The Assignment Model

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Assignment model

- Trans-Tools operates in 5 separate networks:
  - Road network (Person cars in 3 modes and Trucks)
  - Rail passenger network (Persons in 3 modes)
  - Air passenger network (Persons in 3 modes)
  - Rail freight network (Tonnes)
  - Waterways networks (Tonnes in 5 CEMT-classes)

- In each of these networks the assignments are carried out independently and therefore each assignment can be started separately

- However most following models will expect results for each network – so for instance you need to have assignments results from the road network, the rail passenger network and the air network to run the passenger model
Assignments more than just loading traffic in the network

- Passenger model
  - Operates in NUTS3-level
  - **For Air and Rail**: Number of passengers in each trip purpose per year
  - **For Road**: Number of passengers and vehicles in each trip purpose per year

- Freight models (Freight Trade, Modal Split and Logistic)
  - Operates in NUTS2-level
  - **Waterways and Rail**: Tonnes in each NSTR-group per year
  - **For Road**: Tonnes and vehicles in each NSTR-group per year

- The assignment model operates on NUTS3-level. In most networks an average year day is assigned (except roads). Conversions before and after the assignments are therefore necessary

- The conversions are run as part of the Assignment models
Conversions before assignment

- Before assignments:
  
  Freight:
  - All freight matrixes are split into NUTS3-level
  - For freight rail the tonnes are summed and divided by 365
  - For waterways tonnes are split into the 5 different SHIP-types (CEMT2 to CEMT6) and divided by 365.

  Passenger:
  - Passenger matrixes for rail and air are divided by 365

  Special for road:
  - Furthermore both cars and trucks are divided into different periods and trip distances to calculate congestion correct

  All matrixes are converted into ZoneID (1 to 1269) from NUTS3-code
Road assignment

- Road assignment is carried out 7 periods

- First the year is divided into 4 day types
  - Normal weekday (NWD) – 200 days
  - Weekday in summer (WD) – 35 days
  - Weekend day (WE) – 110 days
  - Holyday (HO) – 20 days

- Secondly the Normal weekday is divided into long and short trips (250 km)
  - Short trips
  - Long trips (DA)

- Finally the short trips are split into 3 time periods
  - Morning peak hour - 7 am to 9 am (AM)
  - Afternoon peak hour - 3 pm to 5 pm (PM)
  - Outside peak hour (OP)
Overview of conversions before assignments

Freight
- Converts trip Matrix to N0
- Divides the volumes by 365 and changes the ID
- Calculates VEH
- Calculates TRAFFIC
- Calculates truck's and cars to one road matrix

Passenger
- Converts trip Matrix to N0
- Divides the volumes by 365 and changes the ID
- Calculates VEH
- Calculates TRAFFIC

Road
- Calculates VEH
- Calculates TRAFFIC
- Calculates truck's and cars to one road matrix
Road Assignment – Calculation order and preloads

- To model congestion correct in the network local traffic has to be preload

- The user has to specify preload for the 6 of the 7 assignment periods
  - AM, PM, OP, WE, WD and HO

- The calculation will carried out in the following order
  1. AM (with AM preloaded)
  2. PM (with PM preloaded)
  3. OP (with OP preloaded)
  4. DA (with the results of the 3 first assignments preloaded)
  5. WD (with WD preloaded)
  6. WE (with WE preloaded)
  7. HO (with HO preloaded)
Assignment inputs

- Network
  - Network.mdb\* (networks and short distance preload table)

- Matrixes
  - \N2Matrixes.mdb\N2FreightRailWithLogisticsTripMatrix
  - \N2Matrixes.mdb\N2FreightRoadWithLogisticsTripMatrix
  - \N2Matrixes.mdb\N2FreightWaterwaysWithLogisticsTripMatrix
  - \N3Matrixes.mdb\N3PassengerAirTripMatrix
  - \N3Matrixes.mdb\N3PassengerRailTripMatrix
  - \N3Matrixes.mdb\N3PassengerRoadVehicleMatrix
  - \FreightLOSCosts.mdb\* (tables for calculating freight transportation costs)

- Input (not scenario dependent)
  - *.mdb\* (parameters for splitting matrixes and assignment parameters)

- Zones
  - \Zones.mdb\N3ZoneData
Road assignment - Iterations

- Each of the seven different matrixes are assigned in the network with the following settings:
  - Morning peak hour (AM): 50 Iterations (user equilibrium)
  - Afternoon peak hour (PM): 50 Iterations (user equilibrium)
  - Outside peak hour (OP): 100 Iterations (stochastic user equilibrium)
  - Long trips (DA): 150 Iterations (stochastic user equilibrium)
  - Weekday in summer (WD): 50 Iterations (stochastic user equilibrium)
  - Weekend day (WE): 50 Iterations (stochastic user equilibrium)
  - Holyday (HO): All-or-Nothing
Other Assignments - Iterations

- Air assignment:
  - 200 iterations (stochastic user equilibrium)

- Rail passenger
  - 200 iterations (stochastic user equilibrium)

- Rail freight
  - 200 iterations (stochastic user equilibrium)

- Waterways
  - 5 assignments (each CEMT class is assigned for it self)
  - All 5 assignments carried out as All-or-Nothing
The calculation folder

- All temporary results during the assignment can be found in the calculation folder

- The folder is divided into 5 subfolders - 1 for each network

- It stores the calculated matrixes for the assignments in each network in a database called TripMatrix?.mdb

- Raw assignment results on link and connector level are stored in databases called Results?.mdb. (raw link results are without preloads)

- Raw assignment results on zone-to-zone level (LOS-matrixes) are store in CSV-files called CostMatrix?.csv

- Each time a assignment is executed all temporary results are overwritten
Conversions after assignments – Level-of-Service

- From the raw assignment output length, times, toll costs and generic costs are collected.

- For the road network the raw cost matrixes for each period are weighted together to one average year day matrix.

- For waterways the raw cost matrixes for each CEMT-class are weighted together.

- For freight the matrixes are aggregated back to NUTS2-level.

- For freight matrixes the transportation costs are calculated from length and time costs:
  - For Road and Rail based on an average load size, time cost and length cost per NSTR group.
  - For Waterways based on a time cost and length cost for each CEMT type.
Conversion after assignments – Link level results

- For roads all link results are summed with the preload in the period
  - Flows and speeds for cars and trucks are calculated for a normal weekday
  - Flows and speeds for cars and trucks are calculated for an average year day

- For air and rail passengers the total number of passengers on a normal weekday is calculated

- For waterways, rail freight the tonnes on an average year day are calculated

- A table with driven kilometers/driven tonnes kilometers in each country (for road further subdivided in motorways, non urban roads and urban roads)

- A table containing the revenue of toll and generic costs on NUTS2-level
Assignments outputs

- **Flow**
  - `AirFlow.mdb\AirLinkFlows`
  - `RailPassengerFlow.mdb\RailPassengerLinkFlows`
  - `RailFreightFlow.mdb\RailFreightLinkFlows`
  - `WaterwaysFlow.mdb\WaterwaysLinkFlows`
  - `RoadFlow.mdb\RoadLinkFlows` (normal weekday)
  - `RoadFlow.mdb\RoadLinkFlows_Detailed` (each assigned matrix)
  - `RoadFlow.mdb\RoadLinkSpeeds` (resulting speeds)
  - `TrafficVolumesForImpactModels.mdb\TrafficVolumesForImpactModels`

- **Matrixes**
  - `N3CostMatrixes.mdb\N3PassengerAirCostMatrix`
  - `N3CostMatrixes.mdb\N3PassengerRailCostMatrix`
  - `N3CostMatrixes.mdb\N3PassengerRoadCostMatrix`
Assignments outputs 2

- Matrixes
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2Revenue
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2FreightRailCostMatrix
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2FreightRailConnectivityMatrix
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2FreightRoadCostMatrix
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2FreightRoadConnectivityMatrix
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2FreightWaterwaysCostMatrix
  - \textbackslash N2\textbackslash Matrixes.mdb\textbackslash N2FreightWaterwaysConnectivityMatrix
# Output on zone-to-zone level - Cost Matrix

## Road Passenger (NUTS 3 Level)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FromZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td>Between Trans-Tools European NUTS 3 zones described by six digit numbers (1010100-)</td>
</tr>
<tr>
<td>ToZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td></td>
</tr>
</tbody>
</table>
| TripPurpose     | Long  | Number  | 1 = Business  
2 = Private (including commuters)  
3 = Holiday |
| Length          | Double| KM      | Travel distance including connector length                                  |
| FreeTime        | Double| Hour    | Driving time excluded congested time                                        |
| CongTime        | Double| Hour    | Congested driving time                                                      |
| FerrySailingTime| Double| Hour    | Sailing time if ferry is used otherwise 0                                   |
| FerryWaitingTime| Double| Hour    | Waiting time if ferry is used otherwise 0                                   |
| TollCost        | Double| Euro per vehicle | Toll costs per vehicle including ferry costs}|
### Rail Passenger (NUTS 3 Level)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FromZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td>Between Trans-Tools European NUTS 3 zones described by six digit numbers (1010100- )</td>
</tr>
<tr>
<td>ToZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td></td>
</tr>
</tbody>
</table>
| TripPurpose         | Long    | Number      | 1 = Business  
2 = Private (including commuters)  
3 = Holiday          |
| AccessEgressLength  | Double  | KM          | Sum of connectors’ length                                                   |
| AccessEgressTime    | Double  | Hour        | Sum of connectors’ time                                                     |
| OnboardLength       | Double  | KM          | Travel distance (include ferry distances)                                  |
| OnboardTime         | Double  | Hour        | In-vehicle time excluded sailing time                                       |
| FerrySailingTime    | Double  | Hour        | Sailing time if ferry used otherwise 0                                     |
| Frequency           | Double  | Depar. per day | Average frequency between origin and destination                           |
Output on zone-to-zone level - Cost Matrix (3)

Road Freight (NUTS 2 Level)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FromZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td>Between Trans-Tools European NUTS 2 zones described by six digit numbers (1010100-)</td>
</tr>
<tr>
<td>ToZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td></td>
</tr>
<tr>
<td>Commodity</td>
<td>Long</td>
<td>NST/R</td>
<td>Commodity groups 0-10</td>
</tr>
<tr>
<td>Length</td>
<td>Double</td>
<td>KM</td>
<td>Transport distance including connector length</td>
</tr>
<tr>
<td>FreeTime</td>
<td>Double</td>
<td>Hour</td>
<td>Driving time excluded congested time</td>
</tr>
<tr>
<td>CongTime</td>
<td>Double</td>
<td>Hour</td>
<td>Congested driving time</td>
</tr>
<tr>
<td>FerrySailingTime</td>
<td>Double</td>
<td>Hour</td>
<td>Sailing time if ferry is used otherwise 0</td>
</tr>
<tr>
<td>FerryWaitingTime</td>
<td>Double</td>
<td>Hour</td>
<td>Waiting time if ferry is used otherwise 0</td>
</tr>
<tr>
<td>TollCost</td>
<td>Double</td>
<td>Euro per tonnes</td>
<td>Toll costs per vehicle including ferry costs</td>
</tr>
<tr>
<td>DrivingCost</td>
<td>Double</td>
<td>Euro per tonnes</td>
<td>Calculated costs depending on distance and time</td>
</tr>
<tr>
<td>BorderCrossings</td>
<td>Double</td>
<td>Number</td>
<td>Number of critical border crossings (0=no critical crossing)</td>
</tr>
</tbody>
</table>
## Rail Freight (NUTS 2 Level)

<table>
<thead>
<tr>
<th>Name</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FromZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td>Between Trans-Tools European NUTS 2 zones described by six digit numbers (1010100-)</td>
</tr>
<tr>
<td>ToZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td></td>
</tr>
<tr>
<td>Commodity</td>
<td>Long</td>
<td>NST/R</td>
<td>Commodity groups 0-10</td>
</tr>
<tr>
<td>AccessEgressLength</td>
<td>Double</td>
<td>KM</td>
<td>Sum of connectors’ length</td>
</tr>
<tr>
<td>AccessEgressTime</td>
<td>Double</td>
<td>Hour</td>
<td>Sum of connectors’ time</td>
</tr>
<tr>
<td>OnboardLength</td>
<td>Double</td>
<td>KM</td>
<td>Transport distance</td>
</tr>
<tr>
<td>OnboardTime</td>
<td>Double</td>
<td>Hour</td>
<td>Transport time</td>
</tr>
<tr>
<td>BorderCrossings</td>
<td>Double</td>
<td>Number</td>
<td>Number of critical border crossings (0=no critical crossing)</td>
</tr>
<tr>
<td>Cost</td>
<td>Double</td>
<td>Euro per tonnes</td>
<td>Calculated costs depending on distance and time</td>
</tr>
</tbody>
</table>
Output on zone-to-zone level - Cost Matrix (5)

Inland Waterways Freight (NUTS 2 Level)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FromZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td>Between Trans-Tools European NUTS 2 zones described by six digit numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1010100- )</td>
</tr>
<tr>
<td>ToZoneID</td>
<td>Long</td>
<td>1010100-</td>
<td></td>
</tr>
<tr>
<td>Commodity</td>
<td>Long</td>
<td>NST/R</td>
<td>Commodity groups 0-10</td>
</tr>
<tr>
<td>AccessEgressLength</td>
<td>Double</td>
<td>KM</td>
<td>Sum of connectors’ length weighed across ship types</td>
</tr>
<tr>
<td>AccessEgressTime</td>
<td>Double</td>
<td>Hour</td>
<td>Sum of connectors’ time weighed across ship types</td>
</tr>
<tr>
<td>OnboardLength</td>
<td>Double</td>
<td>KM</td>
<td>Sailing distance weighted across ship types</td>
</tr>
<tr>
<td>OnboardTime</td>
<td>Double</td>
<td>Hour</td>
<td>Sailing time weighed across ship types</td>
</tr>
<tr>
<td>Price</td>
<td>Double</td>
<td>Euro per tonnes</td>
<td>Calculated costs depending on distance and time weighed across ship types</td>
</tr>
</tbody>
</table>