Time Distance Diagram

A time distance diagram is a very important tool for making timetables. Planning departments make hundreds of them every year.

On a time distance diagram, you see the headways of the trains on a rail section. On one axis you see the distance. On the other axis you see the time. The line represents the movement of the train over time.

We use a vertical line on the graph to depict that the train has temporarily stopped moving. While this can be anywhere on the track, in a regular situation, this will be at a station.

The speed difference between kinds of trains is the most defining feature for the capacity of a rail track.

On separate tracks, a faster interstate train covers more distance in less time than a slower, local train.

On a single track, however, the speed of the faster moving train is restricted by a slower moving vehicle in front of it. The faster train will have to reduce speed and keep a safe distance.

However, this can be avoided by constructing an overtake or passing station on a single track.

Another alternative is two separate tracks for fast and slower trains. This is more efficient, but can be very expensive and difficult to construct in densely populated areas. Thus it is more common to have several types of trains on one track.

But single tracks incrue another issue: braking distances for railway vehicles significantly exceed the viewing range of the driver. This means that on a single track, as soon as a driver sees the vehicle ahead, he is already too late to prevent a collision.

For regular train movements, train separation requires a system which works independently from the viewing range of the driver.

To solve this, signals are used to indicate safe or no passage. A basic signaling operation is called the fixed block control system.

As long as a train occupies a block, no other train is allowed to enter that particular block. This ensures a safe distance between trains.

The time interval in which a section of track is used by a train and therefore blocked for other trains is called the blocking time.

In the time-distance diagram, this can be indicated by blocks. The so-called blocking- time stairway represents the operational use of a line by a train.

Blocks of other trains may not overlap. The blocking time is the minimum time interval between two trains.

A way to improve capacity is by modifying the signaling arrangement. More signals means shorter blocks.

By increasing the amount of block sections the minimum distance between trains is reduced and capacity increases.

A development in block operations is the moving block. Instead of dividing a railway track in fixed blocks, the moving block operation essentially recognizes the actual train. This is done by maintaining a virtual block, which moves together with the train.

Fixed signals along the track become useless if the blocks they have to guard are moving.

Therefore, methods are developed to display this information directly in the train driver's cabin. This is a high-end control system to increase train frequency in a safe way.

But, it requires a communication link between each train and the control center, where the required train separation distances. These are calculated so train(driver)s can be updated on their allowed velocity.

Moving block operations are still under development, but will become the standard in the near future.