



TISA Guideline

Implementation Guidelines
TMC conflation

Document Control Sheet

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1.0	20/07/2017	Ref: SP17005
2.0	24/08/2020	Ref.SP20015 - Clarifications and/or additional examples were included for: <ul style="list-style-type: none">• General Principal for TMCs (section 3.2)• P3.37 build-up areas, now documented with examples (4.4.5)• Rest Area and POIs (section 4.4.1)• Tunnels and Bridges (section 4.4.9)• Complex intersections / junctions• Motorway triangles (section 4.5)• Redundant TMC points (new section)
2.1	08/02/2022	New sections for roundabout, new examples for bridges and tunnels, new section for redundant TMC Points, add cases for dealing with parallel exit ramps and clarify begin/end of motorway triangles

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1 PURPOSE OF THIS DOCUMENT

This document describes the guidelines to be taken into account when using TMC Location Tables. The act of creating and encoding a TMC in a digital map involves an interpretation of the road geometries at each location. Different digital map makers may implement TMC Location Tables in slightly different ways, which may be reasonable interpretations when viewed in isolation. However, this may lead to some users of TMC tables (table owner, map provider, traffic provider, client device) interpreting a table differently, resulting in unexpected behavior. The guidelines aim to align all users of TMC tables with a uniform set of methods for encoding and decoding TMC locations.

TMC Location Tables are a simplified representation of an existing road network in a certain region.

A selected part of the network is coded into different .DAT –files (the LTEF = Location Table

Exchange Format). As it is a rough and simple representation of the road network, TMC Location Tables are widely used within the TISA value chain. It can be considered a “universal language” between different partners:



Figure 1 TISA Value Chain

Although the TMC Location Tables are checked, verified and certified by TISA, a correct interpretation of the coded network is essential. Points/Nodes in the network (**TMC Points**) might be vaguely described and therefore the intention of this guideline is to aid with the interpretation of parts of the road between succeeding points in the TMC Location Table (**TMC Links**).

The intended audience for these guidelines is anyone who can benefit from a pre-defined, coded road network. This includes map makers, producers of traffic information, both public and private, buyers such as automobile manufacturers, personal navigation solution providers, or roadway network operators, as well as all intermediaries, third-party stakeholders and facilitators such as government agencies.

2 TERMS AND DEFINITIONS

For the purposes of this *guideline*, the following terms and definitions apply. The following terms are applied throughout this guideline: “Shall”, “Should” and “May”. The usage of these terms follow conventional definitions and the definitions are restated here to help clarify this guideline: “Shall” represents a mandatory guideline, “Should” indicates that this is the expected guideline and there are potential exceptions, “May” indicates a possible scenario regarding the guideline.

Term	Description
EABC	Lorem Ipsum
ETL	Extended TMC Location Referencing
External TMC Link	The part of the TMC Link between the last entrance of the intersection represented by origin TMC Point and the first exit of the intersection represented by the destination TMC Point. Represented with either “+” or “-” symbol before TMC location.
Internal TMC Link	The part of the TMC Link between the first/last entrance and exit of the intersection represented by the destination TMC Point of the TMC Link. Represented with either “P” or “N” before TMC location.
Intersection	Both road surfaces are motorways.
ISO	International Organization of Standardization
Junction	At least 1 road surface is not a motorway.
LTEF	Location Table Exchange Format – The official format of the TMC Location Table. See specification SP08001, listed in References Section 5.1
Positive/Negative Direction	The positive and negative direction of a chain of TMC Points as defined in the POFFSETS.DAT file from the LTEF.
TISA	Traveller Information Services Association
TMC Link	A road segment between two consecutively defined TMC Points. For each TMC Link we have an origin TMC Point and a destination TMC Point.
TMC Path	A TMC Path is an ordered chain of TMC locations where the first TMC location has no Previous Location and the last TMC location has no Next TMC location. In the TMC table, points in a chain are defined by the previous and next TMC.
TMC Point	A point/node in the road network defined in the TMC Location Table.

Table 1 Terms and definitions

3 STANDARD RULES

3.1 Internal and External TMC Links

Internal to a location indicates the links that are within the actual TMC Point. External to a location indicates the links that are located between the TMC Points. See GDF 3.0 Reference Manual v59.0, Appendix C.2. Listed in References Section 5.2.

The External TMC Link defines the part of the road between two succeeding TMC Points as it is defined in the POFFSETS.DAT in the LTEF. In the positive direction this is defined as +xxxxx with xxxxx the Location Code of the TMC Point where the TMC Link is going towards. In the negative direction this will be -xxxxx.

Note: Leading zeros may be used on TMC Point references. The zero is part of a concatenated string in raw TMC table data files, but in diagram labels can use a shorter representation. For example, +01000 may be shown in diagrams or referenced as +1000.

Please note: For a TMC Point 01000, the positive External TMC Link +01000 and the negative External TMC Link -01000 will not be aligned.

The Internal TMC Link defines the part of road *within* the TMC Point, mostly encountered at an exit/entrance complex. In the positive direction this is defined as Pxxxxx with xxxxx the Location Code of the TMC Point. In the negative direction this will be Nxxxxx. For Internal TMC Links it is more likely, but still not guaranteed, that the positive and negative directions are aligned. See section 4.2.1 for example diagram of unaligned internals.

Internal TMC Links may also occur without exit/entrances. A well-known example are one-sided locations for exit/entrances or parking areas. Here, internal TMC Links are also defined on the roadside without the exit/entrance. These are aligned with the internal TMC Links on the opposite direction. This is illustrated in section 4.4.1.

The global TMC Link is the combination of the External TMC Link with the Internal TMC Link.

3.2 General Principles for TMCs

- Conflation shall respect the sequence in the TMC Location Table.
- Conflation should avoid overlaps.
- Conflation shall cover both sides of the road, even if the TMC location is physically only present on one side only (e.g. Rest area).
- Conflation of a TMC path should start and end with an TMC-internal.
- Conflation of a TMC internal location should start at the first exit/entry and end at the last entry/exit of that location. A few exceptions are contained in this guideline.

3.3 Without Internal TMC Links

If the TMC Point describes a single point like a POI or a crossroads without an exit/entrance complex, only External TMC Links are defined.

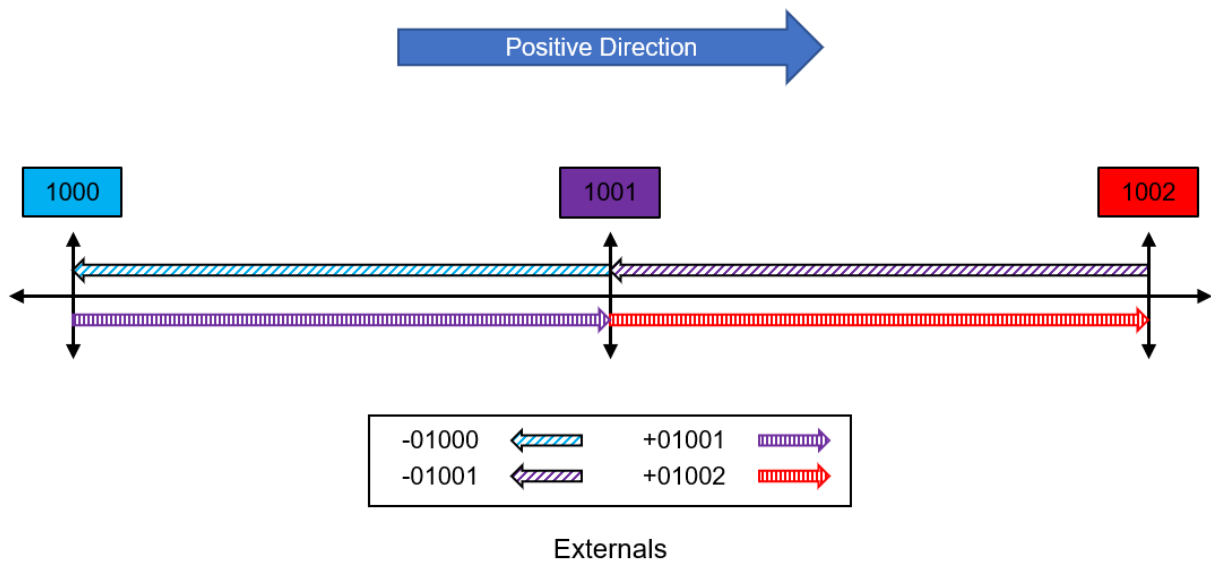


Figure 2 TMC Link without Internal

3.4 With Internal TMC Links

If the TMC Point describes a more complex junction, for example the ramps of a controlled access road, internal TMC Links are defined alongside the external TMC Links.

The internal TMC Link is the part of road between the exit ramp of the junction and the entrance ramp of the junction. For the positive direction it is referred to by Pxxxxx, the negative direction uses Nxxxxx, with xxxxx the Location Code of the TMC Point. See Figure 3 below:

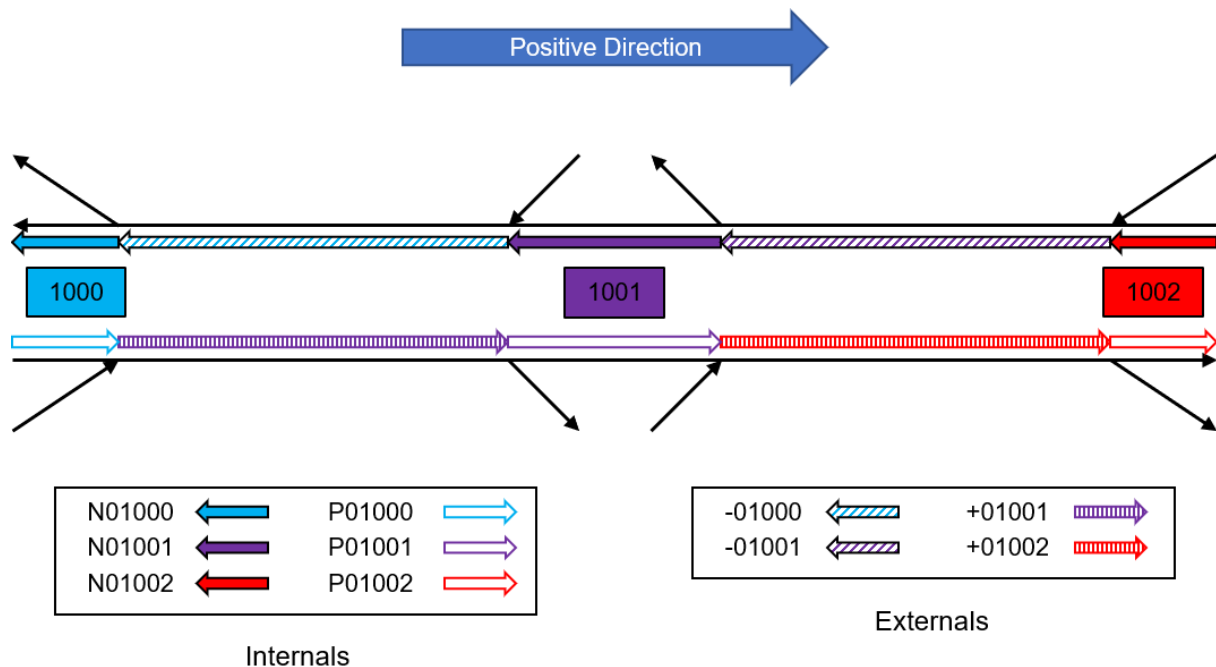


Figure 3 TMC Link with Internal

Here the External TMC Link (+01001 and -01001) ends at the exit of the junction. The Internal TMC Link (P01001 and N01001) is defined between the exit and entrance ramp. Not all TMC points will have an internal link, in some cases only external links will exist.

4 CODING CONVENTIONS

4.1 Introduction and Rationale

TMC technology was developed originally to replace a radio station's spoken Traffic Announcements (TA) with digitally synthesized traffic messages in the language of the driver, rather than the language of the radio station. Purpose was twofold: firstly to provide information in the language of choice for the driver, secondly to have a more timely distribution via a digital sub carrier, rather than being constricted to a typically bi-hourly traffic report on a radio station.

The granularity of TMC location coding and the TMC Location Tables was also tailored for use with spoken announcements. With the advent of navigation systems, it was quickly recognized that the navigation systems could combine TMC information with digital maps to offer the driver new ways of presenting and filtering traffic information, with much more precise and timely warnings for traffic ahead. To enable the use of TMC technology with navigation systems and digital maps, a coding convention was needed how to 'bind' TMC locations to the digital road segments contained in these maps.

This coding convention would need to ensure that traffic events as indicated on a service provider's map would be placed at the same location on a receiver's map, even though the receiver could have a map of a different map vendor. Furthermore, this coding convention would need to ensure that the rather coarse granularity of the TMC Location Table (e.g. A single point describing a complete motorway intersection) could be correctly mapped to the many individual road segments making up that complex motorway intersection.

To do so the concept of internal and external TMC links was introduced:

- Internal TMC links comprise of the road segments 'internal' to the TMC point, i.e. Typically those road segments between the first/last exit or entrance of that TMC point.
- External TMC links comprise of the road segments between successive TMC points, where one necessarily would end up at the (internal links of) TMC point, i.e. Where the last exit opportunity to avoid this TMC point would have been passed.

These coding conventions were informally harmonized between major map vendors, but never documented in a public guideline.

Over the years, traffic information got more precise, started to include secondary roads, and contained status information on roads next to incidents. A need was identified to make these coding conventions explicit and describe in detail a number of 'complex' situations with non-standard intersections where above high-level description could be interpreted in multiple ways.

The coding conventions described in this section aim to precisely and accurately describe the highlevel concept descriptions above for both standard use cases, as well as more complex use cases. More use cases may be added over time as the need arises for clarifying interoperability and consistency between maps and map vendors.

4.2 Standard Use Cases

4.2.1 Parking/fuel area – unaligned internals

A rest area that may have parking, fuel, bathrooms, etc. Often on both sides of motorway, but often slightly offset from each other and not perfectly mirrored across the motorway. The rest area offset may be even larger than depicted in diagram below, with only a small amount overlapping.

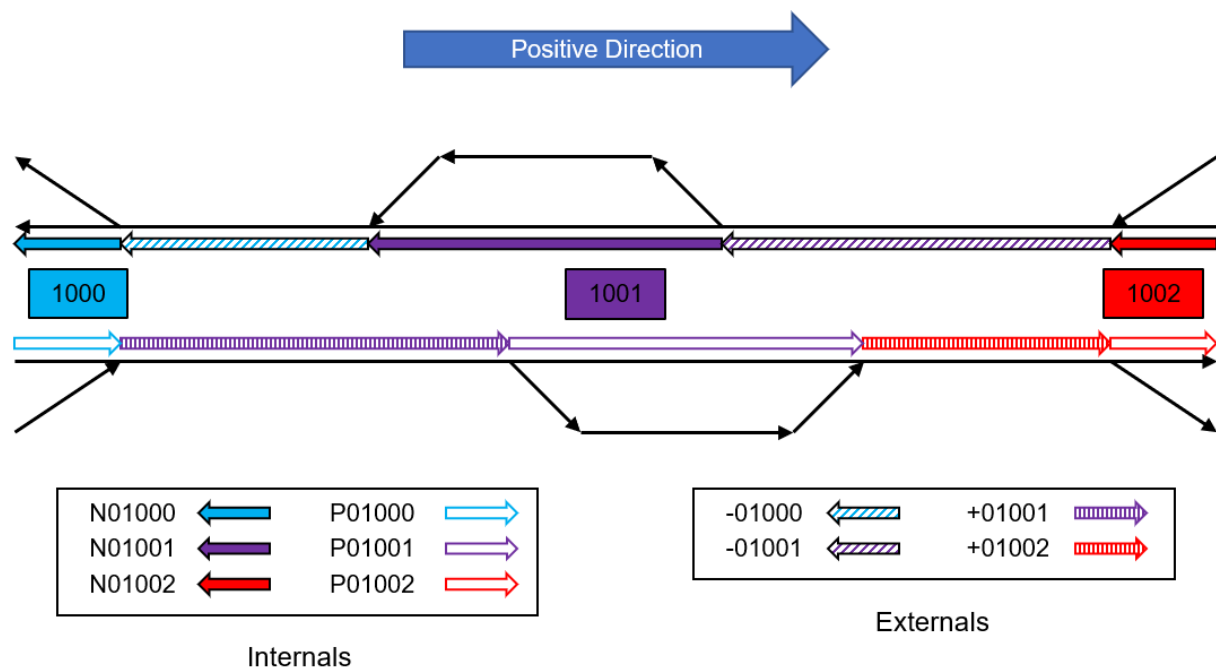


Figure 4 Parking/fuel area, unaligned Internals

4.3 Begin or End of a TMC Path

The begin or end of a TMC Path is defined when a TMC Point does not have either a NEG_OFF_LCD or a POS_OFF_LCD defined in the POFFSETS.DAT file. For this, the INTERRUPTSROAD-variable in the POINTS.DAT file is not taken into account.

Each begin and end of a TMC Path described by TMC Links shall have an internal TMC Link. When no clear entrance/exit of the road can be defined, this internal TMC Link shall be 5 to 20 meters long.

The more complex motorway triangles are described in more detail in section **4.5 Motorway Triangles**.

4.3.1 Motorway with T-junctions at ends and exit/entry in middle

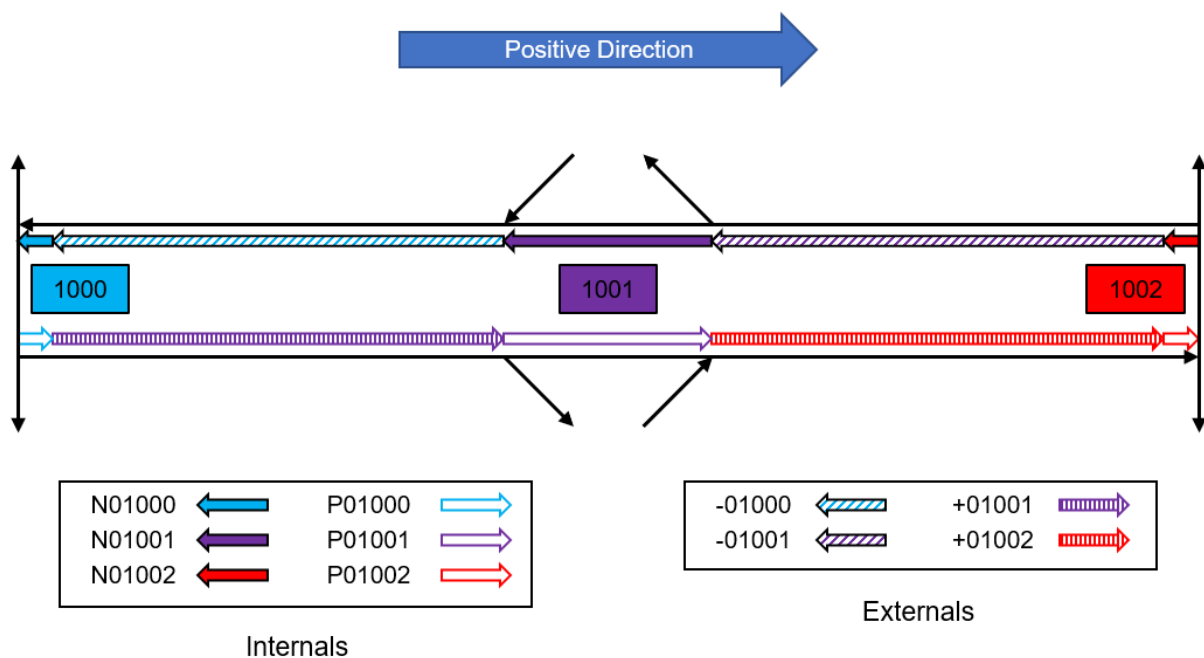


Figure 5 TMC Link with Internal and T-junctions at beginning and end

4.3.2 Minor roads, not controlled-access

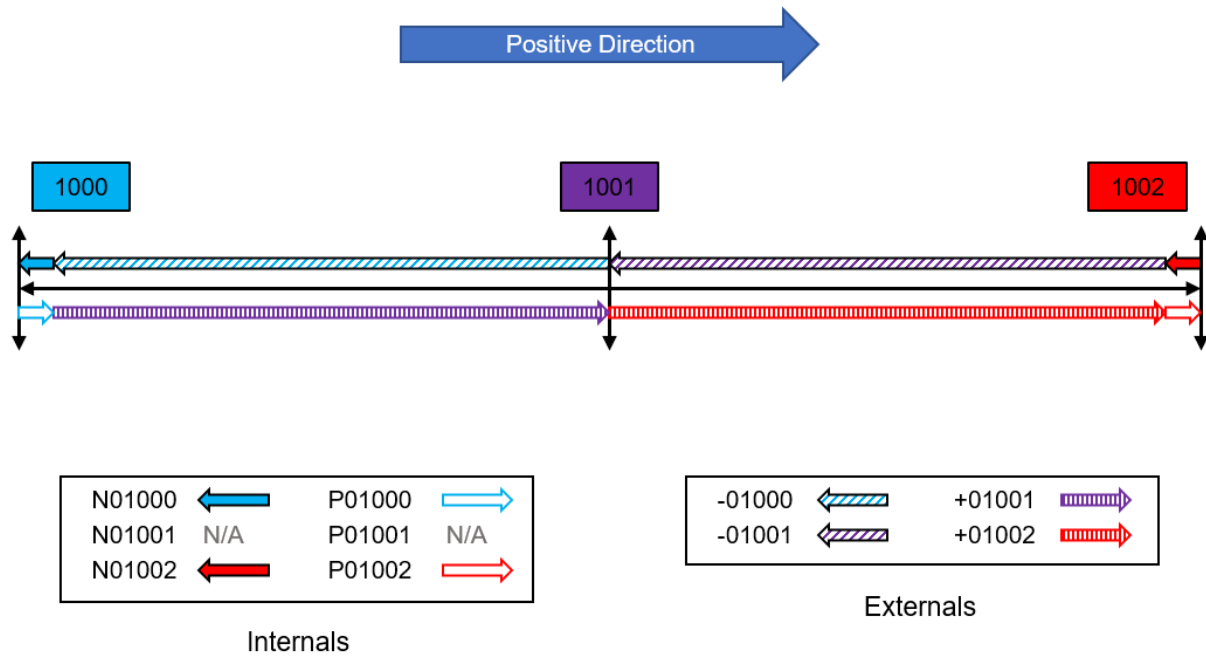


Figure 6 TMC Link with no Internals and T-junctions at beginning and end

This is also the case for smaller roads, where otherwise no internal TMC links are defined.

4.3.3 TMC Path crossing boundary

If a TMC Path starts or ends at a boundary, for example a state or country border at TMC Point 1000, an internal TMC Link shall be defined.

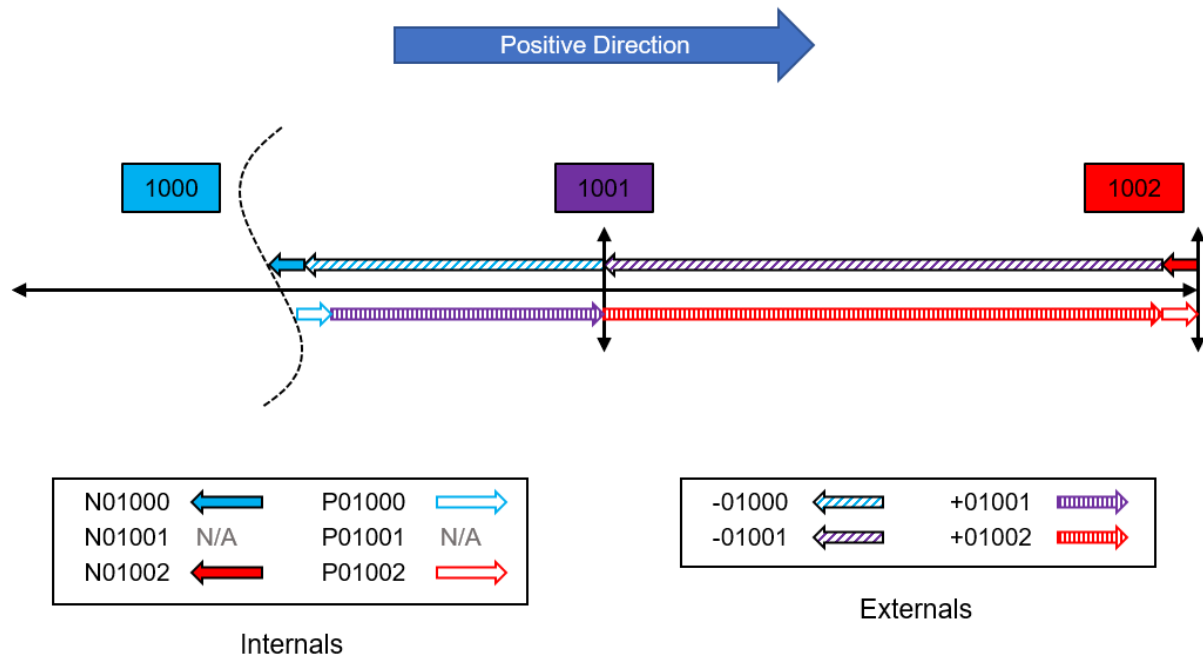


Figure 7 TMC Path crossing boundary

The location could also be described in an adjacent TMC Location Table; the same rule applies in that table.

When there is a TMC path crossing country border, only the TMC locations which are physically present in the appropriate country shall be conflated. Any TMC locations which are present on the opposite side of the border should not be coded. In case of below example, only the TMC locations from Country B are coded, because the TMC path belongs to this country. Small links from 5 to 20 meters shall be placed before the border for the last location in Country B.

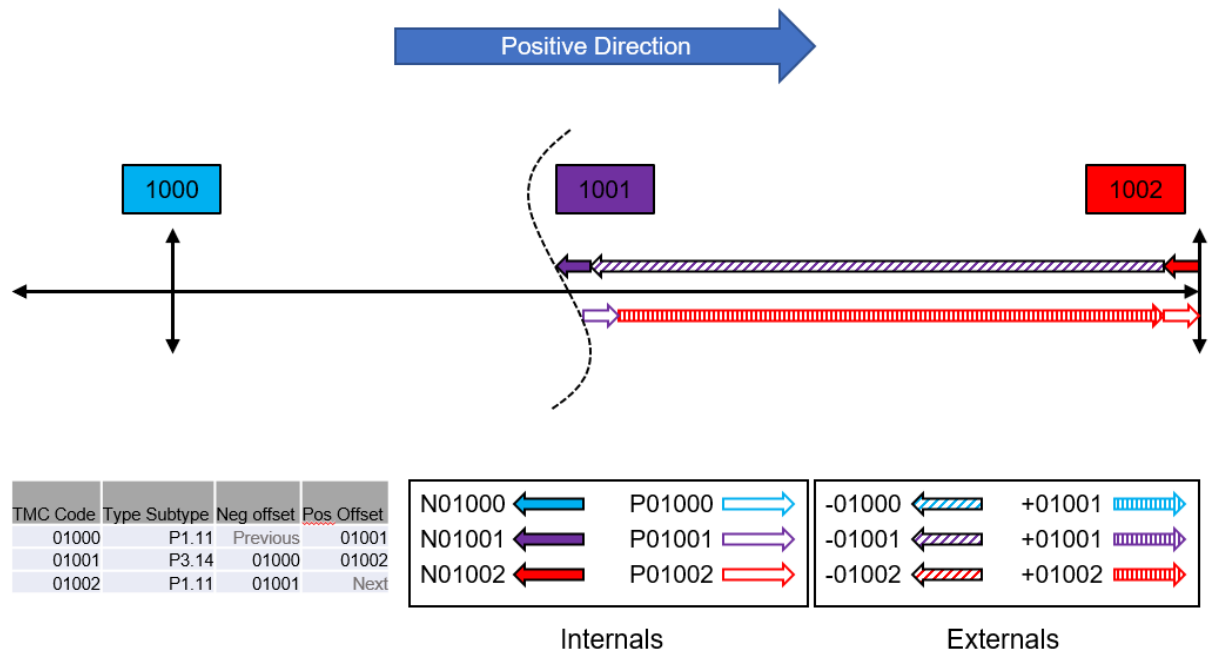


Figure 8 TMC Path crossing country border, with the last location P3.14

In cases when the last TMC location before the country border has a different type than P3.14 (border/frontier), the next location should be still conflated until the border, even if it is physically located on the other side of the border, in order to keep the continuation of TMC information. Small links before the border shall be also used in this case.

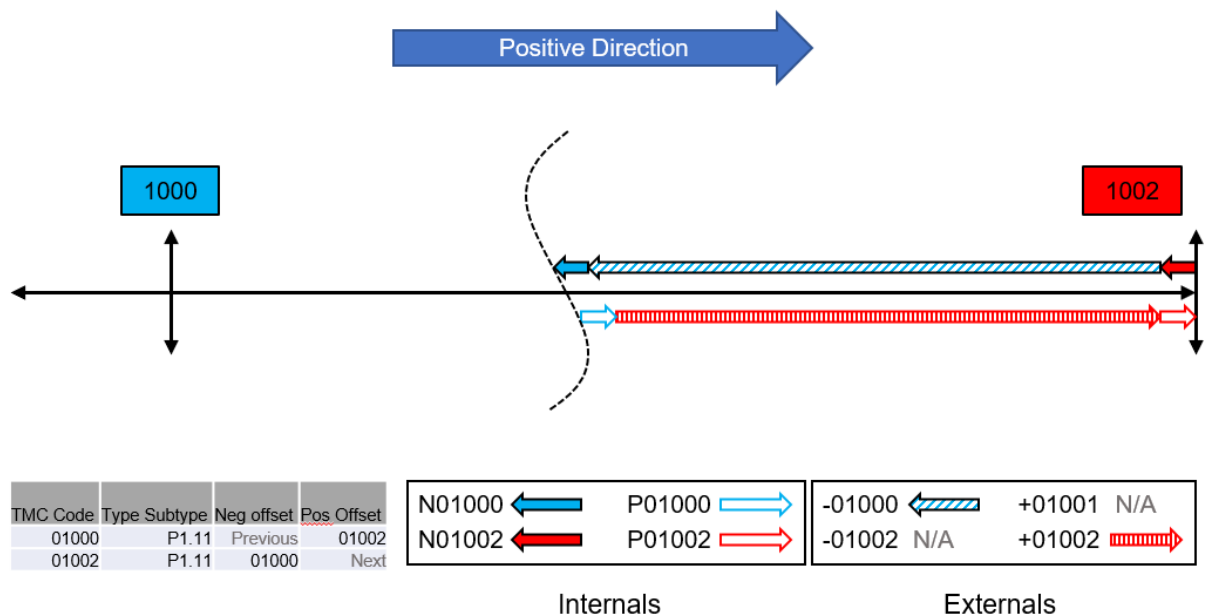


Figure 9 TMC Path crossing country border, with the last location different than P3.14

4.3.4 Roundabout at the beginning or end of TMC path

If a TMC path starts or ends at a roundabout, an internal TMC link of the first/last TMC location shall be captured at the appropriate part of the roundabout.

The following rules should be followed:

- First/last TMC location of the TMC path is always coded on the roundabout geometry,
- It doesn't matter if the positive or negative direction of the TMC path ends on the roundabout; always the same part of the roundabout shall be coded,
- In case of symmetrical roundabout (even number of connected roads), last link of the TMC path (positive or negative) shall be captured on the half of the roundabout geometry, based on the number of intersections,
- In case of asymmetrical roundabout (odd number of connected roads), last link of the TMC path (positive or negative) shall be captured until the last intersection before the half of the roundabout, based on the number of intersections,
- Remaining part of the roundabout shall be coded by the internal TMC link of the opposite direction (positive or negative).

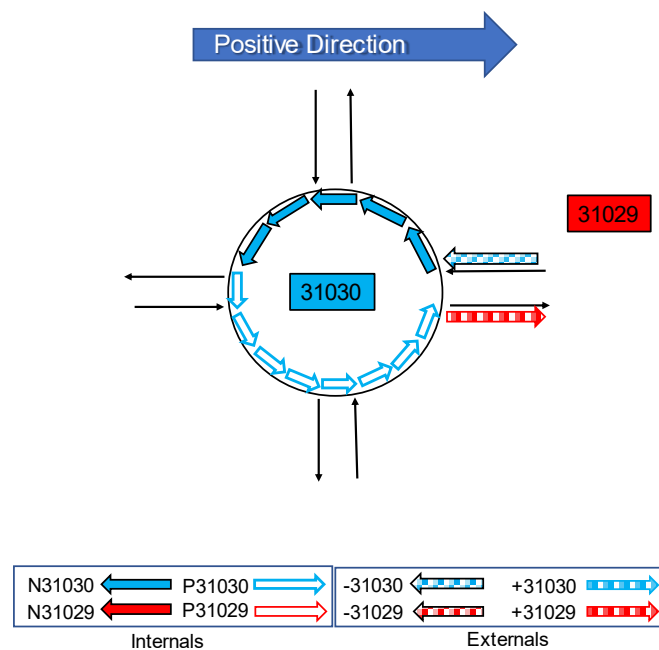


Figure 10 Conflation of symmetrical roundabout at the beginning of TMC path

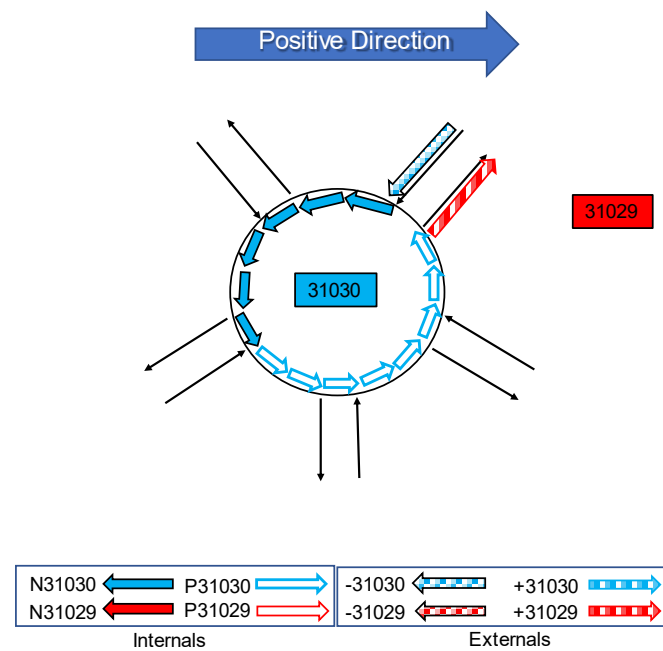


Figure 11 Conflation of asymmetrical roundabout at the beginning of TMC path

4.4 Special Use Cases

4.4.1 One Sided Locations – Intersection, Parking, Fuel, etc...

An intersection, rest area, or POI may be present only on one side of the motorway. Similarly, a rest area on both sides of the motorway may be coded with two individual TMC points. This may be because:

- The rest area name has a direction indication (e.g. West, east, etc.)
- The rest area TMC points have different type, subtype information (e.g. P3.9 and P3.10, P3.11 and P3.12, etc.).

Follow the guiding principles when applying TMC coding to links that have one-sided locations:

- No overlaps if it can be avoided
- Sequence of TMC codes shall be preserved
- Conflation shall cover both sides of the road, even if the TMC location is physically only present on one side only (e.g. Rest area).
- Project perpendicularly the one-sided location to conflate it in the opposite direction, in which the TMC location is not present.
- If the projection is not possible without disrupting the TMC sequence or overlapping TMC links a small external TMC link should be added in the correct position to keep the sequence. The length of the said link should be 5 to 20 meters long. This should be minimized but it is unavoidable in certain cases.
- For TMCs that are not present on both sides of the road, try to represent the internal links of the present TMC at the correct location so that this TMC is properly referenced.
- Primary or head of an event will begin on internal
- If no suitable internal for an event location on a carriageway, then there is no internal for that location.

The presentPOS and presentNeg should be ignored for purposes of conflating TMCs because these fields are not consistently used by TMC Location Table providers.

4.4.1.1 Simple One Sided Location

This is a simple case for handling a one-sided location. An exit and/or entry is present on only one side of divided motorway. The internal TMC Link in the picture below is defined by the exit/entrance in the negative direction. This location is then projected perpendicular to the road towards the opposite, positive direction. In both directions internal TMC Links are defined.

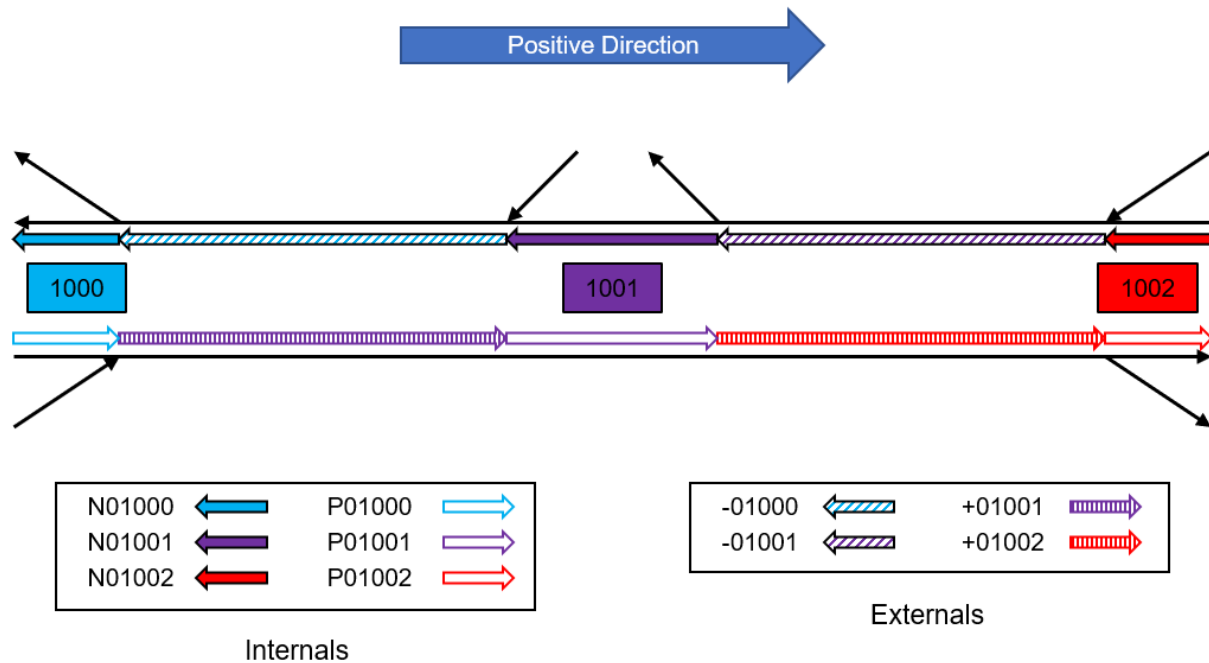


Figure 12 Simple one-sided location

4.4.1.2 Parking/fuel area - duplicated locations per direction, situation 1

Duplicate locations where non present location is upstream from present location. The non present locations can be coded without introducing small links. The location on the driving side (3 in Positive direction) should be represented at the correct geographic location, and the non present location should fit into the appropriate sequence, which can be done using the roadway leading up to the location.

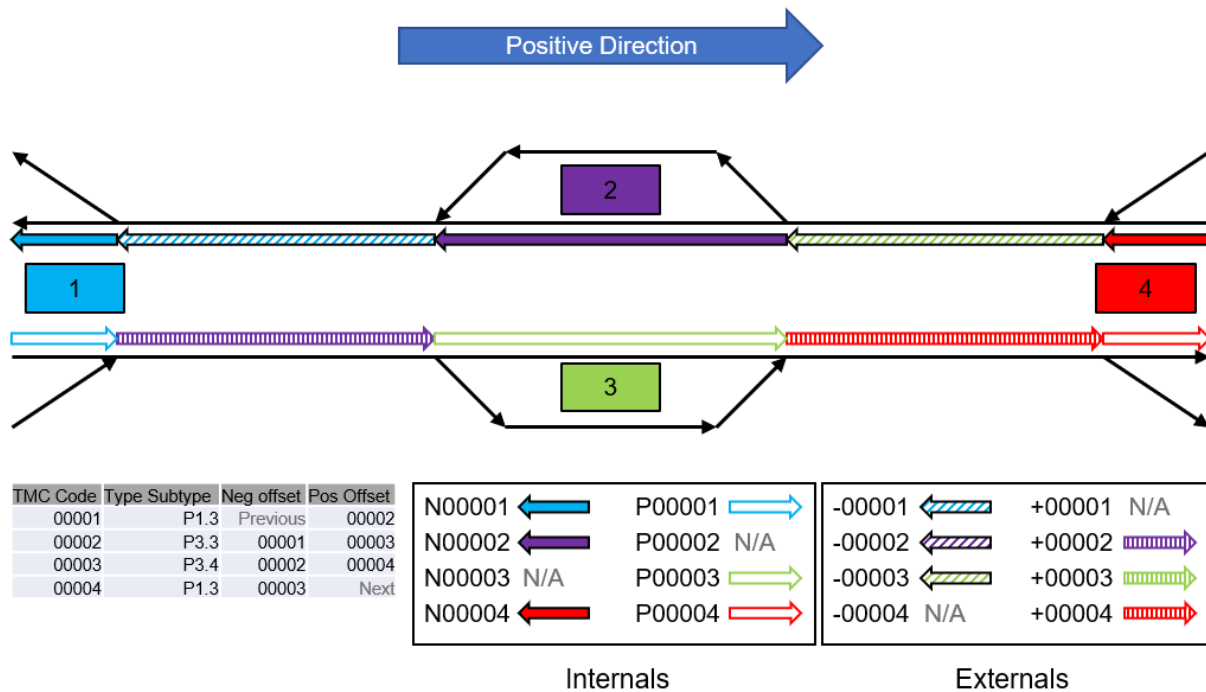


Figure 13 Parking/fuel area, one-sided locations aligned

4.4.1.3 Parking/fuel area - duplicated locations per direction, situation 2

Duplicate locations where non present location is downstream from present location. The location on the driving side (3 in Positive direction) should be represented at the correct geographic location, and the non present location should fit into the appropriate sequence, which can be done using the roadway leading up to the location. In this case, it is unavoidable to have a small TMC (2 in Positive Direction) to represent the non present location.

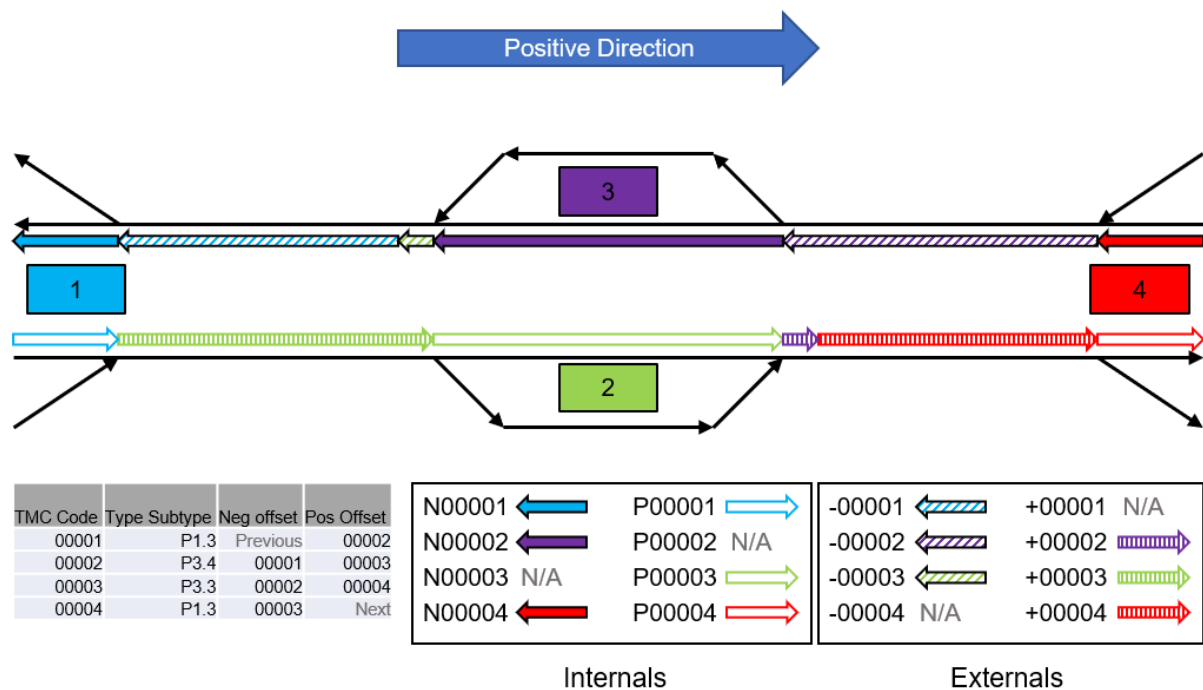


Figure 14 Parking/fuel area, one-sided locations aligned

4.4.1.4 Parking/fuel area - duplicated locations per direction, situation 3

A rest area on both sides of roadway, where the exit and entry of a rest area on one side is within the bounds of the exit and entry of a rest area on other side. The non present location is upstream from the present location. The location on the driving side (3 in Positive direction) should be represented at the correct geographic location, and the non present location (2 in Positive direction) should fit into the appropriate sequence.

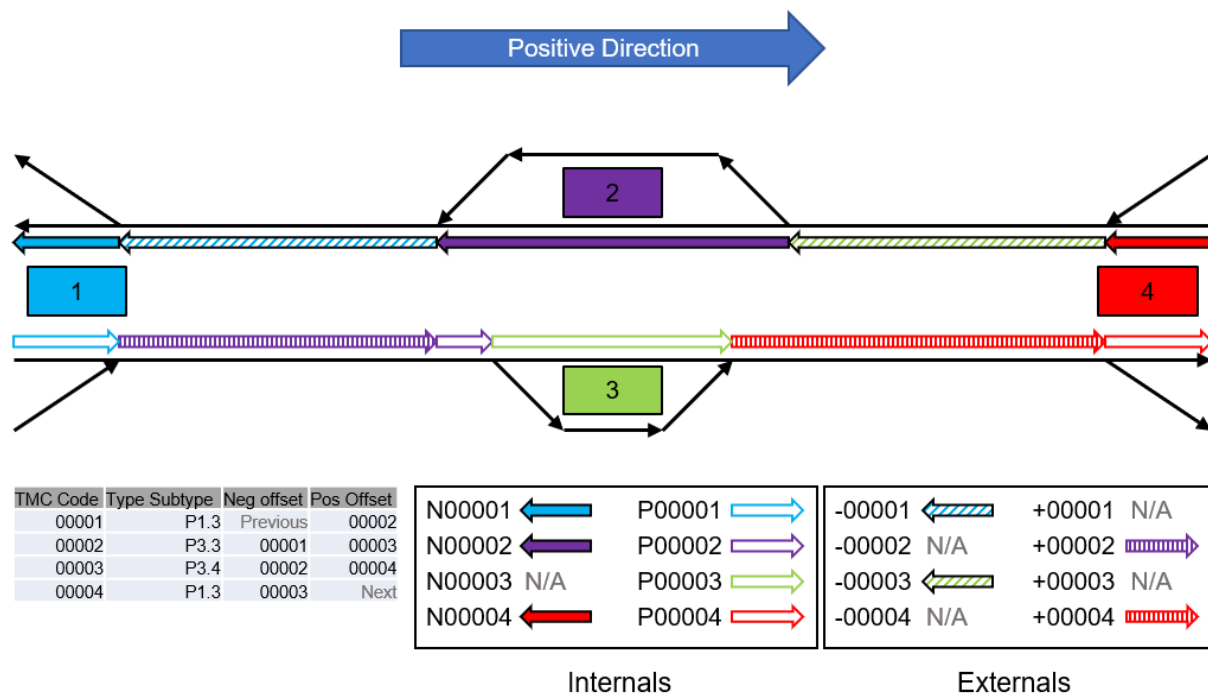


Figure 15 Parking/fuel area, exit and entry from one side within exit and entry from other side

4.4.1.5 Parking/fuel area - duplicated locations per direction, situation 4

A rest area on both sides of roadway, where the exit and entry of a rest area on one side is within the bounds of the exit and entry of a rest area on other side. The non present location is downstream from the present location. The location on the driving side (2 in Positive direction) should be represented at the correct geographic location, and the non present location (60598 in Positive direction) should fit into the appropriate sequence. In this case, it is unavoidable to have a small TMC (2 in Negative Direction) to represent the non present location.

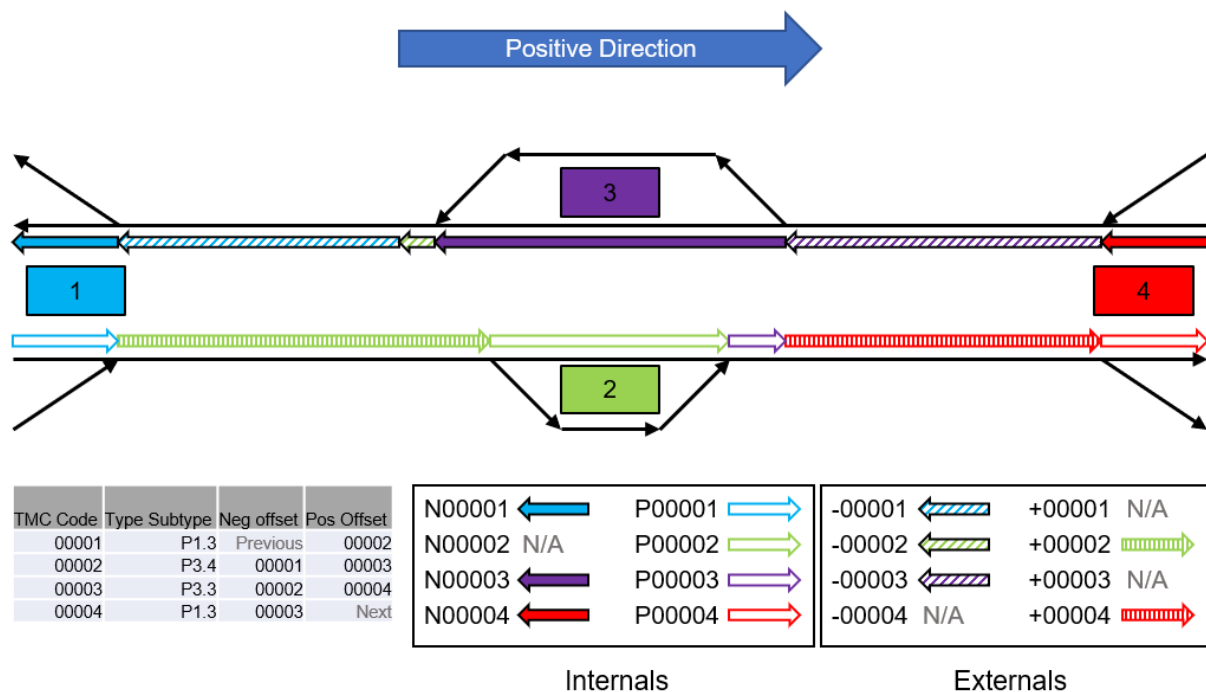


Figure 16 Parking/fuel area, exit and entry from one side within exit and entry from other side

4.4.1.6 Parking/fuel area - duplicated locations per direction, situation 5

A rest area on both sides of roadway, where the exit and entry of a rest area on one side partially overlaps with the exit and entry of a rest area on other side. The non present location is upstream from the present location. The location on the driving side (12731 in Positive direction) should be represented at the correct geographic location, and the non present location (60598 in Positive direction) should fit into the appropriate sequence.

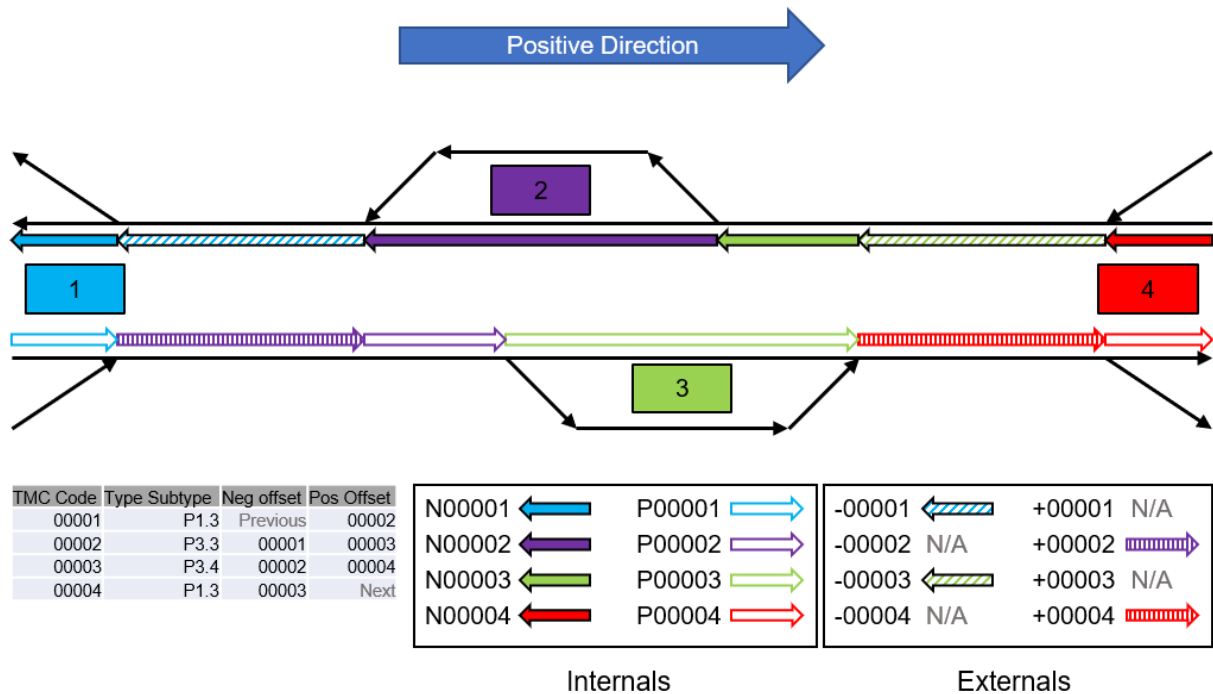


Figure 17 Parking/fuel area, partially aligned on each side

4.4.1.7 Parking/fuel area - duplicated locations per direction, situation 6

A rest area on both sides of roadway, where the exit and entry of a rest area on one side partially overlaps with the exit and entry of a rest area on other side. The location on the driving side (12731 in Positive direction) should be represented at the correct geographic location, and the non present location (60598 in Positive direction) should fit into the appropriate sequence, which requires a short TMC 60598 to be created.

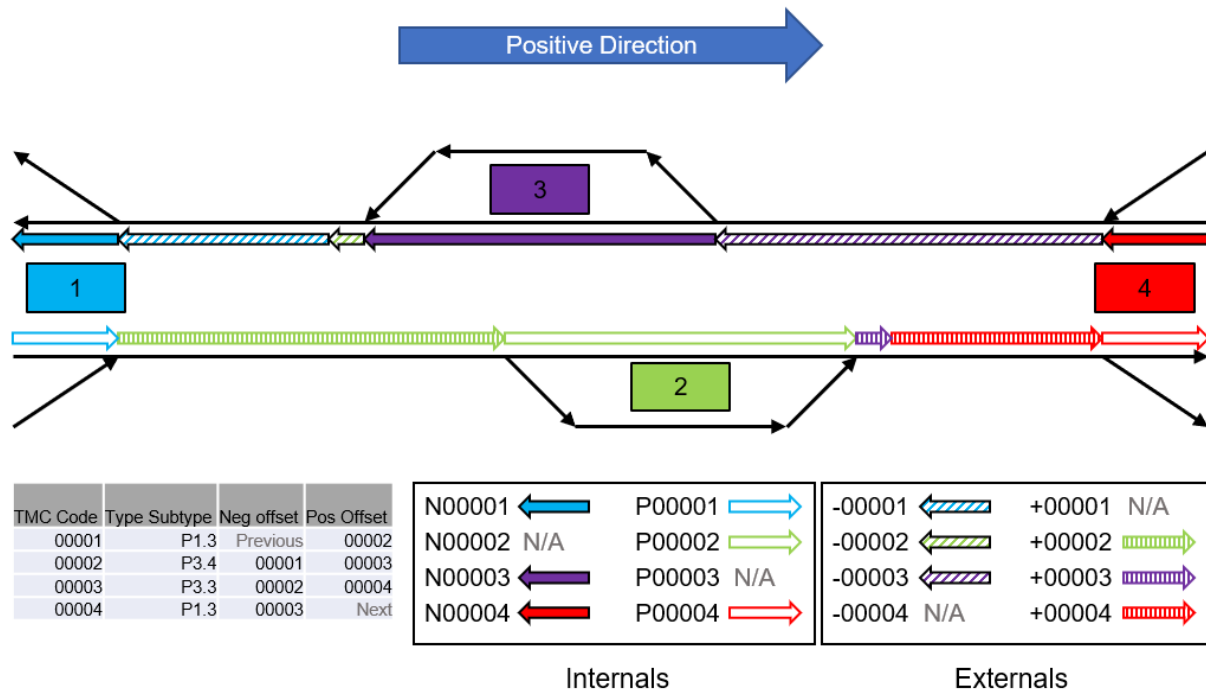


Figure 18 Parking/fuel area, partially aligned on each side

4.4.1.8 Parking/fuel area - duplicated locations per direction, situation 7

A parking/fuel area on both sides of roadway, where the exit and entry of a rest area on one side is in the proximity of the exit and entry of a rest area on other side, but they are separated by a moderate distance. The location on the driving side (12731 in Positive direction) should be represented at the correct geographic location, and the non present location (60598 in Positive direction) should fit into the appropriate sequence.

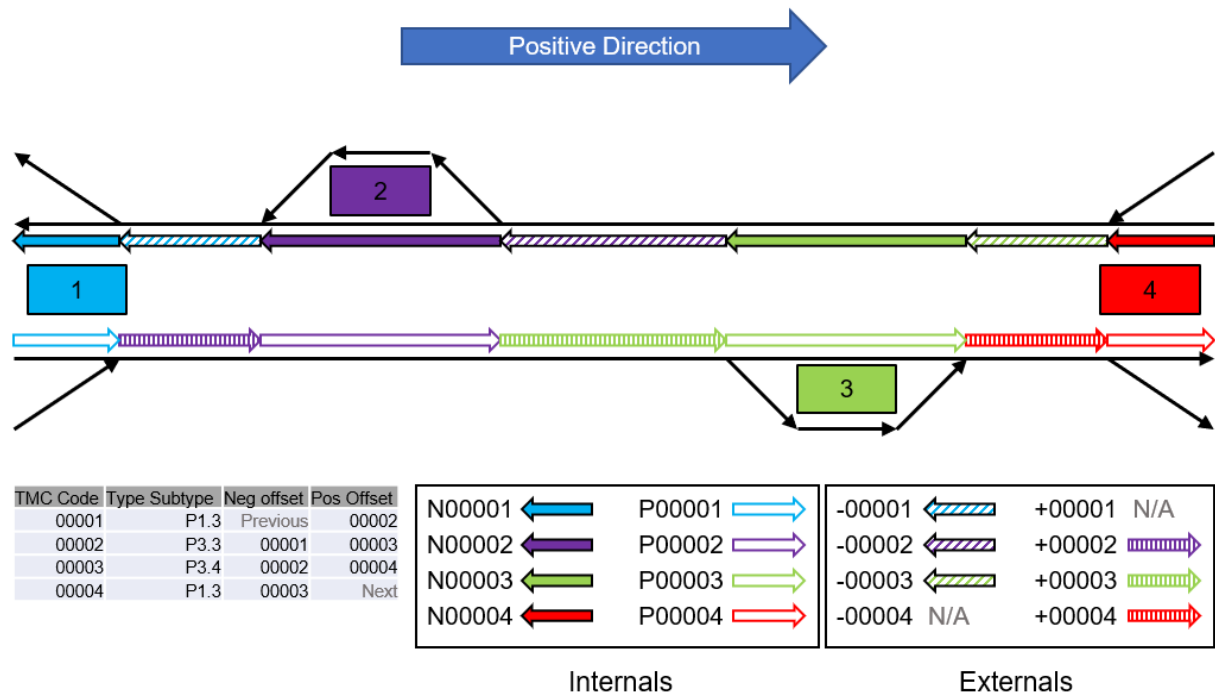


Figure 19 Parking/fuel area, non-aligned on each side

4.4.2 Rest area plus exit

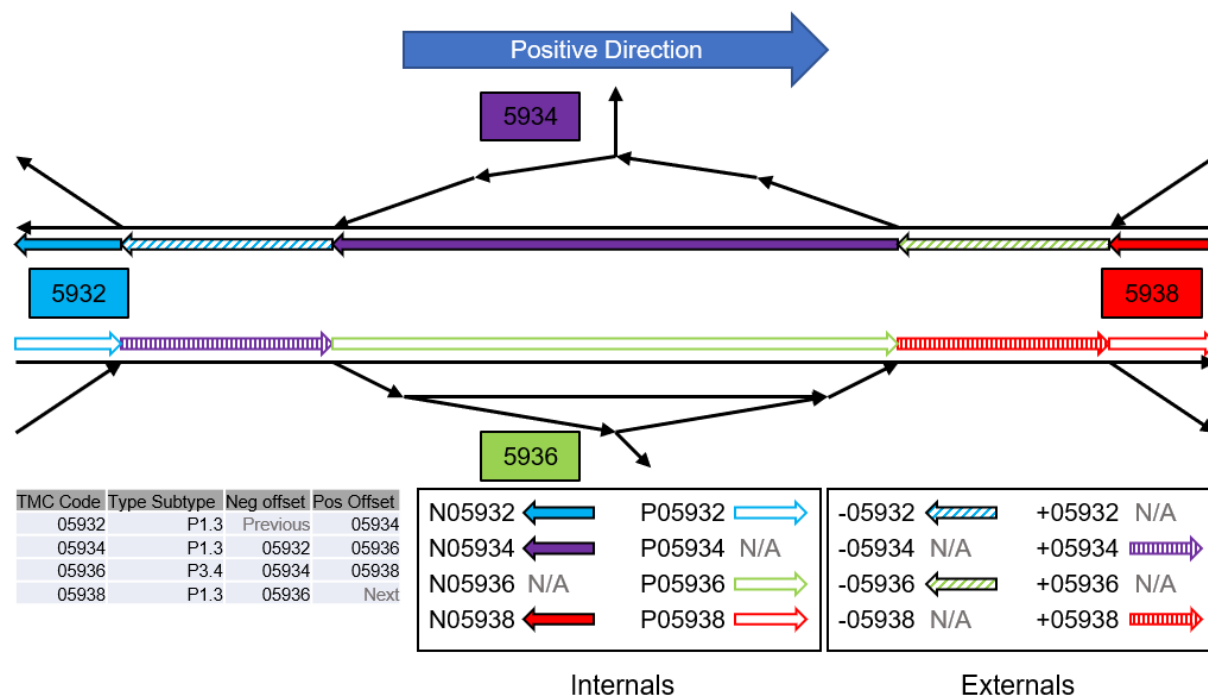


Figure 20 Rest area plus exit

4.4.3 Parallel link roads serving for subsequent cross-roads / TMC locations

The Parallel Road as present in the TMC table refers to only one parallel road and will not be coded in the opposite direction.

The TMC direction of the Parallel Roads is always positive and is not affected by the main road. The parallel road shall be coded for each direction of the main road independently. In Figure 21 below, the main road is drawn only to provide context for the parallel roads.

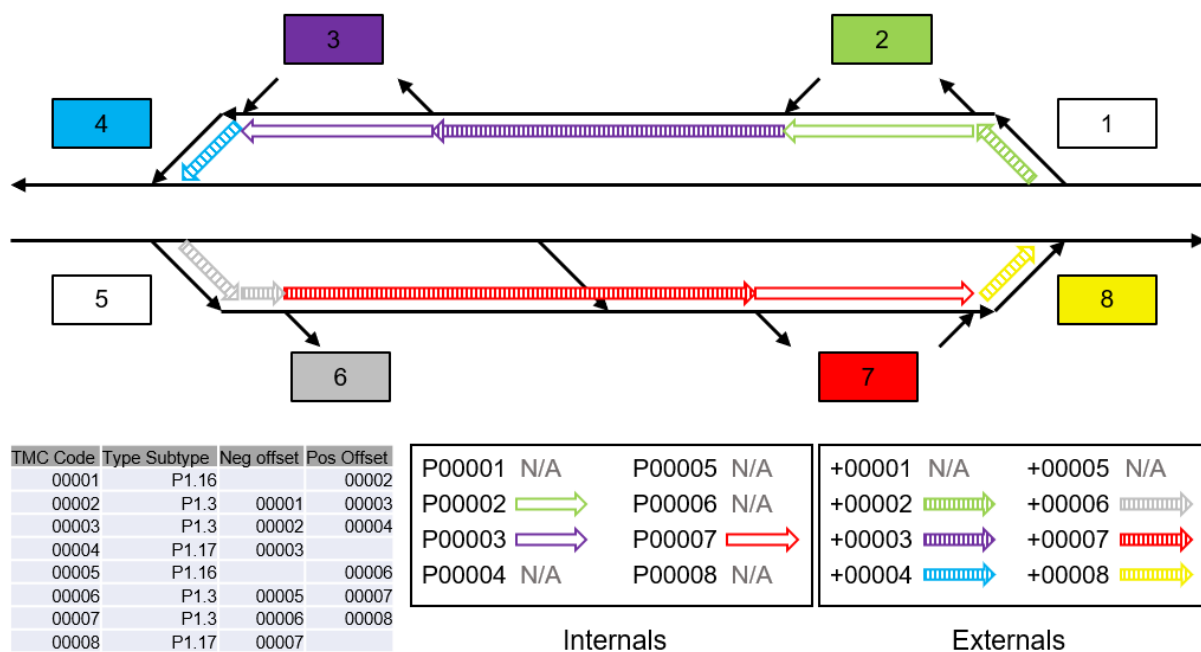


Figure 21 Parallel link roads

The P1.16 and P1.17 subtypes refer to the nodes where the parallel road connects to the main road. For the start of parallel road, P1.16, the only link which could theoretically be coded would be the link before the node. But since this link would be on the main road and not the parallel road, no P1.16 external shall be coded. The internal of P1.16 is the node, and therefore no internal link is coded.

For end of parallel road, P1.17, the internal is the node, and therefore is not coded. Since P1.17 is the end node of the parallel road, the external is coded since it is the last link of the parallel road before it connects to the main road.

4.4.4 Use of link roads (P4/L7) in case of complex intersections

P4.0 locations always refer to an L7.0 Linear Location.

For P4.0 locations, no positive or negative offset is present. The direction of P4.0 is only coded as positive.

The direction of the TMC path for P4.0 locations is provided by the information in the First Name and Second Name of the L7.0 Linear Location, the direction being positive from the First Name to the Second Name.

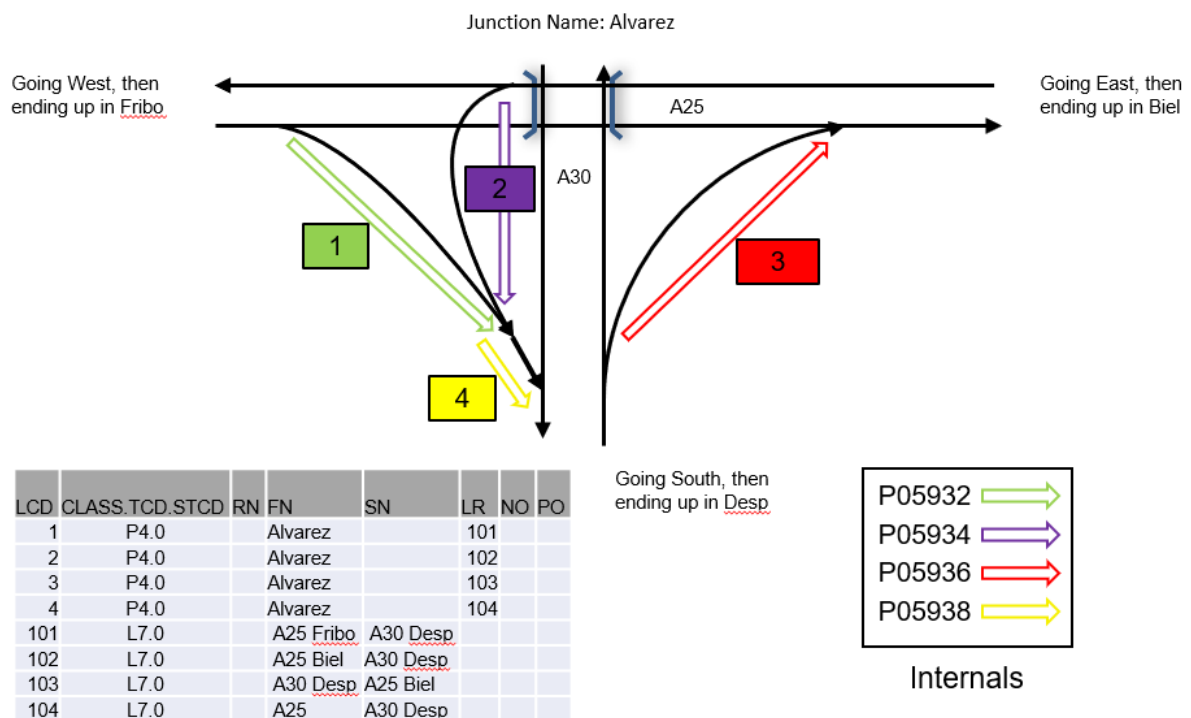


Figure 22 Coding of Links for Slip Roads

The above shown example shows the coding of all slip road (ramp) links of the junction, however whether or not to code one of more of these links is the responsibility of the Table Owner. And if the Table Owner e.g. decides to code the ramps, he might decide to not code LCD 4 as a message containing both LCD 1 and 2 could normally be used to present the same information. For North America, the naming of First and Second name could use for example eastbound or westbound instead of city name (Biel or Fribo, respectively).

4.4.5 P3.37 Built Up Areas

The intent of TMC Location Tables is to provide an unambiguous representation of locations (area, linear, or point) that any map maker or client terminal will interpret in precisely the same manner. However, some locations could, and in some cases have been, interpreted differently by different parties. This section seeks to clarify coding of point location type P3.37 (Place Name) within Built Up Areas (BUA).

There are general rules that should be followed for conflation of P3.37 TMC locations:

- If a TMC path refers to a specific road number, the path matching should follow this road number.
- TMC network should be connected. This can be reached by placing TMC locations preferably at junctions which are crossed by more than one TMC path.
- The map makers shall not code the entire road within the BUA as internal, but only the junction, bridge, square, or other feature nearest to the coordinates as present in the TMC table.

4.4.5.1 For a road that goes through the BUA

If the junction corresponding to the P3.37 location has an internal part (e.g. Between exit and entry) then the TMC location will also have internal links. In the example the P3.37 location 2 uses both internal and external links as it describes a junction with entrance/exit. The P3.37 location with TMC code 3 uses only external links as it describes a simple junction.

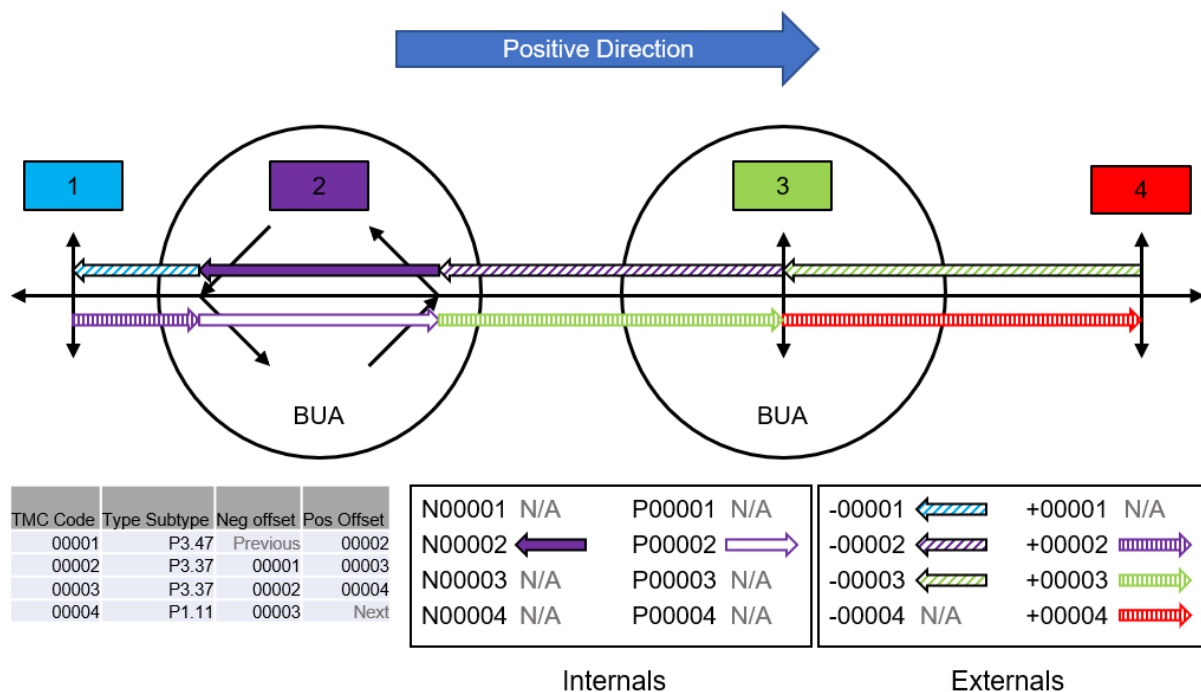


Figure 23 Road through BUA

4.4.5.2 For a road that passes the BUA, situation A

TMC locations are defined by the coordinates from TMC Source; in the example below the coordinates of P3.37 describe a junction with entrances and exits, i.e. Location 2.

Map makers will keep coding this situation according to current specification, no change required.

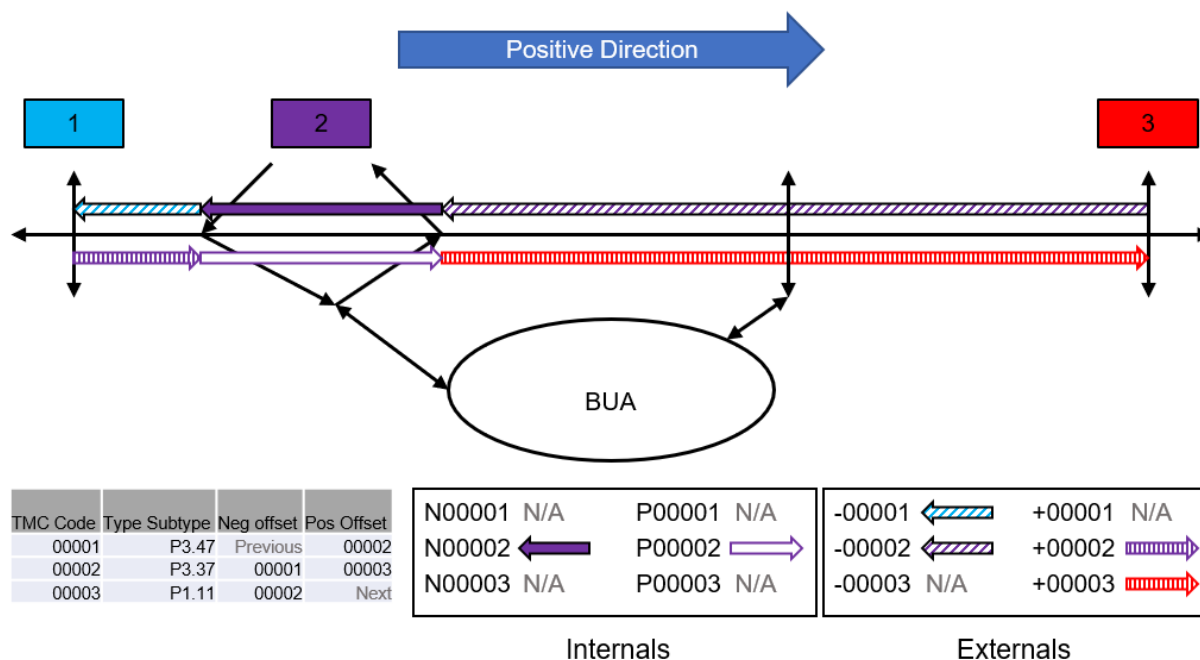


Figure 24 Road passing BUA

4.4.5.3 For a road that passes the BUA, situation B

TMC locations are defined by the coordinates from TMC Source; in this example the coordinates of the P3.37 location describe a simple junction.

Map makers will not code the entire path between the junctions where a crossing road is going into the BUA as internal, but the internal will only be placed on the link or node (based on if the junction has internal nodes) of the junction or rest area, etc. Nearest to the coordinate as present in the TMC table.

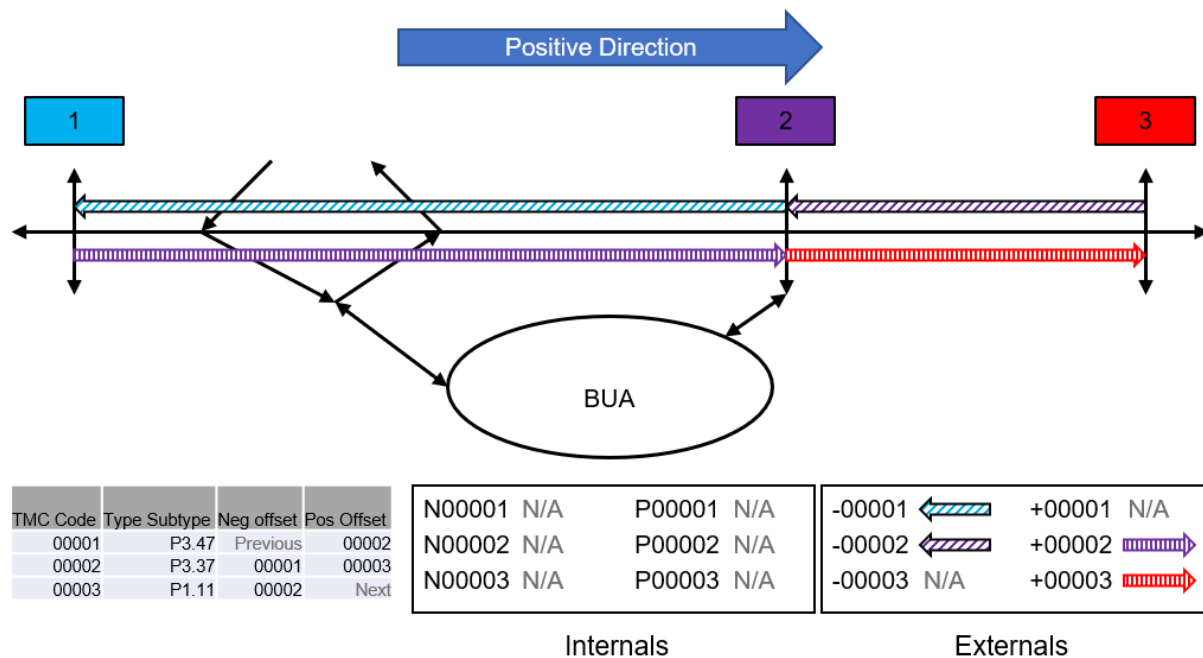


Figure 25 Road passing BUA

4.4.5.4 Anti-pattern for TMC table providers

Sometimes the location described in the TMC tables for P3.37 locations does not allow to choose clearly the correct junction or feature to conflate the location on the map. This section includes some examples that should be avoided by TMC table providers.

The location defined in the TMC tables should point clearly to a major junction or feature.

Examples that show the problems that can arise from such a definition are contained in Figure 26.

In Figure 26, the original position defined in the TMC tables is marked as a blue dot. The junctions where this P3.37 location could be decoded are marked with question marks. The location defined in the table should point unequivocally to one of these junctions so that there would be no discrepancies between map providers that would lead to a misplacement of traffic and travel information events.



Figure 26 Left - Example Inning am Ammersee (Germany). Right – Example Au in der Hallertau (Germany)

4.4.6 Combined rest area complex junction, symmetrical

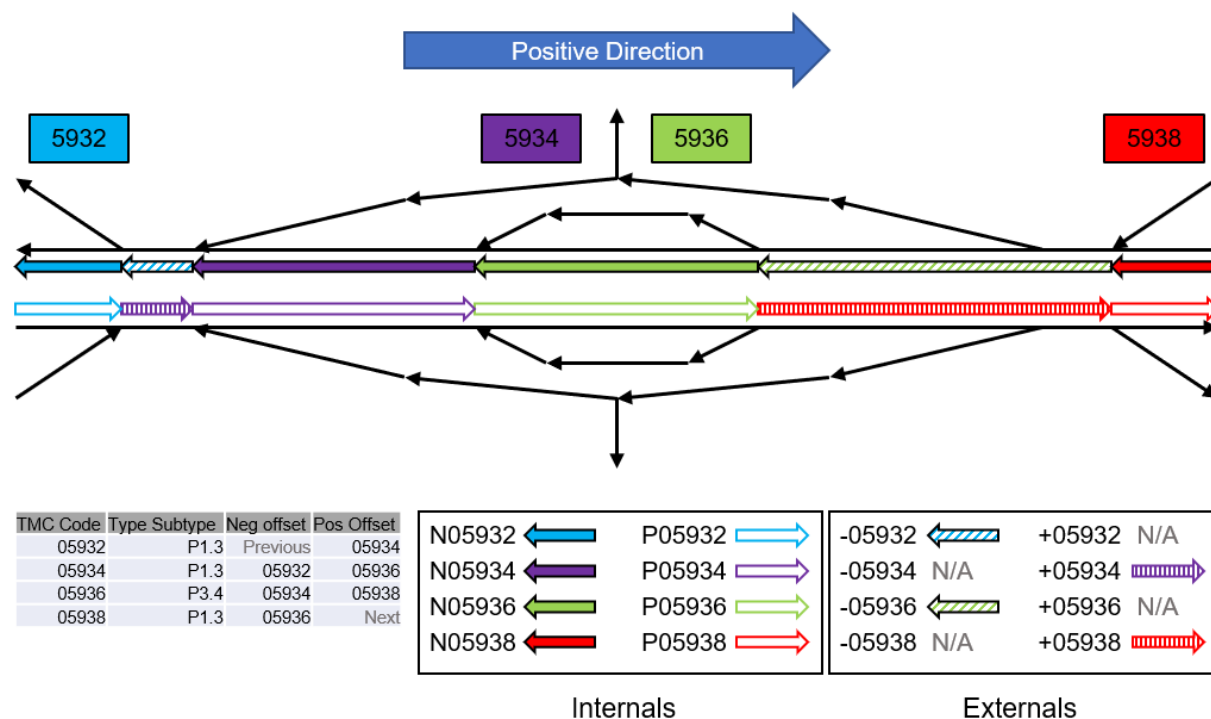


Figure 27 Combined rest area, symmetrical

4.4.7 Combined rest area complex junction, asymmetrical

In rare or unusual situations where an internal cannot be logically placed, the goal is to prevent TMC overlaps and preserve the sequence of TMCs.

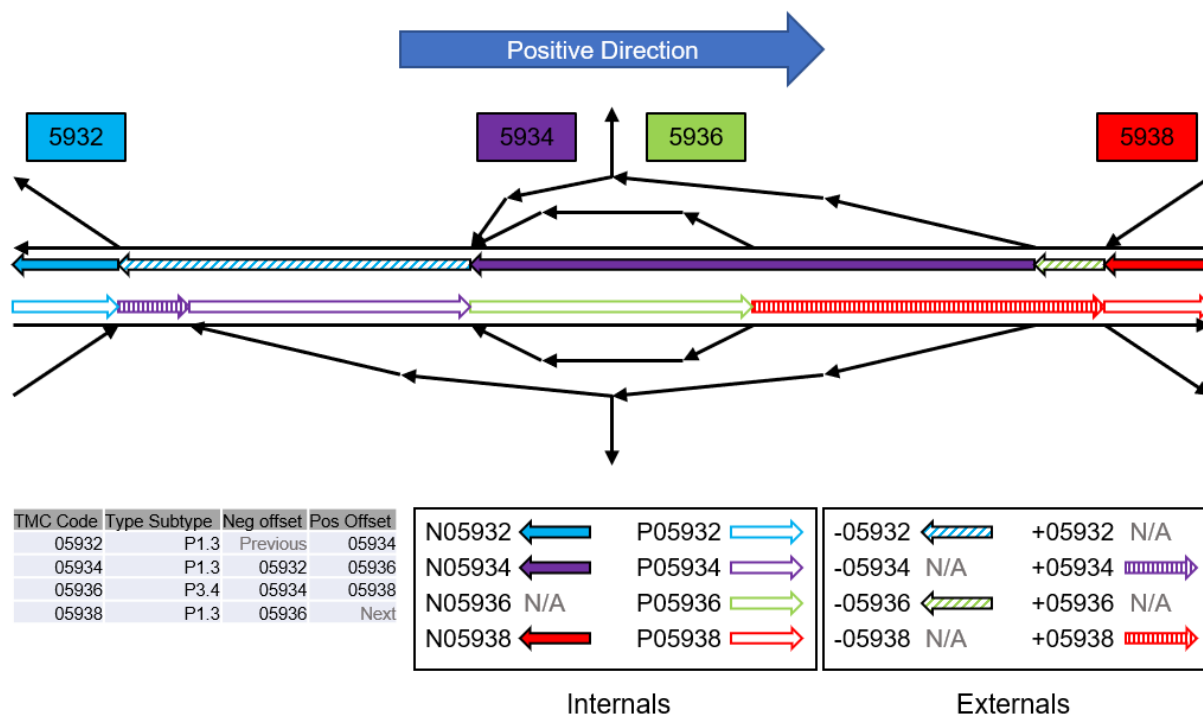


Figure 28 Combined rest area, asymmetrical

4.4.8 Crossing Exit and Entry

The crossing exit and entry links are at different z-levels, and do not actually intersect. Internal should stop before the exit of the next TMC Point, no matter the direction, in cases where they overlap.

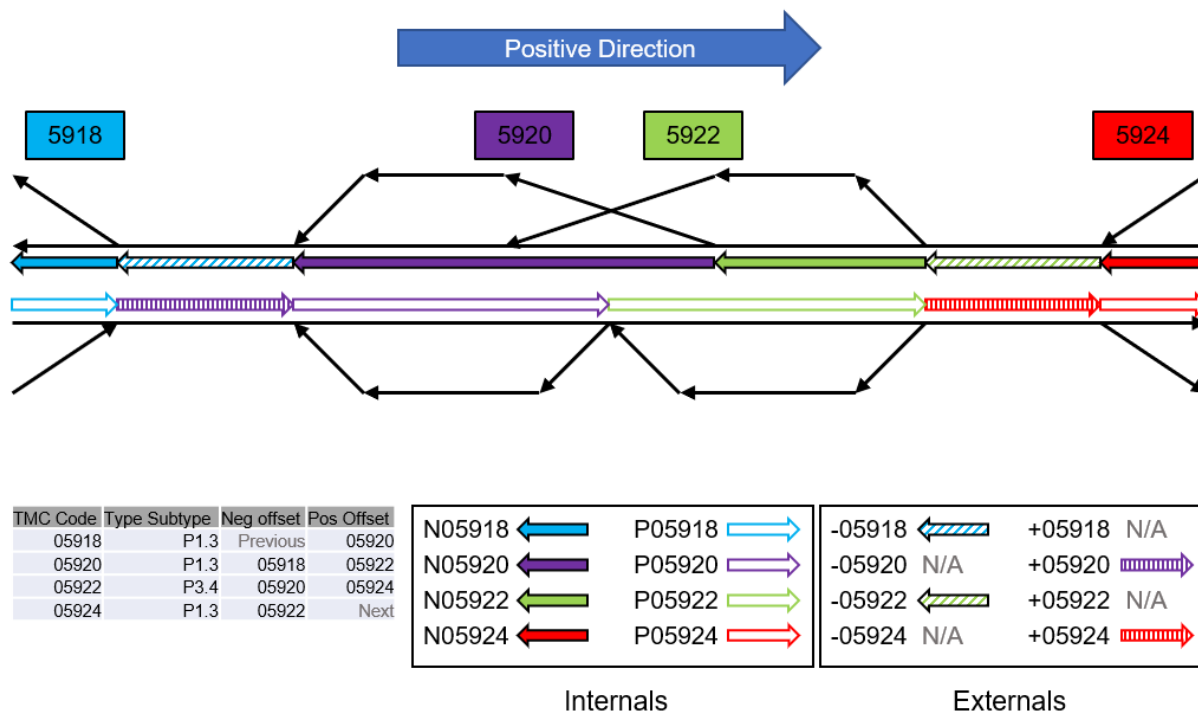


Figure 29 Crossing exit and entry

4.4.9 Tunnels and bridges

By following the general rule “*conflation of a TMC internal location shall start at the first exit/entry and end at the last entry/exit of that location*” the usual way to decode a P3.1 (tunnel) or a P3.2 (bridge) is the one depicted in Figure 30. The internal link shall cover the entire stretch of the tunnel or bridge.

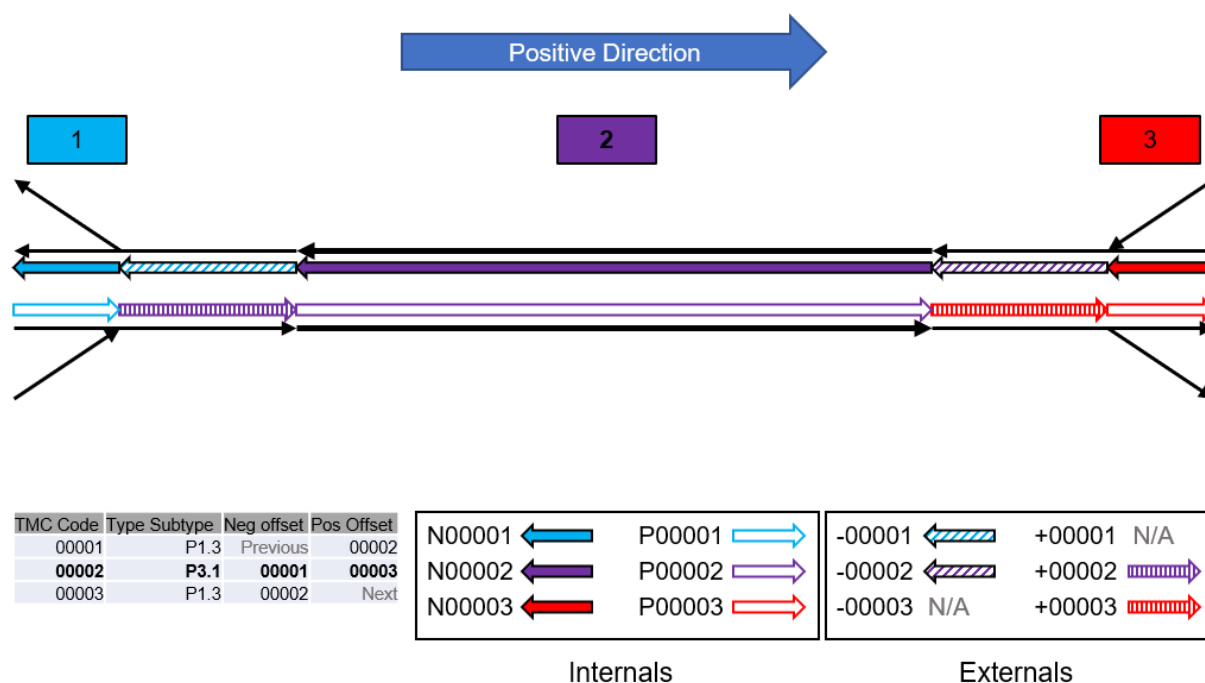


Figure 30 Conflation of P3.1 and P3.2 point locations

In some occasions, tunnels and bridges have other TMC locations in the middle. In order to avoid overlaps and keep the TMC sequence, the conflation on these cases shall be done as shown in Figure 31 and Figure 32.

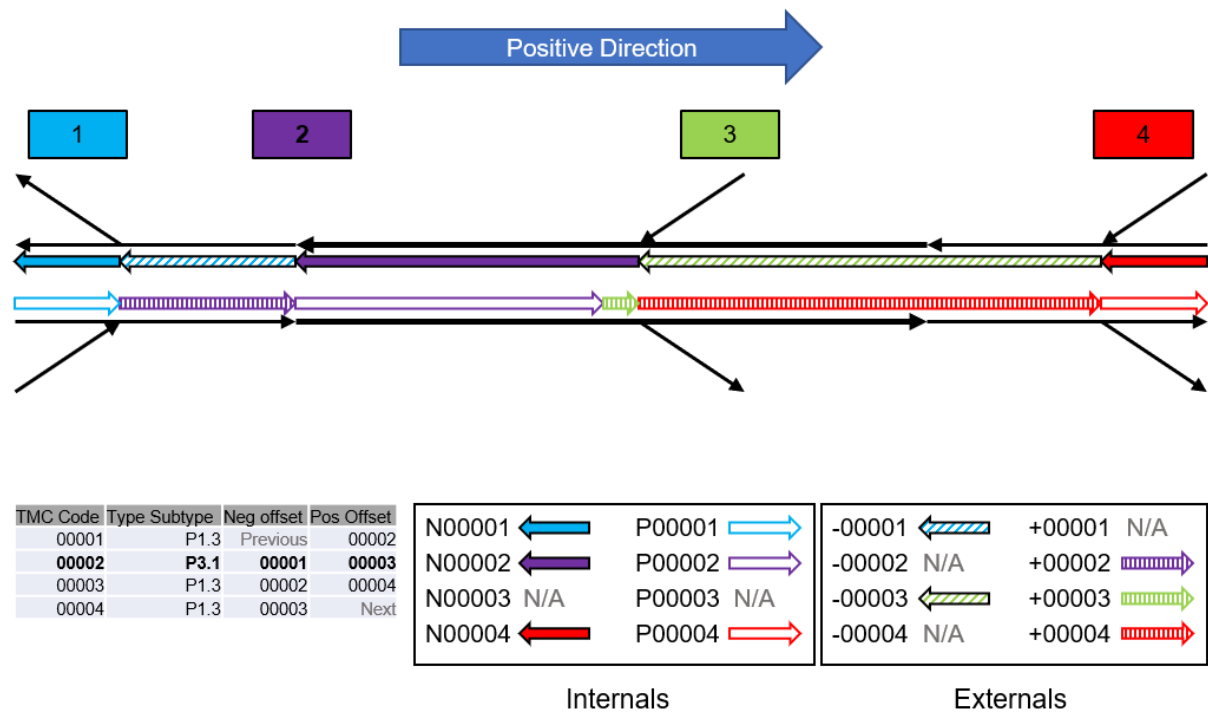


Figure 31 Conflation of tunnels and bridges with simple location inside

If the location inside (yellow) is a simple one, i.e. Does not contain any internal links, a small link with a length from 5 to 20 meters shall be conflated before the location in the direction where the P3.1 or P3.2 location (green) is upstream of the location inside it (yellow). Whether this small link is internal or external is a decision of the map maker. The rest of the tunnel or bridge shall be part of the next location in the sequence (blue).

If the location inside the tunnel or bridge is a complex location, i.e. Contains internal links, then the small link is no longer necessary (see Figure 32).

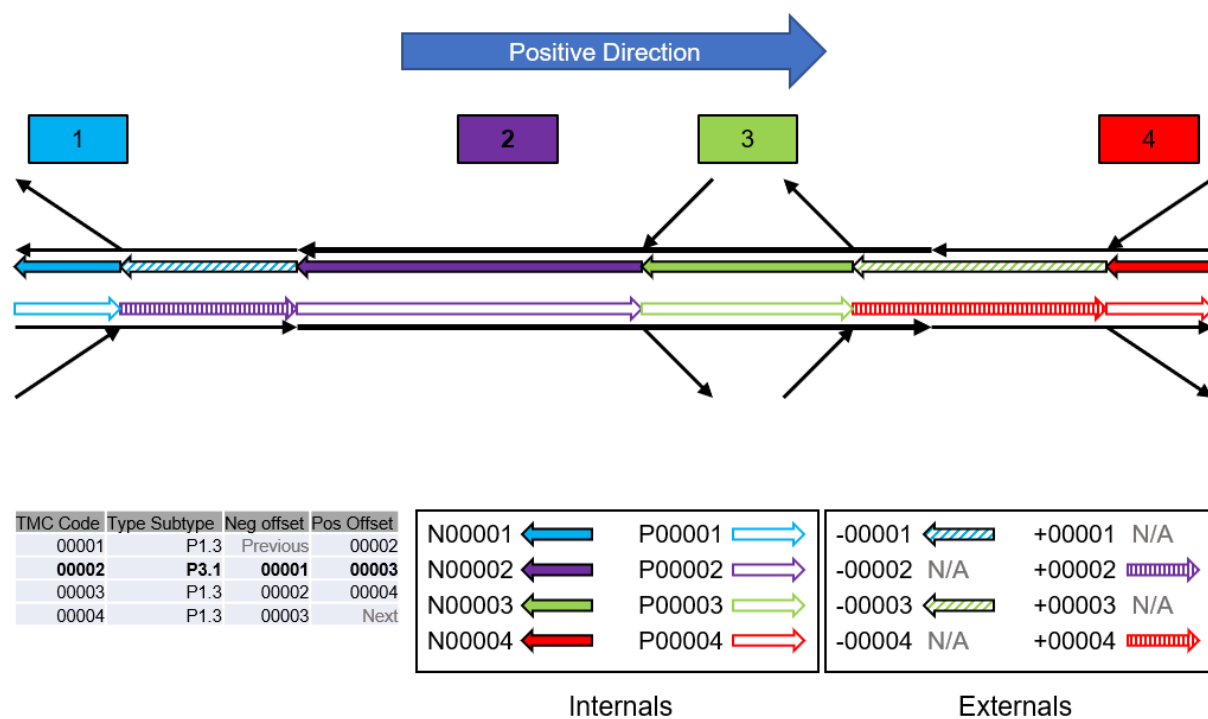


Figure 32 Conflation of tunnels and bridges with complex location inside

4.4.9.1 Special case: Each side of the tunnel or bridge has a designated location

If the tunnel or bridge is very long and each end of the tunnel or bridge has its own designated TMC location and there is no additional TMC location in between, first TMC location in the sequence is captured as an external TMC link before the tunnel or bridge; second TMC location in the sequence is captured as an external TMC link on the entire length of the tunnel or bridge.

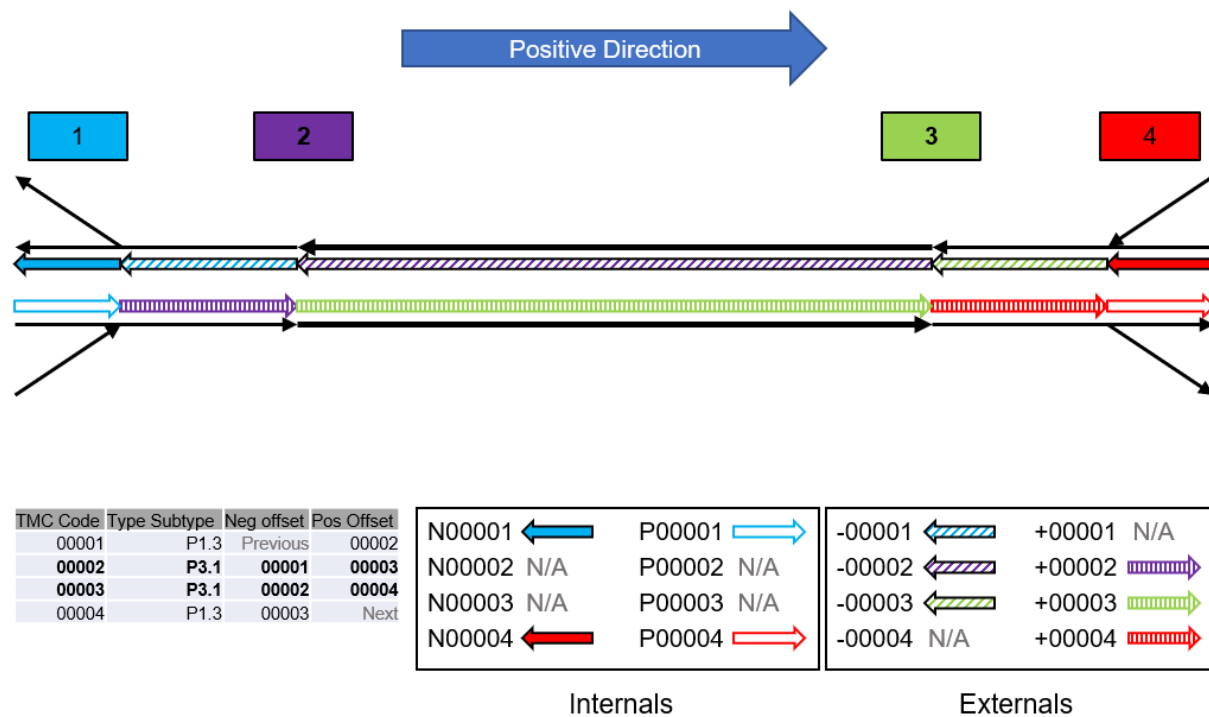


Figure 33 Conflation for tunnels and bridges with one TMC location at each end and no locations in between

Figure 34 depicts an example of conflation in the following cases:

Case description	Conflation example
There is one location to define each end of the tunnel or bridge	The external start tunnel link will be the one leading to the tunnel, i.e. These locations will have external links only in one of the directions (see external links of 00002 and 00005). In these cases, the internal part of the tunnel should be represented by the 2 nd tunnel TMC Location point so the junction TMCs must be represented in order (i.e. Location s00003/00004) until leading to the 2 nd tunnel TMC location.
There is more than one location inside the tunnel	The part between both locations will be part of the next link and not part of any tunnel or bridge location (see external links of locations 00003 and 00004)

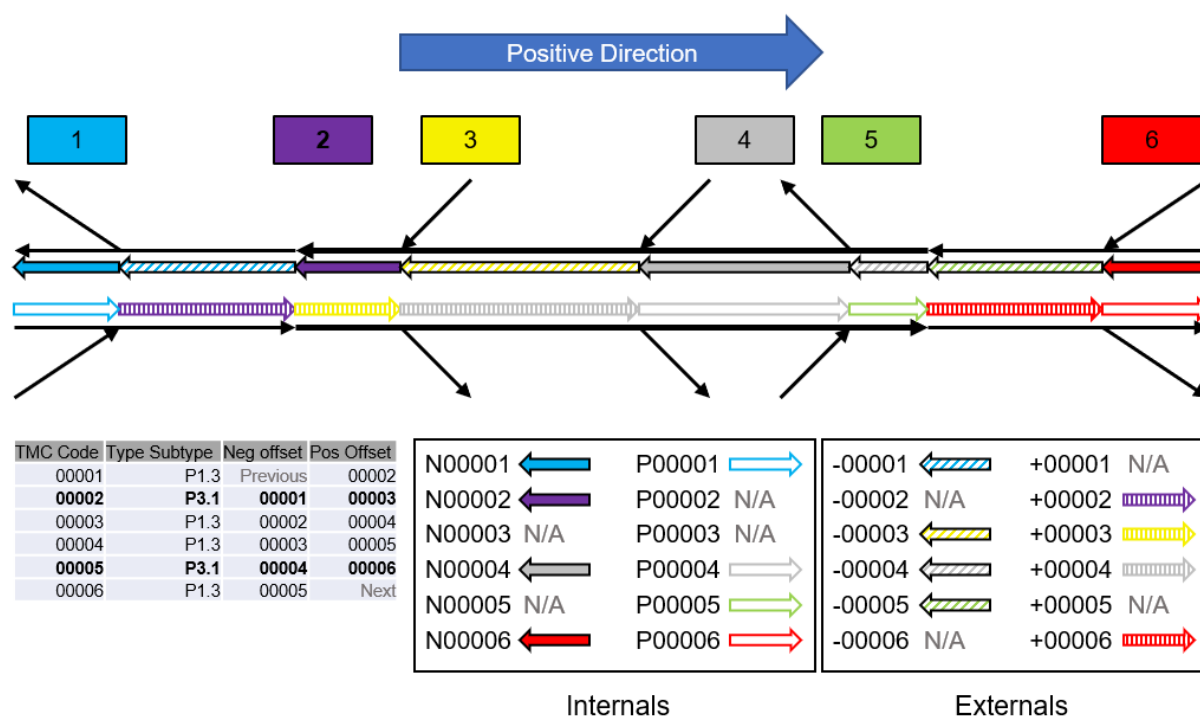


Figure 34 Conflation for tunnels and bridges with locations inside and one location at each end

4.4.9.2 Special case: There is not enough space in the tunnel or bridge to include a small link

It may happen a few times, that the location inside the tunnel or bridge is so close to the entrance that there is no space to fit the small link. These situations are very unusual because it requires that:

- The location inside the tunnel or bridge is a simple location, i.e. Does not contain internal links.
- The location inside the tunnel or bridge is less than 20m away from the entrance.

In these cases, the small link shall exceed the entrance and the tunnel or bridge location will be shifted enough just to fit the 5 to 20m link. The option of adding a small internal link depends on the preference of the map maker. This should not shift the TMC reference point.

From a TMC Location Table perspective, a more logical approach would be to have Junction 2 as the exit and Junction 3 as the tunnel. When creating new linears and locations, this is the preferred method.

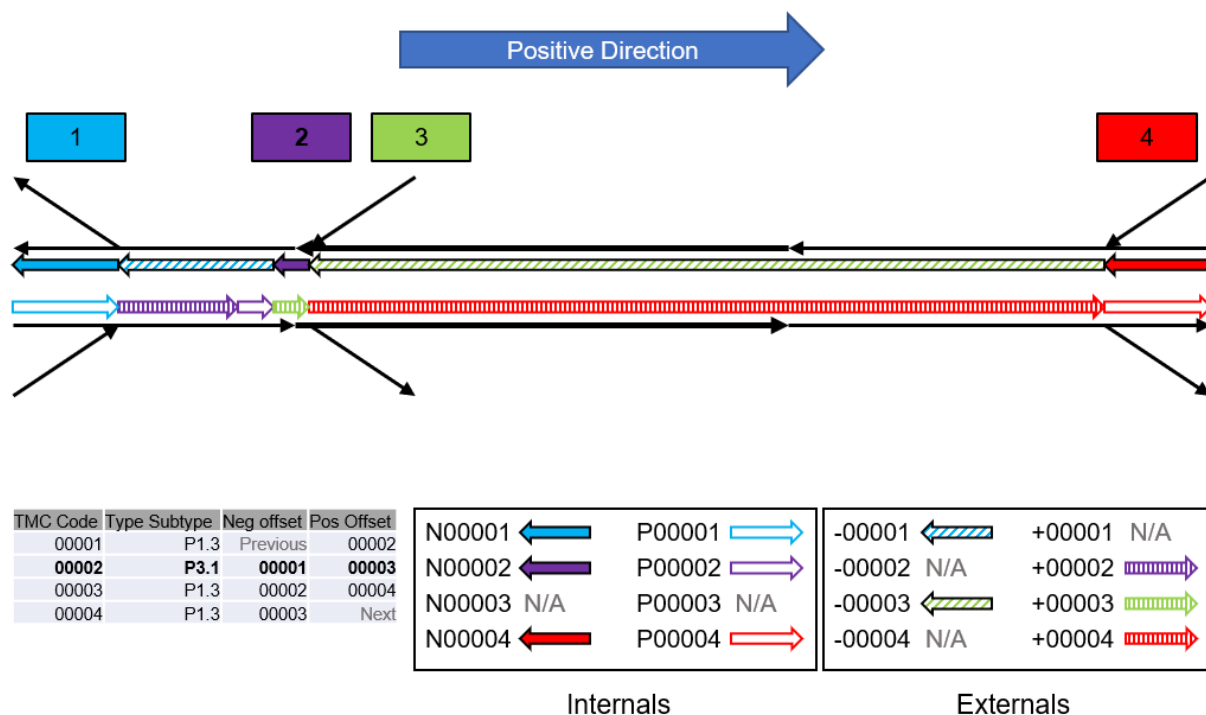


Figure 35 Small link does not fit inside the tunnel or bridge

4.4.10 Parallel slip/ramp leading to multiple TMC points

Case where there is a parallel slip/ramp that leads to multiple slip/ramp TMC points. The general guideline is to extend the first location to the relevant location related to the final point on the parallel road related to the entry or exit point; the first location should be extended at the point in the main road which is perpendicular to the main road to the final point on the parallel road. When referring to perpendicular points, the point should be based on the perpendicularity to the main road rather than the slip road.

The second location should be extended until the end of the final entry related to both TMC points.

This first case where the exit point is prior to the entry point.

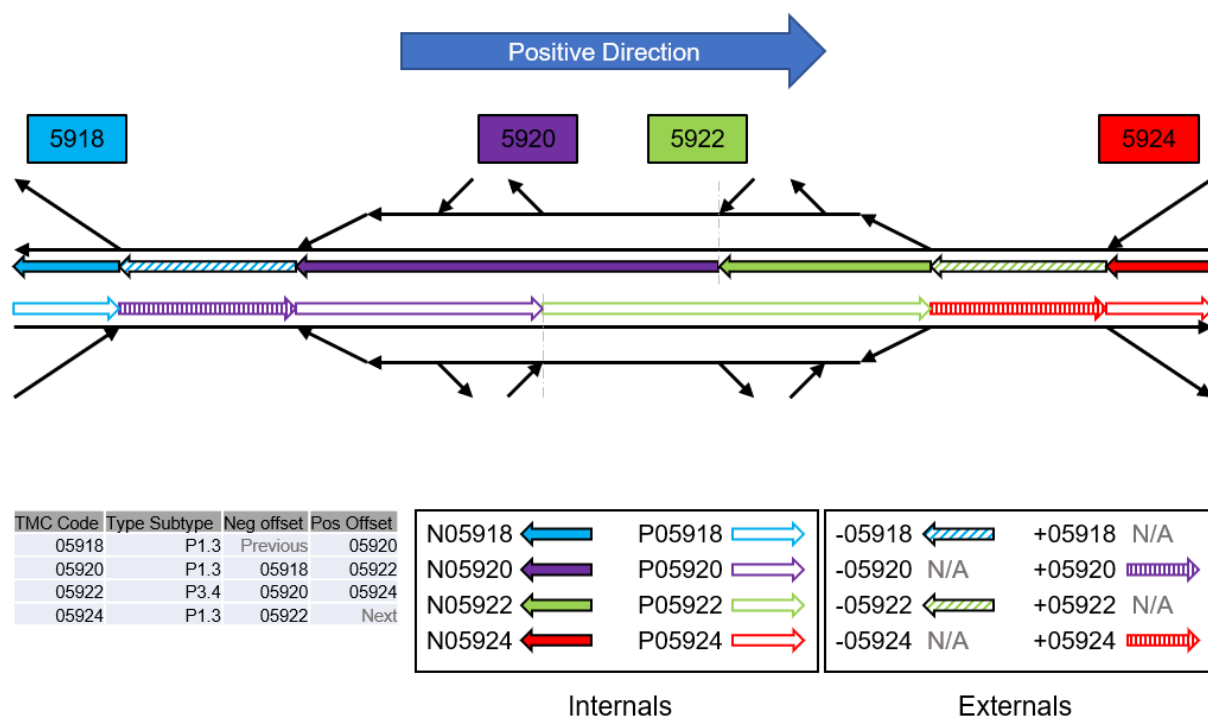


Figure 36 Parallel slip leading to multiple TMC points, case 1

This second case where the entry point is prior to the exit point.

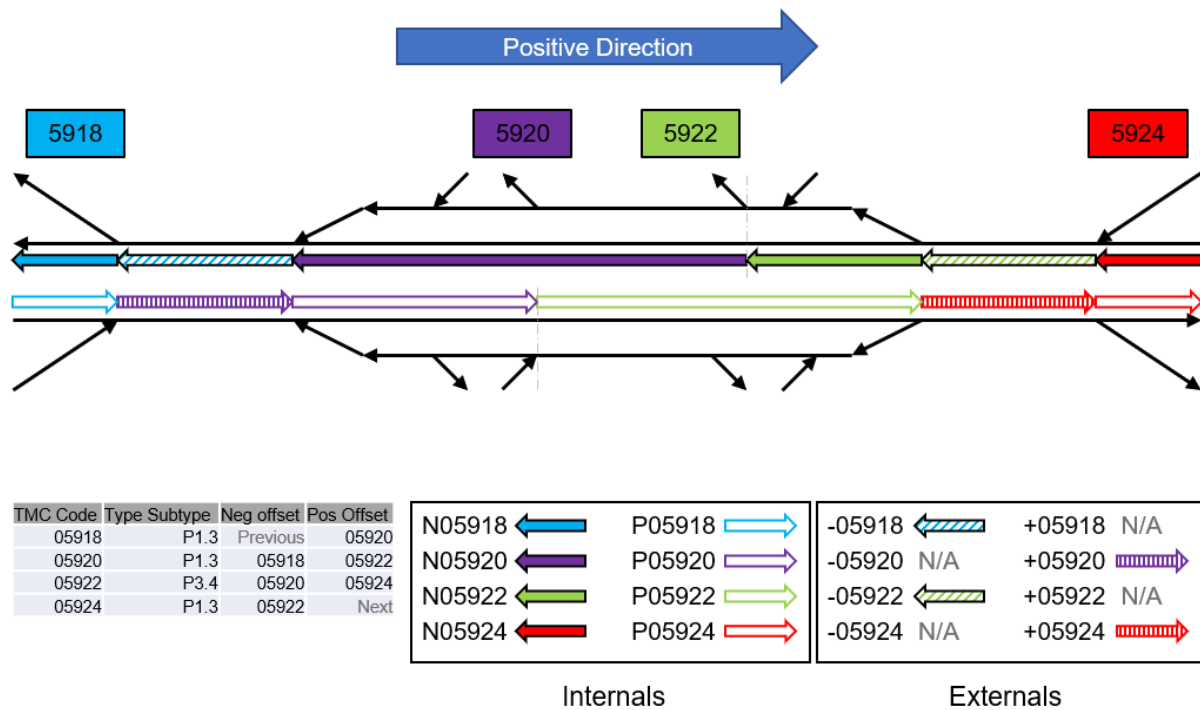


Figure 37 Parallel slip leading to multiple TMC points, case 2

4.4.11 Overpass or Underpass

Simple case with an overpass/underpass on a roadway. The external TMC is coded and the internal TMC is not recommended.

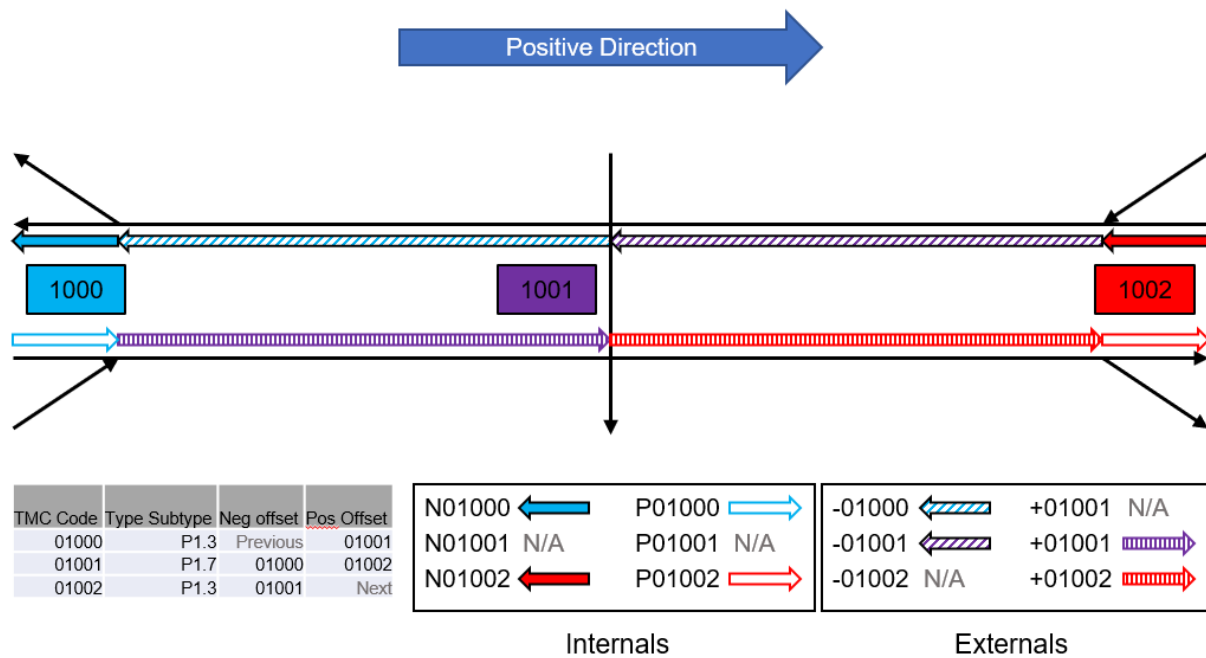


Figure 38 Overpass or Underpass

4.4.12 Redundant TMC Points

It may happen that more than one TMC location is inside a motorway junction or exit. Many of these overlap and redundant cases are defined by specific rules in these guidelines. For cases that are not handled by specific rules, the following rule applies for redundant TMC point definitions. All other general principles described in Section 3.2 apply. For these redundant cases, the major TMC point on the roadway should be given the priority compared to other minor TMC points. The major point will be extended to the logical end of the point, and the minor TMC points should be defined by small links at the end of the redundant points. The major points are typically P1.1/P1.2/P1.3/P1.4 (Motorways), while the minor TMC points are P1.6/P1.7 (Overpass, Underpass), and P3.x (other landmark points).

In the below diagram, TMC 11030 is a major TMC point and the TMC is extended in both directions, while the redundant points 11029 and 11031 are minor TMC points.

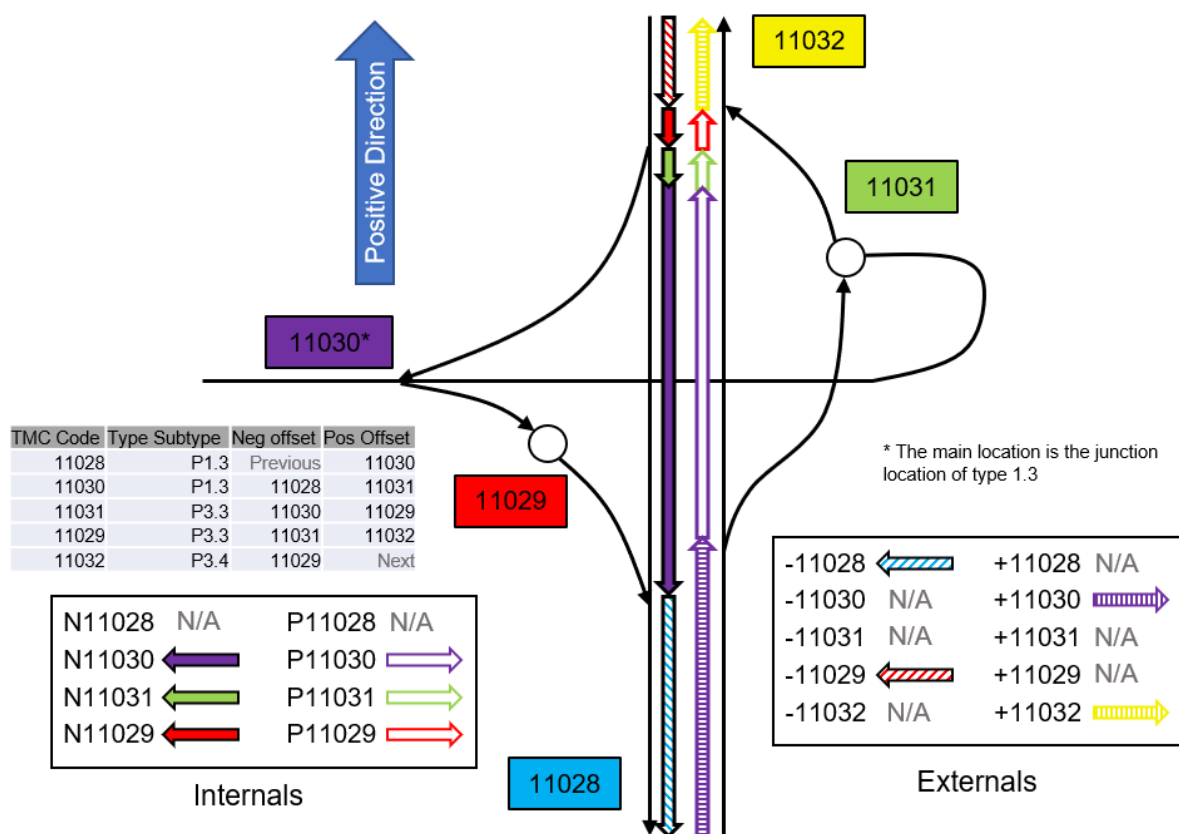


Figure 39 Multiple TMC Points within Junction with Clear Major Point

In cases where there is not a major point, the first point in the sequence should be given priority and extended as defined by the major point logic. In the below diagram, all points are classified as subtype 3.3 so there is not a clear major point. The first redundant point in each direction is given the priority.

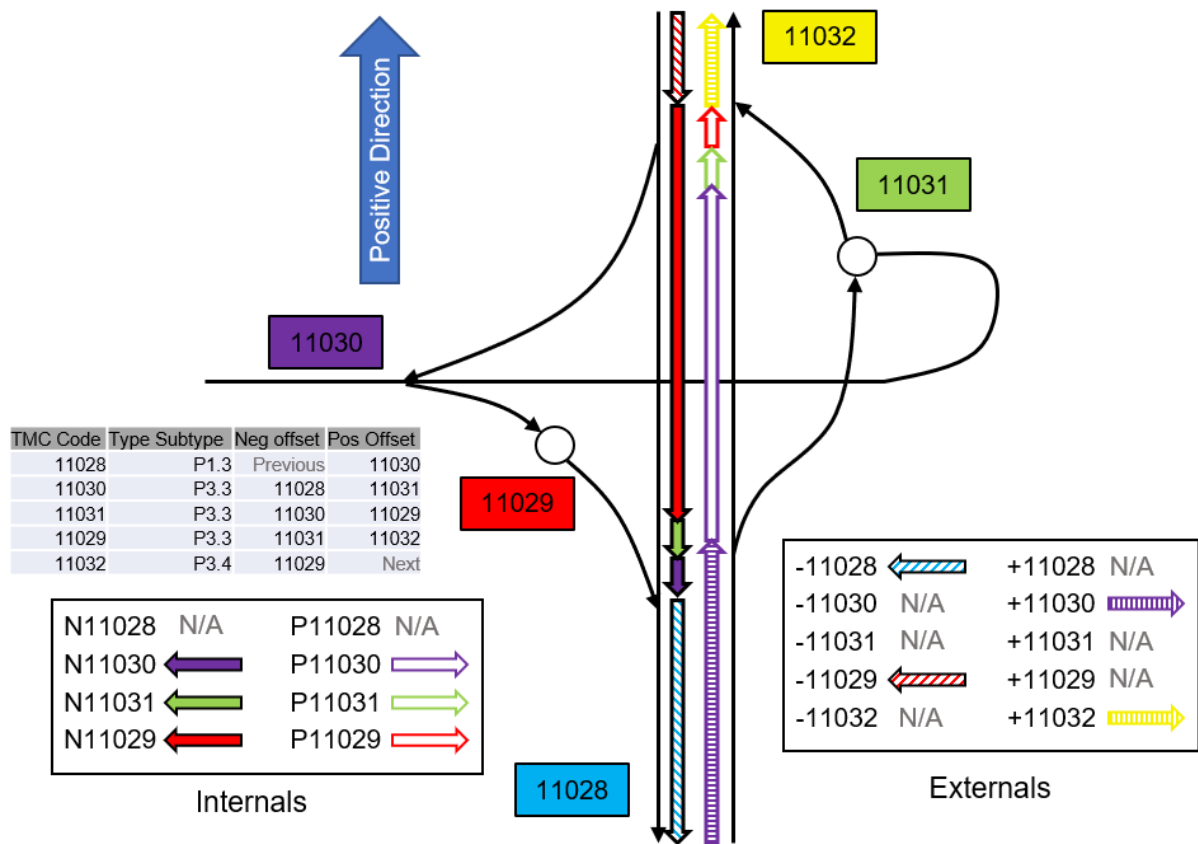


Figure 40 Multiple TMC Points within Junction with no Clear Major Point

4.4.12.1 Redundant Point at Roundabouts

There can be also instances with more than one TMC locations related to a roundabout. In such cases, the first TMC in the sequence should be coded as external and the second TMC in the sequence should be coded as internal.

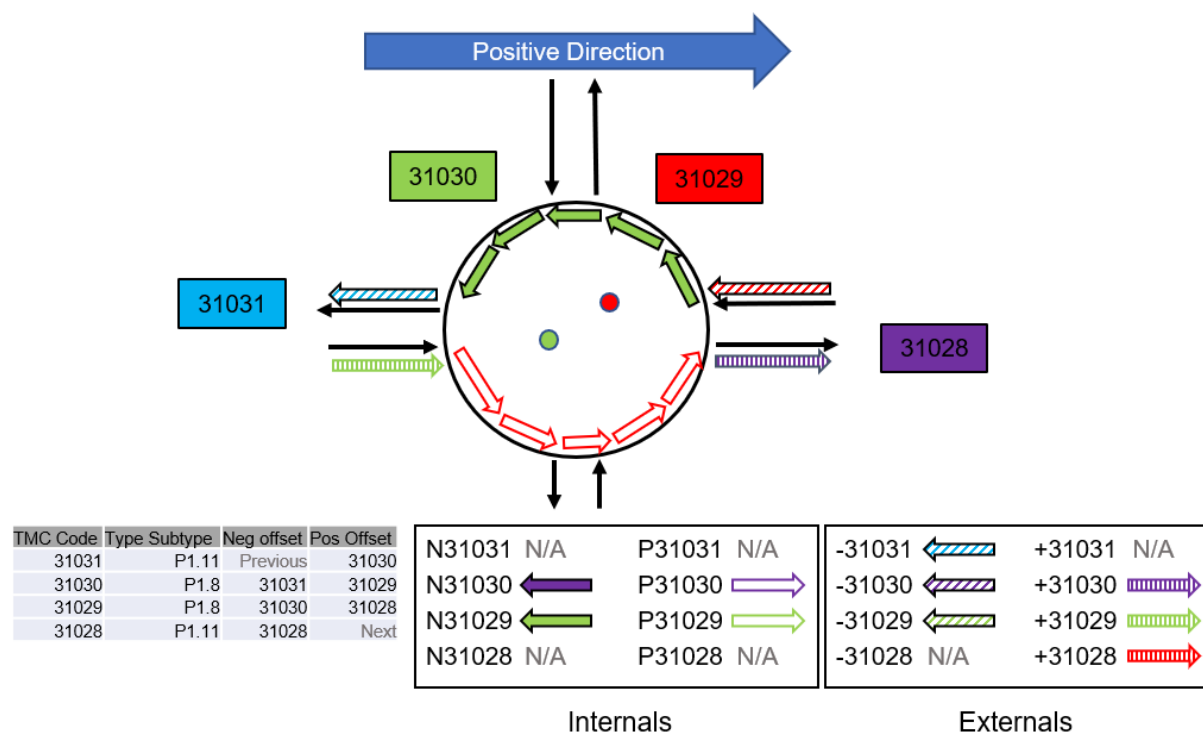


Figure 41 Multiple TMC locations within roundabout

4.5 Motorway triangles

This sub-chapter defines how to code the start/end of a TMC path with a junction not at grade. Generally, ramps shall not be coded as part of a TMC path, exceptions are beginning and end of TMC paths ending in ramps. This topology is more common on motorways, but this rule applies to all TMC paths ending in ramps. Figure 42 below shows the start of a motorway into the north direction. The most inner ramps, one exit and entry, starting the motorway shall be TMC coded, and shall be coded internal to the junction.

The definition of most inner ramps is the pair of ramps whose sum of the absolute value of the angles they form with the last segment of the highway is closer to zero.

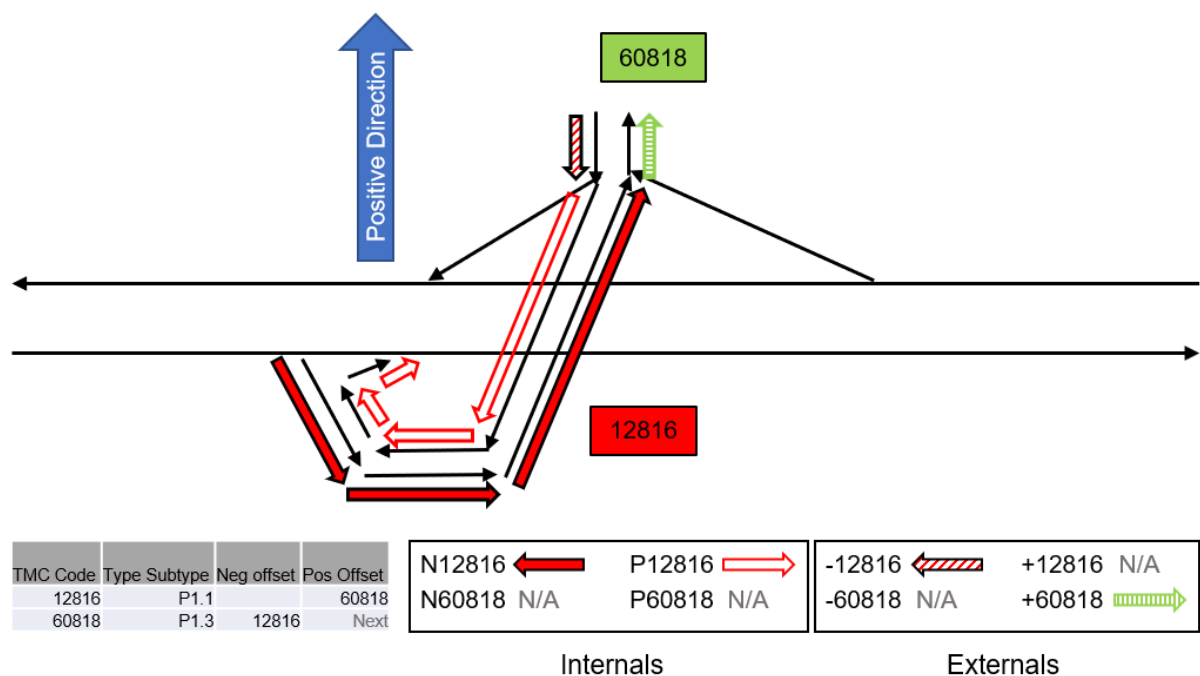


Figure 42 Motorway triangle

In the example above there are two pairs of ramps. One pair connected to the eastbound direction of the other highway (A), and the other pair connected to the westbound direction (B). The sums of the angles these pairs form with the highway are shown below. The pair with the angles closest to zero is A.

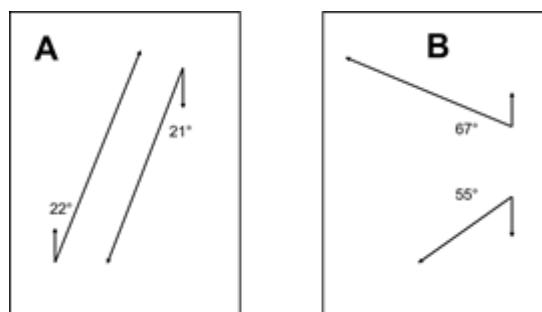


Figure 43 Angles of the pairs contained in the motorway triangle example

5 REFERENCES

1. 5.1 SP08001 – TISA TMC Location Table Exchange Format
2. 5.2 GDF 3.0 Reference Manual v59.0, 1 July 2016 5.3 14819-3:2011 Intelligent Transport Systems — Traffic and Travel Information Messages via Traffic Message Coding — Part 3: Location referencing for Radio Data System - Traffic Message
3. Channel (RDS-TMC) using ALERT-C
4. 5.4 SP10017 – 20100429 – Coding of Link Roads
5. 5.5 SP10036 - TPEG2-TFP_1.0/002 Intelligent Transport Systems (ITS) - Traffic and Travel Information (TTI) via Transport Protocol Experts Group, Generation 2 (TPEG2) – Part 18: Traffic Flow and Prediction application
6. 5.6 SP13003 - TPEG2-ETL_1.0/001 20130315 Intelligent Transport Systems (ITS) - Traffic and Travel Information (TTI) via Transport Protocol Experts Group, Generation 2 (TPEG2) – Part 20: Extended TMC Locations for Applications

6 APPENDIX A: TMC LOCATION CONFLATION CONVENTIONS IN TMC, TPEG

This appendix describes conventions in both RDS-TMC (ISO 14819 series) as TPEG (ISO 21219 series) how to conflate transmitted location references to road segments in the digital road map, using the internal TMC links and external TMC links as coded in the digital roadmap.

6.1 Conflation conventions for TMC location references

This section lists the basic conflation convention for TMC location references.

Extent 0 TMC location references

In Figure 44 the basic convention for an extent 0 TMC location reference is depicted. Given an extent 0 TMC location reference, only the TMC internal links of the primary location are considered to be affected.

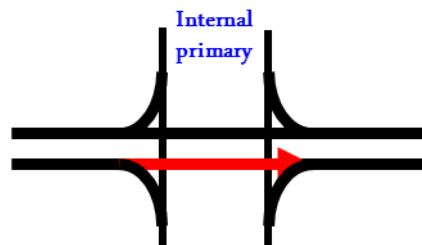


Figure 44 Conflation convention for TMC extent 0 location references

Extent > 0 TMC location references

In Figure 45, the basic convention for an extent greater than 0 TMC location reference is depicted. Given an extent greater than 0 TMC location reference, both the TMC internal and TMC external links of the primary location and all further intermediate TMC locations are considered to be affected.

However neither the TMC internal links of the Secondary location, nor the TMC external links of the secondary location are considered to be affected, see Figure 45.

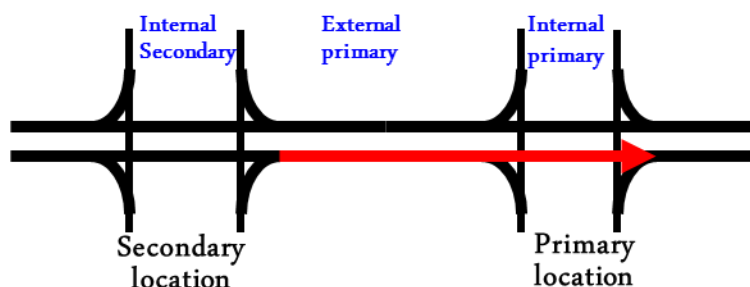


Figure 45 Conflation convention for TMC extent > 0 location reference

6.2 TPEG additional conflation conventions for TMC locations

TPEG follows the basic conflation conventions for TMC location references as defined in section A.1. TPEG however also has defined an “Extended TMC location reference” (to become part of ISO 17572-

2) to enable specific inclusion/exclusion of the TMC internal links of the primary and secondary location, as to reference entries and exits of a TMC location. Furthermore, TPEG2-TFP (Traffic Flow and Prediction) defines a specific spatial reference point for a TMC location, which is of note.

These two aspects are described in this section.

6.2.1 TPEG-TFP: Spatial Reference Point for TMC locations

TPEG2-TFP (ISO TS 21219-18) is a TPEG application to encode and transmitted traffic flow and predictive traffic flow information on stretches of roads, e.g. Sections of free flow and congested traffic (slow, queuing or stationary traffic). To achieve an efficient encoding, TPEG2-TFP contains a single location reference, usually a longer stretch of road of multiple kilometres. Specific sections of congested or free-flow traffic are indicated by offsets relative to a spatial reference point.

This spatial reference point is defined as shown in Figure 46. The end of the location reference (in driving direction) defines the Spatial Reference Point. Based on this Reference Point offsets are used to dedicated points on the road stretch.

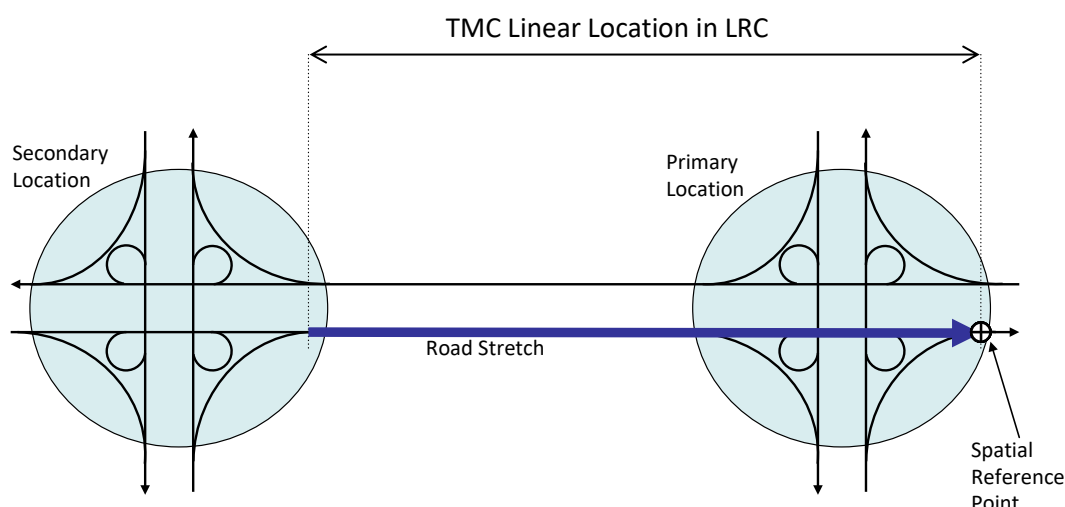


Figure 46 TPEG2-TFP Application of TMC location references and spatial reference point

If TMC location referencing is used as location referencing method, then the Spatial Reference Point shall be always the Primary Location. As the TMC Primary Location defines only an intersection and is thus not very accurate the following convention is applied in TFP for TMC locations: the Spatial Reference Point for TMC locations is the position on the road stretch where the last entry or exit in driving direction is entering or leaving the road stretch (see Figure 46 above).

6.2.2 TPEG2- ETL: Internal and External TMC link inclusion/exclusion

TPEG has defined an “Extended TMC location reference” (to become part of ISO 17572-2) to enable specific inclusion/exclusion of the TMC internal links of the primary and secondary location, as to reference entries and exits of a TMC location.

Figure 47 shows the definition of the TMC internal road segments (TMC internal links; shown for primary and secondary location) and TMC external road segments (TMC external links; shown for the primary location only in this figure). Figure 47 graphic is detailing internal and external TMC through road section of the primary and secondary location. In the sample location reference the internal TMC links of the primary location are included; the internal TMC links of the secondary location are not.

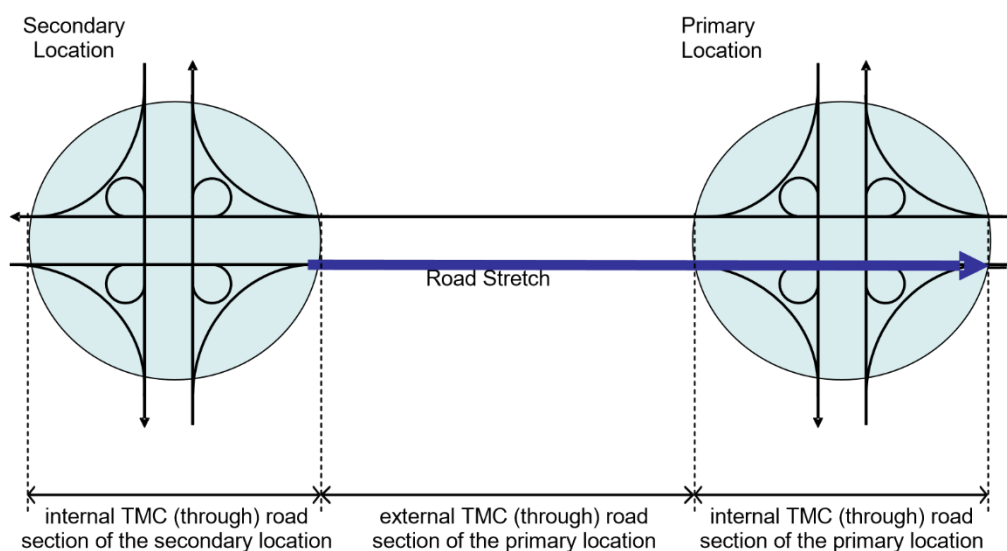


Figure 47 Internal and external TMC

An Extended TMC location reference in TPEG2-ETL contains two Boolean flags to indicate whether these TMC internal links of the primary and secondary location are considered to be part of the location to be resolved or not. Specifically, in ETL:

- The Boolean 'useInternalPrimaryLocation' indicates whether the TMC internal (through) road segments of the primary location shall be considered part of the location to be referenced or not.
- The Boolean 'useInternalSecondaryLocation' indicates whether the TMC internal (through) road segments of the secondary location shall be considered part of the location to be referenced or not.

By setting or unsetting these two Boolean flags the location reference can signal explicitly whether the location reference to be conflated shall include or exclude the TMC internal links of the primary and/or secondary location.

6.2.3 TPEG2- ETL: referencing entries and exits of TMC locations

TPEG has defined an "Extended TMC location reference" (TPEG2-ETL; to become part of ISO 17572-2) to enable specific inclusion/exclusion of the TMC internal links of the primary and secondary location, as to reference entries and exits of a TMC location.

Based on an extent 0 TMC location, with Extended TMC location referencing it is possible to refer to an entry or exit of that location, and if multiple entries or exits exists, which one.

Figure 48 below shows a sample TPEG2-ETL coding for an Entry location.

In this coding, the main through road is excluded since the flag 'useinternalprimarylocation' is not set; it is an entry since the Boolean 'isexitoreentry' has value False (i.e. Entry). It is also the first entry of in total one entries in this direction.

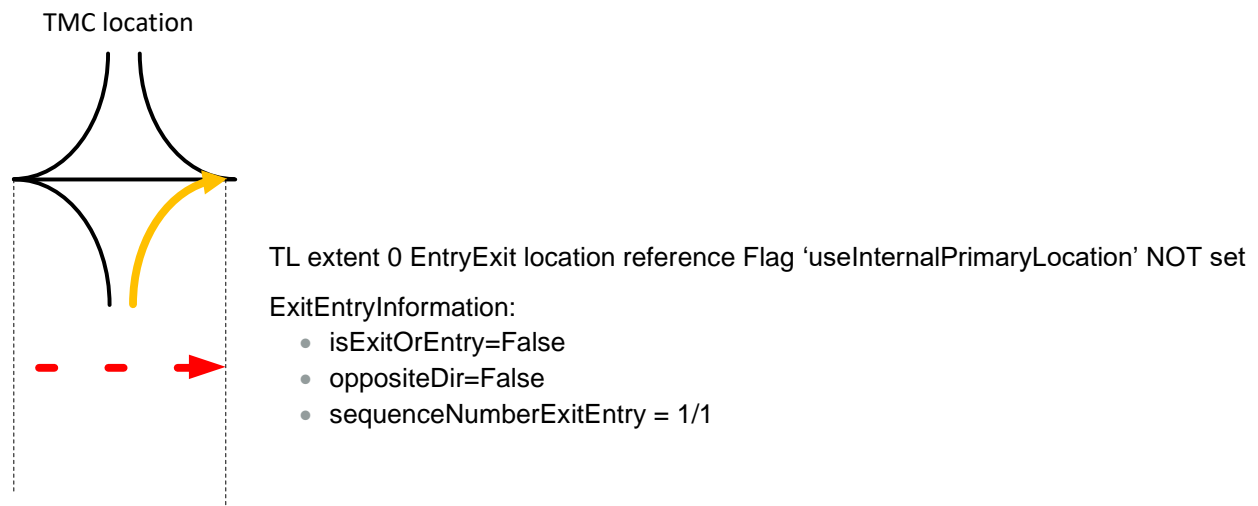


Figure 48 Sample ETL ExitEntry location to an entry location in driving direction left to right

Multiple entries and exits

To identify which of potentially multiple entries or exits is meant/affected by the content of a location based message, TPEG2-ETL contains two further fields to identify the specific entry or specific exit, as follows:

- totalNumberOfExitEntries
- sequenceNumberExitEntry

The total number of exit or entries defines the total number of exit or entries in a direction. Exits and entries are counted and totalled separately. Per driving direction separate counts and totals are maintained.

The SequenceNumber identifies in case of an exit the affected exit vs total number of exits on one side of the road, or in case of an entry the affected entry vs total number of entries on one side of the road. This SequenceNumber start at 1 up to total number of exits, respectively entries, and the first exit or entry encountered in driving direction shall be numbered 1.

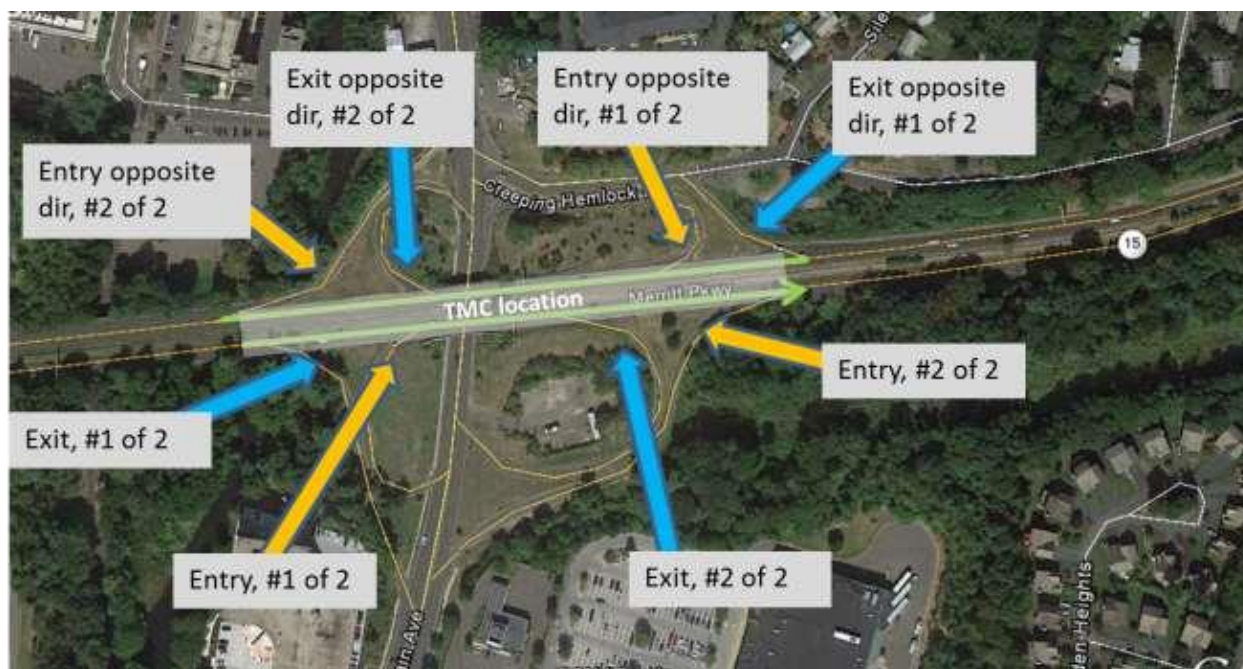


Figure 49 Example ETL entry/exit coding for a TMC location with multiple ramps

In Figure 49 above an example is shown for a complex intersection with multiple exits and entries on both sides of the road. This is an example of a complicated intersection with a bi-directional extent 0 TMC location reference. In TPEG2-ETL, the exits and entries are coded with the attribute settings as in the following table:

	IsExitOrEntry	oppositeDir	sequenceNumberExitEntry
First Exit	True	False	1/2
Second Exit	True	False	2/2
First Exit opposite side	True	True	1/2
Second Exit opposite side	True	True	2/2
First Entry	False	False	1/2
Second Entry	False	False	2/2

Table 2 Example of how exits and entries are coded

Note that the 'SequenceNumberExitEntry' counts separately per side and per type (Entry or Exit).