

## DATA STRUCTURE REFERENCE SYSTEM

The reference system is needed for to locate track-side elements (changes in maximum speed, changes in gradients, location to display text, end of authority,...) which are given as a distance from the nominal position of a certain BG.

The BG which serves as a location reference for a track-side side element can be any already passed BG as well as announced BG's still in advance of the train.

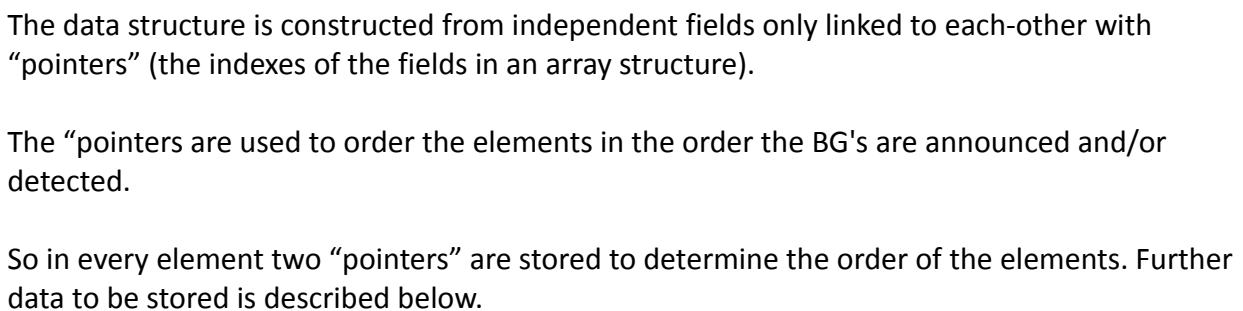
The train position is known as a (minimum, estimated and maximum) distance from the detected position of the "last relevant BG" (LRBG) which is the last detected linked BG. "Linked" means that the BG is marked as linked, thus that the distance between the BG's nominal position and the nominal BG of the first BG in rear might (but not shall!) be known.

The distance between the train front end and a track side element can be calculated as:  
the distance between the detected position of the LRBG and the track-side element minus  
the distance between the detected position of the LRBG and the train front end.

The minimum and maximum distance between the detected position of the LRBG and the train front end are known by measurement (odometer) and  
the distance between the nominal position of the "original reference BG" (ORBG) and the track-side element is given from track-side.

Thus the distance between the nominal position of the ORBG and the detected position of the LRBG shall be calculated for all ORBG's (detected as well as announced).

Announced BG      linked BG      unlinked BG or Oldest BG      Empty field



Additional variables to be stored per announced BG:

1. A qualifier indicating that the BG is announced (possible values: announced, linked, unlinked)
2. BG identifier NID\_BG/NID\_C
3. Expected passing direction
4. Linking distance to the previous BG (might be unknown in case of repositioning).
5. The calculated minimum, estimated and maximum distance from the nominal position of the BG to the detected position of the LRBG (positive in the driving direction, thus normally negative for announced BG's)
6. Installation accuracy of the BG: from LOCACC
7. Linking reaction

Additional variables to be stored per detected BG (including the LRBG):

1. A qualifier indicating if the BG is linked (possible values: announced, linked, unlinked)
2. BG identifier NID\_BG/NID\_C
3. The direction in which the BG was passed (nominal, reverse or unknown)
4. The linking distance to the first linked BG in rear of the BG  
(for BG "i": Dlink\_i-1\_i, i.e. the linking distance from the first BG in rear of BG "i" (which is BG "i-1") to BG "i".)
5. The calculated minimum, estimated and maximum distance from the nominal position of the BG to the detected position of the LRBG (positive in the driving direction, thus normally positive for detected BG's in rear of the LRBG.  
For the LRBG these distances are equal to the maximum and minimum distance from the nominal to the detected position of the BG.
6. Minimum and maximum distance between the nominal and the detected location of the BG (for BG "i": Dmin\_nom-det\_i and Dmax\_nom-det\_i)
7. A "pointer" to (the index of) the first linked BG in rear of the BG  
*thus if a BG is detected, for the newly detected BG this "pointer" will always "point" to the structure where the previous LRBG was stored.*
8. A "pointer" to (the index of) the first linked BG in advance of the BG  
*thus if a linked BG is detected this "pointer" will "point" to the newly detected BG, from the previous LRBG and all unlinked BG's between the previous LRBG and the newly detected BG.*
9. The time the BG was detected (time stamp)
10. The odometer values (minimum, estimated and maximum distance since start-up) at the moment the BG was detected.
11. The distance from the BG to the furthest track-element which uses the BG as the "original reference BG" (ORBG).

Generic data to be stored:

1. "pointer" to (index of) the data structure where the information concerning the LRBG is stored.
2. "pointer" to (index of) the data structure where the information concerning the expected BG is stored
3. "pointer" to (index of) the data structure where the information concerning the most rear (not yet deleted) BG is stored
4. "pointer" to (index of) the data structure where the information concerning the most rear actual BG (i.e. BG to which track-elements not yet passed) are referring.

5. "pointer" to (index of) the data structure where the information concerning the furthest announced BG is stored.
6. "pointer" to (index of) the first free BG structure: element of the data structure where the next announced or (not announced before) detected BG shall be stored.

Functions working on the data structure:

- Receiving linking information (packet 5)
  - for BG's in advance of the LRBG
  - (partly) for BG's in rear of the LRBG
  - (partly) for BG's in rear of the LRBG and excluding some already detected linked BG's (which shall be stored as unlinked BG's for further use)
- Detecting a BG (consistency checking is assumed before this function):
  - detecting an unlinked BG
  - detecting the expected BG
  - detecting an announced BG not being the expected BG
  - detecting a linked BG while no BG is announced
  - detecting a not announced linked BG while others are announced
- Deleting BG information and free the data structure when all related track-elements are passed.

If the data structure is full when a new BG is detected (which was not announced) or announced, then the BG shall not be stored.

If a BG was detected and the received BG-message includes location based data, this data shall be stored with the remaining LRBG as reference and the distance increased by the estimated distance between the LRBG and the detected BG (safe solution).

As the BG information is not stored and the new detected BG will not become LRBG, it is not reported to the RBC and will thus not be used as reference BG in RBC messages.