WHITE PAPER
Historical Traffic Information

Introduction

TomTom has a legacy of developing innovative navigation and traffic solutions from years as a leading provider to the market. Leveraging its innovations with community feedback, TomTom is able to use anonymous GPS measurements, globally, and to build a picture of road-network performance that is completely unique in the industry. Since 2007, over 5 trillion anonymous consumer-driven GPS based measurements have been collected from TomTom users around the world. With over 50 million TomTom GPS navigation devices already in use, and growing every day, the historical traffic information collected in this way gives valuable insight into the traffic situation on the road network throughout the day.

With engineers and planners seeking data to support sophisticated traffic models and to assist in analysing road conditions and traffic performance, consumer-driven and highly detailed roadway data is becoming more and more valuable. With its historical traffic information TomTom can provide highly granular speed and bottleneck information for roads around the world. TomTom's ever-expanding historical traffic database makes it possible to obtain actual driven travel times, speeds and a traffic volume indicator on any stretch of road over any period of time and time of day. The historical data collected by TomTom covers major motorways, regional, state and local highways, arterials and many local streets throughout Europe, North America and other markets throughout the world. TomTom can provide detailed traffic analysis on the entire network instead of only the fixed locations where measurement equipment is available, so offering valuable insights into traffic conditions for a variety of users. Nearly 40 countries are currently populated with historical traffic information.

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The need for traffic analysis for government and commercial organisations

Countries all over the world are affected by increasing car ownership and traffic volumes leading to intensifying congestion problems on their road networks.

The negative impact this congestion has on the economy and environment has led to the topic being given a high profile for attention at the relevant government agencies, both regional and national. Addressing the causes is time-consuming and expensive, and therefore detailed and reliable decision-making support tools are required for experts and policy-makers to make timely and cost-effective decisions on changes to their local traffic system. These experts need accurate and comprehensive information about travel times, traffic speeds, volumes and local accessibility and travel patterns - the basic building blocks for forming a cohesive traffic management & infrastructure plan.

Traffic data is also valuable for commercial organisations. Property developers, market research firms, outdoor advertising agencies and planning & engineering firms are always in search of reliable information about what is happening on our road networks for all their location based analysis & planning. Whether it is for the purpose of maximizing the value of their advertisements or evaluating the suitability of one or several sites.

TomTom historical traffic information can be used for the following activities, among others:

- Network performance monitoring
- Road network bottleneck reporting
- Noise and emission hotspot identification
- Before and after studies of changes in the road infrastructure
- Performance analysis of intersections
- Site location studies and advertisement valuation

Traffic Data Sources

Data on both real-time and historical traffic behaviour have been collected for years using a variety of different collection methodologies. Some of the first systems using traditional technologies are still used today, but an increasing number of users are turning to the newer technologies – including floating car data.

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Traditional methodology for traffic data collection

Currently most road authorities use loops, cameras or infrared sensors to measure traffic performance. Although, these traditional systems are proven methods of collecting traffic data, they each also have certain disadvantages:

- The initial cost can be quite high because these systems involve the installation of hardware alongside the road or directly on the road surface;
- Maintenance costs can be significant, due to damage by extreme weather conditions or vandalism;
- Most of these traditional systems are not able to accurately measure travel times and can only provide estimated speeds at point locations;
- While camera systems with automatic license plate recognition can measure travel times, they cannot measure differences in speed between two camera locations or provide local-level speed measurements along the trajectory;
- Camera and loop systems require calibration and validation before they can provide reliable measurements.

Floating Car Data Methodology for traffic data collection

Floating Car Data (FCD) provides a new method for measuring speeds, travel times and thus road performance. Probe devices in vehicles, which may be cellular phones, or more commonly GPS devices, provide this FCD data. As these vehicles with probe devices are free to travel anywhere on the road network they are called 'floating' probes and are not limited to roadside infrastructure to communicate with the FCD system. FCD can, as a result, measure traffic speeds everywhere probe vehicles are travelling, providing a number of major advantages when compared to the traditional methods described above:

- FCD does not require any installation or main¬tenance of roadside equipment, saving con¬siderable costs and avoiding any interruptions to traffic flow;
- FCD provides information on the entire road network and is not restricted to sections where road infrastructure has been installed;
- FCD measures speeds and travel times on longer stretches as well as the variance in speed along the way;
- FCD provides accurate data on any complex trajectory;
- FCD is most dense where there is congestion, hence increasing the accuracy and confidence in the data;
- FCD is environmentally friendly because it does not require any extra hardware or energy;
- FCD replaces a large amount of fieldwork with desk work, providing cost savings and allowing efficient allocation of resources to the true problem areas on the network.

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TomTom Historical Traffic Data

Historical traffic information is collected by millions of TomTom navigation device users who voluntarily agree to share their anonymous usage statistics. When connecting their GPS device to their computer - using free desktop software TomTom HOME - these users report data anonymously for each of their journeys. As a result, TomTom now has a database containing more than 5 trillion measurements, collected since 2007 from millions of TomTom users. Every day, more than 6 billion new measurements are added to the database and this figure increases exponentially.

TomTom is the only company in the world leveraging this kind of information primarily from passenger vehicles. Over 50 million TomTom users globally make this possible. The devices provide an anonymous log file of speed measurements on the roads over which the devices have travelled. All of this information was initially collected to provide TomTom's customers with a superior navigation experience, based on services such as HD Traffic and IQ Routes. Today, TomTom provides these anonymous data sources to the government and enterprise market in new forms, including through the Traffic Stats internet portal.

Although TomTom uses both GPS-based FCD and GSM-based FCD in the real time traffic services, the historical database used by TomTom for the historical traffic products described in this white paper uses only GPS measurements and does not include any cell phone derived trace data.
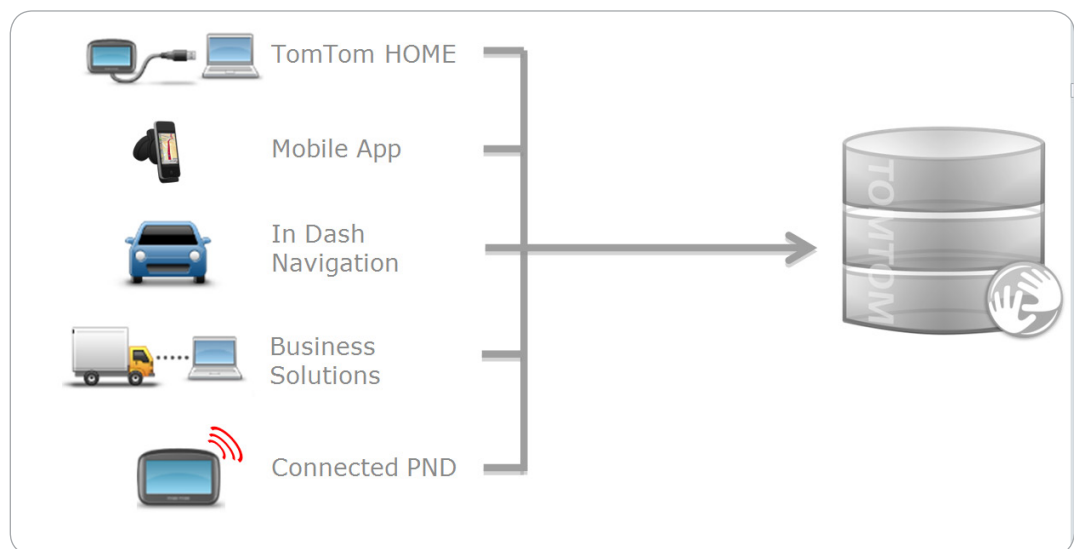

Figure 1 - Different sources contributing to TomTom historical traffic database

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Unique Characteristics

TomTom's historical traffic database has a number of unique characteristics, including:

- The database contains a very large sample size, filled by millions of different drivers. This means that the measurements provide a representative picture of what is actually happening on the road. These measurements are not dependent on specific drivers or survey samples. Because measurements are continually being made, the information is not vulnerable to, for example, bad weather conditions on one or two surveyed days.
- The database is primarily filled with information from passenger cars as opposed to delivery fleets or goods vehicles. This means that it provides a very clear picture of the traffic and travel conditions on the road network – unrestricted by speed limiters or heavy goods movement.
- The historical GPS speed measurements are accurately matched to TomTom's detailed road map, by individual road segment. The road segments are very detailed, ranging in length from approximately 1 metre to less than 2 kilometres (1 yard to around 1 mile). Road segments are split at every intersection or change in geometry, providing a highly granular view of the road network.

Historical Data Processing

TomTom processes the raw GPS information received from customers in a number of ways in order to protect privacy, filter out possible inaccurate measurements and create geographic databases which can be queried. The most important part of this process is map-matching.

In the map-matching process, the GPS measurements are matched to a digital map using a map-matching algorithm. This process assigns each GPS speed measurement to a road segment with the highest possible confidence level. The algorithm looks at the path of consecutive GPS points in a journey file to define the path of a vehicle in order to produce the most accurate speed information possible. For example, the map-matcher filters out traces which could not be matched to a map (due to, for example, changes in the road infrastructure, the use of the GPS device outside a vehicle, etc.), detects u-turns and losing GPS signals in tunnels.

When the map-matching is done, an aggregated geographic database (geobase) of measured road speeds is produced. These geobases are updated regularly for each map of each region or country to take into account the growing historical GPS speed database as well as updates and changes in the road network. This digital map with attached speed information is used as a source for all historical traffic products.
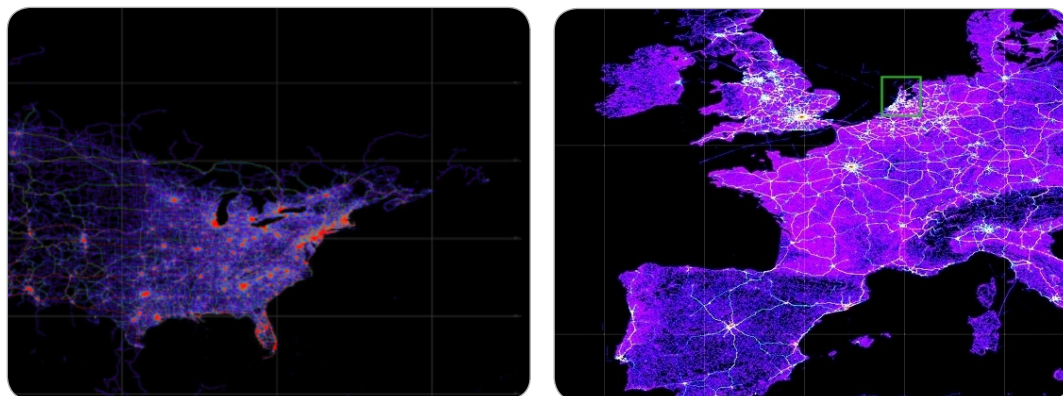
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Figure 2- Example of plots of anonymous GPS measurements in US and Europe from a few months sample from TomTom historical traffic database

Access to the data and products

TomTom makes the majority of the historical traffic information available to governments and commercial organisations:

- Through a dedicated internet portal (Traffic Stats), or
- Via an API which can access the analysis directly from partner applications (e.g. traffic modelling software), or
- The data may be provided as a bespoke service and delivery project, or
- The data may be delivered as a database file.

Traffic Stats internet portal

Historical traffic products from TomTom are being delivered in the cloud through a self-service web portal solution, called Traffic Stats. The portal ensures that with the simplest set of inputs, the user can specify a customised query for their own area / road of interest, their specific days of interest and the time periods in that date range that are of interest. The results are computed and a report is available through the portal in 24 hours – for download or viewing in the portal.
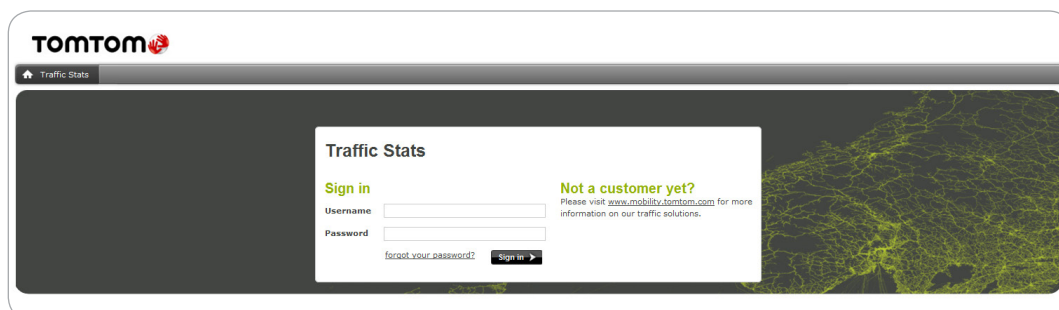

Figure 3 - Traffic Stats internet portal to access TomTom historical traffic products

Access to the Traffic Stats portal is controlled by password and subscription for the various modules, and is available from any internet enabled computer 24/7.

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Products

TomTom has an increasing number of products available that use the historical traffic database:

Custom Travel Times

This product can be used to examine specific routes on the road network for the driven travel times. Results can be viewed on a complete route level - to view statistics such as the average travel times and spread over different drivers - or to view individual road segments in fine detail to quickly discover exactly where along the route any bottlenecks occur.
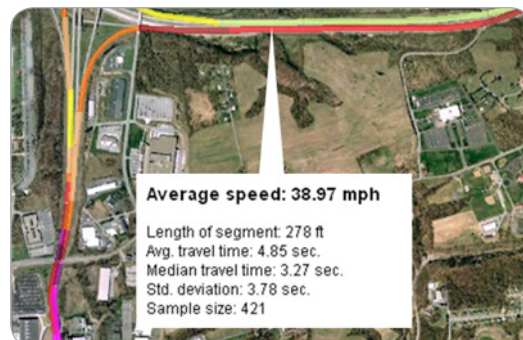

Custom Area Analysis

This product provides an overview of traffic conditions for an entire city or region. Speed and travel time statistics are given for each road segment and the output format is ideal to support traffic modelling and other more advanced applications that require detailed knowledge of speeds driven over a wide road network area.
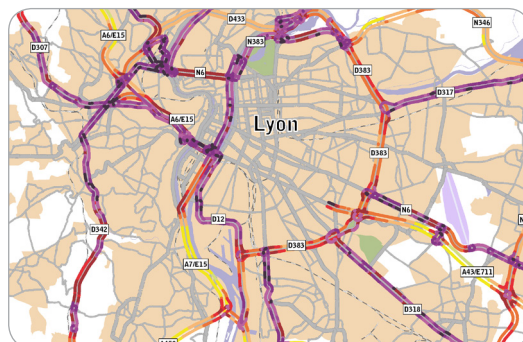

Custom Probe Counts

Governmental and business markets are offered an indicator of relative traffic density for their area of interest with this product. Customers can create queries for a set of locations or an entire area and specific date and time periods. The end result is suitable for use cases such as general site-location studies and the valuation of road-side advertisement sites.
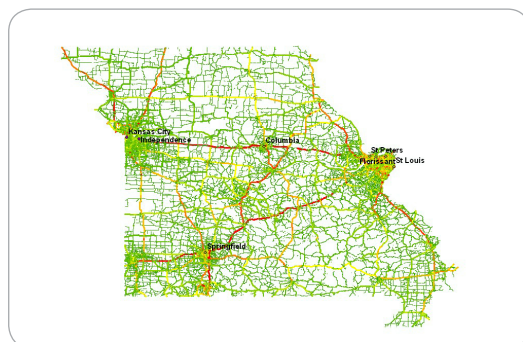
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Speed Profiles

This compact file is generated as a side file to the TomTom MultiNet map to provide the expected speed for each MultiNet road link for each 5-minute period of each day of the week. This is typically used as an onboard file in navigation devices to quickly assess the expected travel time on a route for the specific time of day.
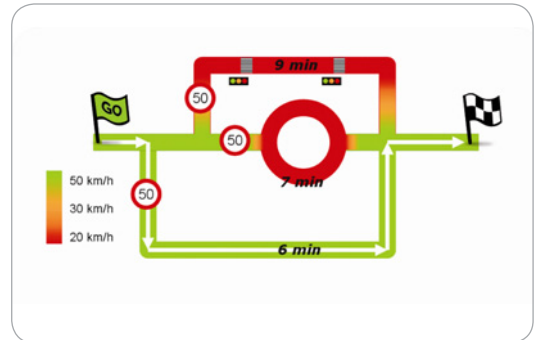

TomTom Custom Travel Times

Custom Travel Times gives access to a uniquely large database of historical travel information to the governmental and business markets to analyse specific roads or routes in fine detail.

Selection method

A Custom Travel Times query is specified and submitted in three simple steps:

1. Route
The road stretch or specific route must be defined. This can be done in an easy way through the Traffic Stats self-service portal, either by clicking on a map or entering address strings.
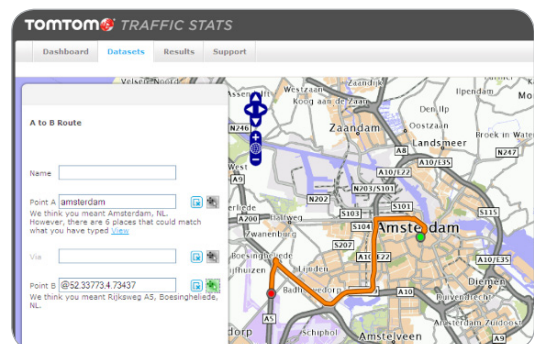

2. Date range
The specific date range of interest must be selected. This can range from a week to more than 2 years worth of data. The portal allows for filtering out days that are not interesting, for example public holidays or days with extreme weather conditions. Using the filtering of individual days it is possible to arrive at a selection for the query which includes just a single day if the user chooses.

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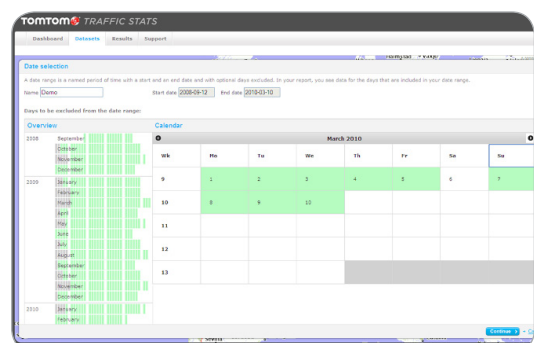
3. Time of day

The specific times of the day can be selected for the query – up to 7 time periods in the day are possible for each query. For example: night time/free flow, morning rush hour, mid day traffic and evening rush hour.
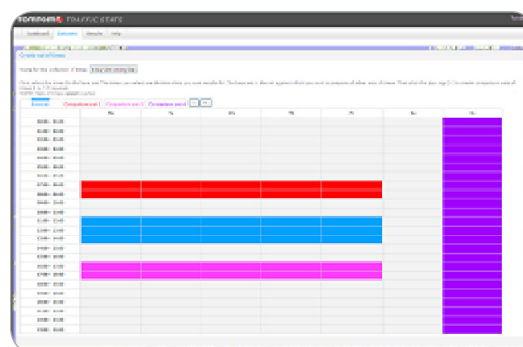
Using these selection steps it is possible to completely customise the query to give maximum flexibility and usefulness of the resulting report for the specific investigation required.

Calculation Method

Custom Travel Times has numerous applications in traffic planning, logistics and marketing. Floating Car Data is a widely accepted, recently available technique for measuring route based travel times.

There are two commonly used methods for aggregating multiple FCD journey files to calculate route travel times:

- Use FCD only from vehicles that drove the en¬tire route in question. If a sufficient number of vehicles made trips across the entire route, it is possible to determine an extremely accurate aggregated route travel time. It is possible, however, that there are in¬sufficient records from vehicles that have traversed the entire route for the period being studied.
- Use probe data from every vehicle traversing any of the road segments along the route be¬ing studied in the required time period. This means that for each of the individual road segments on the route an aggregated travel time is determined. The segment-based average or median travel times can be calculated and subsequently summed. Although this method appears reasonable at first sight, experiments and simulation show that route travel times ob¬tained with this method are misleading. For example it is wrong to include certain measurements at junctions, because travel time at junctions is turn dependent. Next to that, calculating the 'worst case' (95th percentile) route travel time can result in an overestimate of the travel time. This method bases the route travel times on 'worst cases', as if, for example, in the 95th percentile category all vehicles have to stop at all traffic lights along the route.

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Each of the above aggregation methods has benefits and limitations. TomTom's Custom Travel Times combines both methods to create the best possible solution. The method TomTom has implemented in Custom Travel Times uses full trips on the route where available, and supplements them with data from trips which only cover part of the route where necessary to improve the accuracy and confidence in the data. It also leaves out measurements that could be different to the turn dependency at intersections. In this way, the system is using as much data as possible while limiting the over/under estimation of 'worst case' travel times.
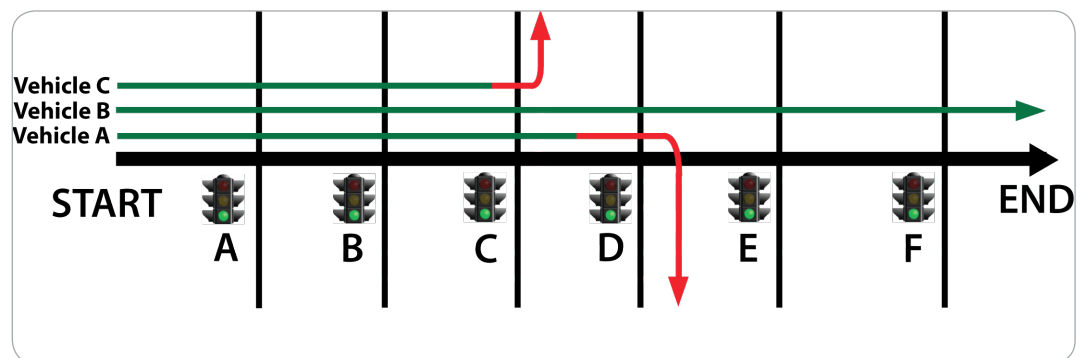
For calculation of the above route consider vehicle A, B and C have travelled across parts of the route. The green parts of every vehicle will be included in travel time calculations. Because of the turn dependent travel time of vehicle A and C just before the intersection, this part of the measurements will not be taken into account. Furthermore when calculating route based percentile values, the total travel time of a vehicle on the route is taken into account and smeared across the segments instead of just being summed per segment per vehicle. In this way it is prevented that the route based percentile value will include an 'all red lights' or 'all green lights' situation (of which the probability is very low). With this methodology an over- or underestimation of the route based percentile travel times is minimized, while as many measurements as possible are included.

Figure 4 - Illustration of which trace measurements will contribute to Custom Travel Times results

The added data from segments where a vehicle only traversed a part of the route are selected but being mindful only to include traces from vehicles that have entered the road segment and leave the road segment in the same direction (same road) as the vehicles that travel the entire route. This will avoid incorrect travel times resulting from different 'turn penalties' from vehicles slowing to take a turn off the route.

Results

The results are given in three different types of output:
- Excel file
- KML file
- Charts

The charts can be viewed within the portal – but also, because the Excel file contains all the data points used for all the charts, it is possible to create custom graphs based on the delivered data.

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Attributes contained in each output type

Excel file	Route based statistics	• Length of route
		• Sample size of unique vehicles over the entire route (or part of the route)
		• Arithmetic average travel time across the route
		• Arithmetic median travel time across the route
		• Harmonic average speed over route
		• Travel time ratio (for 'comparison set' time period compared to the 'base set' time period)
		• Average travel time across the route for the 5th percentile, 10th percentile, … , 90th percentile, 95th percentile
Charts	Route based statistics	• Harmonic average speeds per segment
		• Harmonic median speeds per segment
		• Percentile average speeds for the route
		• Cumulative arithmetic average travel time for the route
		• Relative travel time (for the 'comparison set' time period compared to the 'base set' time period)
		• Standard deviation per segment
KML file	Road segment based statistics	• Length of the segment being looked at
		• Sample size – the number of vehicles contributing to the segment data
		• Harmonic average speed on the segment
		• Arithmetic average travel time across the segment
		• Arithmetic median travel time across the segment
		• Standard deviation of average travel times
		• Travel time ratio between the 'comparison set' time period compared to the 'base set' time period

Note: Each of the variables requires a different calculation technique which can be found in most of the basic books about statistics (see Appendix of this paper for an example definition).
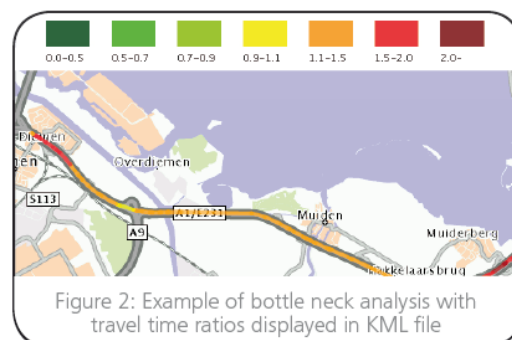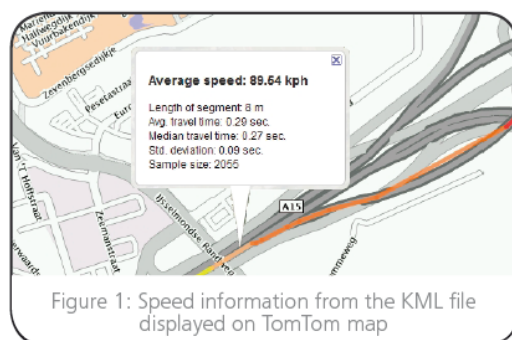
Figure 1: Speed information from the KML file displayed on TomTom map

Figure 2: Example of bottle neck analysis with travel time ratios displayed in KML file

Figure 5 - Speed information (left) and travel time ratio information (right) as presented in the Custom Travel Times KML output file

TomTom Custom Area Analysis

Custom Area Analysis offers governmental and business markets an extremely detailed set of information across a wide road network for various use cases – including bottleneck analysis, performance measurement, traffic modelling support and site location studies.

Selection method

Area, Date and Time selections are all that is required to specify a query in Custom Area Analysis in a similar way to Custom Travel Times.

- A specific area of interest (simple rectangle) is created for the user's account. The user chooses the lowest functional road class (FRC) of interest for their investigation and this is set as a part of the license area criteria. The bounding area and the FRC limit determine the extent of every query: each individual query gives results for the entire licensed area and to the entire extent of the roads within their selected FRC limit (e.g. if FRC 3 is the lowest road class in the license, the report will include all roads in the area in FRC0, FRC1, FRC2 and FRC3).
- The specific date range of interest must be selected. This can range from a week to more than 2 years' worth of data. The portal allows for filtering out days that are not interesting, for instance public holidays or days with extreme weather conditions. Using the filtering of individual days it is possible to arrive at a selection for the query which includes just a single day if the user chooses.
- The specific times of the day can be selected for the query – up to 7 time periods in the day are possible for each query. For example: night time/free flow, morning rush hour, mid-day traffic and evening rush hour.
- Using these selection steps it is possible to completely customise the query to give maximum flexibility and usefulness of the resulting report for the specific investigation required.

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Calculation Method

Individual measurements from TomTom FCD are collected for every road segment and then used to create final statistics for that segment. Based on this group of data the following statistics are determined:

- Average travel time (harmonic)
- Median travel time (harmonic)
- Travel time ratio
- Average speed (arithmetic)
- Median speed (arithmetic)
- Standard deviation of the speed
- Sample size (hits)
- 5th percentile, 10th percentile, … , 90th percentile, 95th percentile.

Note: Each of the variables above requires a different calculation technique which can be found in most of the basic books about statistics (see Appendix of this paper for an example definition).
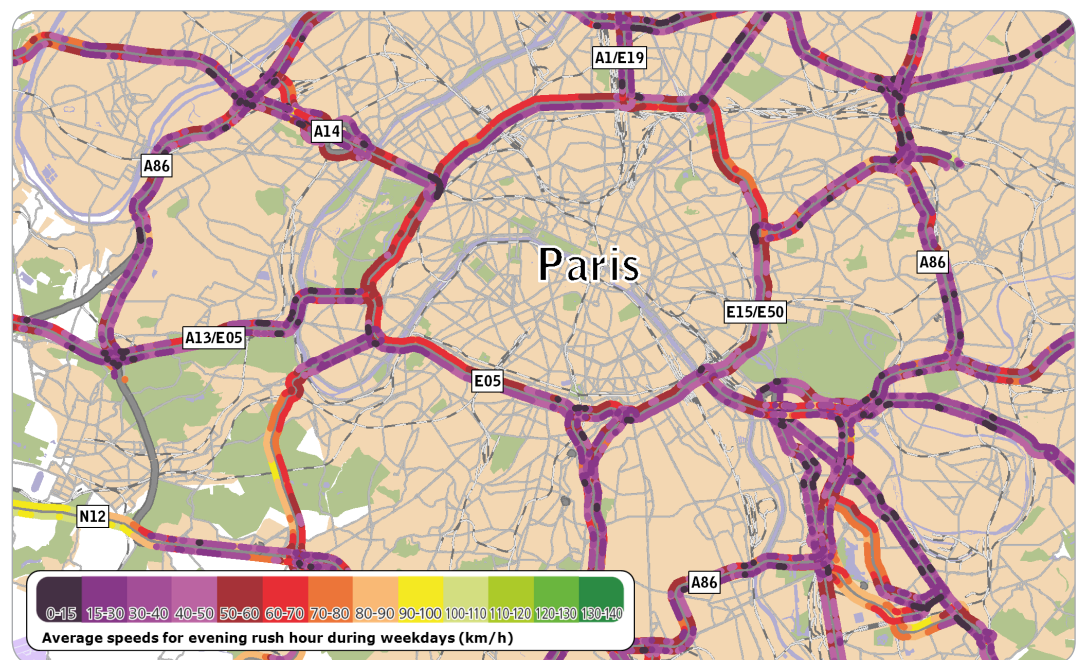
Results

Figure 7 - Peak hour average speeds on major roads in Paris using data from Custom Area Analysis

The results are given in an industry standard Esri Shapefile format containing the geometry of the road segments and a set of additional Dbase files containing the statistics per road segment.

A GIS tool can analyse and visualise the results, there are many software vendors to choose from and there are also free GIS software packages available. More information about the Esri Shapefile format can be found in the ESRI Shapefile

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Technical Description document published at the ESRI website (http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf).

An additional DBF side file will appear for each time group selected. The first defined time group will be the 'base set' (BS). This is the time group against which the ratio value of all the following time groups is calculated. The next time group (or comparison set) that is defined will be called 'CS2', the one after that 'CS3', and so on up to the maximum of 7 time groups, which would be 'CS7'.
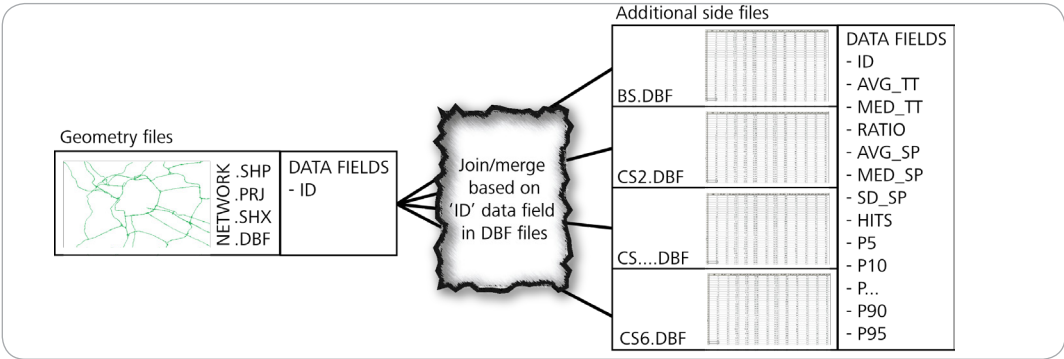

Figure 6 - Overview of the data structure of the results set

Explanation of file types

NETWORK .SHP, .SHX, .DBF, .PRJ	Sharing a same common prefix name (network), these files are necessary to describe the geometry of the road segments. Each road segment has a polyline and a unique ID value that can be used to join or merge the additional side files.
.DBF Side files	For each time group an additional DBF side file is delivered containing all the relevant statistics for that time group. Each road segment can recognized and related to the geometry using the ID value.

Explanation of the data fields within the additional DBF side files

ID	The ID for this road segment in the side file for the base set or comparison set. This field must be joined with the ID field in the network.dbf to attach the information to the actual geometry.
AVG_TT	The harmonic average travel time for this road segment in the base set or comparison set file for the selected date / time period.
MED_TT	The harmonic median travel time for this segment in the base set or the comparison set file for the selected date / time period.

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RATIO	The travel time ratio - the average travel time for the Comparison set divided by the average travel time for the Base Set (BS) for the selected date / time period.
AVG_SP	The arithmetic average speed of drivers for this segment in the comparison set in kilometres or miles per hour (depending on user preferences for the area of analysis – determined during the provisioning process) for the selected date / time period.
MED_SP	The arithmetic median speed of drivers for this segment in the comparison set in kilometres or miles per hour (depending on user preferences for the area of analysis – determined during the provisioning process) for the selected date / time period.
SD_SP	The standard deviation for the speed of drivers for this segment in the comparison set in kilometres or miles per hour (depending on user preferences for the area of analysis – determined during the provisioning process) for the selected date / time period.
HITS	The number of cars (sample size) passing over this road segment in the base set or the comparison set in the selected date / time period.
P5	The 5th percentile speed. A percentile, or centile, is the value of a variable above which a certain percent of observations fall. The 5th percentile gives the best situation, so if the 5th percentile states a speed of 123 kilometres per hour (kph) this means that 5% of the driven speeds on this segment are above 123 kph. 95% of the driven speeds are below 123 kph.
P10	The 10th percentile speed. See 'P5' for further explanation.
P…	The percentile speeds are given in steps of 5. This means that in total there are 18 percentile values.
P90	The 90th percentile speed. See 'P5' for further explanation.
P95	The 95th percentile speed. See 'P5' for further explanation. The 95th percentile gives the worst situation, so if the 95th percentile states a speed of 18 kph this means that 5% of the driven speeds on this segment are below 18 kph. 95% of the driven speeds are above 18 kph.

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TomTom Custom Probe Counts

Custom Probe Counts offers governmental and business markets an indicator of relative traffic density for their area of interest. Customers can create queries for a set of locations or an entire area and specific date and time periods through a simple web interface. The end result is suitable for use cases such as site-location studies and the valuation of road-side advertisement sites.

Selection method

As with the other historical traffic products the input definition exists of three steps: defining a location; picking a date range and selecting an aggregation level. All of these selection parameters together form a request.
- Selecting a location is possible through coordinates of one or multiple point locations and a corresponding radius of maximum 300 meters or by defining coordinates of a (simple rectangle) bounding box. The user can also choose to only investigate a selection of FRC classes.
- The specific date range of interest must be selected, for this product the user has the ability to select any date range from a maximum of one year (365 days) down to the detail of one specific day.
- For choosing granularity in the output the user has the following options:
  - Year
  - Month
  - Day of week
  - Hour

Using these selection steps it is possible to completely customise the query to give maximum flexibility and usefulness of the resulting report for the specific investigation required.

Calculation Method

Individual measurements from TomTom FCD are collected for every road segment found within the given area, specified FRC filter and time definition and then used to create final statistics for each segment. Based on this group of data the count values are determined.

Results

The results are given in an industry standard Esri Shapefile compatible dBASE file and can be downloaded through a simple web interface, once confirmation has been given that the job has been processed. The file includes the following fields:

Explanation of the data fields within the dBASE delivery file

MNID	ID that relates to the latest MultiNet map feature ID.
Direction	Explains the direction of in which the counts are valid for this feature.
FRC	Functional Road Class as found in the MultiNet map.

Year	Year for which the count value is produced.
Month	Month for which the count value is produced
Weekday	Date for which the count value is produced.
Hour	Hour for which the count value is produced.
Count	Number of anonymous probes counted during the given time period.

A GIS tool and a compatible version of the TomTom MultiNet map are required to analyse and visualise the results; there are many software vendors to choose from and there are also free GIS software packages available. More information about the Esri Shapefile format can be found in the Esri Shapefile Technical Description document published at the Esri website (http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf). For more information about acquiring the latest TomTom MultiNet map for your area of interest, please visit www.tomtom.com/licensing.
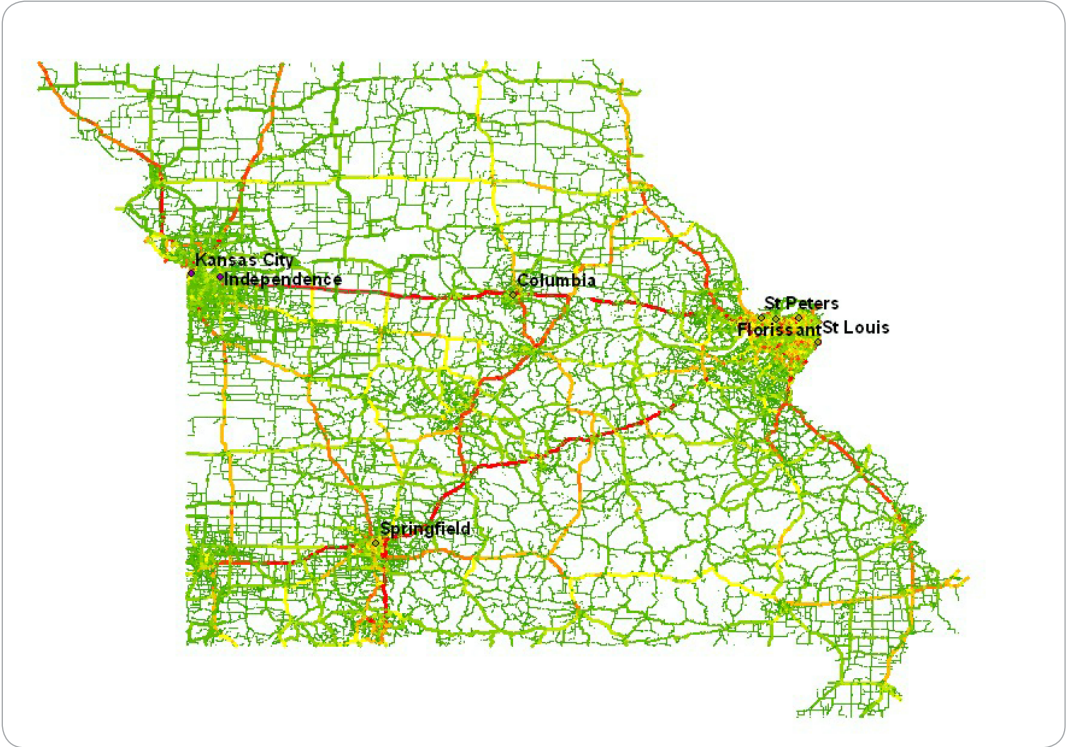

Figure 8 - Visualized relative count values for the state of Missouri in the United States through Custom Probe Count output

TomTom Speed Profiles

Background

Speed Profiles have been generated by TomTom for a large number of countries since September 2008 to provide a basis for better estimation of arrival times (ETA) and smarter routing in navigational devices by incorporating historical speed information with the TomTom MultiNet map product.

Navigation systems without Speed Profiles are likely to use a single travel time value for each road that will not vary by time of day. This often results in a poor driver experience as the route recommended is likely to pass through regularly congested areas at peak times, whereas it might be possible to have a faster arrival time using an alternative route.

TomTom recognized that, in order for a navigation routing engine to recommend the fastest route on any specific day, and time of day, it must take into account the likely traffic speed at that moment in time. Speed Profiles was developed as an add-on file for Multinet maps that describes the differing speeds that are likely to be experienced on each road link at various times of day. The speeds predicted have a different value every 5 minutes through the day and vary by day of the week. These time-variable speeds can be used by a routing engine to ensure the fastest route is recommended for all times of the day.

In TomTom navigation devices, the smart routing using Speed Profiles in conjunction with a dedicated routing algorithm capable of taking the varying speed profiles into account at the specific times of the day is called IQ Routes (IQR).
How a routing engine might use Speed Profiles

Each Multinet Link ID will have a 'Speed Profile ID' number assigned to it as an attribute that refers to the speed profile shape to use depending on the day of the week.

- There are around 100 different speed profile shapes to select from in the total Speed Profile database.
- Each of the individual link speed profiles is adjusted to the specific link by referring to the free-flow speed of the link.
- By using the appointed speed profile, the routing algorithm can look up the speed applicable for that specific day and time of day and assign the correct travel time for that link.
- The speed profile assigned to each Multinet Link ID is a fixed profile – there is no seasonality applied.
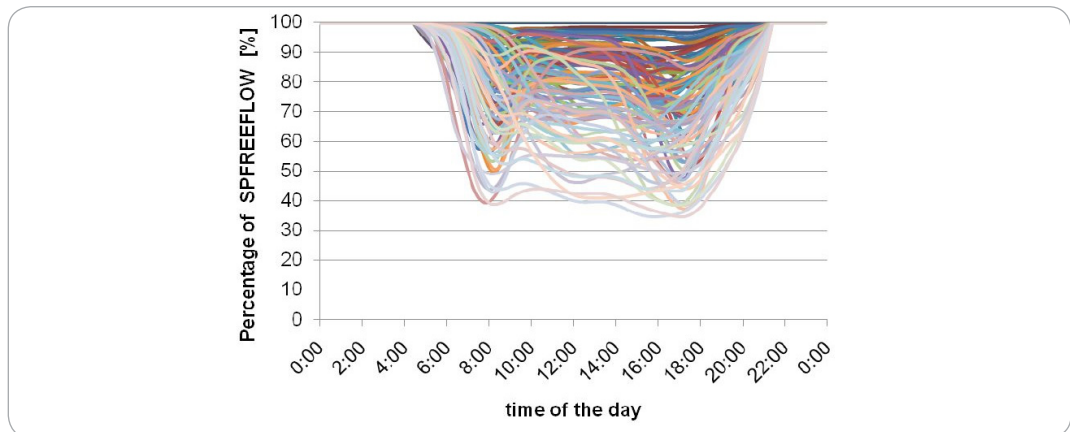
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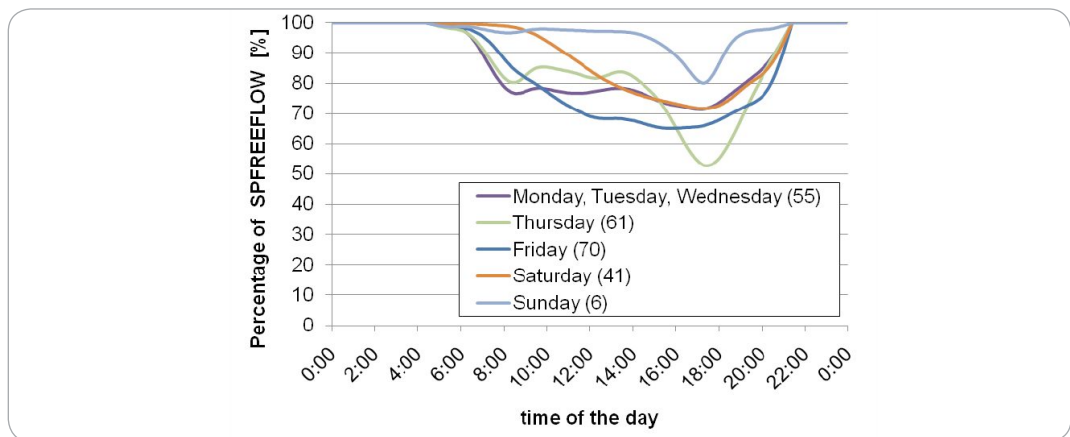Figure 9 - Speed Profiles 'shapes' used for the MultiNet links

Figure 10 - Example of one set of profiles used for a single MultiNet link ID showing the variation across day of the week and time of day

Creation of Speed Profiles

- An updated Speed Profiles file is generated for each country every time a new map is generated (currently quarterly).
- At each update cycle, trip data is taken from the historical database for the previous 24 months and is map-matched against the new map.
- If there is sufficient trip data in the historical database for the link, an average speed is generated for each direction of travel for each 5 minutes of each day of the week (i.e. 7 different profiles per direction for the road link).
- If the road has insufficient data to generate speed profiles for each individual day of the week, the system generates an average speed for 'weekdays' and 'weekend days'.

Customer uses for Speed Profiles data

The compact file size of Speed Profiles data is a valuable addition for on-board navigation devices. TomTom navigation devices use Speed Profiles in the IQ Routes processing for smart time-specific routing in all formats – consumer PND, automotive embedded systems and iPhone, etc.

Limitations for use of Speed Profiles data

Speed Profiles are created for the purpose described in the previous section.
There are some analysis requirements where Speed Profiles may not be the best
TomTom product as:

- Speed Profiles smooth the effect of any seasonal variations by averaging the
  speeds from a 2 year period, so this average speed will not give accurate speeds
  for either seasonal extreme.
- Speed Profiles cannot help where travel times need to be compared for two
  different time periods (e.g. spanning a temporary road work period).
- Other products from TomTom, such as Custom Travel Times or Custom Area
  Analysis, use the historical traffic database in a more customised form to
  eliminate the limiting characteristics of Speed Profiles for more detailed analysis
  use-cases.
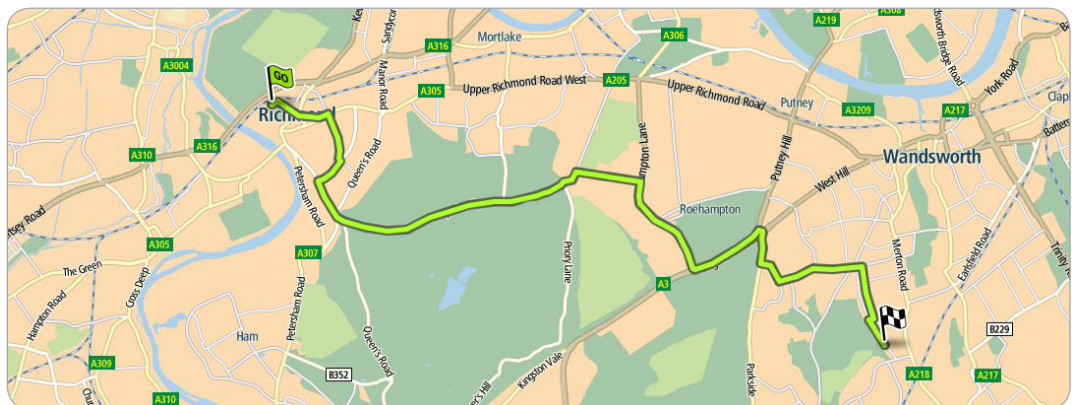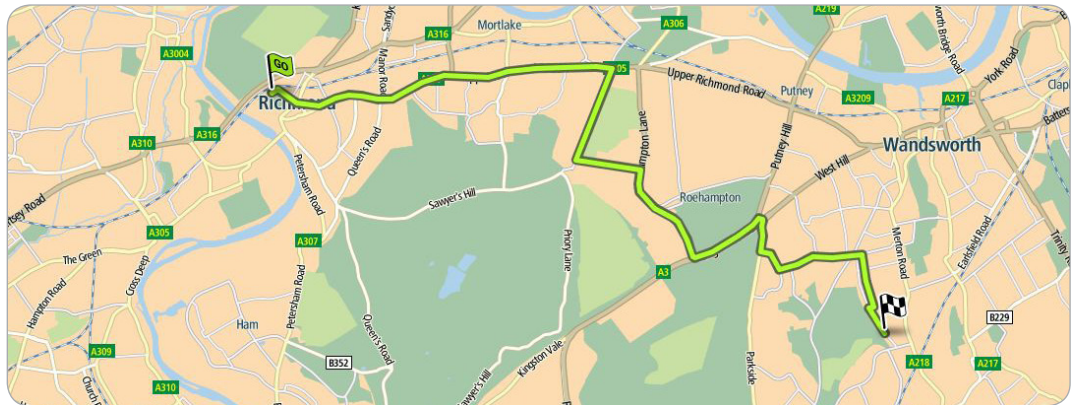
Future developments

TomTom has many more products under development that will take advantage of
the unique historical traffic data. Follow new developments directly on
http://www.tomtom.com/licensing.

Appendix

Arithmetic Mean Definition – from easycalculation.com

Arithmetic mean is commonly called as average. Mean or Average is defined as the sum of all the given elements divided by the total number of elements.

Formula:

Mean = sum of elements / number of elements

= a1+a2+a3+.....+an/n

Example: To find the mean of 3,5,7.
  Step 1: Find the sum of the numbers.
    3+5+7 = 15

  Step 2: Calculate the total number.
    there are 3 numbers.

  Step 3: Finding mean.
    15/3 = 5

Harmonic Mean Definition – from easycalculation.com

Harmonic mean is used to calculate the average of a set of numbers. Here the number of elements will be averaged and divided by the sum of the reciprocals of the elements. The Harmonic mean is always the lowest mean.

Harmonic Mean Formula :

Harmonic Mean = N/(1/a1+1/a2+1/a3+1/a4+.......+1/aN)
where

X = Individual score
N = Sample size (Number of scores)

Harmonic Mean Example: To find the Harmonic Mean of 1,2,3,4,5.

Step 1: Calculate the total number of values.
    N = 5

Step 2: Now find Harmonic Mean using the above formula.
    N/(1/a1+1/a2+1/a3+1/a4+.......+1/aN)
    = 5/(1/1+1/2+1/3+1/4+1/5)
    = 5/(1+0.5+0.33+0.25+0.2)
    = 5/2.28
    So, Harmonic Mean = 2.19

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