kirkwood Road connection) and the local network level. Previously commissioned highway upgrade projects should also be considered as part of the master plan.

Numerous upgrade scenarios were formulated to assess the effect of various highway connections and/or service road combinations at the Banora Point northern interchange and Kirkwood Road. Of particular importance, the scenarios were assessed on how they altered traffic patterns and how they affected both the Banora Point upgrade and the local road network.

It should be noted that the traffic arrangements between Kennedy Drive and the Tugun bypass interchange, now in construction, are a result of earlier master plan work. The study also reviewed the implications for the local road network of including an interchange at Boyd Street as part of the Tugun bypass project.

2. Background

2.1 Needs and objectives

The TSC and RTA have recognised the ongoing concerns of the community and stakeholders regarding local traffic conditions and the road hierarchy in the Tweed Heads area. In recent years these concerns have heightened in reaction to the proposed Tugun bypass and the reactivation of the planning process for the Banora Point upgrade, which has been on-hold since the mid 1990s.

The form and functionality of the Banora Point upgrade has been recognised as playing a pivotal role in the operation of the Tweed road network. The configuration of the Banora Point upgrade northern interchange largely determines how traffic from the south or west accesses the Tweed Heads commercial precinct.

The local community has expressed a strong desire for a highway interchange with the proposed Kirkwood Road extension. The inclusion of such an interchange greatly influences network movements approaching and departing the Tweed Heads commercial district. Numerous arrangements for such an interchange have been suggested, each with varying effects on the operation of the highway and local road network.

Discussions between TSC and RTA regarding the Kirkwood Road extension and interchange have been on-going since late 2000. Further proposals regarding interaction between the local road network and the Pacific Highway have also been the topic of ongoing debate, for example, the inclusion of a Boyd Street overpass or interchange on the Tugun bypass.

It is apparent that an integrated traffic solution is required by the government bodies to effectively introduce highway and local network upgrades into the Tweed road network. To meet this requirement the TSC and RTA have jointly engaged in the development of a master plan for the highway between Chinderah and the Tugun bypass.

The Tweed traffic master plan considers the long term needs of the region in terms of both highway and local network functionality. The principal objective of the study is to identify the most beneficial arrangement for the integration of planned highway and local road improvements into the Tweed network. Specifically, the study aims to identify an arrangement which would:

- maintain acceptable levels of service on the Pacific Highway and local arterials
- improve local access to, and surrounding the Pacific Highway
- prevent bottle-necks on the local road network through the provision of multiple accesses to key traffic generators
- cater for the continuing commercial and residential development of the Tweed area
- improve road safety through the separation of highway and local traffic and deterrence of short local trips on the highway.

2.2 Major upgrades to the Tweed road network

Several major road upgrades have been constructed or are proposed by the TSC, RTA and Queensland Department of Main Roads (QDMR) within the Tweed road network. The following provides a summary of these projects and proposals. A reference plan, illustrating the location of each of the projects is provided in Figure 2-1.

2.2.1 Chinderah bypass

All major contract works for the Chinderah bypass were completed in January 1997.

The 5.8 km upgrade provides a high standard dual carriageway from Oak Avenue to Banora Point. The project provides six lanes north of Wommin Bay Road and a major bridge over the Tweed River at Barneys Point.

The later completion of the Yelgun to Chinderah upgrade in 2002 resulted in a rapid increase in the number of heavy vehicles on the Pacific Highway through Chinderah and the Tweed Heads South area.

2.2.2 Banora Point upgrade

The RTA previously commissioned strategic concept development for an upgrade of the Pacific Highway at Banora Point in 1993. The process examined the broad engineering, environmental and planning constraints that would apply to the upgrading of this length of the Pacific Highway and included community input, primarily related to local issues. A strategic concept design was completed in 1995.

The road corridor defined by the strategic concept design was incorporated into the Tweed Shire Council Local Environmental Plan in 2000.

In response to traffic safety concerns, a short-term proposal for the Terranora Road intersection was considered and later implemented in 1996. This involved the provision of traffic signals and separate turning lanes on the existing highway alignment.

Further short term measures implemented since, to improve traffic and pedestrian safety at this location include:

- reduction of the signposted speeds
- installation of a speed camera to deter speeding motorists
- provision of a pedestrian/cyclist overpass at Sexton Hill
- route lighting
- improved road surface.

To progress the previous studies, PB was engaged by the RTA in 2004 to investigate options for upgrading the 2.5 km length of highway with the aim of providing highway conditions, reducing congestion and travel times, and improving road safety. The Banora Point upgrade would adjoin the Chinderah bypass to the south and the Tweed Heads bypass to the north.

Two route options, option A and option B were on public display for community comment in April and May 2005.



Figure 2.1: MAJOR UPGRADES TO THE TWEED ROAD NETWORK

Following the community response to the public display, a value management workshop and project team assessment, option B was adopted as the basis for development of the preferred concept. The process of developing the preferred concept involved substantial modification and refinement of the concept design for option B, drawing on input from a number of sources including TSC and the community. Development of the preferred concept also drew on elements of option A. The preferred concept (further discussed in Chapter 5 of this report) incorporates a range of additional functional features and design elements that provide further benefits for users of both local roads and the highway. The preferred concept will be taken forward for environmental assessment and further associated concept design development.

The preferred concept is considered to be the design solution that would best meet the objectives of the project, the needs of the community and the site-specific constraints within the various limitations of the RTA's overall program, including availability of funding.

Key features of the preferred concept include:

- a new, six-lane highway to the east of the existing route
- existing highway retained for use by local traffic
- highway horizontal radii within the 600–1,200 m range
- south-facing ramps at Barneys Point Bridge
- a 360 m viaduct across the southern valley up to approximately 25 m in height
- moderate grades either side of Sexton Hill (3.5–4.5%)
- a deep cutting through Sexton Hill with Wilson Park reinstated on a land bridge approximately 100 m in length and spanning the deep cutting
- retention of the existing pedestrian/cyclist bridge
- realignment of Laura Street to intersect the existing highway and Short Street at a four-way signalised intersection.

Determination of the optimal configuration for the Banora Point upgrade northern interchange is dependent upon broader master planning considerations as discussed in subsequent sections of this report.

2.2.3 Tweed Heads bypass

The 5.7 km long Tweed Heads bypass was completed in two stages. The first stage, Kennedy Drive to the Queensland border was completed in 1986, with Stage 2 between Sexton Hill and Kennedy Drive completed in November 1997.

The bypass provides four traffic lanes on dual carriageways and includes interchanges with Minjungbal Drive (old Pacific Highway) and Kennedy Drive and a major bridge over Terranora Creek.

A requirement for future widening of the bypass to six lanes to meet traffic demand is expected to develop around the year 2025. As such, a six-lane configuration has been allowed for in the 2030 traffic modelling.

2.2.4 Tugun bypass

The Tugun bypass, currently under construction, will provide a new motorway between Currumbin in Queensland and Tweed Heads in NSW, and will significantly relieve traffic congestion in the existing road corridor.

The existing road network linking the Pacific Motorway and the Gold Coast Highway in southeast Queensland with the Tweed Heads bypass in northern NSW is currently operating near capacity. Traffic flows during peak periods exceed the capacity of the road network, resulting in delays. The congestion worsens significantly during holiday periods, when delays of an hour or more are common.

This part of the road network is the main route used by traffic travelling between NSW and Queensland, including heavy vehicles. This results in a conflict between the need for an efficient and fast cross-border route, and the need to provide a high level of access for the local community.

The southern limit of the bypass will be at the Tweed Heads bypass interchange, north of Kennedy Drive. The route then follows an alignment west of the Gold Coast Airport main runway, joining the Pacific Motorway at Stewart Road, Currumbin.

Actual works associated with the Tugun bypass extend south beyond the Tweed Heads bypass interchange to Kennedy Drive. These works include the replacement of the north-facing Kennedy Drive ramps with one-way service roads either side of the highway between Kennedy Drive and the Tweed Heads bypass interchange. These arrangements are as agreed between TSC and RTA as part of development of the master plan.

The proposed bypass will be approximately 7-kilometres long, and involve the construction and operation of a four-lane controlled-access motorway with a central median to separate north–south traffic flows at a posted speed of 100 km/h. The median will be wide enough to allow future upgrading to six lanes. Grade-separated interchanges will be provided at the Tweed Heads bypass in NSW and at Stewart Road in Queensland. These will provide for all traffic movements and provide connections to the local road network. An overpass will also be provided within the Gold Coast Airport to maintain existing access.

The Tugun bypass Environmental Impact Statement recognised the proposal for a western extension of the existing Boyd Street access track to service the Cobaki Lakes development. The inclusion of a Boyd Street overpass and interchange was considered through the route selection process but was excluded from the final proposal deemed more suitable to a separate project, requiring separate approvals.

For the purposes of traffic assessment, all road network updates relating to the Tugun bypass have been assumed as completed.

2.2.5 Kirkwood Road extension

The extension of Kirkwood Road was a recommendation of the 2003 revision of the *Tweed Shire Council – Tweed Road Development Strategy (July 2003)*. Under the proposal, Kirkwood Road would be extended from Falcon Way to Fraser Drive, also allowing for the extension of Enterprise Avenue.

Earlier versions of the *Tweed Road Development Strategy* proposed a further western extension of Kirkwood Road, over Terranora Creek to adjoin to The Lakes Drive. This particular section of the proposal was ultimately rejected due to environmental concerns and local resident objections.

Highway connections to the proposed Kirkwood Road extension have previously been requested by TSC and allowed for in its Tweed Road Contribution Plan. Previous

expectations anticipated north-facing ramps would be most beneficial to the local road network, providing connections to the local road network immediately south of Terranora Creek.

The suitability of north facing ramps connecting to Kirkwood Road and the consideration of alternative interchange configurations are assessed within this report.

For the purposes of traffic assessment, the Kirkwood Road extension and the intersection upgrade at Fraser Drive have been assumed to be complete.

2.2.6 Cobaki Parkway

A significant component of the Tweed distributor road network is a proposed road linking Scenic Drive at Bilambil Heights to Piggabeen Road and then onto the Cobaki Parkway which links to Boyd Street in Queensland and a possible future interchange with the Tugun bypass.

This network link will cater for the major development release areas of Bilambil Heights and Cobaki without traffic from these developments exceeding the capacity of Kennedy Drive.

3. Options development

The master planning studies have aimed to identify the arrangement for future highway and local road upgrades most beneficial to the overall traffic operations of the Tweed road network.

This was to be achieved through traffic modelling and evaluating the performances and impacts of the various link options and configurations on the road network. In particular, this assessment of the broader traffic operations includes consideration of:

- the Banora Point upgrade's northern interchange configuration
- the impacts of various options for allowing access onto the Pacific Highway from Kirkwood Road through the use of ramps, service roads to Kennedy Drive or a combination of both.

For a means of comparison, two base case options were formulated; the existing road network option ('do nothing' option) and the Banora Point upgrade only option.

3.1 Banora Point northern interchange

Traffic volumes utilising the Banora Point northern interchange vary significantly depending upon its configuration and the ease of access to major trip generators such as the Tweed City commercial precinct.

The options developed for this northern interchange vary substantially in both form and functionality. The two major options evaluated as part of the development of the master plan were:

- the RTA displayed option B arrangement, which includes a northbound on-ramp and southbound off-ramp to Minjungbal Drive
- a modification of the option B northern interchange, which incorporates input from TSC. Key features of the modified interchange include a northbound on-ramp and southbound off-ramp direct to Darlington Drive, and an extension of Minjungbal Drive under the highway to meet Darlington Drive.

A third configuration, a permutation of the modified option B northern interchange configuration, was developed to analyse the effect of including a 'left-slip' link from the southbound off-ramp directly onto Minjungbal Drive. Each of the configurations is illustrated schematically in Figure 3-1.

Following determination of the preferred master plan configuration a review of the concept design for the Banora Point upgrade determined that further development of the preferred concept was desirable. These developments of the preferred concept and the implications for the Lower Tweed and Pacific Highway traffic master plan are discussed further in section 5 of this report.

3.2 Kirkwood Road interchange

The introduction of a Kirkwood Road interchange to the Tweed road network potentially offers an additional access to the Tweed City commercial precinct, relieving congestion on the other accesses. However, an inappropriate interchange configuration may encourage undesirable short local trips along the highway or result in the under-use of the interchange altogether.

Three configurations, shown schematically in Figure 3-2, were developed combining the use of highway ramps at Kirkwood Road and service roads over Terranora Creek:

- south-facing ramps connecting the highway with Terranora Creek service roads:
 - one-way service roads both sides of the existing highway extending from Kirkwood Road to Kennedy Drive (Terranora Creek service roads) and south-facing ramps under-passing Kirkwood Road to connect the highway directly to the service roads:
 - such an option would not allow for movements between Kirkwood Road and the highway south of Kirkwood Road, eliminating opportunities for short local trips along the highway
- south-facing ramps directly from the highway onto Kirkwood Road:
 - one-way service roads both sides of the existing highway extending from Kirkwood Road to Kennedy Drive (Terranora Creek service roads) and south-facing ramps connecting the highway to Kirkwood Road and the service roads via signalised intersections:
 - such an option would allow movements between Kirkwood Road and the highway south of Kirkwood Road, but provide opportunities for short local trips along the highway
- a full interchange at Kirkwood Road:
 - a single two way service road on the western side of the existing highway between Kirkwood Road and Kennedy Drive (Terranora Creek) and a full four-ramp interchange at Kirkwood Road:
 - such an option would require a southern offset of the Kirkwood Road overpass to provide sufficient acceleration length for the northbound on-ramp prior to Terranora Creek.

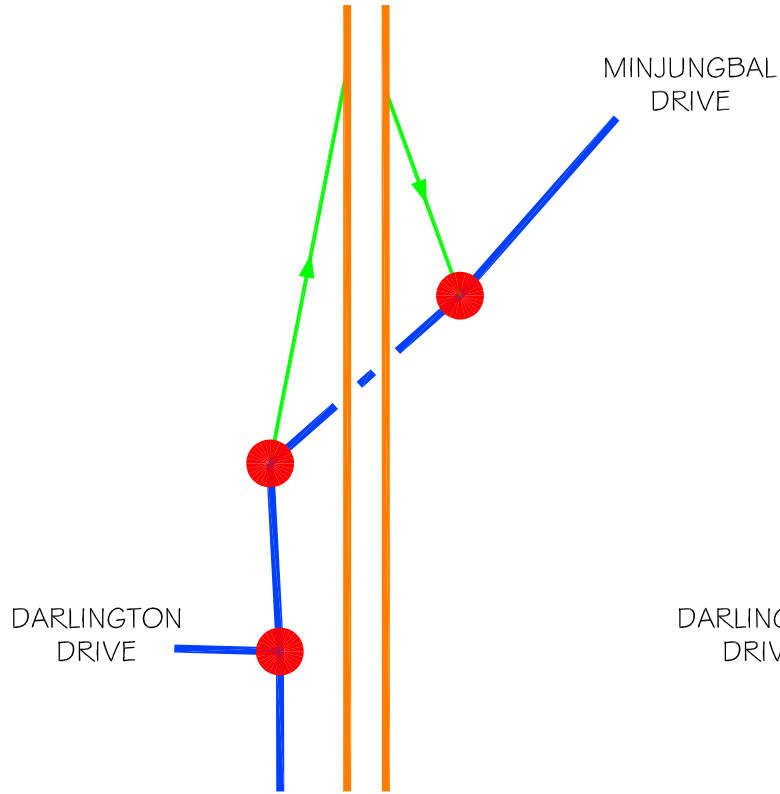
Each Kirkwood Road interchange configuration that was considered had one or more service roads over Terranora Creek. An option with no service roads would not be suitable due to traffic safety and capacity issues on the existing Terranora Creek Bridge.

3.3 Base cases

To determine the effectiveness and implications of the Banora Point upgrade and Kirkwood Road interchange options, two base case scenarios were developed:

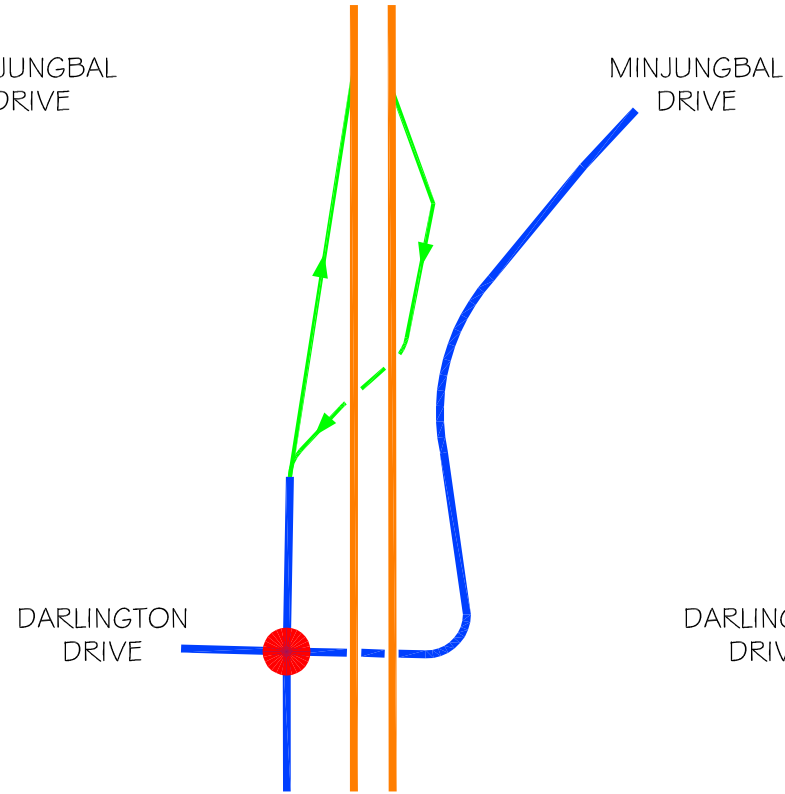
- base case A – the 'do-nothing' scenario where no Banora Point upgrade is implemented. No connections are provided to Kirkwood Road under this option
- base case B – only the Banora Point upgrade is implemented. This option assumes the adoption of the modification of the option B northern interchange (see Figure 3-1) and involves no highway or service road connections to the Kirkwood Road extension.

TO TWEED
HEADS BYPASS



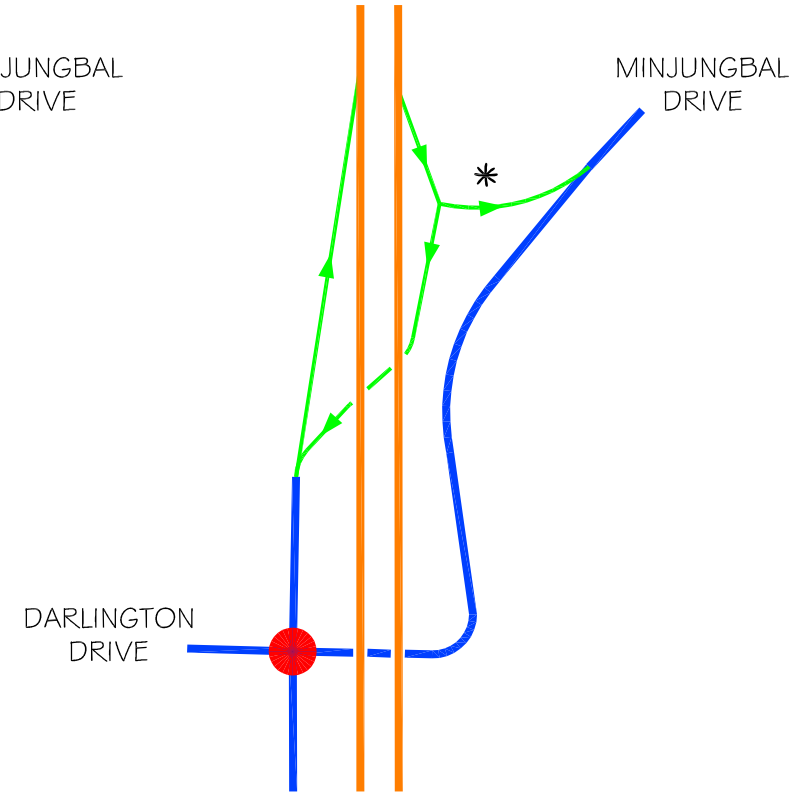
Option B northern
interchange

TO TWEED
HEADS BYPASS







Modification of Option B
northern interchange

TO TWEED
HEADS BYPASS



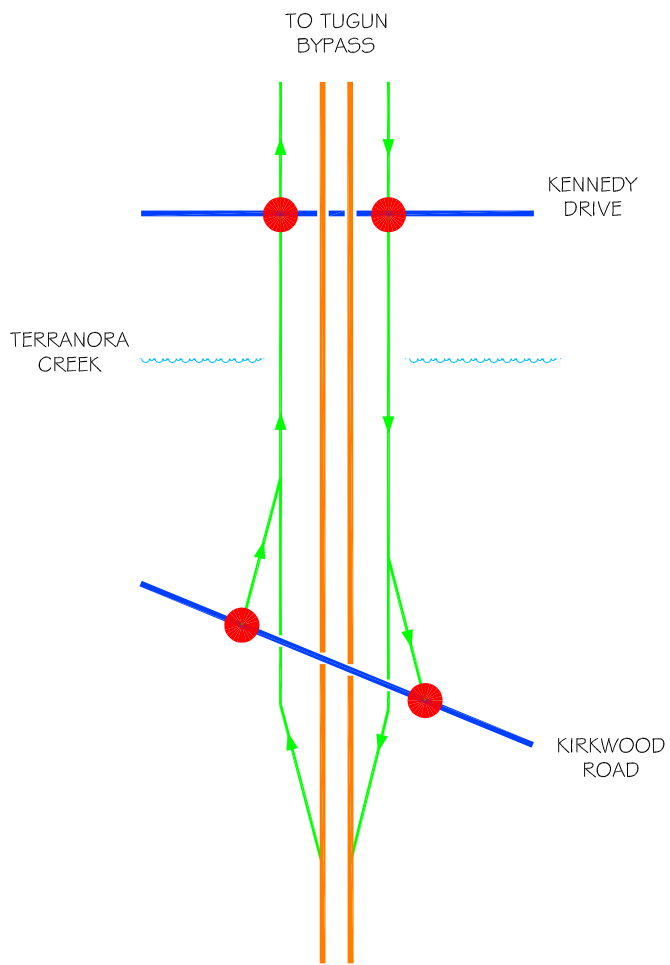
Modification of Option B
northern interchange with
'left-slip' to Minjungbal Drive

LEGEND

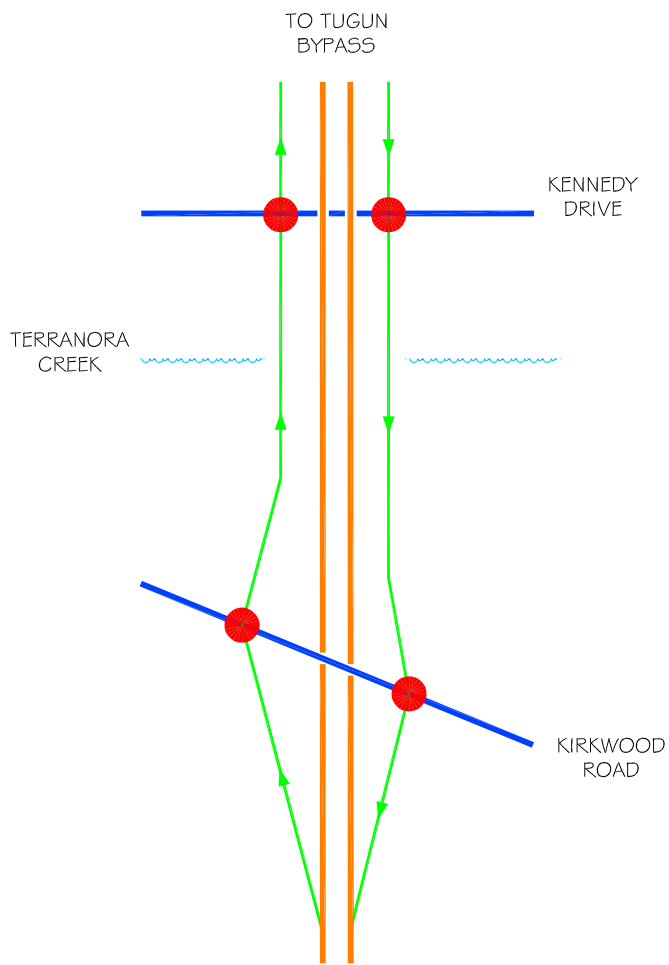
-  HIGHWAY CARRIAGEWAY
-  TWO WAY SERVICE ROAD
-  ONE WAY SERVICE ROAD/RAMP
-  SIGNALISED INTERSECTION

* Left slip may be closed in the long term to maintain traffic safety and flow

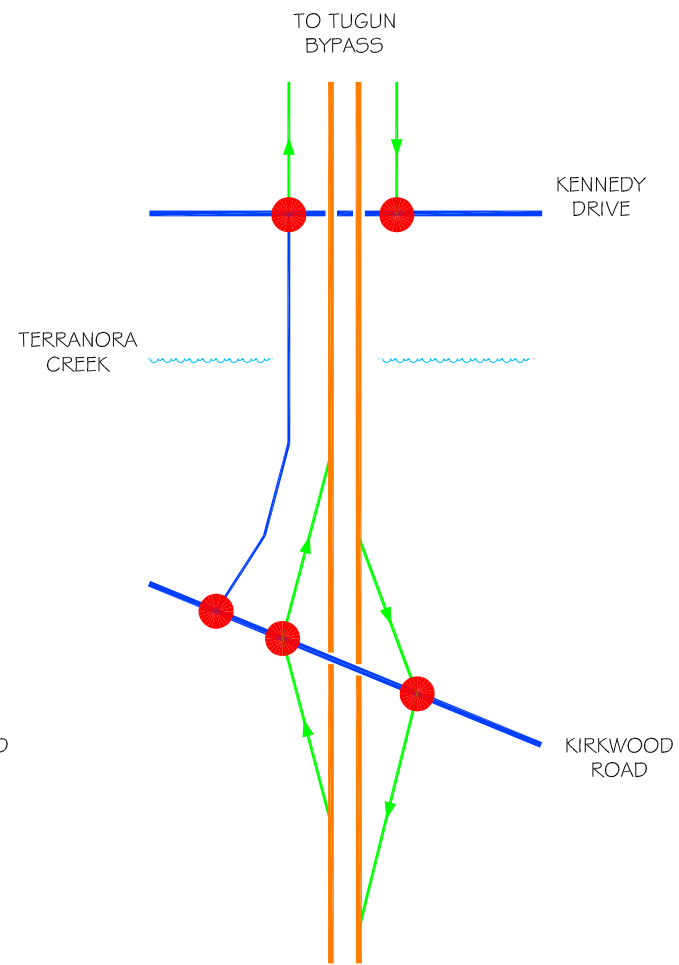
Figure 3.1: BANORA POINT NORTHERN INTERCHANGE CONFIGURATIONS



South-facing ramps connecting the highway with Terranora Creek service roads



South-facing ramps directly from the highway onto Kirkwood Road



Full interchange at Kirkwood Road, 2-way Terranora Creek service road

- LEGEND**
-  HIGHWAY CARRIAGEWAY
 -  TWO WAY SERVICE ROAD
 -  ONE WAY SERVICE ROAD/RAMP
 -  SIGNALISED INTERSECTION

Figure 3.2: KIRKWOOD ROAD INTERCHANGE OPTIONS

3.4 Scenario development

Nine scenarios and two base cases were developed based upon each possible combination of the two master planning elements under consideration. Table 3.1 below summarises the geometrical features of the options.

Table 3-1: Summary of master planning scenarios

Scenario	Banora Point northern interchange options			Kirkwood Road interchange options		
	Displayed option B	Modification of option B northern interchange	Modification of option B northern interchange with southbound off-ramp link to Minjungbal Drive	South-facing ramps onto service roads	South-facing ramps onto Kirkwood Road	Full interchange with Kirkwood Road
Base case A						
Base case B		✓				
1	✓			✓		
2		✓		✓		
2a			✓	✓		
3	✓				✓	
4		✓			✓	
4a			✓		✓	
5	✓					✓
6		✓				✓
6a			✓			✓

4. Option analysis

The following section provides an analysis of the master planning options considered. Each of the candidate options assumes an ultimate network arrangement including a six-lane Pacific Highway and inclusion of all applicable local road upgrades.

4.1 Discussion of results

The 2030 traffic scenario has been considered for each of the master planning options. The Level of Service and traffic volume plots are summarised below and contained in Appendix A.

4.1.1 Base cases

Base case A)

The performance of the existing Pacific Highway would deteriorate to such an extent (Level of Service E or F at peak times) that congestion would affect the Tweeds Heads bypass. In avoidance of the highway congestion, local motorists would inevitably attempt to rat-run through local roads.

Base case B)

Under this option, traffic originating south of Barneys Point Bridge would travel via the Banora Point service road (existing Pacific Highway) to access Minjungbal Drive.

The proposed highway alignment through Banora Point would operate at Level of Service of C at worst (disregarding highway grades).

The absence of a connection between the Pacific Highway and Kirkwood Road limits the volumes of traffic using the Kirkwood Road extension, questioning the overall benefits gained by introducing it into the local road network.

The increased travel distance for traffic from the north accessing Minjungbal Drive, resulting from the incorporation of the amended northern interchange, has no practical implications for traffic volumes on the highway due to the absence of any connections to Kirkwood Road. Motorists originating from north of Terranora Creek would access Minjungbal Drive via Kennedy Drive.

4.1.2 Options with south-facing ramps onto Terranora Creek service roads

Option 1

Traffic originating south of Barneys Point Bridge would travel via the Banora Point service road to access Minjungbal Drive.

The proposed highway alignment through Banora Point would operate at Level of Service of C at worst (disregarding highway grades).

The southbound highway off-ramp at the northern interchange encourages additional traffic to remain on the highway along the Tweed Heads bypass to access Minjungbal and Shallow Bay drives.

Kirkwood Road is underused in both peak periods, with the service roads generally being used for local traffic movements only.

Option 2

Traffic originating south of Barneys Point Bridge would travel via the Banora Point service road to access Minjungbal Drive.

The proposed highway alignment through Banora Point would operate at Level of Service of C at worst (disregarding highway grades).

The increased travel distance for traffic from the north accessing Minjungbal Drive, resulting from the incorporation of the amended Banora Point upgrade northern interchange, encourages traffic to use Kirkwood Road via the Terranora Creek service roads to access Minjungbal Drive.

Traffic accessing Darlington Drive from the highway avoids Minjungbal Drive, improving the traffic performance through its southern extents when compared to the displayed option B configuration.

The Terranora Creek service roads are generally being used for local traffic movements between Kirkwood Road and Kennedy Drive.

Option 2a

With the exception of the Minjungbal Drive area, the operation of this network scenario is generally similar to that of option 2. The Minjungbal Drive area operates similarly to option 1 with a reduction in travel distance for traffic from the north accessing the southern end of Minjungbal Drive.

Along the Tweed Heads bypass southbound carriageway, during the AM and PM peaks, option 2a results in an increase in traffic of 84 and 73 vehicles respectively when compared to option 2. This additional traffic consists of vehicles originating from north of Terranora Creek accessing Minjungbal Drive via the southbound link. This additional link also reduces the volume of traffic originating from north of Terranora Creek that would otherwise be encouraged to use Kirkwood Road to access Minjungbal Drive.

4.1.3 Options with south-facing ramps directly onto Kirkwood Road

Option 3

With the exception of the Tweed Heads bypass, the operation of this network scenario is generally similar to that of option 1.

Under this option, the Tweeds Heads bypass incurs a minor decrease in performance due to a slight increase in traffic, approximately 200 vehicles per peak hour using the highway via the Kirkwood Road ramps.

Option 4

The operation of this network scenario is generally similar to that of option 2.

There is a negligible increase in traffic along the Tweed Heads bypass with the inclusion of the direct ramps onto Kirkwood Road when compared to option 2. The use of the amended northern interchange in this option discourages short trips along the highway between Banora Point and Kirkwood Road due to the additional travel distance created by the connection to Darlington Drive. Local traffic is encouraged to remain on local links such as Kirkwood Road.

Option 4a

Option 4a eliminates the network benefits exhibited under option 4.

The option reduces the travel distance for traffic seeking to access the southern end of Minjungbal Drive from the north. Consequently, along the Tweed Heads bypass southbound carriageway, during the AM and PM peaks, option 4a results in an increase in traffic of 292 (13.9% increase) and 210 (4.8% increase) vehicles respectively when compared to option 4. Increases of these magnitudes would represent a depreciation of the highways performance.

The combined existence of the Kirkwood Road ramps and the additional southbound off-ramp link would encourage the use of the highway for short local trips rather than the use of local routes.

4.1.4 Options with a full interchange at Kirkwood Road

Option 5

South of Kirkwood Road, the operation of this network scenario is generally similar to that of option 1.

When compared to options 1 or 3, local motorists over Terranora Creek shift from the service roads between Kirkwood Road and Kennedy Drive back to the highway, questioning the justification of a service road when combined with a full interchange at Kirkwood Road. Such an option would ultimately reduce the highways life over Terranora Creek.

Option 6

South of Kirkwood Road, the operation of this network scenario is generally similar to that of option 2.

Increased traffic volumes access Minjungbal Drive via Kirkwood Road rather than detour via the loop in the Banora Point northern interchange.

Similar to option 5, the highway over Terranora Creek would experience heavy traffic while the service road would be underused.

Option 6a

Along the Tweed Heads bypass southbound carriageway, during the AM and PM peaks, option 6a results in an increase in traffic of 375 (20.7% increase) and 218 (5.2% increase) vehicles respectively when compared to option 6. Increases of these magnitudes would represent a depreciation of the highways performance.

This can generally be attributed to the reduction in travel distance for motorists seeking to access the southern extents of Minjungbal Drive.

The combined existence of the Kirkwood Road ramps and the additional southbound off-ramp link would encourage the use of the highway for short local trips rather than the use of local routes.

4.2 Summary of key outcomes

The following section summarises the findings of the road network traffic modelling.

4.2.1 Banora Point northern interchange

The option B northern interchange would encourage local traffic from the north to access Minjungbal Drive via the highway due to the direct access from the southbound off-ramp onto Minjungbal Drive. Short, local trips on the highway are considered undesirable leading to more frequent merging and diverging manoeuvres and subsequently, a likely decrease in the safety performance of the highway.

The modification of the option B northern interchange arrangement lengthens the trip distance for southbound highway traffic accessing Minjungbal Drive sufficient to encourage motorists to route via the Kirkwood Road to Kennedy Drive service roads and Kirkwood Road when accessing Minjungbal Drive from the north. The additional length in this ramp also increases safety provisions with an increased storage length for peak queues.

The modification of the option B northern interchange would provide an improved level of service along Minjungbal Drive between Darlington Drive and Shallow Bay Drive. This is achieved by distributing the vehicles accessing Minjungbal Drive rather than funnelling them through its southern entry.

In the absence of a service road connection between Kirkwood Road and Kennedy Drive, or north-facing ramps at Kirkwood Road, the improved connections at the northern interchange provided through implementation of the Banora Point upgrade would encourage a shift of traffic from Minjungbal Drive to the Pacific Highway for travel between west Banora Point and Coolangatta. Consequently, the Kirkwood Road extension would be grossly underused.

‘Left-slip’ link to Minjungbal Drive

The combined provision of a southbound highway connection direct from Kirkwood Road and the retention of the ‘left-slip’ link on the southbound off-ramp of the Banora Point northern interchange would effectively reverse the benefits of the amended northern interchange by encouraging short local trips along the highway, reducing the storage length along the off-ramp and increasing delays and traffic congestion at Minjungbal Drive’s southern connection.

Subject to ongoing reviews of traffic and safety performance during operation, the left-slip to Minjungbal Drive could remain prior to the introduction of a Kirkwood Road interchange.

4.2.2 Kirkwood Road interchange

South-facing ramps connecting to Kirkwood Road have been demonstrated to have varying effects on the predicted highway traffic volumes along the Tweed Heads bypass depending upon the Banora Point northern interchange configuration. The inclusion of a direct connection to Minjungbal Drive, as featured in the option B northern interchange or the modification of the option B northern interchange with the ‘left-slip’ link, results in a significant increase in traffic volumes south along the Tweed Heads bypass. Consequently, additional traffic would also be routed northbound along the southern sections of Minjungbal Drive.

Motorists originating from south of Leisure Drive would continue to access Minjungbal Drive and the Pacific Highway via Darlington Drive. The provision of south-facing ramps at Kirkwood Road would encourage motorists, originating from north of Leisure Drive, that previously accessed the highway via Darlington Drive to re-route via the Kirkwood Road interchange due to the direct highway connections.

The inclusion of north-facing ramps at the Kirkwood Road interchange generally would not influence the traffic patterns south of Kirkwood Road when compared to options which provide a service road over Terranora Creek to Kennedy Drive.

The full interchange encourages a shift of local traffic onto the highway over Terranora Creek rather than encouraging the use of the service road for short local trips. Short local trips along the highway are deemed inappropriate due to road safety and traffic efficiency implications. In comparison to those options providing a service road over Terranora Creek, this increase in two-way traffic equates to approximately 1000 vehicles per peak hour, significantly deteriorating the highway's level of service.

4.2.3 Construction sequence

As demonstrated by base case B, and when comparing with base case A, the Banora Point Upgrade can be undertaken without the construction of an interchange at Kirkwood Road.

Furthermore, the Kirkwood Road interchange arrangement could be staged to include, in the short to medium term, a single two-way service road on the western side of the Pacific Highway under options 3, 3a, 4 and 4a. This would operate satisfactorily in the medium term (10-15 years) with the Banora Point Upgrade in operation.

4.3 Conclusions

From the analyses that have been undertaken as part of this master planning process, it can be concluded that an appropriate balanced arrangement for the development of both the Pacific Highway and adjoining local road network can be achieved.

The key elements of the master planning scenario believed to represent this balanced network are:

- the modification of the option B northern interchange arrangement for the Banora Point upgrade project
- possible retention of the 'left-slip' to Minjungbal Drive prior to construction of a Kirkwood Road interchange
- south-facing ramps directly from the highway to Kirkwood Road with signalised connections to one-way service roads either side of the existing Terranora Creek Bridge extending north to Kennedy Drive
- a staged introduction of the Kirkwood Road to Kennedy Drive service roads (if necessary to meet funding requirements), with the initial construction of a two way service road on the west of the highway, and delayed construction of the eastern service road (allowing the previously constructed western service road to become one-way).

5. Banora Point upgrade preferred concept

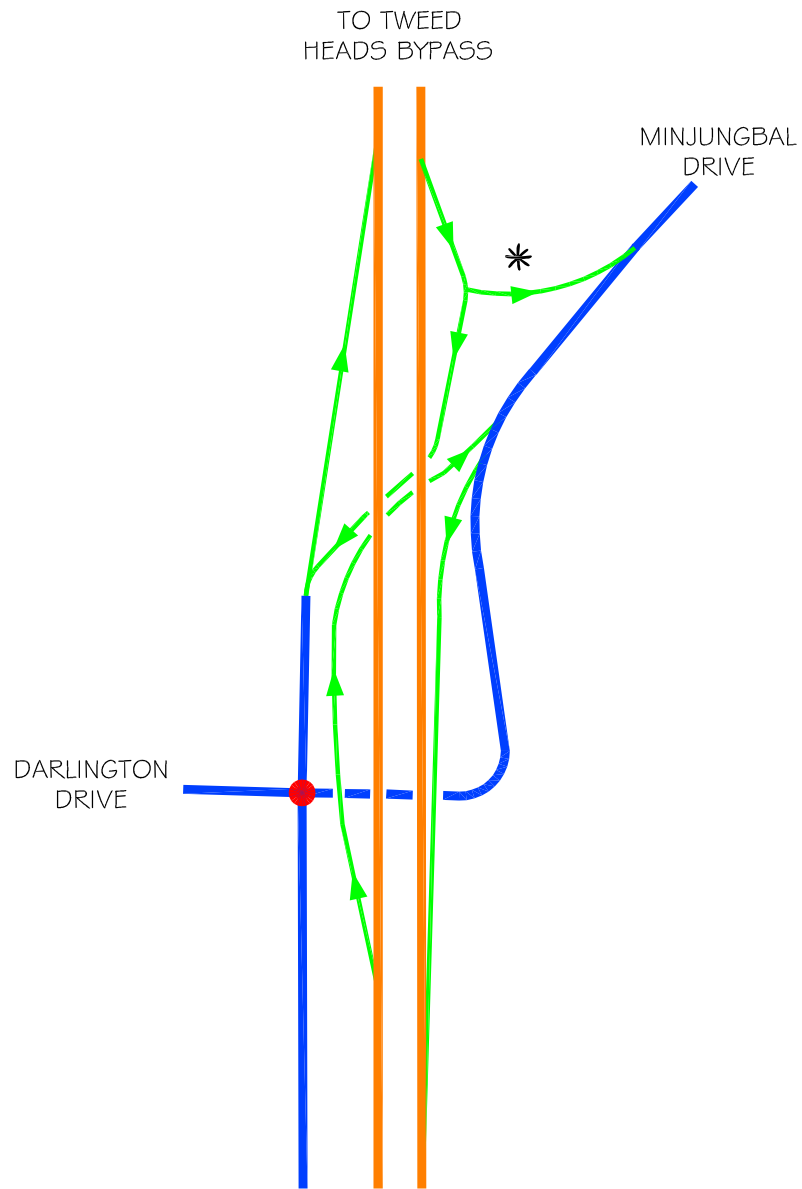
Following the value management workshop recommendations, the network modelling and determination of the preferred master plan configuration further design development of the Banora Point upgrade was undertaken.

A review of the concept design for the Banora Point upgrade determined that an additional northbound off-ramp and southbound on-ramp linking the upgrade directly to with Minjungbal Drive should be provided as part of the project. Previously, allowances had been made in the concept design for the Banora Point upgrade to allow possible construction of these ramps in the future but they had not been considered as part of the current project. Figure 5-1 provides a schematic illustration of the northern interchange for the Banora Point upgrade preferred concept.

The preferred concept for the Banora Point upgrade is illustrated in 7-2. Key features of the preferred concept include:

- a new highway alignment to the east of the existing route
- existing highway maintained for use by local traffic
- highway horizontal radii within the 600–1,200 m range
- a six-lane highway with sealed shoulders
- northbound off-ramp and southbound on-ramp at the southern end, connecting to the existing highway route
- a viaduct across the southern valley, approximately 360 m in length
- moderate grades either side of Sexton Hill (3.5–4.5%)
- a deep cutting with vertical walls up to 20 m high
- a land bridge over an approximately 100 m length of the walled section
- Wilson Park reinstated over the land bridge
- retention of the existing pedestrian/cyclist bridge
- realignment of Laura Street to intersect the existing highway and Short Street at a four-way signalised intersection
- a 300 m (approximate) extension of Minjungbal Drive, passing below the highway upgrade and connecting to Darlington Drive
- a southbound off-ramp and a northbound on-ramp connecting to the Darlington Drive intersection
- a southbound on-ramp and northbound off-ramp connecting directly to Minjungbal Drive
- a signalised intersection on the service road incorporating all movements between Minjungbal Drive, Darlington Drive, the Pacific Highway (north) and the service road.

The master planning scenarios considered thus far have evaluated network configurations primarily affecting traffic between Leisure Drive at Banora Point and Kennedy Drive at Tweed Heads. The additional links proposed by the Banora Point upgrade preferred concept would affect motorist routes through Banora Point exclusively. Therefore, all previous assessments and conclusions made throughout the master planning study remain valid.



LEGEND

- HIGHWAY CARRIAGEWAY
- TWO WAY SERVICE ROAD
- ONE WAY SERVICE ROAD/RAMP
- SIGNALISED INTERSECTION

* Left slip may be closed in the long term to maintain traffic safety and flow

Figure 5.1: Banora Point upgrade preferred concept - northern interchange

The Level of Service and traffic volume plots incorporating the Banora Point upgrade preferred concept are contained in Appendix B.

The incorporation into the preferred concept of the southbound on-ramp and northbound off-ramp connecting directly to Minjungbal Drive would remove approximately 60% of the traffic from the Banora Point service road (existing highway) and southern interchange ramps. Such an arrangement would provide various benefits, including improved travel times and road safety for both highway and local traffic, and alleviate traffic volumes through the proposed Darlington Drive intersection.

6. Boyd Street interchange (Tugun bypass) and Cobaki Parkway

6.1 Context

In addition to the previously discussed master planning network options, the traffic assessment was extended to investigate the network impacts of including or excluding ramps at Boyd Street from the proposed Tugun bypass. These ramps would provide a direct link from the Cobaki Parkway to the Tugun bypass.

6.2 Methodology and results

As per the remainder of the Lower Tweed and Pacific Highway traffic master planning, traffic volumes for the assessment of a Boyd Street interchange have been provided by Veitch Lister Consulting Pty Ltd. These traffic volumes are the result of separate modelling undertaken by Veitch Lister Consulting on behalf of the TSC.

Table 6-1 details the traffic volumes on the Tugun bypass, Tweed Heads bypass and Kennedy Drive (west of the Pacific Highway) for configurations with and without the Boyd Street interchange on the Tugun bypass.

Table 6-1: Traffic volumes with and without ramps at Boyd Street

Time period	Without interchange	With interchange	Difference	% Difference
Tugun bypass (north of Tweed Heads bypass)				
AM peak	5,200	5,100	-100	-2%
PM peak	6,000	5,800	-200	-3%
Daily	58,700	60,400	1,700	3%
Tweed Heads bypass (south of Tugun bypass)				
AM peak	1,800	1,700	-100	-6%
PM peak	2,100	1,900	-200	-11%
Daily	17,600	15,100	-2,500	-17%
Kennedy Drive (west of Pacific Highway)				
AM peak	2,100	2,000	-100	-5%
PM peak	2,400	2,200	-200	-9%
Daily	26,000	24,300	-1,700	-7%

Source: VLC (2005)

Note: AM Peak – 2 hours (7:00am to 9:00 am) and PM Peak – 2 hours (4:00 pm to 6:00 pm)

6.3 Summary of results

Key traffic outcomes arising from the inclusion of the Boyd Street interchange with the Tugun bypass include:

- an approximate 3% increase in the daily traffic volumes on the Tugun bypass, between Boyd Street and the proposed Tweed Heads interchange
- an approximate 17% reduction in the daily traffic volumes along the Tweed Heads bypass, north of the proposed Tweed Heads interchange
- an approximate 7% reduction in the daily traffic volumes on Kennedy Drive, west of the highway
- no major impacts on the traffic volumes experienced along the Pacific Highway south of Terranora Creek
- negligible impacts on the traffic volumes along Minjungbal Drive.

In addition, the modelling of the road network shows that the proposed Cobaki Parkway link would result in Kennedy Drive traffic volumes remaining relatively constant as any traffic from the new developments attracted to Kennedy Drive is offset by existing traffic being attracted to the Cobaki Parkway and Boyd Street.

7. Option for further development

The various options analyses undertaken as part of the joint TSC/RTA master planning study have concluded that an appropriate balanced ultimate arrangement for the development of both the Pacific Highway and adjoining local road network is the use of:

- the Banora Point upgrade preferred concept, as described in Section 5 and Figure 7-2.
 - south-facing ramps at Barneys Point Bridge
 - south-facing ramps direct to Minjungbal Drive and north-facing ramps connecting to the Darlington Drive intersection.
- and a Kirkwood Road interchange, including:
 - the extension of Kirkwood Road to Fraser Drive
 - one-way service roads both sides of the existing highway extending from Kirkwood Road to Kennedy Drive (Terranora Creek service roads)
 - south-facing ramps connecting directly from the highway to Kirkwood Road and the Terranora Creek service roads via signalised intersections.

A key plan demonstrating the agreed master plan option for further development is illustrated in Figure 7-1. The subsequent figures, Figures 7-2 to 7-4, provide details of the agreed master planning elements.

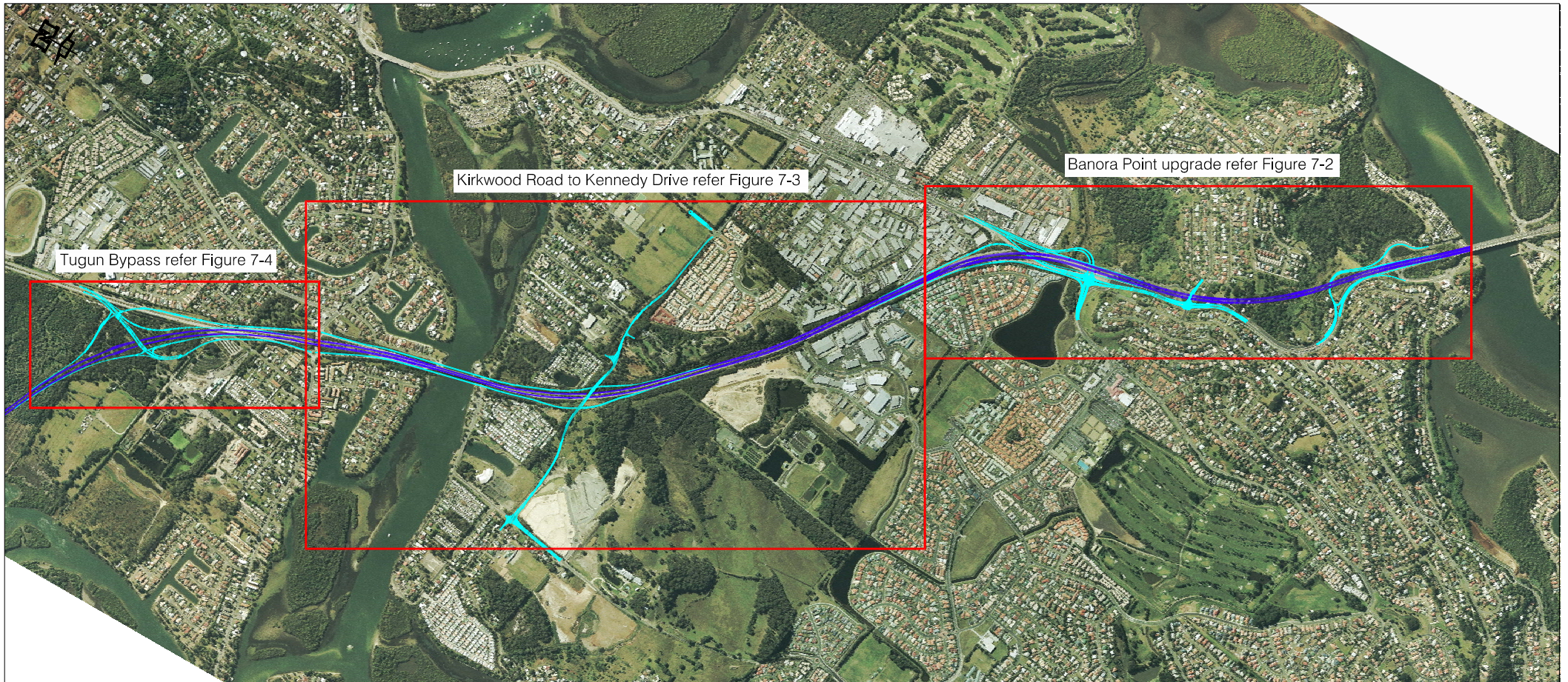
Construction of the Banora Point upgrade preferred concept would improve the movement of local and through traffic in the area, removing many heavy vehicles from the local road network and improving safety. Such a project is not only considered an improvement, but essential to the future operation of the southern Tweed Heads road network.

With the Banora Point upgrade operational, the short-term deferral of the construction of the Kirkwood Road interchange is possible. However, interpolation of traffic modelling results have shown that by 2015, with the absence of certain elements of this interchange, the effects would be noticeable with increased traffic along the Tweed Heads bypass (south of Kirkwood Road) and congestion through the Banora Point northern interchange.

The early construction of a two-way service road, west of the existing Terranora Creek Bridge would alleviate congestion along the Tweed Heads bypass, providing an additional link between west Banora Point and Coolangatta. Construction of the Terranora Creek service roads would reduce traffic volumes along the Tweed Heads bypass and further improve traffic flows through the southern extents of Minjungbal Drive.

Deferred construction of the ultimate Terranora Creek service road scheme is possible with the initial use of a single two-way service road, west of the existing Terranora Creek Bridge. The ultimate proposal of dual one-way service roads over Terranora Creek would represent a further network improvement, providing a more efficient and logical route for motorists.

Construction of the south-facing highway ramps connecting to Kirkwood Road would relieve congestion along the southern extents of Minjungbal Drive. The ramps benefit the local road network by improving local connectivity and providing an additional link to Tweed City commercial district. The removal of any direct southbound connection from the Tweed Heads bypass to Minjungbal Drive is required upon introduction of the south-facing ramps at Kirkwood Road. Such a measure would ensure the continued dispersed use of accesses to Minjungbal Drive and maintain the efficiency and safety of the highway.



AERIAL PHOTOGRAPHY COURTESY OF TWEED SHIRE COUNCIL, JULY 2004.

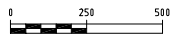


Figure 7.1: AGREED OPTION FOR FURTHER DEVELOPMENT KEY PLAN



AERIAL PHOTOGRAPHY COURTESY OF TWEED SHIRE COUNCIL, JULY 2004.

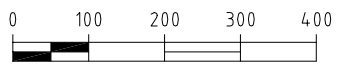


Figure 7.2: BANORA POINT UPGRADE



AERIAL PHOTOGRAPHY COURTESY OF TWEED SHIRE COUNCIL, JULY 2004.

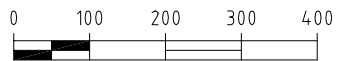
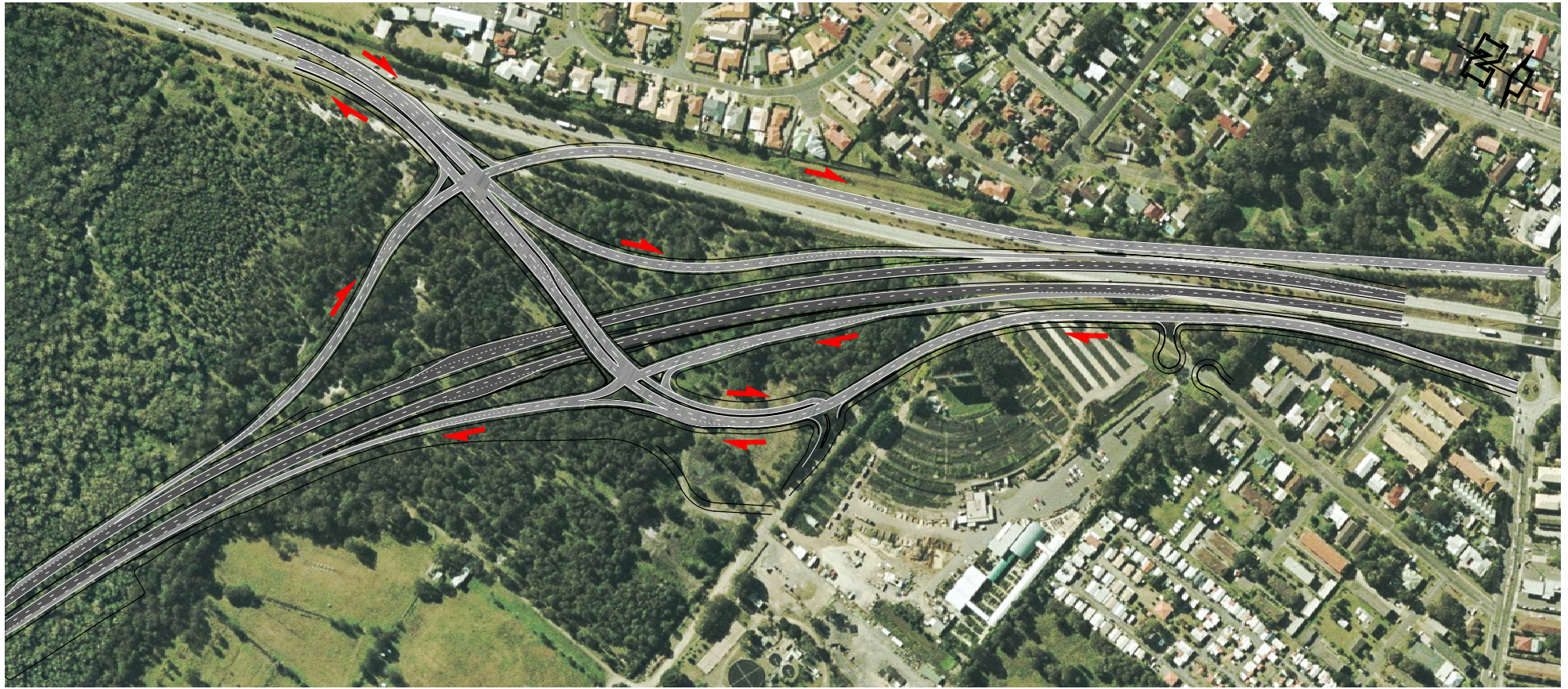


Figure 7.3: KIRKWOOD ROAD TO KENNEDY DRIVE



AERIAL PHOTOGRAPHY COURTESY OF TWEED SHIRE COUNCIL, JULY 2004.

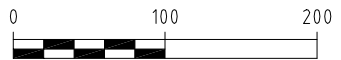


Figure 7.4: TUGUN BYPASS

8. Costs

Table 8-1 details the estimated funding requirements of each of the master planning elements. Table 8-1 also includes indicative target completion dates for each major element of the master plan. These target dates are indicative only and would be adjusted in response to actual traffic demand.

Queensland Main Roads and the New South Wales RTA are co-proponents for the Tugun bypass. The project is being jointly funded by Queensland Main Roads and the Federal Government.

Although detailed estimates have not yet been prepared, cost for the entire scheme within New South Wales would be in the order of \$270-million to \$305-million.

The apportionment of costs for the remaining master planning elements between the TSC and the RTA would be the subject of further analysis and negotiation. It is expected that some elements of the master plan would be jointly funded by the TSC and RTA. Other elements would be expected to be provided at the sole expense of either the TSC or RTA.

Table 8-1 Estimated cost and funding responsibility of master planning elements

Master planning element	Estimated cost** (\$Million)	Funding responsibility	Indicative timing
Kennedy Drive to Tugun bypass service roads	n/a	QDMR/Dotars	Late 2008
Banora Point upgrade	190	RTA	2010 – 2015
Kirkwood Road extension (including modifications to Fraser Drive)	10 - 15	TSC	2015 -2020
Terranora Creek western service road	15 – 20	Joint TSC/RTA	2015 -2020
Kirkwood Road south facing ramps	10 – 15	Joint TSC/RTA	2015 -2020
Terranora Creek eastern service road	15 – 20	Joint TSC/RTA	2025 - 2030
Tweed Heads bypass, widening to 6 lanes*	30 – 45	RTA	2025 - 2030

* estimate for widening of road and bridge. Rehabilitation of existing pavement may be required around same time.

** indicative estimate to be refined with concept design development.

9. Next steps

Approval of the Banora Point upgrade and Kirkwood Road proposals will be requested under the recently introduced Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW). Under this legislation the proposal will be the subject of an environmental assessment which will examine the potential impacts of the preferred concept. Community issues raised in relation to the preferred concept will be considered during the investigations and design development.

The RTA will investigate possible alternative strategies for the construction of the Banora Point upgrade. These investigations will consider staged construction.

The RTA will also consider interim measures on the existing Pacific Highway. The refined design and environmental assessment will be displayed for community comment prior to assessment of the proposal by the Department of Planning and consideration by the Minister for Planning.

Figure 9-1 below illustrates the development and approvals process for the Banora Point upgrade and Kirkwood Road interchange. Each of the projects would be undertaken separately with varying funding arrangements.

The Kirkwood Road interchange remains at a more preliminary stage where further detailed investigation is required to assess the geometrical and design feasibility and any impacts associated with the interchange and associated service roads. This also includes consideration of the impacts on Kirkwood Road's future upgrading requirements to support the inclusion of the interchange.

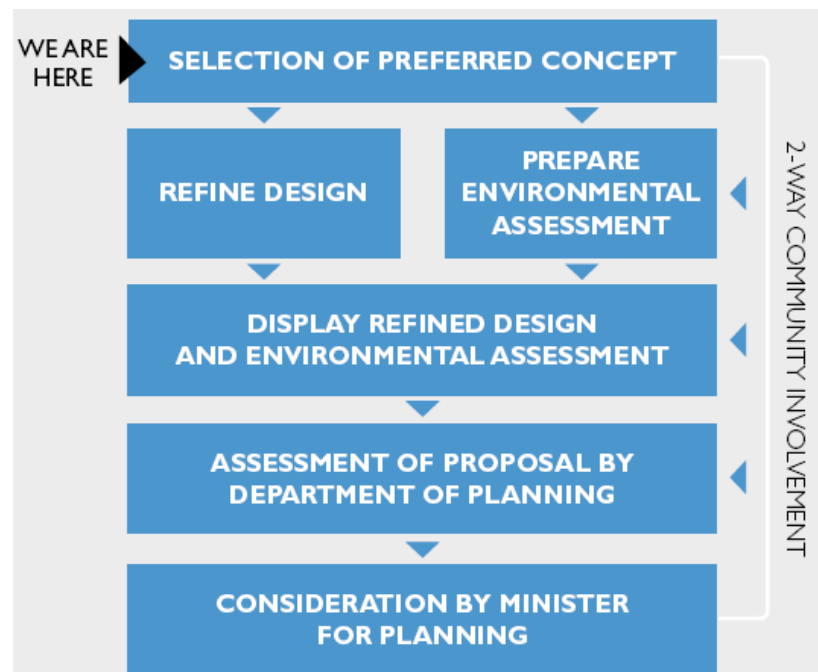
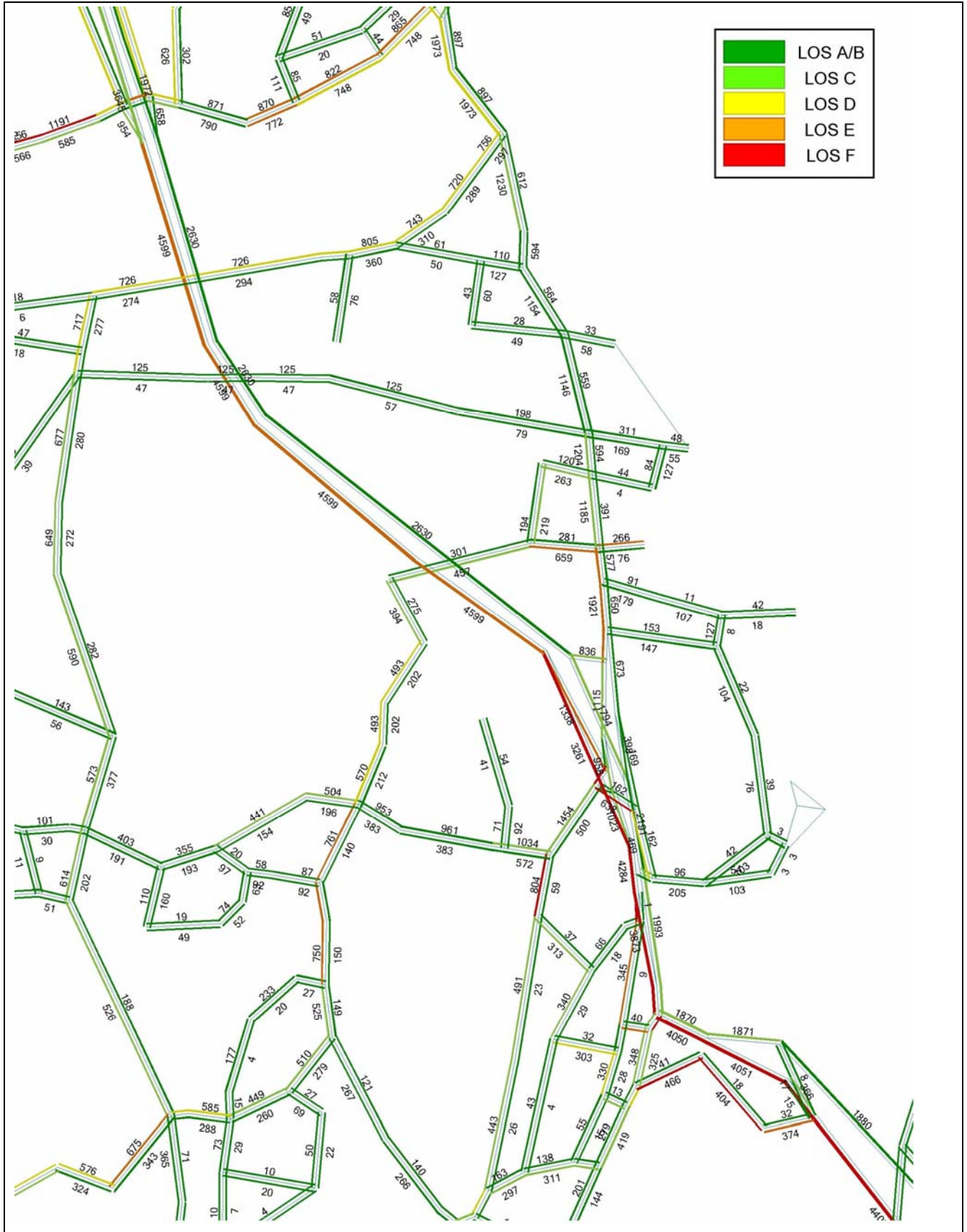


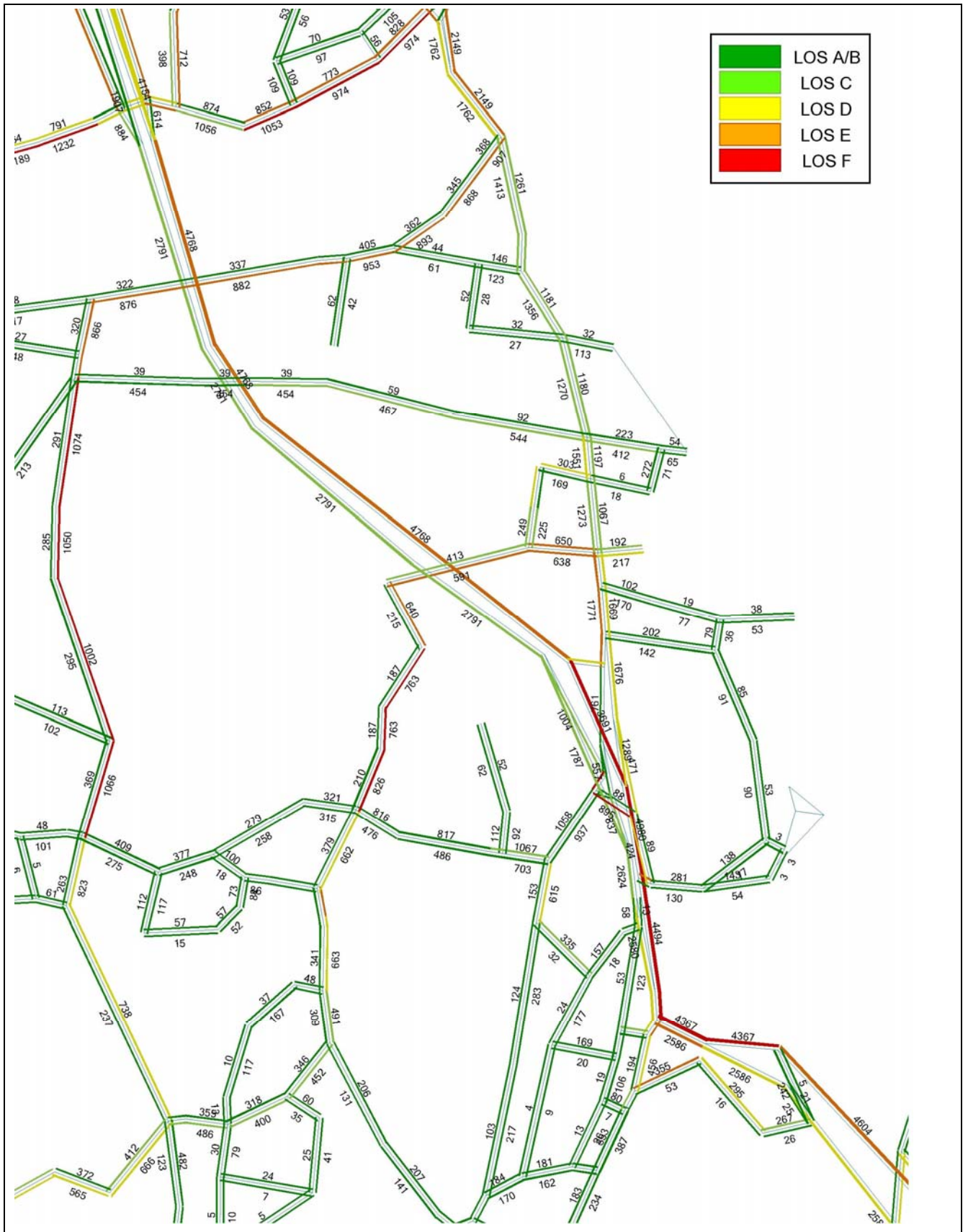
Figure 9-1: Development and approvals process

Appendix A

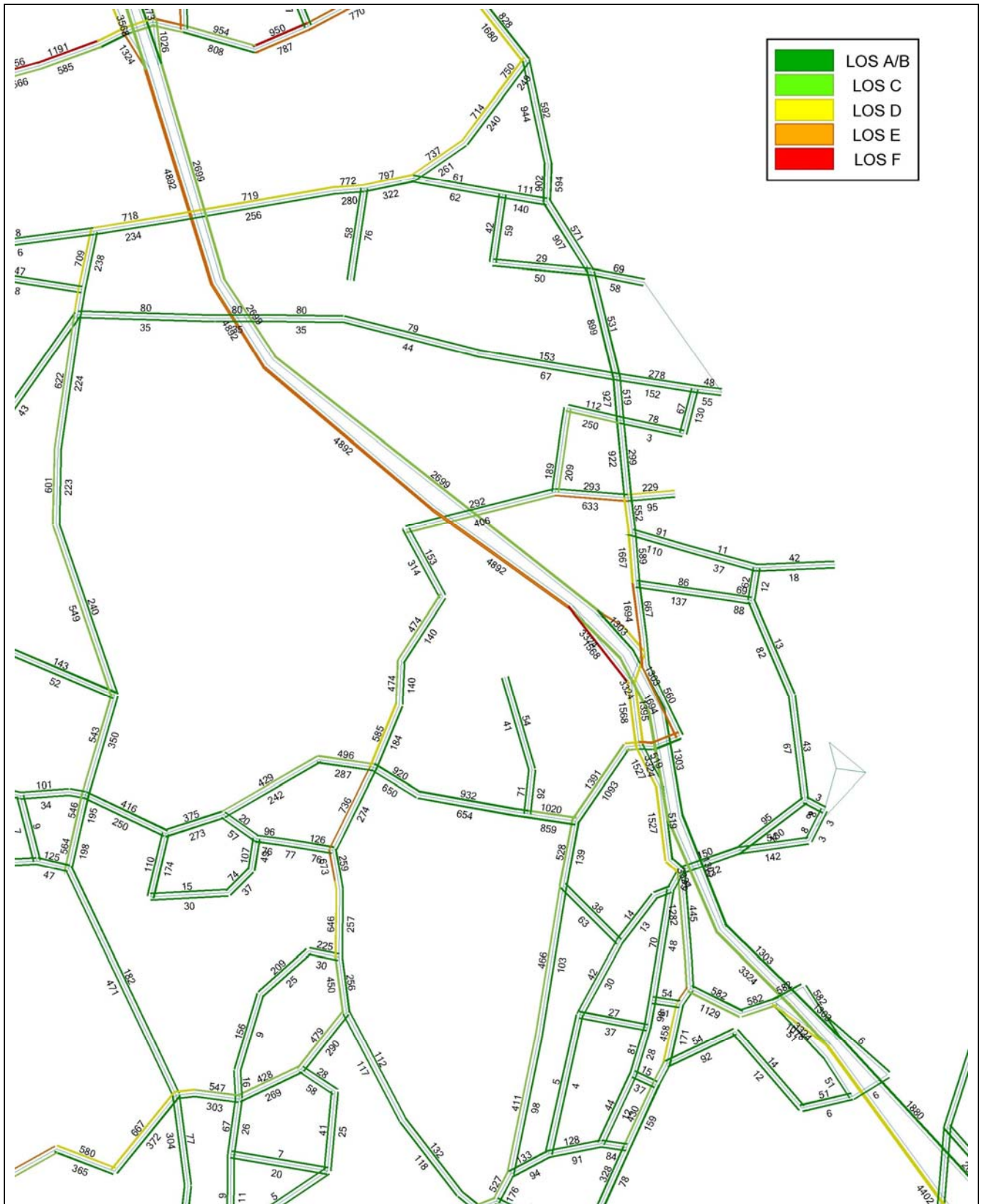
Master planning options – Level of
Service plots



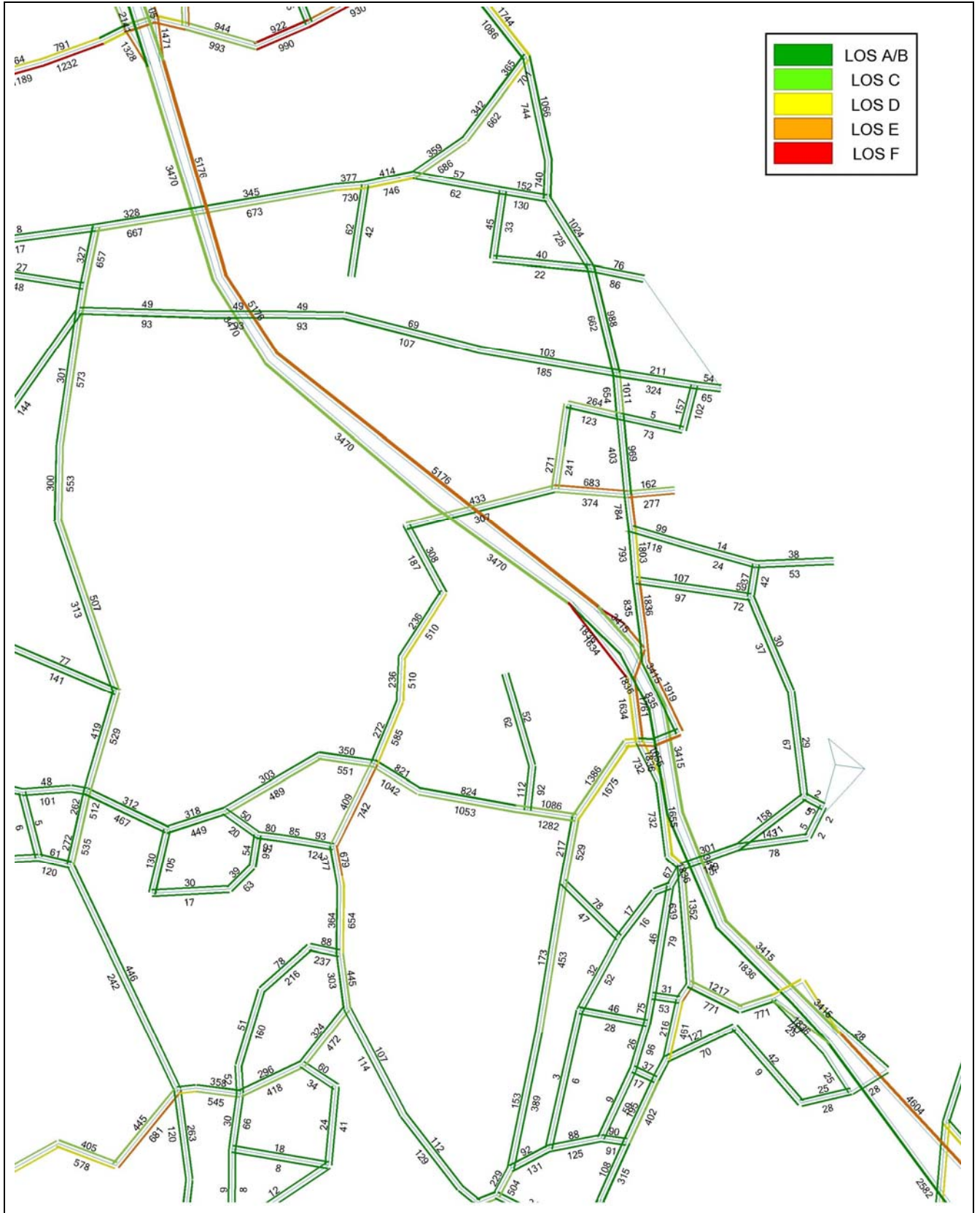
2030 am peak hour – Base case (a)



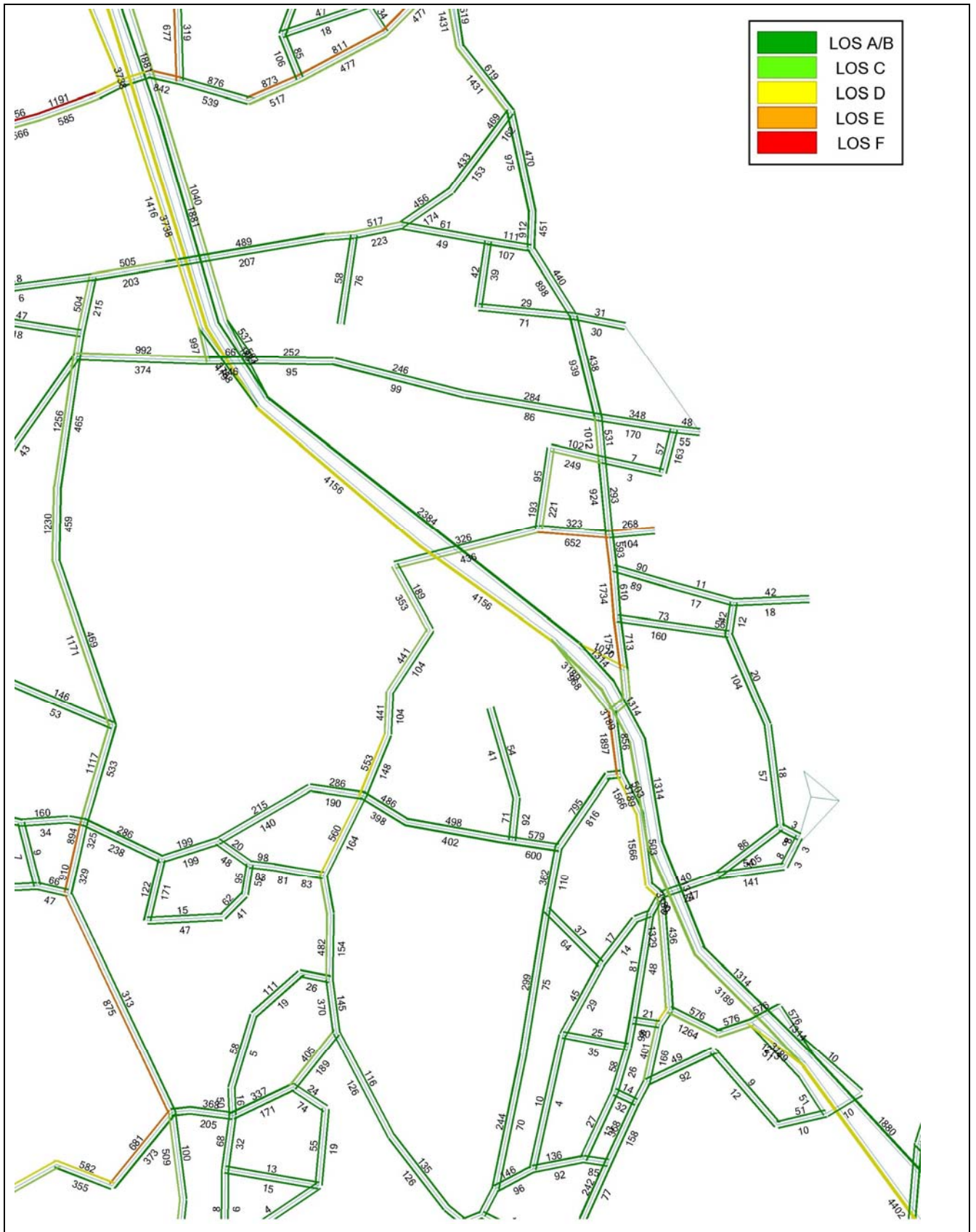
2030 pm peak hour – Base case (a)



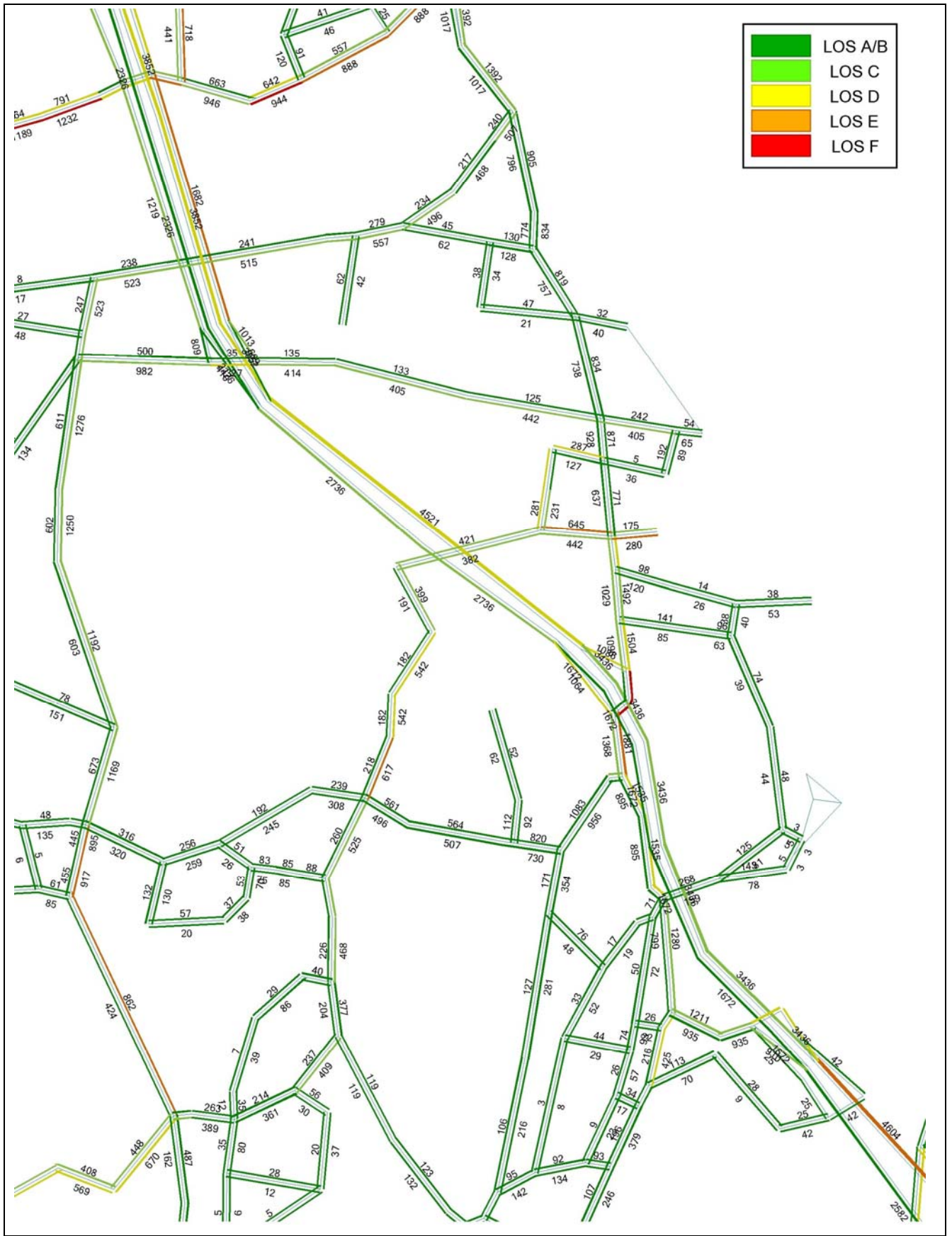
2030 am peak hour – Base case (b)



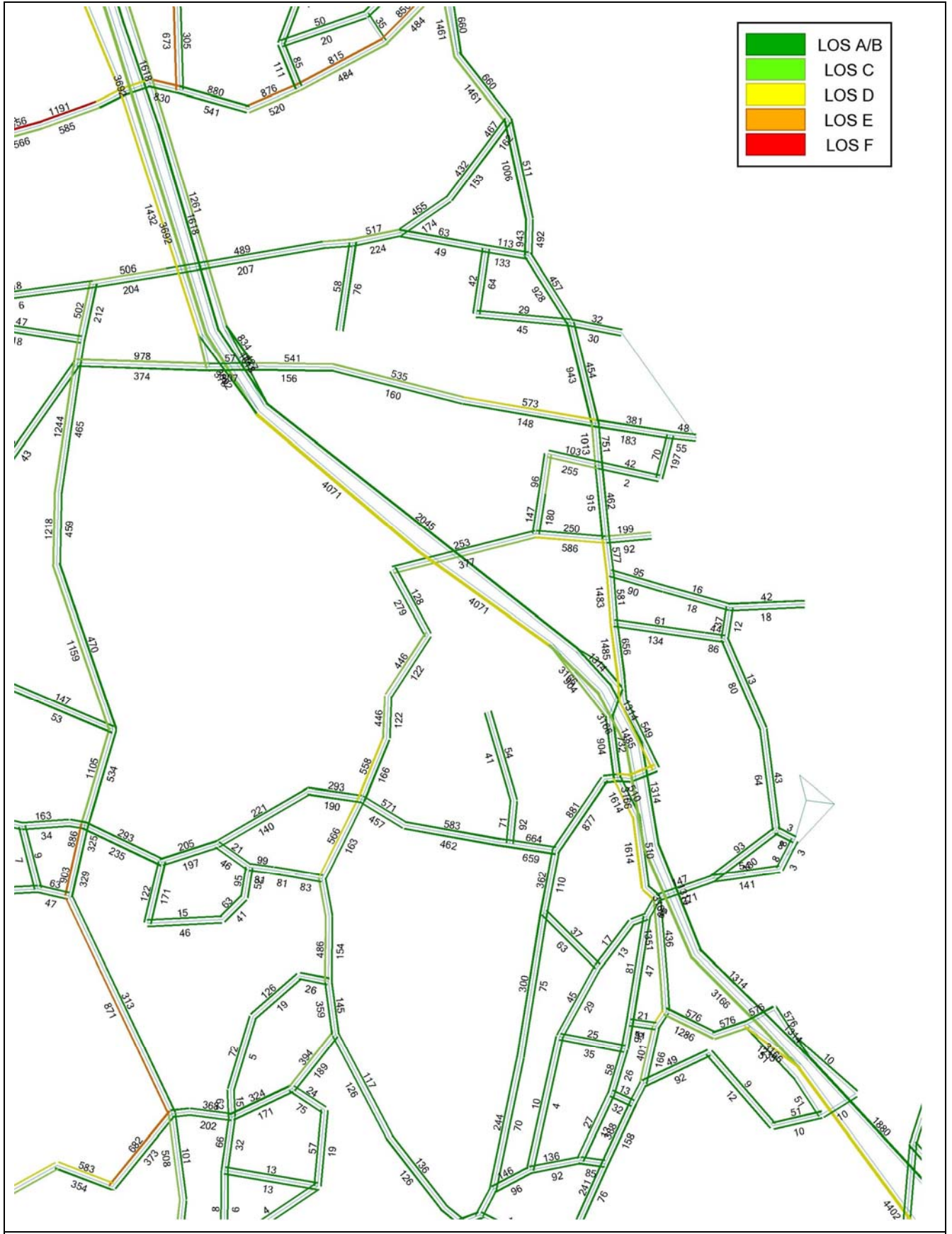
2030 pm peak hour – Base case (b)



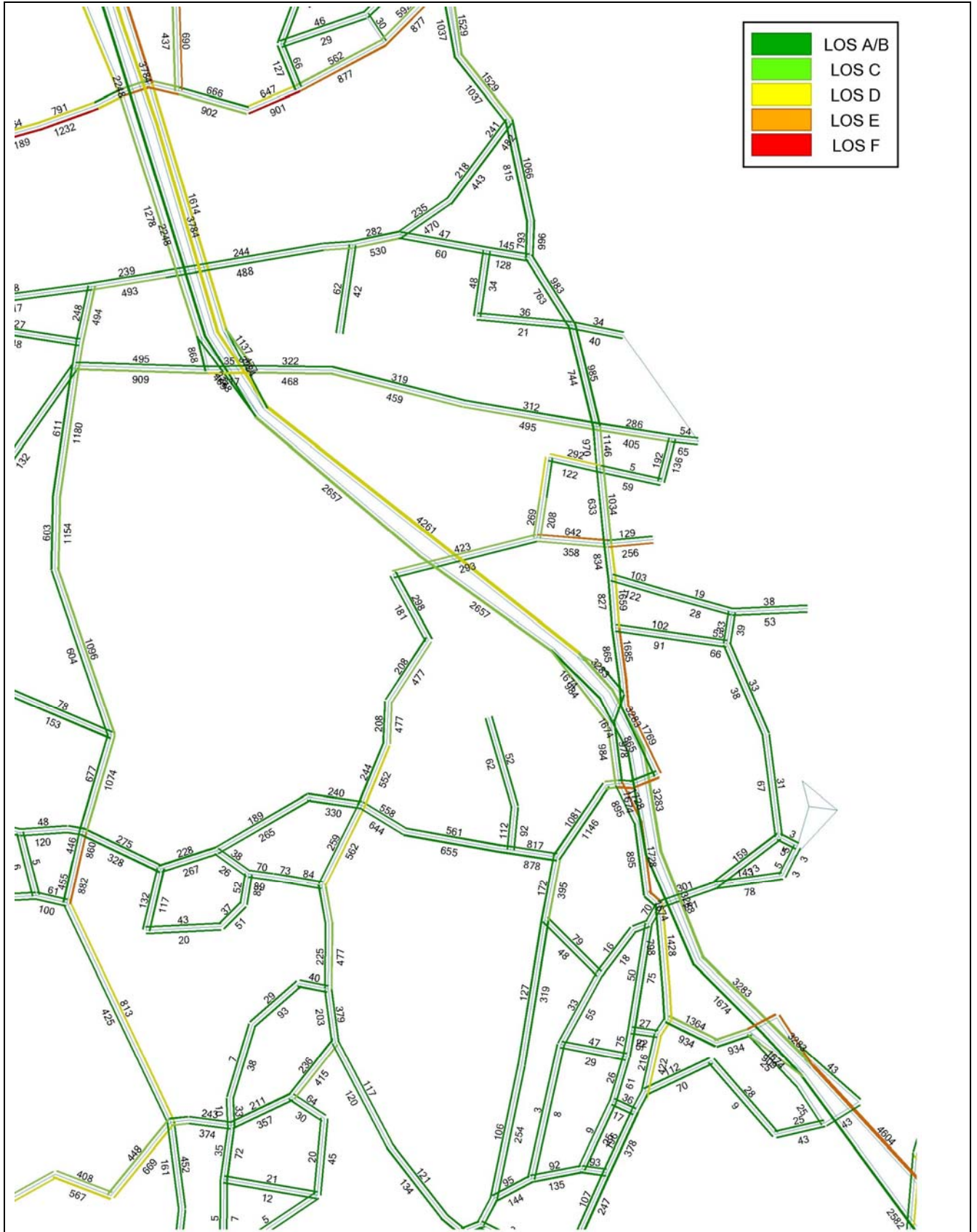
2030 am peak hour – Option 1



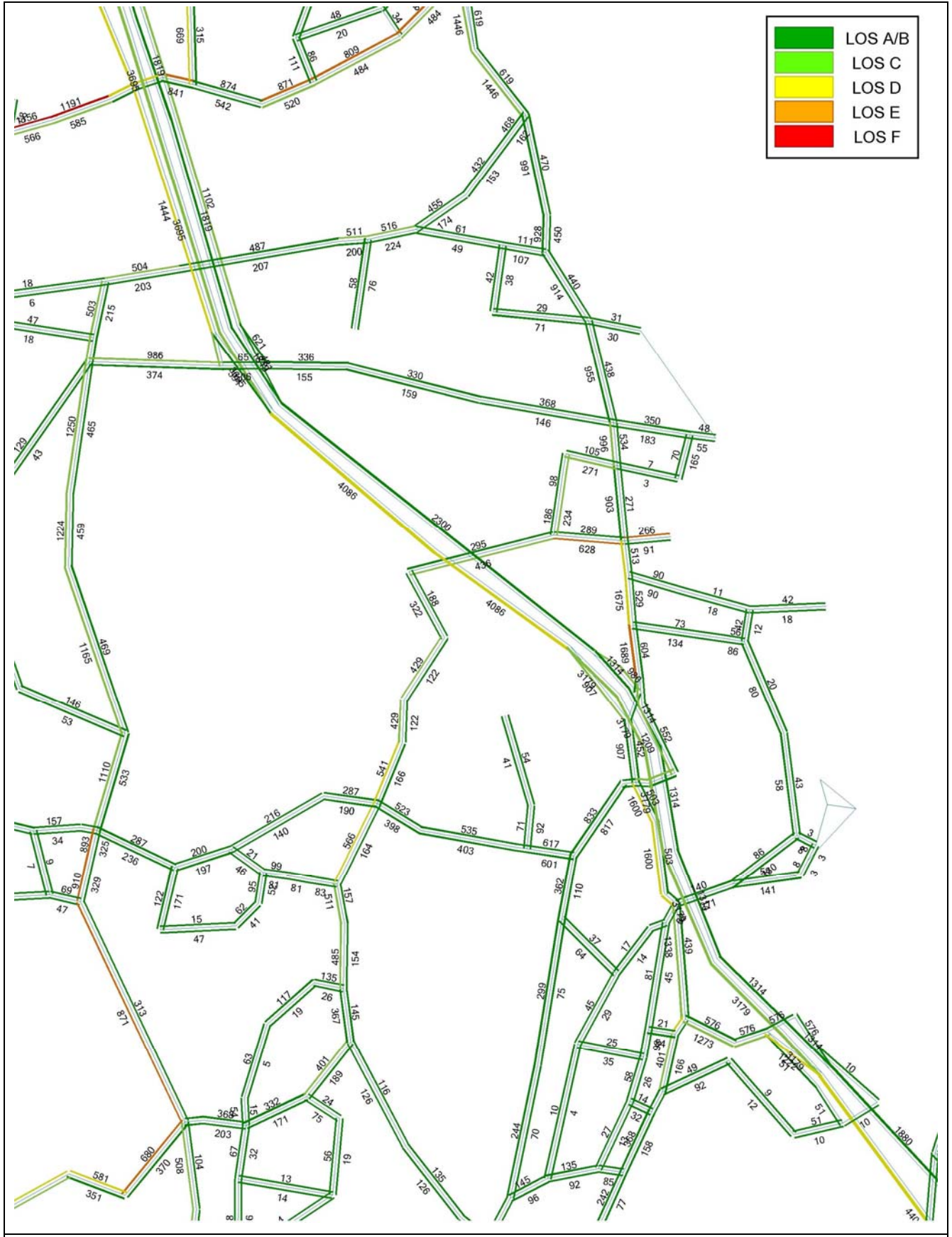
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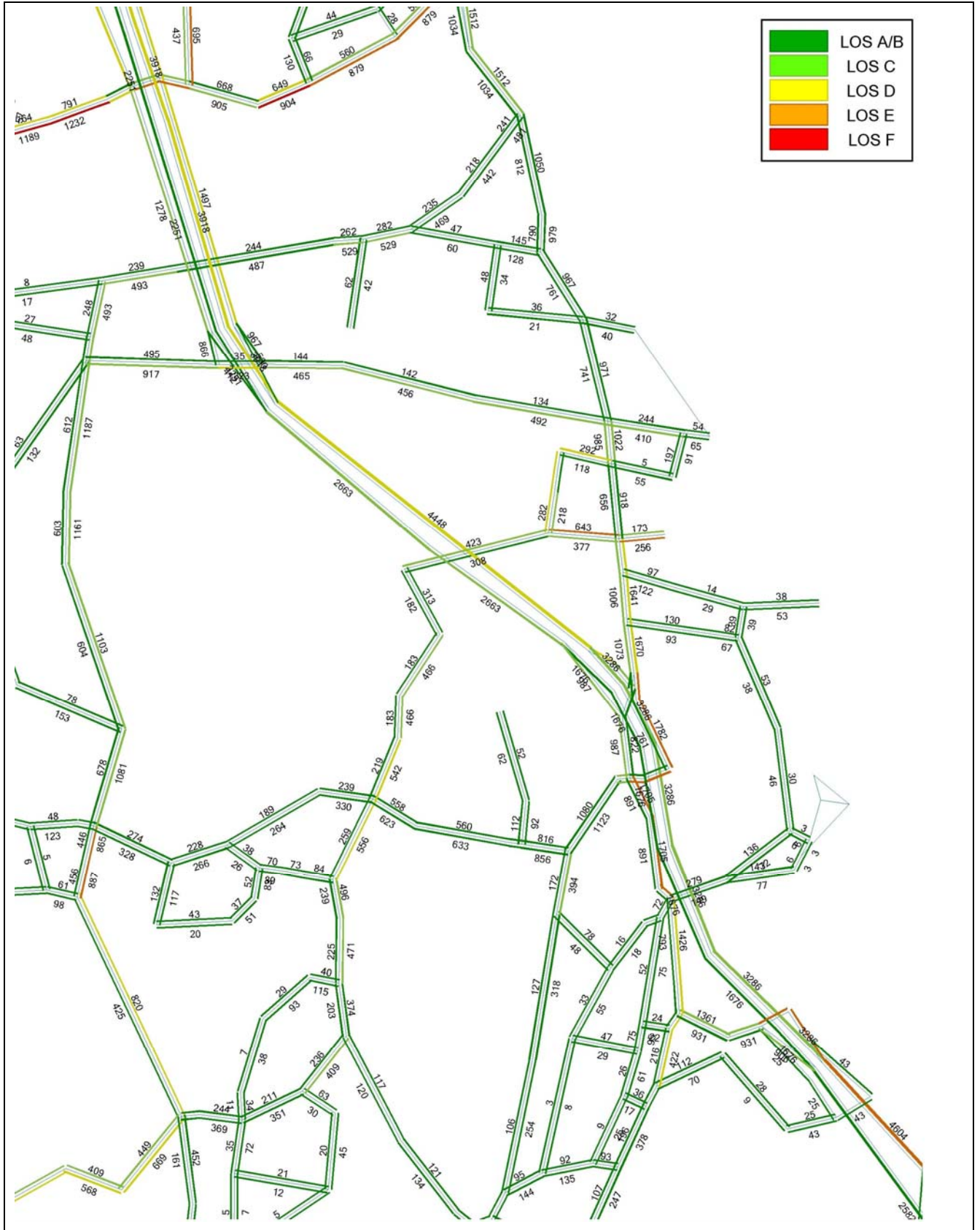
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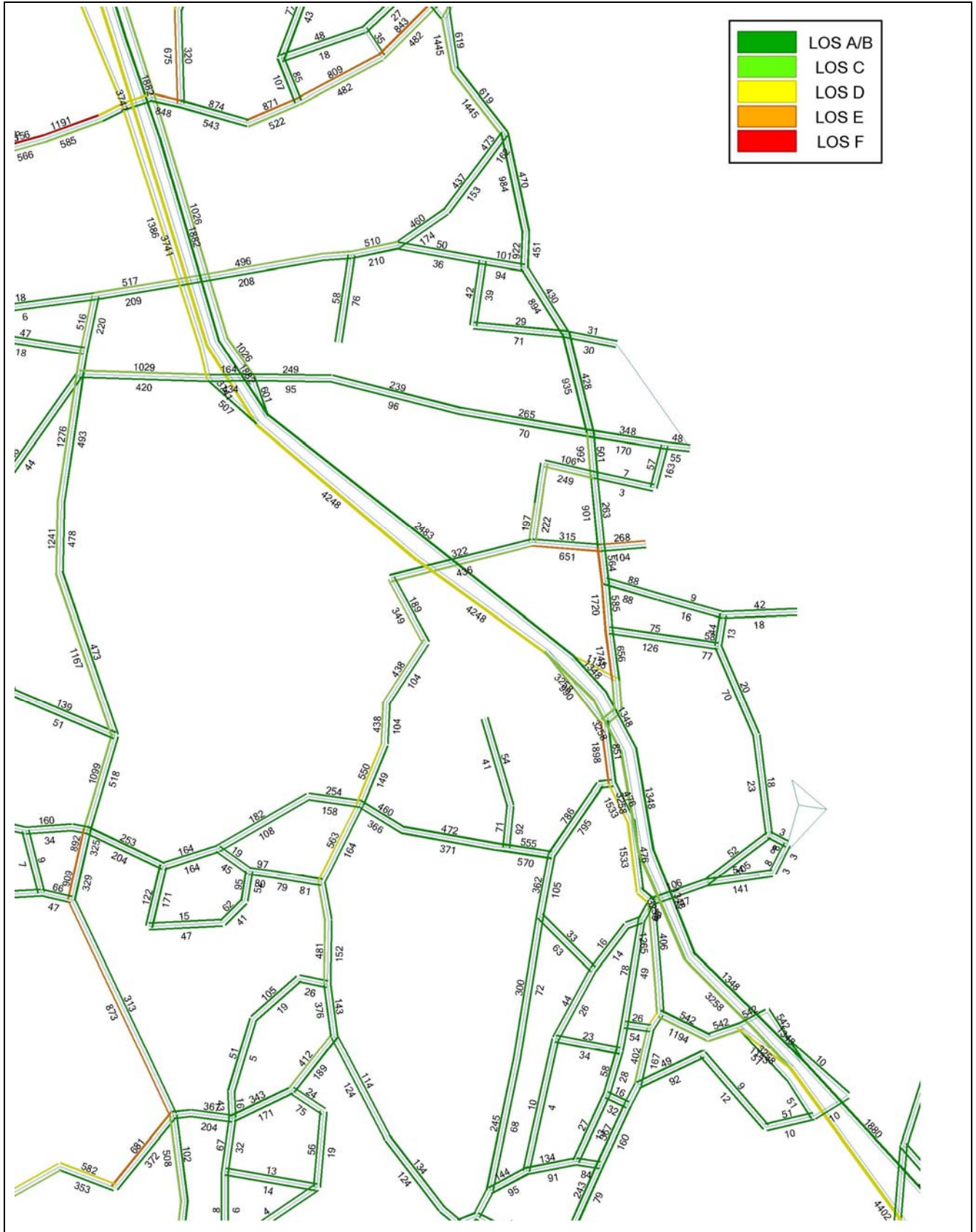
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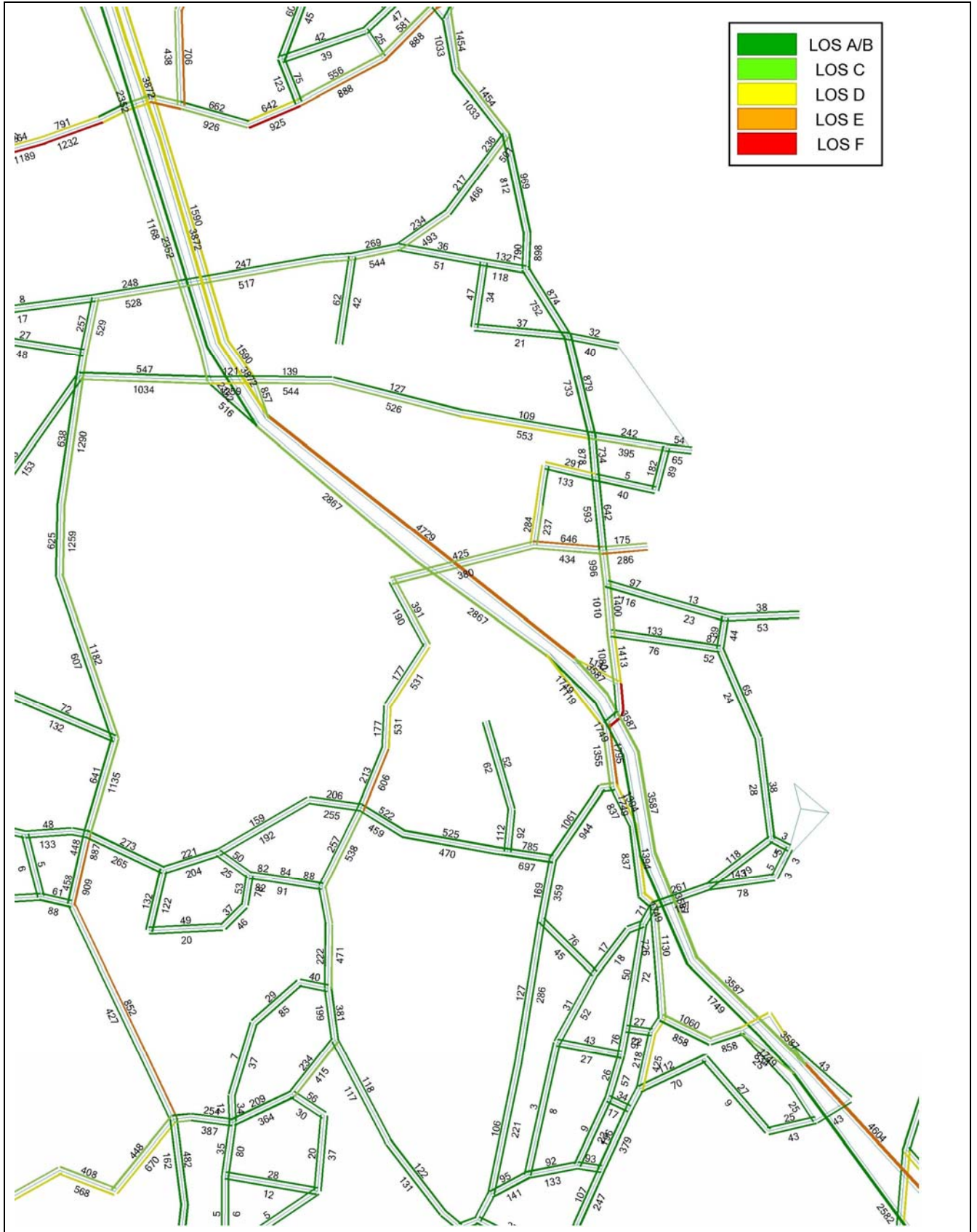
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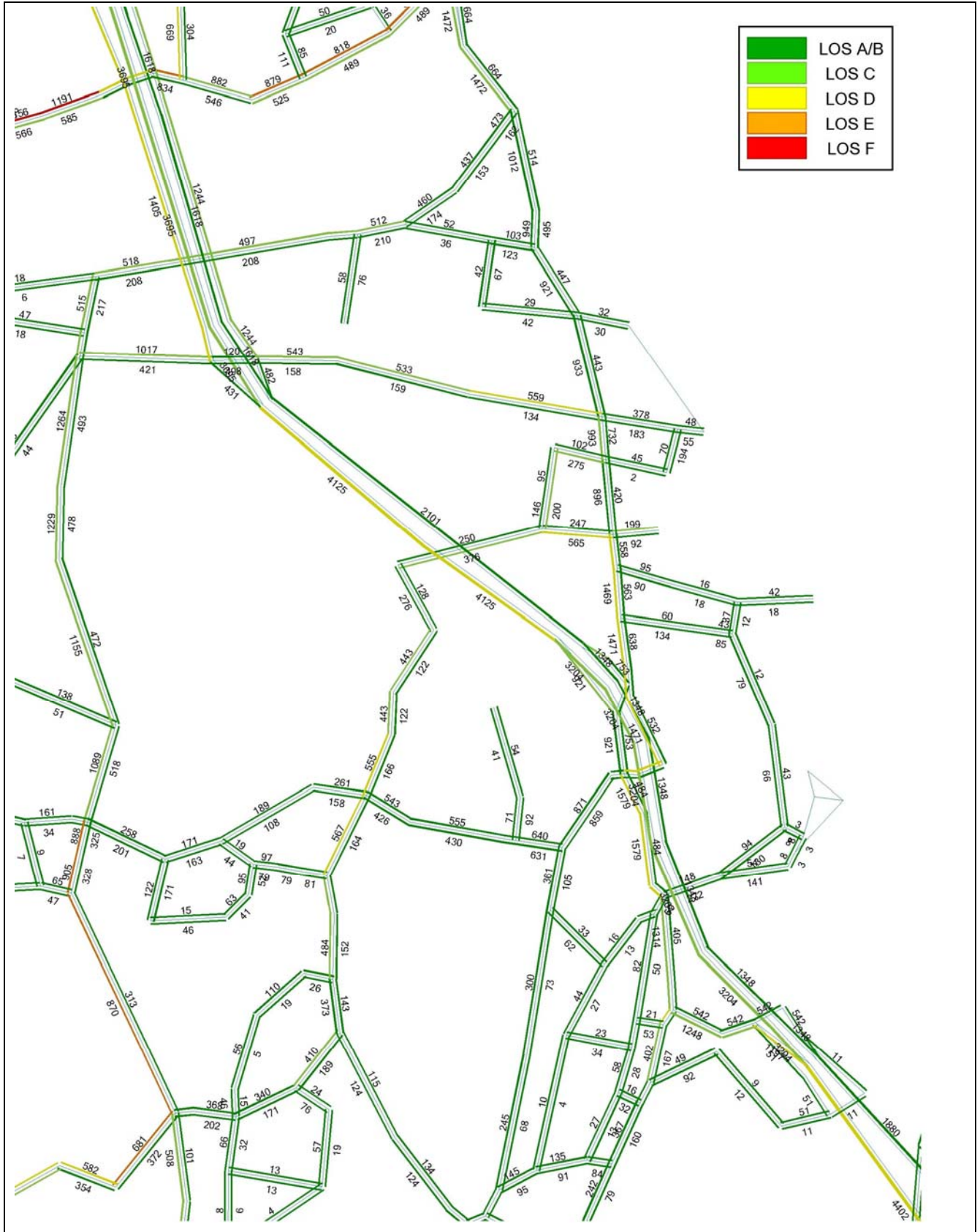
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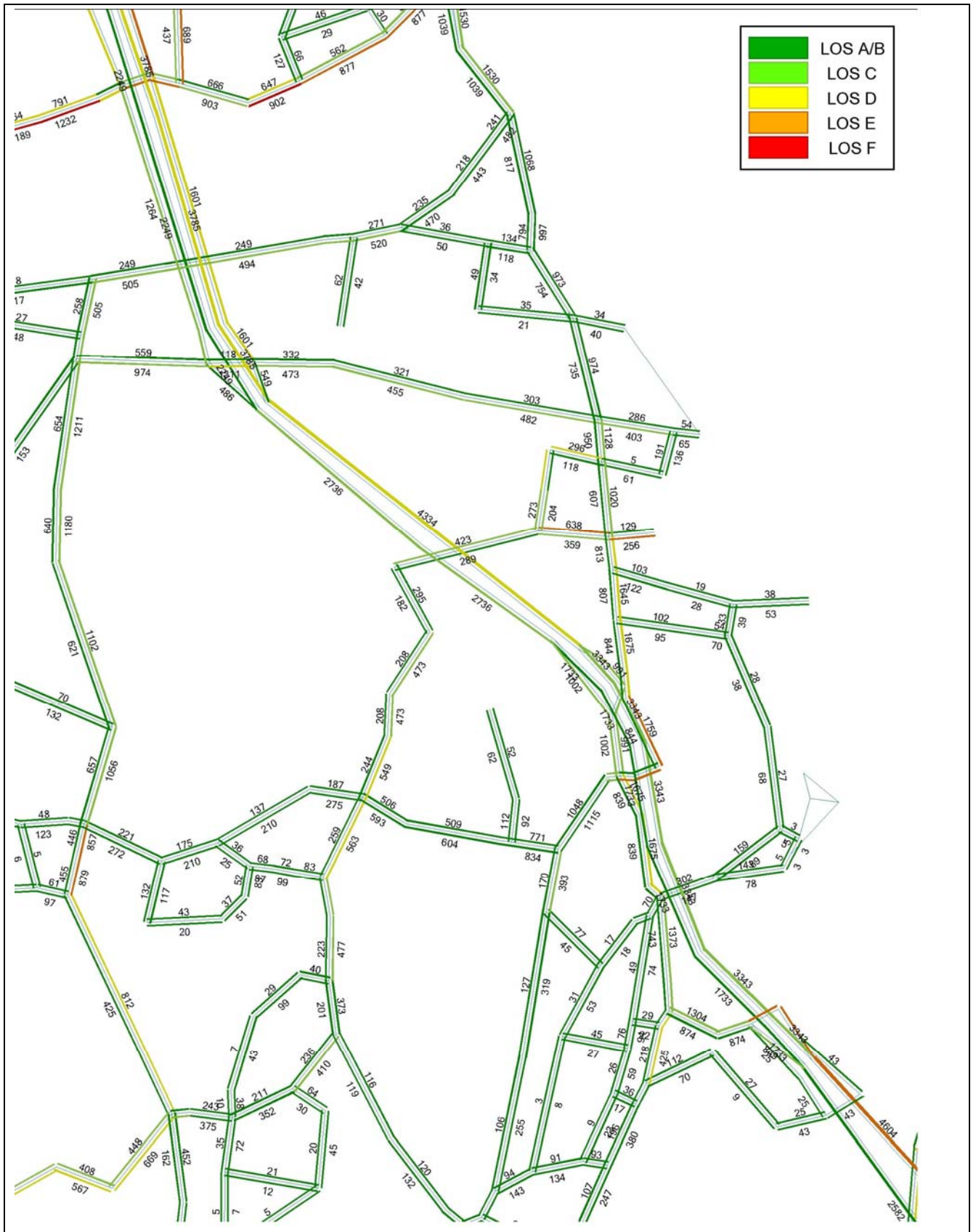
2030 am peak hour – Option 3



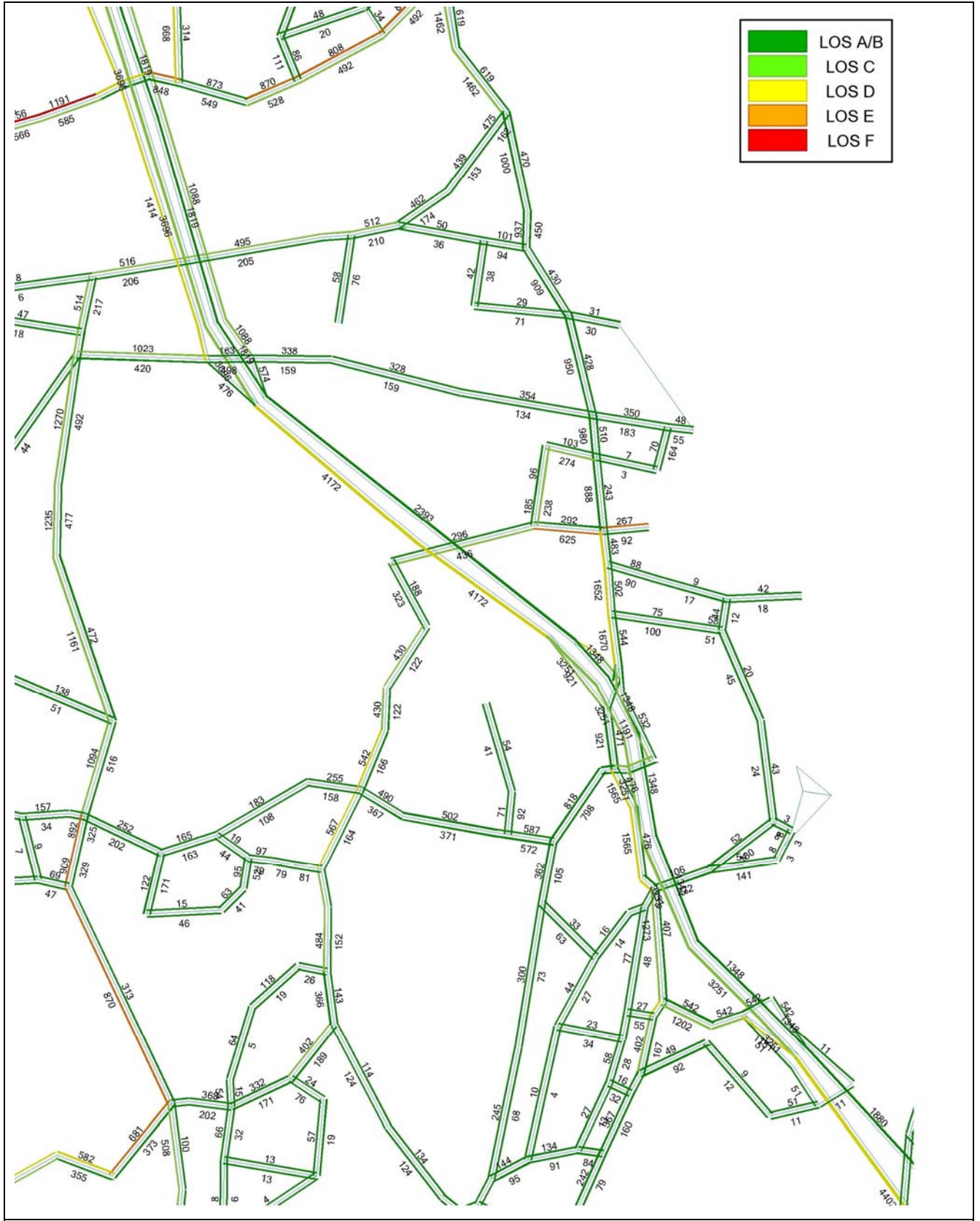
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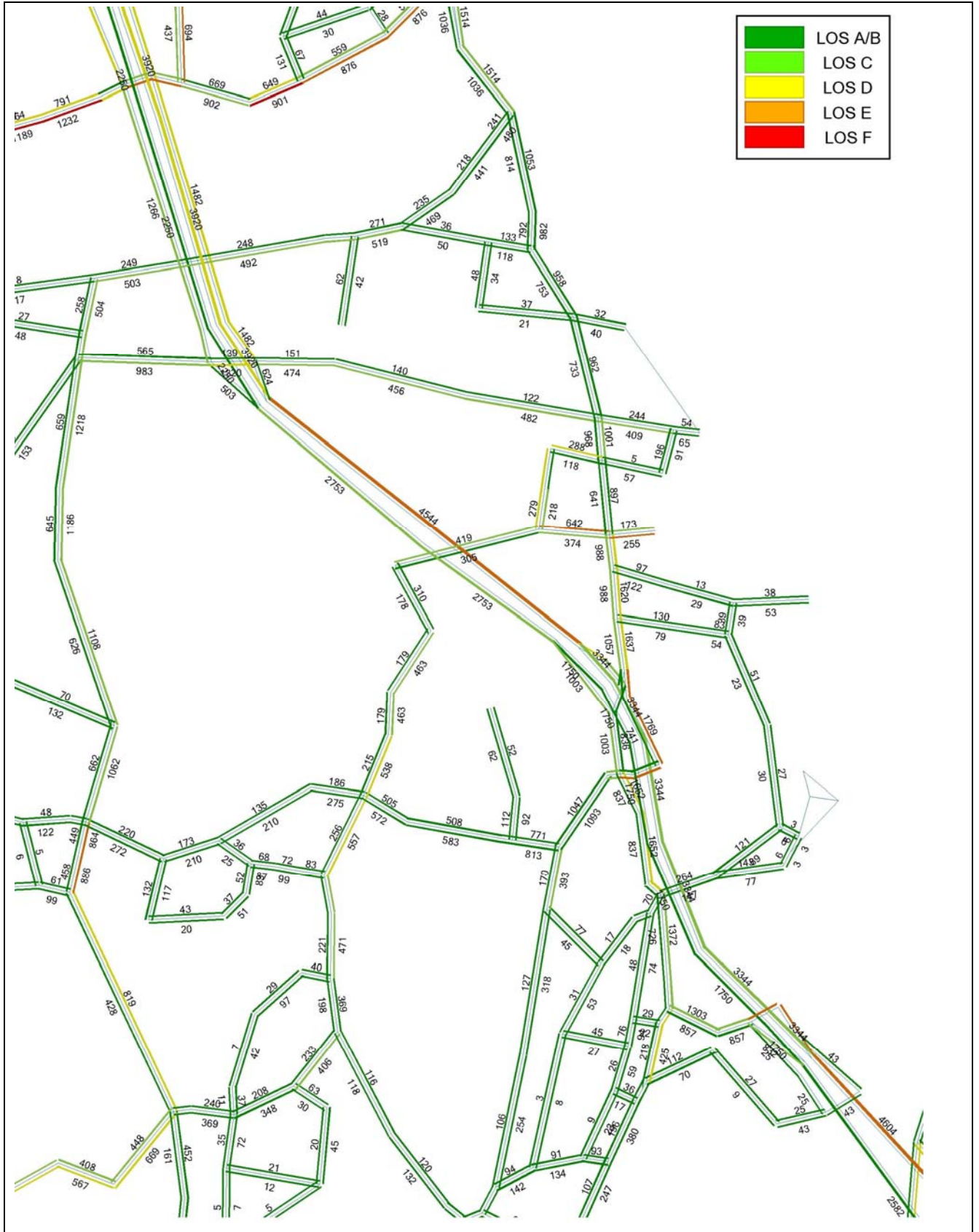
2030 am peak hour – Option 4



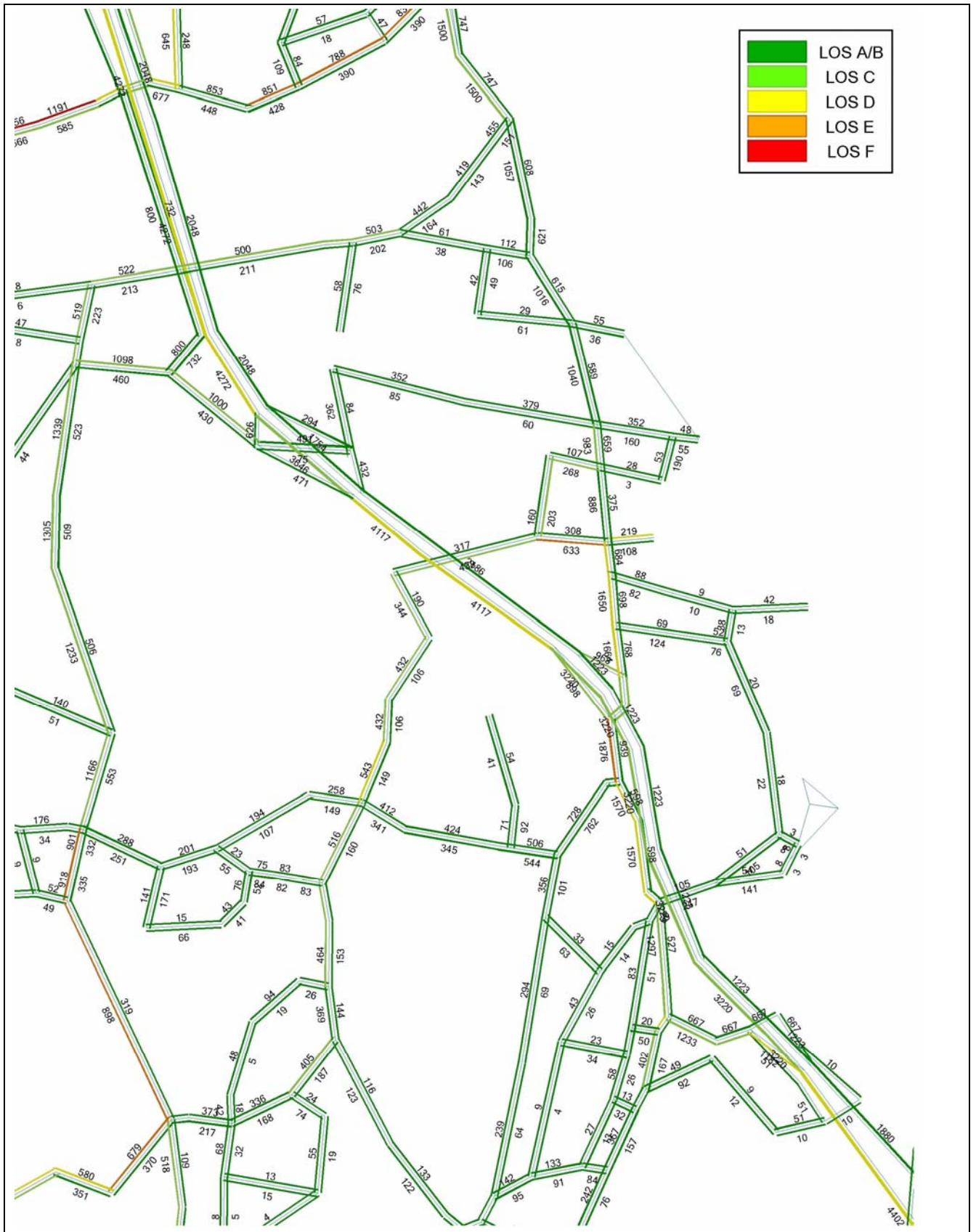
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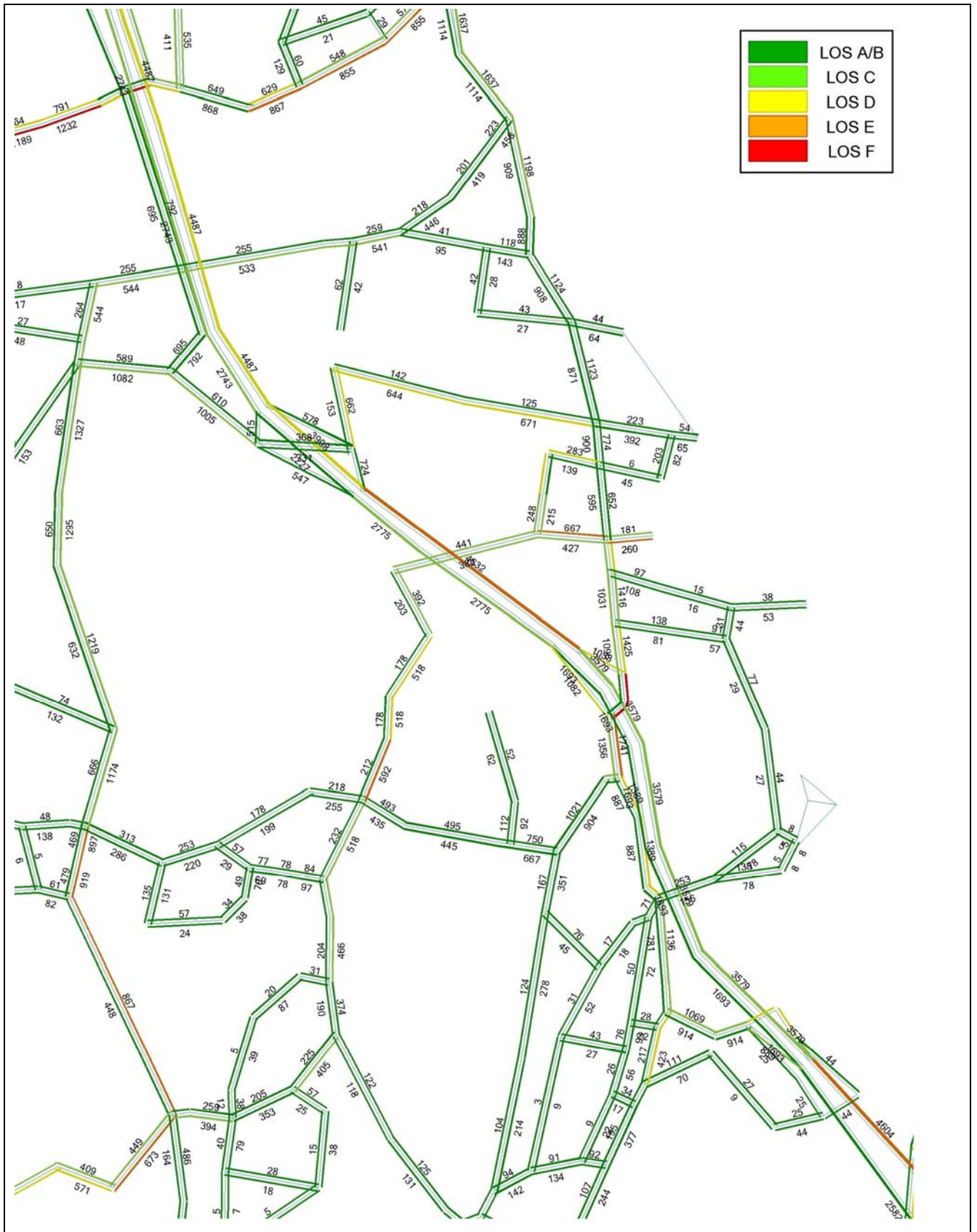
2030 am peak hour – Option 4a



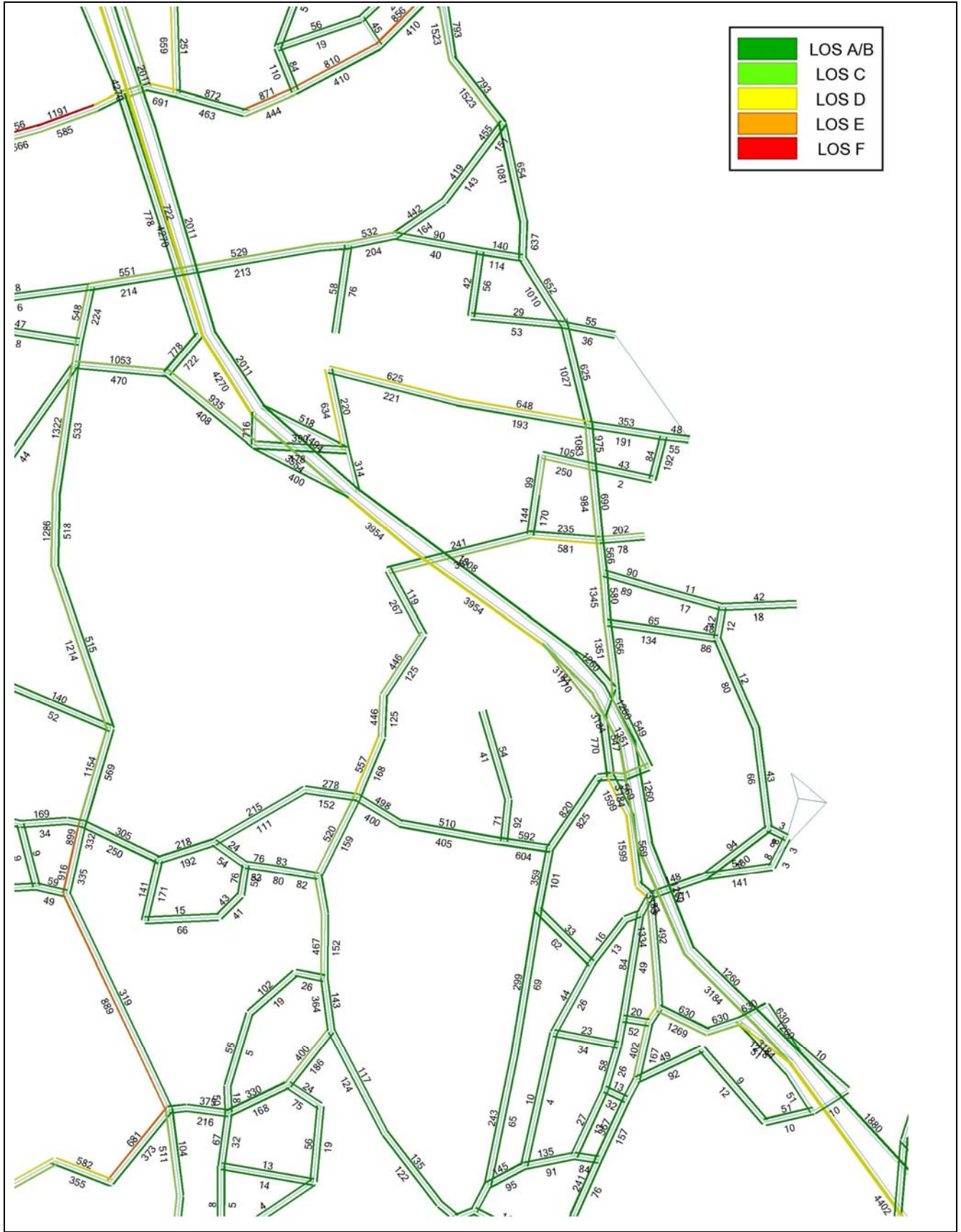
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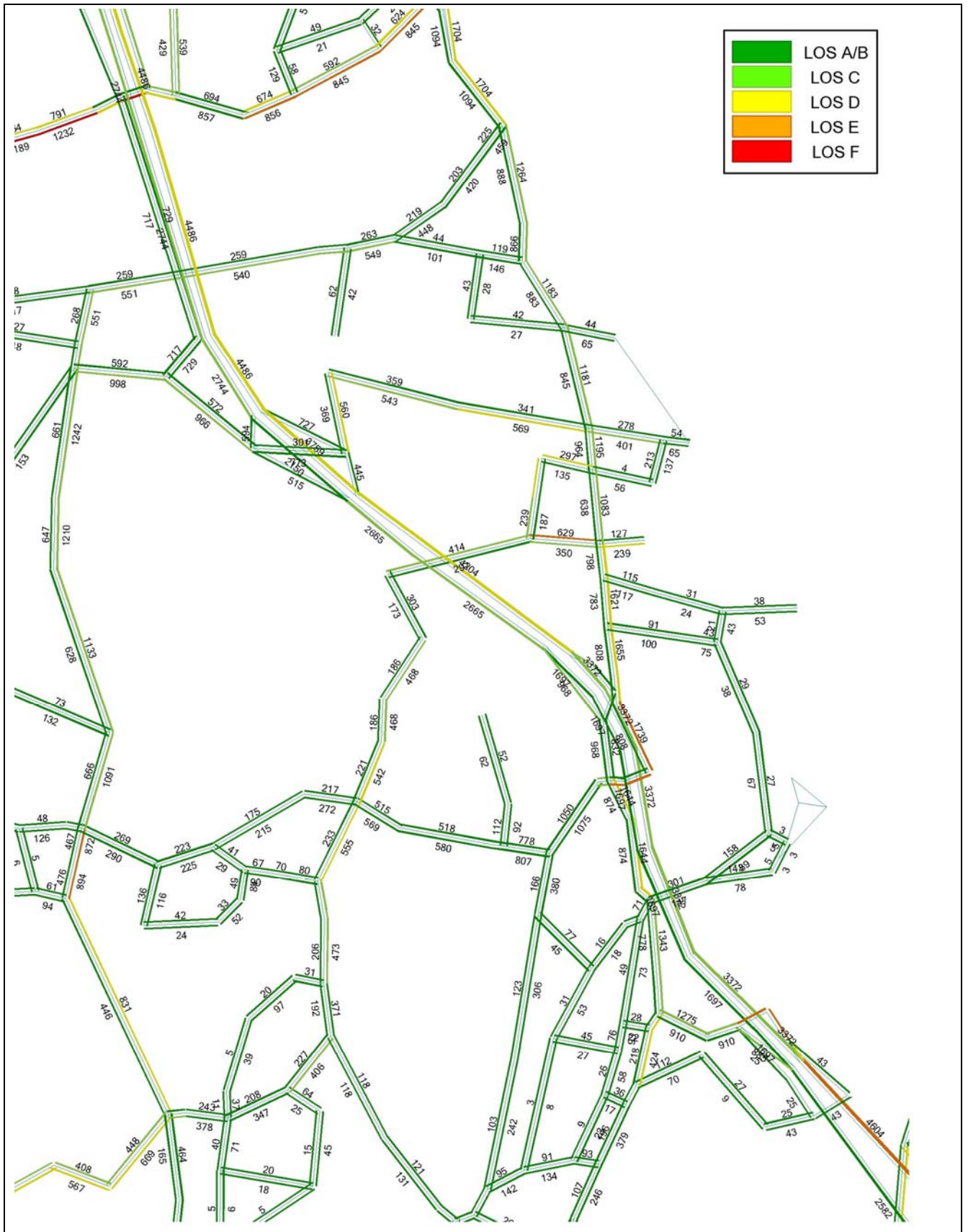
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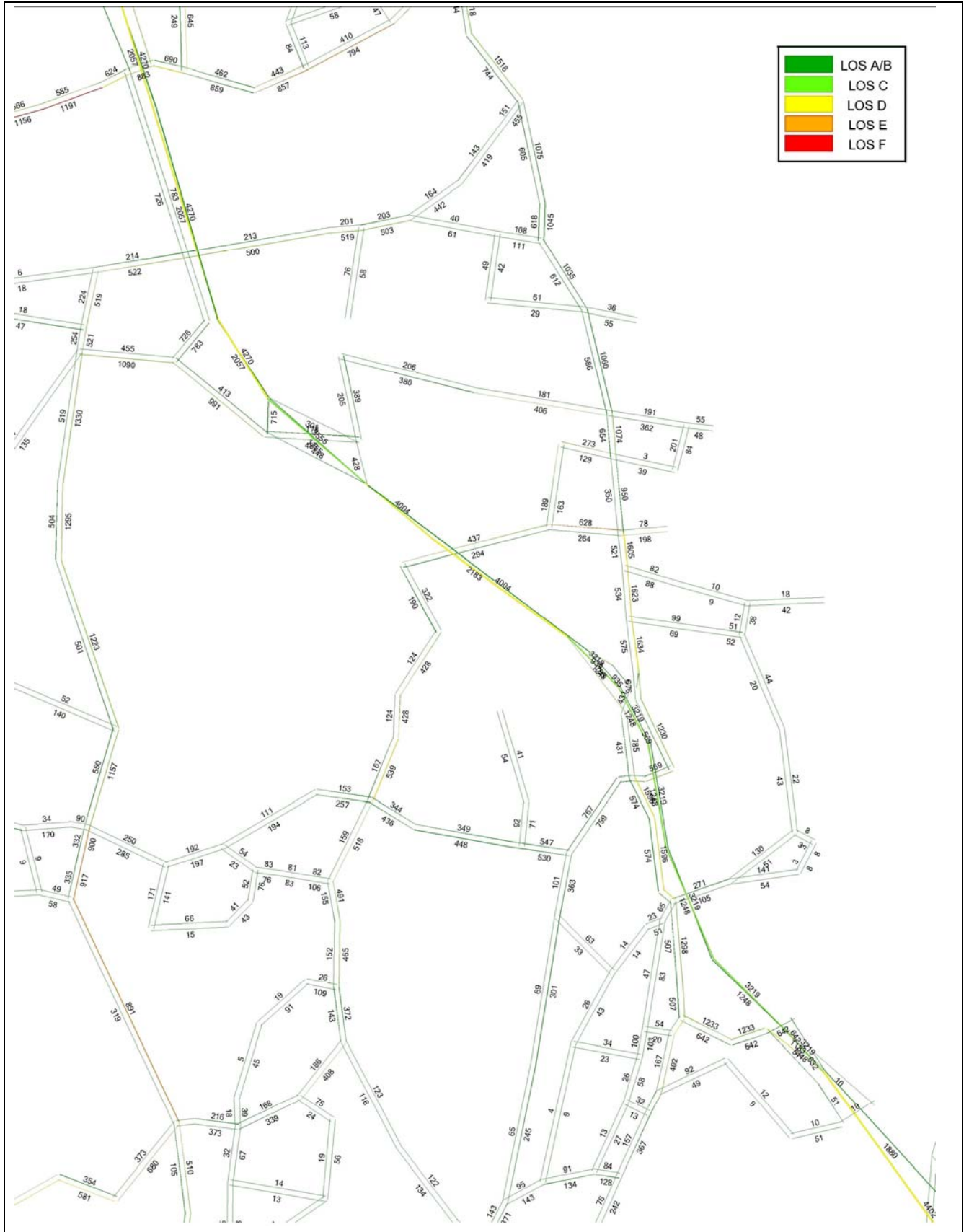
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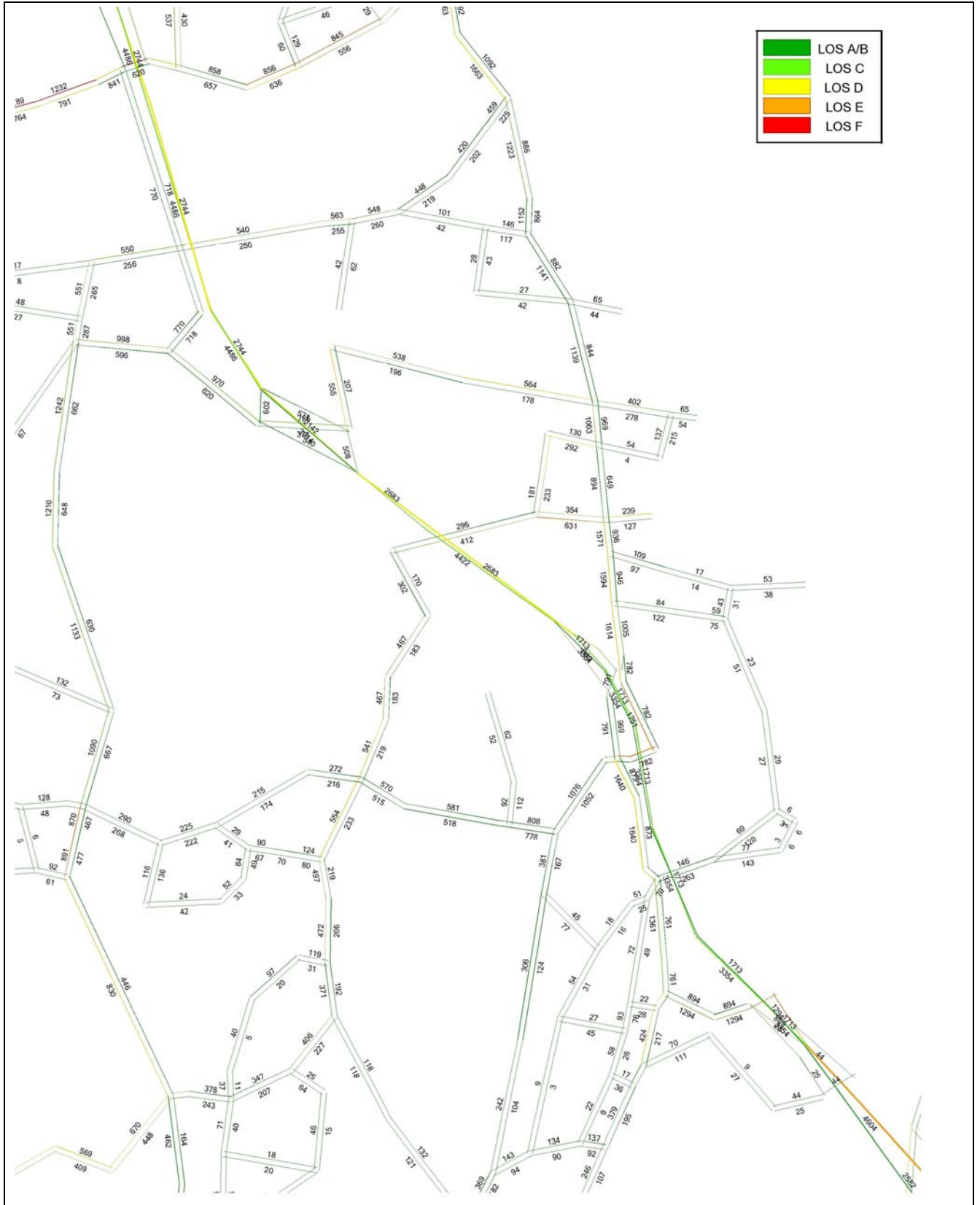
2030 am peak hour – Option 6



2030 pm peak hour – Option 6



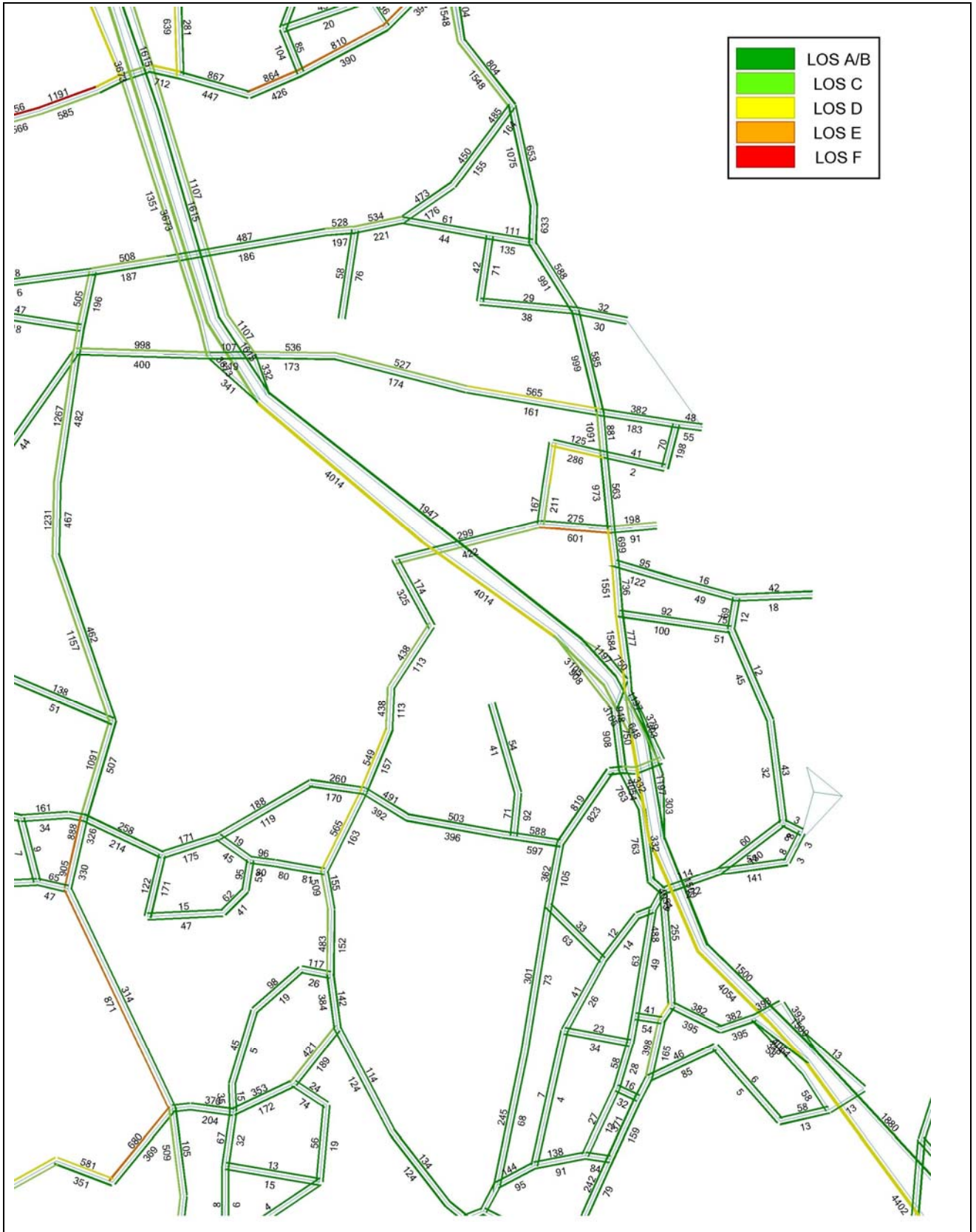
2030 am peak hour – Option 6a



2030 pm peak hour – Option 6a

Appendix B

Master planning preferred option
– Level of Service plots



2030 am peak hour – preferred option

