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(54) **DIGITAL ROAD NETWORK TRAFFIC STATE RECKONING METHOD BASED ON MULTI-SCALE CALCULATION**

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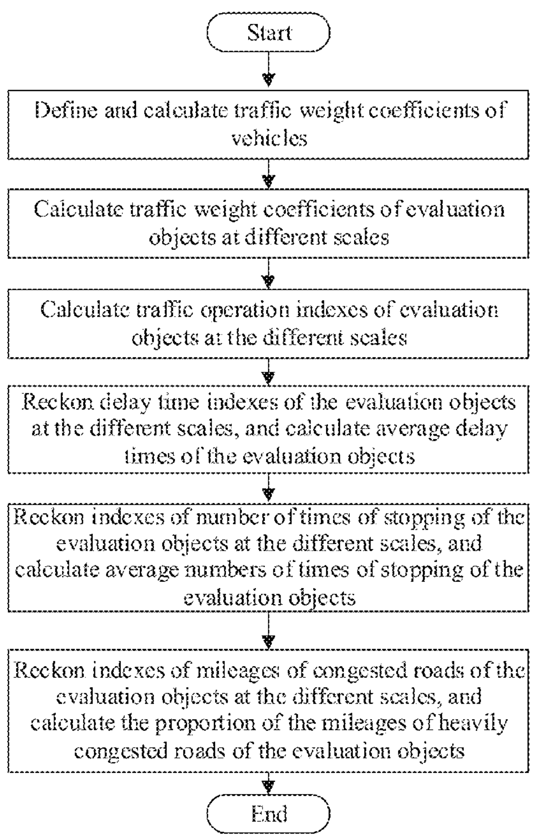
(57) **ABSTRACT**

The present invention discloses a digital road network traffic state reckoning method based on multi-scale calculation, including: S1, acquiring traffic weight coefficients of vehicles according to free-flow driving times of the vehicles and an overall free-flow driving time of a road network; S2, calculating traffic weight coefficients of evaluation objects in the road network at different spatial scales in combination with the traffic weight coefficients of the vehicles and a composition structure of the road network; S3, reckoning traffic operation indexes of the different evaluation objects in the road network by using an average travel time and the traffic weight coefficients of the vehicles; S4, reckoning delay time indexes and average delay times of the different evaluation objects in the road network by using an average delay time and the traffic weight coefficients of the vehicles; S5, reckoning indexes of the numbers of times of stopping and average numbers of times of stopping of the different evaluation objects in the road network by using an average number of times of stopping and the traffic weight coefficients of the vehicles; and S6, reckoning indexes of mileages of congested roads and proportions of mileages of heavily congested roads of the different evaluation objects in the road network by using the mileages of the heavily congested roads and the traffic weight coefficients of the vehicles.



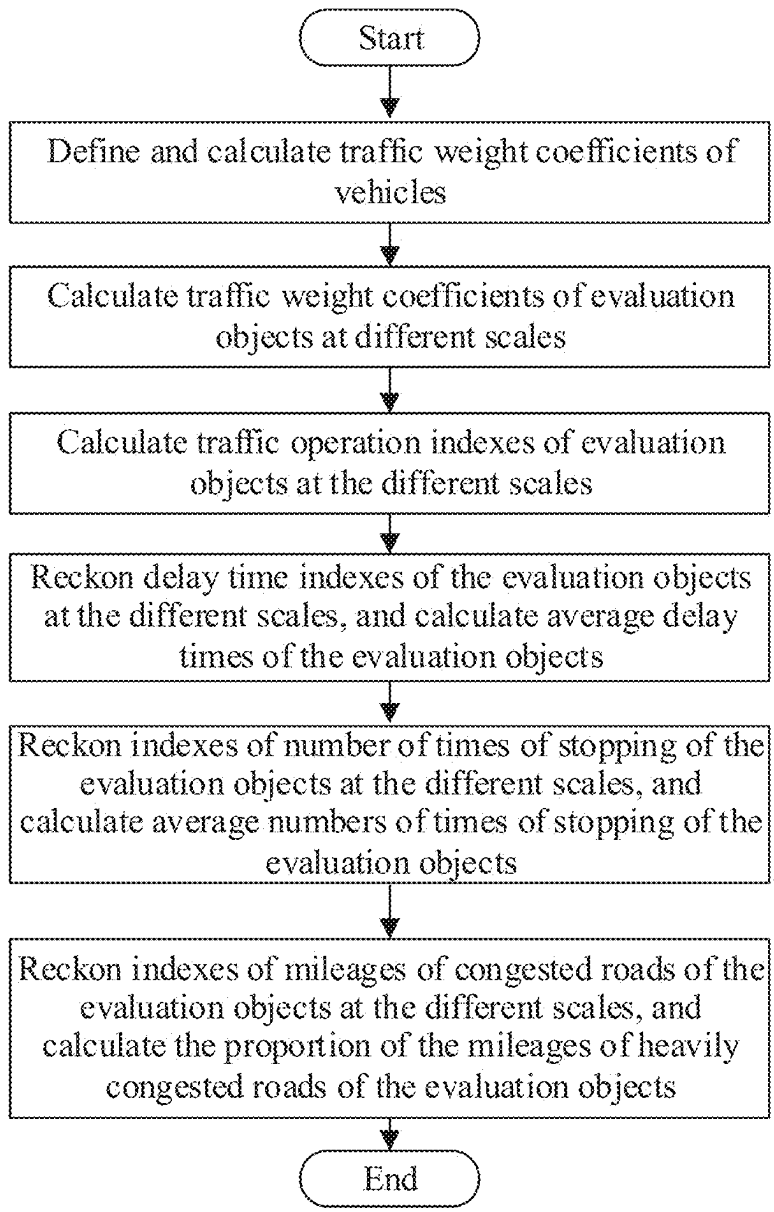
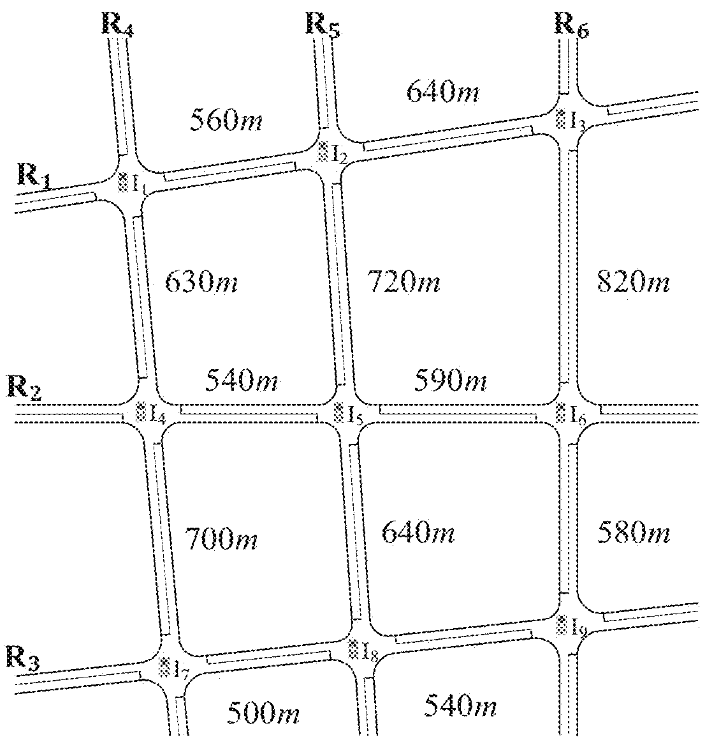
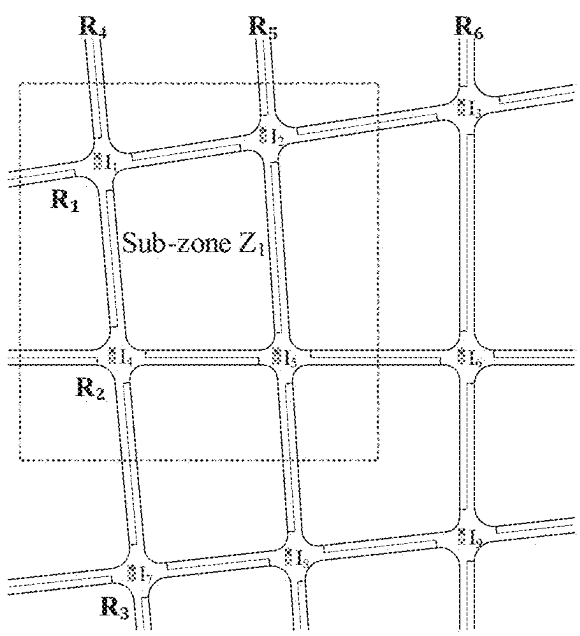

Start
Define and calculate traffic weight coefficients of vehicles
Calculate traffic weight coefficients of evaluation objects at different scales
Calculate traffic operation indexes of evaluation objects at the different scales
Reckon delay time indexes of the evaluation objects at the different scales, and calculate average delay times of the evaluation objects
Reckon indexes of number of times of stopping of the evaluation objects at the different scales, and calculate average numbers of times of stopping of the evaluation objects
Reckon indexes of mileages of congested roads of the evaluation objects at the different scales, and calculate the proportion of the mileages of heavily congested roads of the evaluation objects
End

Fig. 1



R_4
R_5
R_6
560m
640m
R_1
I_1
I_2
I_3
630m
720m
820m
R_2
540m
590m
I_4
I_5
I_6
700m
640m
580m
R_3
I_7
I_8
I_9
500m
540m

Fig. 2



R_4
R_5
R_6
I_1
I_2
I_3
R_1
Sub-zone Z_1
I_4
I_5
I_6
R_2
I_7
I_8
I_9
R_3

Fig. 3

DIGITAL ROAD NETWORK TRAFFIC STATE RECKONING METHOD BASED ON MULTI-SCALE CALCULATION

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This is the U.S. National Stage of International Patent Application No. PCT/CN2022/124945 filed on Oct. 12, 2022, which claims the benefit of priority to Chinese Patent Application No. 202210506795.8, filed May 11, 2022.

FIELD OF THE INVENTION

[0002] The present invention relates to the technical field of traffic operation evaluation, and in particular to a digital road network traffic state reckoning method based on multi-scale calculation.

BACKGROUND OF THE INVENTION

[0003] As characteristic indexes for evaluating urban road network traffic operation states, a traffic operation index, an average delay time, an average number of times of stopping, and a proportion of a mileage of a heavily congested road have been proposed in the national and local urban traffic operation state evaluation norms and standards consecutively. They are important indexes that comprehensively reflect smooth flows and congestion of urban road traffic operation, and have good comparability, relative independence, and an ability of quantitatively describing the road traffic operation states.

[0004] However, at present, relevant evaluation and analysis on traffic operation states of a road network based on the traffic operation state evaluation indexes are mainly to calculate evaluation indexes reflecting traffic operation states of one evaluation object within different evaluation periods, so as to perform comparison to obtain relevant evaluation conclusions. An existing method is usually difficultly applicable to analysis and calculation on various evaluation objects in different sizes, with different structures, and at different scales in a road network. At the same time, deepening development of an intelligent transportation technology puts forward new requirements for research, judgment, and analysis on the urban road network traffic operation states. How to construct a digital urban traffic road network and analyze the operation states from a macro-view road network to a medium-view road to a lane and even a single vehicle has become an internal need for intelligent urban traffic management and control.

[0005] Therefore, how to unify traffic operation state calculation methods for various evaluation objects through scientific and reasonable normalization processing to form a digital road network traffic state reckoning method based on multi-scale calculation, which provides technical support for a design on an urban traffic digital road network architecture, so as to have important theoretical value and practical significance.

SUMMARY OF THE INVENTION

[0006] A purpose of the present invention is to provide a digital road network traffic state reckoning method based on multi-scale calculation, which, on the basis of normalizing traffic operation state evaluation indexes, weights different compositions in a road network by means of traffic weight coefficients, so as to unify traffic operation state evaluation methods in aspects of an evaluation time, an evaluation space, and an evaluation range, thereby enabling relevant evaluation indexes to be applied to evaluation on urban road network traffic operation states in different sizes, with different structures, and at different scales.

[0007] In order to achieve the above purpose of the present invention, the present invention provides the following technical solution:

[0008] A digital road network traffic state reckoning method based on multi-scale calculation provided by the present invention includes the following steps:

- **[0009]** S1, acquiring traffic weight coefficients of vehicles according to free-flow driving times of the vehicles and an overall free-flow driving time of a road network;
- **[0010]** S2, calculating traffic weight coefficients of evaluation objects in the road network at different spatial scales level by level in combination with the traffic weight coefficients of the vehicles and a composition structure of the road network;
- **[0011]** S3, reckoning traffic operation indexes of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average travel time, the free-flow driving times, and the traffic weight coefficients of the vehicles;
- **[0012]** S4, reckoning delay time indexes of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average delay time, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating average delay times of various evaluation objects at the different spatial scales in combination with the free-flow driving times of the vehicles;
- **[0013]** S5, reckoning indexes of numbers of times of stopping of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average number of times of stopping, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating average numbers of times of stopping of various evaluation objects at the different spatial scales in combination with the free-flow driving times of the vehicles; and
- **[0014]** S6, reckoning indexes of mileages of congested roads of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using mileages of heavily congested roads, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating proportions of the mileages of the heavily congested roads of various evaluation objects at the different spatial scales in combination with free-flow driving speeds of the vehicles.

[0015] As a preferred technical solution, in step S1, the traffic weight coefficient of each vehicle is a ratio of the overall free-flow driving time of a certain passing vehicle in the road network to the overall free-flow driving time of all vehicles in the road network, which is obtained by summing the traffic weight coefficients of the vehicle on various through lanes in the road network, and reflects a proportion of the certain passing vehicle occupying an overall road time-space resource of the road network; and a formula of the traffic weight coefficient is as follows:

$$w_v^V = \frac{t_{f_v}^V}{\sum_{v=1}^{N^V} t_{f_v}^V} = \frac{\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{V,v}^L} t_{f_l}^L}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l}^L} = \sum_{l\in S_{V,v}^L} \frac{t_{f_l}^L}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l}^L} = \sum_{l\in S_{V,v}^L} w_{(v,l)}^V$$

[0016] wherein w_v^V is a traffic weight coefficient of the v^{th} vehicle V_v in the road network; t_{fv}^V is an overall free-flow driving time of the vehicle V_v passing the road network; N^V is the number of vehicles passing the road network within an evaluation period; $S_{V,v}^L$ is a set of lanes through which the vehicle V_v passes in the road network within the evaluation period; $t_{f(v,l)}^V$ is a free-flow driving time of the vehicle V_v passing the l^{th} lane L_l in the road network; t_{fl}^L is an average free-flow driving time of the vehicles passing the lane L_l; and $w_{(v,l)}^V$ is a traffic weight coefficient of the vehicle V_v on the lane L_l.

[0017] As a preferred technical solution, step S2 is specifically as follows:

[0018] according to a definition of the traffic weight coefficient, for the traffic weight coefficients of each evaluation object in the road network at the different spatial scales, each value is a ratio of the overall free-flow driving time of all the passing vehicles within a period of time to the overall free-flow driving time of all the vehicles in the whole road network for each evaluation object; and the traffic weight coefficients of all compositions belonging to one evaluation object at a same spatial scale are summed to obtain the traffic weight coefficient of the evaluation object, which is specifically as follows:

[0019] a traffic weight coefficient of the vehicle V_v passing the lane L_l is reckoned as follows:

$$w_{(v,l)}^V = \frac{t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V}$$

[0020] a traffic weight coefficient of the lane L_l is reckoned as follows:

$$w_l^L = \frac{\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \sum_{V\in S_{L,l}^V} \frac{t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \sum_{v\in S_{L,l}^V} w_{(v,l)}^V$$

[0021] a traffic weight coefficient of a subsection U_u is reckoned as follows:

$$w_u^U = \frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \sum_{l\in S_{U,u}^L} \frac{\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \sum_{l\in S_{U,u}^L} w_l^L$$

[0022] a traffic weight coefficient of a section S_s is reckoned as follows:

$$\begin{aligned} w_s^S &= \frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} \\ &= \sum_{u\in S_{S,s}^U} \frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} \\ &= \sum_{u\in S_{S,s}^U} w_u^U \\ &= \sum_{l\in S_{S,s}^L} w_l^L \end{aligned}$$

[0023] a traffic weight coefficient of an intersection I_i is reckoned as follows:

$$w_i^I = \frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \sum_{l\in S_{I,i}^L} \frac{\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} = \sum_{l\in S_{I,i}^L} w_l^L$$

[0024] a traffic weight coefficient of a road R_r is reckoned as follows:

$$\begin{aligned} w_r^R &= \frac{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V + \sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} \\ &= \sum_{s\in S_{R,r}^S} w_s^S + \sum_{i\in S_{R,r}^I} w_i^I = \sum_{l\in S_{R,r}^L} w_l^L \end{aligned}$$

[0025] a traffic weight coefficient of a sub-zone Z_z is reckoned as follows:

$$\begin{aligned} w_z^Z &= \frac{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V + \sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V} \\ &= \sum_{s\in S_{Z,z}^S} w_s^S + \sum_{i\in S_{Z,z}^I} w_i^I \\ &= \sum_{l\in S_{Z,z}^L} w_l^L \end{aligned}$$

[0026] wherein w_l^L is the traffic weight coefficient of the lane L_l; $S_{L,l}^V$ is a set of vehicles passing the lane L_l within the evaluation period; w_u^U is the traffic weight coefficient of the u^{th} subsection U_u in the road network; $S_{U,u}^L$ is a set of lanes contained in the subsection U_u; w_s^S is the traffic weight coefficient of the s^{th} section S_s in the road network; $S_{S,s}^U$ is a set of sub-sections contained in the section S_s; $S_{S,s}^L$ is a set of lanes contained in the section S_s; w_i^I is the traffic weight coefficient of the i^{th} intersection I_i in the road network; $S_{I,i}^L$ is a set of lanes contained in the intersection I_i; w_r^R is the traffic weight coefficient of the r^{th} road R_r in the road network; $S_{R,r}^S$ is a set of sections contained in the road R_r; $S_{R,r}^I$ is a set of intersections contained in the road R_r; $S_{R,r}^L$ is a set of lanes contained in the road R_r; w_z^Z is the traffic weight coefficient of the z^{th} sub-zone Z_z in the road network; $S_{Z,z}^S$ is a set of sections contained in the sub-zone Z_z; $S_{Z,z}^I$ is a set of intersections contained in the sub-zone Z_z; and $S_{Z,z}^L$ is a set of lanes contained in the sub-zone Z_z; and

[0027] according to the definition of the traffic weight coefficient of the road network, the traffic weight coefficients of all the vehicles, lanes, road sections, and intersections in the road network are summed respectively, with each sum being 1; and a formula is as follows:

$$\begin{aligned} w^A &= \frac{\sum_{s=1}^{N^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}^V} + \sum_{i=1}^{N^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}^V}}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_{(v,l)}^V}} \\ &= \sum_{s=1}^{N^S} w_s^S + \sum_{i=1}^{N^I} w_i^I \\ &= \sum_{u=1}^{N^U} w_u^U + \sum_{i=1}^{N^I} w_i^I \\ &= \sum_{l=1}^{N^L} w_l^L \\ &= \sum_{v=1}^{N^V} w_v^V \\ &= \sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V \\ &= 1 \end{aligned}$$

[0028] wherein w^A is the overall traffic weight coefficient of the road network; N^S is the number of sections in the road network; N^I is the number of intersections in the road network; N^U is the number of sub-sections in the road network; and N^L is the number of lanes in the road network.

[0029] As a preferred technical solution, step S3 is specifically as follows:

[0030] the traffic operation index of each evaluation object in the road network is a ratio of an overall travel time of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average travel time of all the passing vehicles in a distance corresponding to a unit free-flow driving time; and

[0031] the traffic operation index of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the traffic operation indexes of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the traffic operation index is dimensionless, specifically as follows:

[0032] a traffic operation index of the vehicle V_v passing the lane L_l is reckoned as follows:

$$PI_{(v,l)}^V = \frac{t_{(v,l)}^V}{t_{f_{(v,l)}^V}}$$

[0033] a traffic operation index of the vehicle V_v is reckoned as follows:

$$\begin{aligned} PI_v^V &= \frac{\sum_{l\in S_{V,v}^L} t_{(v,l)}^V}{\sum_{l\in S_{V,v}^L} t_{f_l^L}} \\ &= \frac{\sum_{l\in S_{V,v}^L}\left(PI_{(v,l)}^V \times t_{f_{(v,l)}^V}\right)}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l^L}} \times \frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l^L}}{\sum_{l\in S_{V,v}^L} t_{f_l^L}} \\ &= \frac{\sum_{l\in S_{V,v}^L}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{V,v}^L} w_{(v,l)}^V} \end{aligned}$$

[0034] a traffic operation index of the lane L_l is reckoned as follows:

$$\begin{aligned} PI_l^L &= \frac{\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}^V}} \\ &= \frac{\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_{(v,l)}^V}} \times \frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_{(v,l)}^V}}{\sum_{v\in S_{L,l}^V} t_{(v,l)}^V} \\ &= \frac{\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} \end{aligned}$$

[0035] a traffic operation index of a subsection U_u is reckoned as follows:

$$\begin{aligned} PI_u^U &= \frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}^V}} \\ &= \frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} \\ &= \frac{\sum_{l\in S_{U,u}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{U,u}^L} w_l^L}; \end{aligned}$$

[0036] a traffic operation index of the section S_s is reckoned as follows:

$$PI_s^S = \frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V} = \frac{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l\in S_{S,s}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{S,s}^L} w_l^L} = \frac{\sum_{u\in S_{S,s}^U}\left(PI_u^U \times w_u^U\right)}{\sum_{u\in S_{S,s}^U} w_u^U}$$

[0037] a traffic operation index of the intersection I_i is reckoned as follows:

$$PI_i^I = \frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V} = \frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l\in S_{I,i}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{I,i}^L} w_l^L}$$

[0038] a traffic operation index of the road R_r is reckoned as follows:

$$PI_r^R = \frac{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V + \sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V + \sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V} = \frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} r_{(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V} = \frac{\sum_{l\in S_{R,r}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{R,r}^L} w_l^L}$$

[0039] a traffic operation index of a sub-zone Z_z is reckoned as follows:

$$PI_z^Z = \frac{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V + \sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V + \sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}$$

-continued

$$= \frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} r_{(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V} = \frac{\sum_{l\in S_{Z,z}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{Z,z}^L} w_l^L}$$

[0040] a traffic operation index of a zone is reckoned as follows:

$$PI^A = \frac{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V + \sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V + \sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V} = \frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{f_{(v,l)}}^V} = \sum_{l\in S_A^L}\left(PI_l^L \times w_l^L\right)$$

[0041] wherein $PI_{(v,l)}^V$ is the traffic operation index of the vehicle V_v on the lane L_l; $t_{(v,l)}^V$ is a travel time of the vehicle V_v passing the lane L_l; PI_v^V, PI_l^L, PI_u^U, PI_s^S, PI_l^I, PI_r^R, PI_z^Z, and PI^A represent traffic operation indexes of the vehicle V_v, the lane L_l, the subsection U_u, the section, S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; S_A^S is a set of sections contained in the zone; S_A^I is a set of intersections contained in the zone; and S_A^L is a set of lanes contained in the zone.

[0042] As a preferred technical solution, step S4 is specifically as follows:

[0043] S401, reckoning the delay time indexes of various evaluation objects at multiple spatial scales, wherein

[0044] the delay time index of each evaluation object in the road network is a ratio of an overall delay time of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average delay time of all the passing vehicles in the distance corresponding to the unit free-flow driving time; and

[0045] the delay time index of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the delay time indexes of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the traffic operation index is dimensionless, having an ability to further calculate the average delay time, specifically as follows:

[0046] a delay time index of the vehicle V_v passing the lane L_l is reckoned as follows:

$$DI_{(v,l)}^V = \frac{d_{(v,l)}^V}{t_{f_{(v,l)}}^V}$$

[0047] a delay time index of the vehicle V_v is reckoned as follows:

$$DI_v^V=\frac{\sum_{l\in S_{V,v}^L} d_{(v,l)}^V}{\sum_{l\in S_{V,v}^L} t_{f_l}^L}=$$

$$\frac{\sum_{l\in S_{V,v}^L}\left(DI_{(v,l)}^V\times t_{f(v,l)}^V\right)}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l}^L}\times\frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l}^L}{\sum_{l\in S_{V,v}^L} t_{f_l}^L}=\frac{\sum_{l\in S_{V,v}^L}\left(DI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{V,v}^L} w_{(v,l)}^V}$$

[0048] a delay time index of the lane L_l is reckoned as follows:

$$DI_l^L=\frac{\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=$$

$$\frac{\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V}\times\frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f(v,l)}^V}{\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=\frac{\sum_{v\in S_{L,l}^V}\left(DI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{v\in S_{L,l}^V} w_{(v,l)}^V}$$

[0049] a delay time index of a subsection U_u is reckoned as follows:

$$DI_u^U=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=$$

$$\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}\left(DI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V}=\frac{\sum_{l\in S_{U,u}^L}\left(DI_l^L\times w_l^L\right)}{\sum_{l\in S_{U,u}^L} w_l^L}$$

[0050] a delay time index of the section S_s is reckoned as follows:

$$DI_s^S=$$

$$\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=\frac{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V}\left(DI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V}=$$

$$\frac{\sum_{l\in S_{S,s}^L}\left(DI_l^L\times w_l^L\right)}{\sum_{l\in S_{S,s}^L} w_l^L}=\frac{\sum_{u\in S_{S,s}^U}\left(DI_u^U\times w_u^U\right)}{\sum_{u\in S_{S,s}^U} w_u^U}$$

[0051] a delay time index of the intersection I_i is reckoned as follows:

$$DI_i^I=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=$$

$$\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}\left(DI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V}=\frac{\sum_{l\in S_{I,i}^L}\left(DI_l^L\times w_l^L\right)}{\sum_{l\in S_{I,i}^L} w_l^L}$$

[0052] a delay time index of the road R_r is reckoned as follows:

$$DI_r^R=\frac{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V+\sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V+\sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=$$

$$\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=\frac{\sum_{l\in S_{R,r}^L}\left(DI_l^L\times w_l^L\right)}{\sum_{l\in S_{R,r}^L} w_l^L}$$

[0053] a delay time index of a sub-zone Z_z is reckoned as follows:

$$DI_z^Z=\frac{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V+\sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V+\sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=$$

$$\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=\frac{\sum_{l\in S_{Z,z}^L}\left(DI_l^L\times w_l^L\right)}{\sum_{l\in S_{Z,z}^L} w_l^L}$$

[0054] a delay time index of a zone is reckoned as follows:

$$DI^A=\frac{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V+\sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V+\sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=$$

$$\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}=\sum_{l\in S_A^L}\left(DI_l^L\times w_l^L\right)$$

[0055] wherein $DI_{(v,l)}^V$ is the delay time index of the vehicle V_v on the lane L_l; $d_{(v,l)}^V$ is the delay time of the vehicle V_v passing the lane L_l; and DI_v^V, DI_l^L, DI_u^U, DI_s^S, DI_i^I, DI_r^R, DI_z^Z, and DI^A represent the delay time indexes of the vehicle V_v, the lane L_l, the subsection U_u, the road S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and

[0056] S402, calculating the average delay times of various evaluation objects, wherein

[0057] according to the acquired delay time indexes of the different evaluation objects at the multiple spatial scales, the average delay time of each evaluation object is calculated, which is specifically as follows:

[0058] an average delay time of the vehicle V_v passing the lane L_l is reckoned as follows:

$$d^V_{(v,l)} = DI^V_{(v,l)} \times t^V_{f(v,l)}$$

[0059] an average delay time of the vehicle V_v is reckoned as follows:

$$d^V_v = \sum_{l\in S^L_{V,v}} d^V_{(v,l)} = DI^V_v \times \sum_{l\in S^L_{V,v}} t^L_{f_l} = DI^V_v \times t^V_{f_v}$$

[0060] an average delay time of the lane L_l is reckoned as follows:

$$\overline{d}^L_l = \frac{\sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V_{L,l}} = \frac{\sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{v\in S^V_{L,l}} t^V_{f(v,l)}} \times \frac{\sum_{v\in S^V_{L,l}} t^V_{f(v,l)}}{N^V_{L,l}} = DI^L_l \times t^L_{f_l}$$

[0061] an average delay time of a subsection U_u is reckoned as follows:

$$\overline{d}^U_u = \frac{\sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V_{U,u}} = \frac{\sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} t^V_{f(v,l)}} \times \frac{\sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} t^V_{f(v,l)}}{N^V_{U,u}} = DI^U_u \times t^U_{f_u}$$

[0062] an average delay time of the section S_s is reckoned as follows:

$$\overline{d}^S_s = \frac{\sum_{u\in S^U_{S,s}} \sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V_{S,s}} = \frac{\sum_{u\in S^U_{S,s}} \sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{u\in S^U_{S,s}} \sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} t^V_{f(v,l)}} \times \frac{\sum_{u\in S^U_{S,s}} \sum_{l\in S^L_{U,u}} \sum_{v\in S^V_{L,l}} t^V_{f(v,l)}}{N^V_{S,s}} = DI^S_s \times t^S_{f_s}$$

[0063] an average delay time of the intersection I_i is reckoned as follows:

$$\overline{d}^I_i = \frac{\sum_{l\in S^L_{I,i}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V_{I,i}} = \frac{\sum_{l\in S^L_{I,i}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{l\in S^L_{I,i}} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}} \times \frac{\sum_{l\in S^L_{I,i}} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}}{N^V_{I,i}} = DI^I_i \times t_{f^I_i}$$

[0064] an average delay time of the road R_r is reckoned as follows:

$$\overline{d}^R_r = \frac{\sum_{l\in S^L_{R,r}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V_{R,r}} = \frac{\sum_{l\in S^L_{R,r}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{l\in S^L_{R,r}} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}} \times \frac{\sum_{l\in S^L_{R,r}} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}}{N^V_{R,r}} = DI^R_r \times t_{f^R_r}$$

[0065] an average delay time of a sub-zone Z_z is reckoned as follows:

$$\overline{d}^Z_z = \frac{\sum_{l\in S^L_{Z,z}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V_{Z,z}} = \frac{\sum_{l\in S^L_{Z,z}} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{l\in S^L_{Z,z}} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}} \times \frac{\sum_{l\in S^L_{Z,z}} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}}{N^V_{Z,z}} = DI^Z_z \times t_{f^Z_z}$$

[0066] an average delay time of the zone is reckoned as follows:

$$\overline{d}^A = \frac{\sum_{l\in S^L_A} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{N^V} = \frac{\sum_{l\in S^L_A} \sum_{v\in S^V_{L,l}} d^V_{(v,l)}}{\sum_{l\in S^L_A} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}} \times \frac{\sum_{l\in S^L_A} \sum_{v\in S^V_{L,l}} t_{f^V_{(v,l)}}}{N^V} = DI^A \times t_f{}^A$$

[0067] wherein $d_v{}^V$ is the delay time of the vehicle V_v; $\overline{d}_l{}^L$, $\overline{d}_u{}^U$, $\overline{d}_s{}^S$, $\overline{d}_i{}^I$, $\overline{d}_r{}^R$, $\overline{d}_z{}^Z$, and $\overline{d}^A$ represent the average delay times of the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; $N_{L,l}{}^V$, $N_{U,u}{}^V$, $N_{S,s}{}^V$, $N_{I,i}{}^V$, $N_{R,r}{}^V$, and $N_{Z,z}{}^V$ represent numbers of vehicles passing the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z within the evaluation period respectively; and $t_{fu}{}^U$, $t_{fs}{}^S$, $t_{fi}{}^I$, $t_{fr}{}^R$, $t_{fz}{}^Z$, and $t_f{}^A$ represent the average free-flow driving times of the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively.

[0068] As a preferred technical solution, step S5 is specifically as follows:

[0069] S501, reckoning the indexes of the numbers of times of stopping of various evaluation objects at the multiple spatial scales, wherein

[0070] the index of the number of times of stopping of each evaluation object in the road network is a ratio of an overall number of times of stopping of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average number of times of stopping of all the passing vehicles in the distance corresponding to the unit free-flow driving time; and

[0071] the index of the number of times of stopping of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the indexes of the numbers of times of stopping of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the index of the number of times of stopping is in a unit of "times/min", having an ability to further calculate the average number of times of stopping, specifically as follows:

[0072] an index of number of times of stopping of the vehicle V_v passing the lane L_l is reckoned as follows:

$$HI^V_{(v,l)} = \frac{h^V_{(v,l)}}{t_{f^V_{(v,l)}}}$$

[0073] an index of number of times of stopping of the vehicle V_v is reckoned as follows:

$$HI_v^V=\frac{\sum_{l\in S_{V,v}^L}h_{(v,l)}^V}{\sum_{l\in S_{V,v}^L}t_{f_l^L}}=\frac{\sum_{l\in S_{V,v}^L}\left(HI_{(v,l)}^V\times t_{f_{(v,l)}^V}\right)}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L}t_{f_l^L}}\times\frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L}t_{f_l^L}}{\sum_{l\in S_{V,v}^L}t_{f_l^L}}=\frac{\sum_{l\in S_{V,v}^L}\left(HI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{V,v}^L}w_{(v,l)}^V}$$

[0074] an index of number of times of stopping of the lane L_l is reckoned as follows:

$$HI_l^L=\frac{\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L}t_{f_{(v,l)}^V}}\times\frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L}t_{f_{(v,l)}^V}}{\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{v\in S_{L,l}^V}\left(HI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{v\in S_{L,l}^V}w_{(v,l)}^V}$$

[0075] an index of number of times of stopping of the subsection U_u is reckoned as follows:

$$HI_u^U=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}\left(HI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}w_{(v,l)}^V}=\frac{\sum_{l\in S_{U,u}^L}\left(HI_l^L\times w_l^L\right)}{\sum_{l\in S_{U,u}^L}w_l^L}$$

[0076] an index of number of times of stopping of the section S_s is reckoned as follows:

$$HI_s^S=\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V}\left(HI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V}w_{(v,l)}^V}=\frac{\sum_{l\in S_{S,s}^L}\left(HI_l^L\times w_l^L\right)}{\sum_{l\in S_{S,s}^L}w_l^L}=\frac{\sum_{u\in S_{S,s}^U}\left(HI_u^U\times w_u^U\right)}{\sum_{u\in S_{S,s}^U}w_u^U}$$

[0077] an index of number of times of stopping of the intersection I_i is reckoned as follows:

$$HI_i^I=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}\left(HI_{(v,l)}^V\times w_{(v,l)}^V\right)}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}w_{(v,l)}^V}=\frac{\sum_{l\in S_{I,i}^L}\left(HI_l^L\times w_l^L\right)}{\sum_{l\in S_{I,i}^L}w_l^L}$$

[0078] an index of number of times of stopping of the road R_r is reckoned as follows:

$$HI_r^R=\frac{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V+\sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}+\sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{Z,z}^L}\left(HI_l^L\times w_l^L\right)}{\sum_{l\in S_{Z,z}^L}w_l^L}$$

[0079] an index of number of times of stopping of the sub-zone Z_z is reckoned as follows:

$$HI_z^Z=\frac{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V+\sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}+\sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_{Z,z}^L}\left(HI_l^L\times w_l^L\right)}{\sum_{l\in S_{Z,z}^L}w_l^L}$$

[0080] an index of number of times of stopping of the zone is reckoned as follows:

$$HI^A=\frac{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V+\sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}+\sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}=\sum_{l\in S_A^L}\left(HI_l^L\times w_l^L\right)$$

[0081] wherein $HI_{(v,l)}^V$ is the index of the number of times of stopping of the vehicle V_v on the lane L_l; $h_{(v,l)}^V$ is the number of times of stopping of the vehicle V_v passing the lane L_l; and HI_v^V, HI_l^L, HI_u^U, HI_s^S, HI_i^I, HI_r^R, HI_z^Z, and HI^A represent the indexes of number of times of stopping of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and

[0082] S502, calculating the average numbers of times of stopping of various evaluation objects, wherein

[0083] according to the acquired indexes of number of times of stopping of the different evaluation objects at the multiple spatial scales, the average numbers of times of stopping of various evaluation objects are calculated, which are specifically as follows:

[0084] an average number of times of stopping of the vehicle V_v passing the lane L_l is reckoned as follows:

$$h_{(v,l)}^{V}=HI_{(v,l)}^{V}\times t_{f_{(v,l)}^{V}}$$

[0085] an average number of times of stopping of the vehicle V_v is reckoned as follows:

$$h_v^V=\sum_{l\in S_{V,v}^L}h_{(v,l)}^V=HI_v^V\times\sum_{l\in S_{V,v}^L}t_{f_l^L}=HI_v^V\times t_{f_v^V}$$

[0086] an average number of times of stopping of the lane L_l is reckoned as follows:

$$\overline{h}_l^L=\frac{\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_{L,l}^V}=\frac{\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_{L,l}^V}=HI_l^L\times t_{f_l^L}$$

[0087] an average number of times of stopping of the subsection U_u is reckoned as follows:

$$\overline{h}_u^U=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_{U,u}^V}=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_{U,u}^V}=HI_u^U\times t_{f_u^U}$$

[0088] an average number of times of stopping of the section S_s is reckoned as follows:

$$\overline{h}_s^S=\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_{S,s}^V}=\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_{S,s}^V}=HI_s^S\times t_{f_s^S}$$

[0089] an average number of times of stopping of the intersection I_i is reckoned as follows:

$$\overline{h}_i^I=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_{I,i}^V}=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_{I,i}^V}=HI_i^I\times t_{f_i^I}$$

[0090] an average number of times of stopping of the road R_r is reckoned as follows:

$$\overline{h}_r^R=\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_{R,r}^V}=\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_{R,r}^V}=HI_r^R\times t_{f_r^R}$$

[0091] an average number of times of stopping of the sub-zone Z_z is reckoned as follows:

$$\overline{h}_z^Z=\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_{Z,z}^V}=\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_{Z,z}^V}=HI_z^Z\times t_{f_z^Z}$$

[0092] an average number of times of stopping of the zone is reckoned as follows:

$$\overline{h}^A=\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{N_A^V}=\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V}h_{(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}\times\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V}t_{f_{(v,l)}^V}}{N_A^V}=HI^A\times t_{f^A}$$

[0093] wherein h_v^V is the number of times of stopping of the vehicle V_v; and $\overline{h}_l^L$, $\overline{h}_u^U$, $\overline{h}_s^S$, $\overline{h}_i^I$, $\overline{h}_r^R$, $\overline{h}_z^Z$, and $\overline{h}^A$ represent the average numbers of times of stopping of the lane L_l, the subsection U_u, the second S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively.

[0094] As a preferred technical solution, step S6 is specifically as follows:

[0095] S601, reckoning the indexes of the mileages of the congested roads of various evaluation objects at the multiple spatial scales, wherein

[0096] the index of the mileage of the congested road of each evaluation object in the road network is a ratio of an overall mileage of a heavily congested road of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average mileage of a heavily congested road of all the passing vehicles in the distance corresponding to the unit free-flow driving time; and

[0097] the index of the mileage of the congested road of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the indexes of the mileages of the congested roads of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the index of the mileage of the congested road is in a unit of “m/min”, having an ability to further calculate the proportion of the mileage of the heavily congested road, specifically as follows:

[0098] an index of a mileage of a congested road of the vehicle V_v passing the lane L_l is reckoned as follows:

$$MI_{(v,l)}^V = \frac{l_{c_{(v,l)}^V}}{t_{f_{(v,l)}^V}}$$

[0099] an index of a mileage of a congested road of the vehicle V_v is reckoned as follows:

$$MI_v^V = \frac{\sum_{l \in S_{V,v}^L} l_{c_{(v,l)}^V}}{\sum_{l \in S_{V,v}^L} t_{f_l^L}} = \frac{\sum_{l \in S_{V,v}^L} \left(MI_{(v,l)}^V \times t_{f_{(v,l)}^V}\right)}{\sum_{v=1}^{N^V} \sum_{l \in S_{V,v}^L} t_{f_l^L}} \times \frac{\sum_{v=1}^{N^V} \sum_{l \in S_{V,v}^L} t_{f_l^L}}{\sum_{l \in S_{V,v}^L} t_{f_l^L}} = \frac{\sum_{l \in S_{V,v}^L} \left(MI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l \in S_{V,v}^L} w_{(v,l)}^V}$$

[0100] an index of a mileage of a congested road of the lane L_l is reckoned as follows:

$$MI_l^L = \frac{\sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{v=1}^{N^V} \sum_{l \in S_{V,v}^L} t_{f_{(v,l)}^V}} \times \frac{\sum_{v=1}^{N^V} \sum_{l \in S_{V,v}^L} t_{f_{(v,l)}^V}}{\sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{v \in S_{L,l}^V} \left(MI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0101] an index of a mileage of a congested road of the subsection U_u is reckoned as follows:

$$MI_u^U = \frac{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} \left(MI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l \in S_{U,u}^L} \left(MI_l^L \times w_l^L\right)}{\sum_{l \in S_{U,u}^L} w_l^L}$$

[0102] an index of a mileage of a congested road of the section S_s is reckoned as follows:

$$MI_s^S = \frac{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{S,s}^L} \sum_{v \in S_{L,l}^V} \left(MI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l \in S_{S,s}^L} \sum_{v \in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l \in S_{S,s}^L} \left(MI_l^L \times w_l^L\right)}{\sum_{l \in S_{S,s}^L} w_l^L} = \frac{\sum_{u \in S_{S,s}^U} \left(MI_u^U \times w_u^U\right)}{\sum_{u \in S_{S,s}^U} w_u^U}$$

[0103] an index of a mileage of a congested road of the intersection I_i is reckoned as follows:

$$MI_i^I = \frac{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} \left(MI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l \in S_{I,i}^L} \left(MI_l^L \times w_l^L\right)}{\sum_{l \in S_{I,i}^L} w_l^L}$$

[0104] an index of a mileage of a congested road of the road R_r is reckoned as follows:

$$MI_r^R = \frac{\sum_{s \in S_{R,r}^S} \sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V} + \sum_{i \in S_{R,r}^I} \sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{s \in S_{R,r}^S} \sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V} + \sum_{i \in S_{R,r}^I} \sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{R,r}^L} \left(MI_l^L \times w_l^L\right)}{\sum_{l \in S_{R,r}^L} w_l^L}$$

[0105] an index of a mileage of a congested road of the sub-zone Z_z is reckoned as follows:

$$MI_z^Z = \frac{\sum_{s \in S_{Z,z}^S} \sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V} + \sum_{i \in S_{Z,z}^I} \sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{s \in S_{Z,z}^S} \sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V} + \sum_{i \in S_{Z,z}^I} \sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} l_{c_{(v,l)}^V}}{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} t_{f_{(v,l)}^V}} = \frac{\sum_{l \in S_{Z,z}^L} \left(MI_l^L \times w_l^L\right)}{\sum_{l \in S_{Z,z}^L} w_l^L}$$

[0106] an index of a mileage of a congested road of the zone is reckoned as follows:

$$MI^A=\frac{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}+\sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}+\sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}=\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}=\sum_{l\in S_A^L}\left(MI_l^L\times w_l^L\right)$$

[0107] wherein $MI_{(v,l)}{}^V$ is the index of the mileage of the congested road of the vehicle V_v on the lane L_l; $l_{c(v,l)}{}^V$ is the mileage of the congested road of the vehicle V_v passing the lane L_l; and $MI_v{}^V$, $MI_l{}^L$, $MI_u{}^U$, $MI_s{}^S$, $MI_i{}^I$, $MI_r{}^R$, $MI_z{}^Z$, and MI^A represent the indexes of the mileages of the congested roads of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and

[0108] S602, calculating the proportions of the mileages of the heavily congested roads of various evaluation objects, wherein

[0109] according to the acquired index of the mileage of the congested road of the different evaluation objects at the multiple spatial scales, the proportion of the mileage of the heavily congested road of each evaluation object is calculated, which is specifically as follows:

[0110] a proportion of a mileage of a heavily congested road of the vehicle V_v passing the lane L_l is reckoned as follows:

$$m^V_{(v,l)}=\frac{l^V_{c_{(v,l)}}}{l^V_{(v,l)}}=\frac{l^V_{c_{(v,l)}}}{t^V_{f_{(v,l)}}}\times\frac{t^V_{f_{(v,l)}}}{l^V_{(v,l)}}=\frac{MI^V_{(v,l)}}{V^V_{f_{(v,l)}}}$$

[0111] a proportion of a mileage of a heavily congested road of the vehicle V_v is reckoned as follows:

$$m_v^V=\frac{\sum_{l\in S_{V,v}^L} l^V_{c_{(v,l)}}}{\sum_{l\in S_{V,v}^L} l^V_{(v,l)}}=\frac{\sum_{l\in S_{V,v}^L} l^V_{c_{(v,l)}}}{\sum_{l\in S_{V,v}^L} t^L_{f_l}}\times\frac{\sum_{l\in S_{V,v}^L} t^L_{f_l}}{\sum_{l\in S_{V,v}^L} l^V_{(v,l)}}=\frac{MI_v^V}{\overline{V}^V_{f_v}}$$

[0112] a proportion of a mileage of a heavily congested road of the lane L_l is reckoned as follows:

$$m_l^L=\frac{\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}\times\frac{\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}{\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{MI_l^L}{\overline{V}^L_{f_l}}$$

[0113] a proportion of a mileage of a heavily congested road of the subsection U_u is reckoned as follows:

$$m_u^U=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}\times\frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{MI_u^U}{\overline{V}^U_{f_u}}$$

[0114] a proportion of a mileage of a heavily congested road of the section S_s is reckoned as follows:

$$m_s^S=\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}\times\frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{MI_s^S}{\overline{V}^S_{f_s}}$$

[0115] a proportion of a mileage of a heavily congested road of the intersection I; is reckoned as follows:

$$m_i^I=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} l^V_{c_{(v,l)}}}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}\times\frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t^V_{f_{(v,l)}}}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} l^V_{(v,l)}}=\frac{MI_i^I}{\overline{V}^I_{f_i}}$$

[0116] a proportion of a mileage of a heavily congested road of the road R_r is reckoned as follows:

$$m_r^R=\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} l_{(v,l)}^V}=\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}\times\frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} l_{(v,l)}^V}=\frac{MI_r^R}{\overline{V}_{fr}^R}$$

[0117] a proportion of a mileage of a heavily congested road of the sub-zone Z_z is reckoned as follows:

$$m_z^Z=\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} l_{(v,l)}^V}=\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}\times\frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}=\frac{MI_z^Z}{\overline{V}_{fz}^Z}$$

[0118] a proportion of a mileage of a heavily congested road of the zone is reckoned as follows:

$$M^A=\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} l_{(v,l)}^V}=\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}\times\frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} l_{c(v,l)}^V}=\frac{MI^A}{\overline{V}_f^A}$$

[0119] wherein $m_{(v,l)}{}^V$ is the proportion of the mileage of the heavily congested road of the vehicle V_v on the lane L_l; $l_{(v,l)}{}^V$ is a vehicle mileage of the vehicle V_v passing the lane L_l; $V_{f(v,l)}{}^V$ is a flow-free driving speed of the vehicle V_v passing the lane L_l; $m_v{}^V$, $m_l{}^L$, $m_u{}^U$, $m_s{}^S$, $m_i{}^I$, $m_r{}^R$, $m_z{}^Z$, and m^A represent proportions of mileages of heavily congested roads of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and $\nabla_{fv}{}^V$, $\nabla_{fl}{}^L$, $\nabla_{fu}{}^U$, $\nabla_{fs}{}^S$, $\hat{\nabla}_{fi}{}^I$, ∇fr^R, ∇fz^Z, and ∇_f^A represent average flow-free driving speeds of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively.

[0120] As a preferred technical solution, a new method for calculating traffic operation state evaluation characteristic indexes is formed collectively by four indexes: the traffic operation index, the delay time index, the index of the number of times of stopping, and the index of the mileage of the congested road, wherein the larger the traffic operation index, the delay time index, the index of the number of times of stopping, and the index of the mileage of the congested road are, the worse the traffic operation state is, that is, the more congested the road traffic is.

[0121] Compared with the prior art, the present invention has the beneficial effects that:

[0122] 1. The present invention provides a method for determining the traffic weight coefficients for combined calculation of the traffic operation states of the road network, to reckon the traffic weight coefficients of various evaluation objects at the different spatial scales, which can effectively reflect the proportions of the road time-space resources of various evaluation objects in the whole road network.

[0123] 2. With the unit free-flow driving time as a quantitative standard, on the basis of a similar capability of calculating original traffic operation state evaluation indexes, the present invention re-establishes a new evaluation index system calculation method, which normalizes the traffic state characteristic indexes, and can be applicable to analysis and comparison on the traffic operation states of different road networks.

[0124] 3. In combination with the traffic weight coefficients, the present invention reckons the traffic operation indexes, the average delay times, the average numbers of times of stopping, the proportions of the mileages of the heavily congested roads, and other traffic operation characteristic indexes at the different spatial scales by weighting different compositions of the roads at the different spatial scales in the road network, which further enriches a theoretical method for digital construction of the urban road network.

BRIEF DESCRIPTION OF THE DRAWINGS

[0125] FIG. **1** is a flowchart of a digital road network traffic state reckoning method based on multi-scale calculation;

[0126] FIG. **2** is a schematic structural diagram of a road network according to an embodiment; and

[0127] FIG. **3** is a division schematic diagram of a traffic sub-zone Z_1 in a road network according to an embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0128] The present invention will be further described in detail below in combination with the accompanying drawings and the specific embodiments, which is not to be construed as limiting to the present invention.

[0129] As shown in FIG. **2**, assuming that a road network consists of three east-west roads (R_1, R_2, and R_3) and three north-south roads (R_4, R_5, and R_6), including 9 signal control intersections, 48 sections, and 336 lanes in total. FIG. **1** is a flowchart of a digital road network traffic state reckoning method based on multi-scale calculation provided by an example, specifically including the following implementation steps:

[0130] Step 1, acquiring traffic weight coefficients of vehicles according to free-flow driving times of the vehicles and an overall free-flow driving time of a road network.

[0131] Based on a vehicle detector and other road traffic data acquisition tools, basic traffic operation data of various passing vehicles in the road network is acquired. According to the acquired free-flow driving times $t_{f(v,l)}^V$ of various passing vehicles on different lanes in the road network, the traffic weight coefficients $w_{(v,l)}^V$ of the vehicles V_v in various lanes L_l are calculated, and the traffic weight coefficients $w_{(v,l)}^V$ of the different lanes in the road network belonging to the vehicles V_v are summed, to obtain the traffic weight coefficient w_v^V of the v^{th} vehicle in the road network as follows:

$$w_v^V = \sum_{l\in S_{V,v}^L} \frac{t_{f_l}^L}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^L} t_{f_l}^L} = \sum_{l\in S_{V,v}^L} w_{(v,l)}^V$$

[0132] Taking vehicles V_{46} and V_{47} as examples, calculation results of the traffic weight coefficients of the vehicles are shown in Table 1.

TABLE 1

Traffic Weight Coefficients of Vehicles

Vehicle number	Lane number	$t_{f(v,l)}^v$/s	$w_{(v,l)}^V$	w_v^V
. . .	. . .	. . .	. . .	. . .
V_{46}	L_4	35.0	0.00013	0.00067
	L_5	37.8	0.00014	
	L_7	2.4	0.00015	
	L_{11}	27.0	0.00010	
	L_{13}	2.4	0.00013	
	L_{123}	0.7	0.00000	
	L_{200}	3.2	0.00001	
	L_{214}	3.1	0.00001	

TABLE 1-continued

Traffic Weight Coefficients of Vehicles

Vehicle number	Lane number	$t_{f(v,l)}^v$/s	$w_{(v,l)}^V$	w_v^V
V_{47}	L_{21}	39.0	0.00014	0.00035
	L_{25}	1.0	0.00000	
	L_{26}	2.7	0.00019	
	L_{276}	3.8	0.00002	
. . .	. . .	. . .	. . .	. . .
Total		169623.2	1	1

[0133] Step 2, calculating traffic weight coefficients of evaluation objects in the road network at different spatial scales level by level in combination with the traffic weight coefficients of the vehicles and a composition structure of the road network.

[0134] According to the traffic weight coefficients $w_{(v,l)}^V$ of the vehicle V_v on different lanes L_l in the road network, the traffic weight coefficients of all compositions belonging to a certain specified evaluation object at one spatial scale are summed to obtain the traffic weight coefficient of the evaluation object.

[0135] In the embodiment, the traffic weight coefficients of various lanes, various intersections, and various roads are calculated by using the traffic weight coefficients $w_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l in Table 1. Calculation results are shown in Table 2, Table 3, and Table 4.

TABLE 2

Traffic Weight Coefficients of Lanes

Lane number	q_l^L/ (vehicle/h)	t_l^L/s	$\bar{d}_l^L$/s	$\bar{h}_l^L$/ time	m_l^L	t_{fl}^L/s	w_l^L
L_1	452	33.67	1.40	0.02	2.67%	32.27	0.0215
L_2	240	23.77	21.35	0.62	35.92%	2.42	0.0009
L_3	228	31.28	28.83	0.68	42.52%	2.45	0.0008
L_4	312	32.00	0.09	0.00	0.26%	31.91	0.0147
L_5	328	39.32	1.25	0.00	2.64%	38.07	0.0184
L_6	176	6.36	3.70	0.14	8.40%	2.67	0.0007
L_7	152	31.50	28.87	0.82	41.15%	2.63	0.0006
L_8	404	43.36	4.84	0.08	5.87%	38.51	0.0229
L_9	236	23.83	21.31	0.56	35.78%	2.52	0.0009
L_{10}	192	24.17	21.68	0.63	41.11%	2.48	0.0007
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Total	5300	207.70	79.68	1.77	5.65%	128.02	1

TABLE 3

Traffic Weight Coefficients of Intersection I_2

Entrance direction	Lane attribute	Lane number	q_l^L/ (vehicle/h)	t_l^L/s	$\bar{d}_l^L$/s	$\bar{h}_l^L$/time	m_l^L	t_{fl}^L/s	w_l^L	Various entrances w	w_i^I
North	Tapered section	L_{261}	80	1.00	0.29	0.00	23.60%	0.72	0.0001	0.0034	0.0118
	Tapered section	L_{262}	100	2.32	1.80	0.08	41.66%	0.52	0.0001		
	Entrance lane	L_{82}	200	26.88	24.78	0.80	47.65%	2.10	0.0006		

TABLE 3-continued

Traffic Weight Coefficients of Intersection I_2												
Entrance direction	Lane attribute	Lane number	q_l^L/ (vehicle/h)	t_l^L/s	$\overline{d}_l^L$/s	$\overline{h}_l^L$/time	m_l^L	$t_{f\,l}^L$/s	w_l^L	Various entrances w	w_i^I
	Entrance lane	L_{83}	216	26.19	23.94	0.74	42.90%	2.24	0.0007		
	Left turning	L_{227}	8	3.50	0.60	0.00	14.56%	2.90	0.0000		
	Straight driving	L_{218}	180	3.98	0.57	0.00	10.98%	3.41	0.0009		
	Straight driving	L_{220}	188	3.91	0.50	0.00	16.97%	3.41	0.0009		
	Right turning	L_{219}	24	2.33	0.48	0.00	9.84%	1.85	0.0001		
East	Tapered section	L_{126}	76	1.05	0.26	0.00	16.39%	0.79	0.0001	0.0026	
	Tapered section	L_{127}	84	2.90	2.26	0.10	28.41%	0.65	0.0001		
	Entrance lane	L_{12}	144	28.61	25.90	0.75	39.75%	2.71	0.0006		
	Entrance lane	L_{13}	148	24.59	21.93	0.73	39.25%	2.66	0.0006		
	Left turning	L_{213}	8	2.50	0.25	0.00	7.57%	2.25	0.0000		
	Straight driving	L_{214}	140	3.60	0.56	0.00	11.98%	3.04	0.0006		
	Straight driving	L_{216}	128	3.69	0.59	0.00	14.72%	3.09	0.0006		
	Right turning	L_{215}	12	2.67	0.43	0.00	12.22%	2.23	0.0000		
South	Tapered section	L_{170}	44	1.00	0.20	0.00	16.92%	0.80	0.0000	0.0021	
	Tapered section	L_{171}	60	1.00	0.21	0.00	17.48%	0.79	0.0001		
	Entrance lane	L_{86}	108	25.74	23.41	0.81	40.84%	2.33	0.0004		
	Entrance lane	L_{87}	124	24.23	21.85	0.68	38.72%	2.38	0.0004		
	Left turning	L_{172}	8	3.50	0.65	0.00	14.80%	2.85	0.0000		
	Straight driving	L_{173}	100	4.00	0.57	0.00	10.34%	3.43	0.0005		
	Straight driving	L_{175}	108	4.07	0.54	0.00	17.16%	3.53	0.0006		
	Right turning	L_{174}	16	3.25	0.70	0.00	9.78%	2.55	0.0001		
West	Tapered section	L_{124}	108	0.53	3.66	0.07	34.79%	0.53	0.0001	0.0037	
	Tapered section	L_{125}	56	0.49	3.23	0.14	39.20%	0.49	0.0000		
	Entrance lane	L_9	236	23.83	21.31	0.56	35.78%	2.52	0.0009		
	Entrance lane	L_{10}	192	24.17	21.68	0.63	41.11%	2.48	0.0007		
	Left turning	L_{205}	16	2.58	0.93	0.00	20.41%	2.58	0.0001		
	Straight driving	L_{206}	220	3.25	0.38	0.00	8.18%	3.25	0.0011		
	Straight driving	L_{208}	180	3.11	0.51	0.00	5.15%	3.11	0.0008		
	Right turning	L_{207}	12	1.90	0.10	0.00	10.84%	1.90	0.0000		

[0136] In Table 3, the "tapered section", the "entrance lane", the "left turning", the "straight driving", and the "right turning" in the lane attributes represent a stretching-tapered section lane of an intersection, an entrance canalized lane of the intersection, and a left turn traffic through lane, a straight traffic through lane, and a right turn traffic through lane in a certain entrance direction in the intersection respectively.

TABLE 4

Traffic Weight Coefficients of Roads

Road number	Section/inter-section number	Lane number	Vehicle number	$w_{(v,l)}^V$	w_l^L	w_s^S/ w_i^I	w_r^R
R_1	S_1	L_1	V_{322}	0.000054	0.021	0.021	0.197
			V_{323}	0.000067			
			V_{1885}	0.000118			
			V_{1892}	0.000112			
			...	...			
	S_2	L_4	...		0.015	0.015	
	I_1		...			0.013	
	S_3	L_5	...		0.018	0.018	
	S_4	L_8	...		0.023	0.023	
	I_2		...			0.012	
	S_5	L_{11}	...		0.021	0.021	
	S_6	L_{14}	...		0.027	0.027	
	I_3		...			0.012	
	S_7	L_{17}	...		0.021	0.021	
	S_8	L_{18}	...		0.014	0.014	
R_2			...				0.182
R_3			...				0.158
R_4			...				0.198
R_5			...				0.182
R_6			...				0.189

[0137] As shown in FIG. **3**, according to the lane composition of the sub-zone Z_1, the traffic weight coefficients w_1^Z of the sub-zone Z_1 is obtained by using the traffic weight coefficients $w_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l in Table 1, as follows:

$$w_1^Z = \sum_{s\in S_{Z,1}^S} w_s^S + \sum_{i\in S_{Z,1}^I} w_i^I = \sum_{l\in S_{Z,1}^L} \sum_{v\in S_{L,l}^V} w_{(v,l)}^V = 0.5274$$

[0138] For the whole road network, the traffic weight coefficients W^A of the road network can also be obtained by summing the traffic weight coefficients $w_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l in the road network:

$$w^A = \sum_{l=1}^{N^L} w_l^L = \sum_{l\in S_A^L} \sum_{v\in S_{L,l}^V} w_{(v,l)}^V = \sum_{v=1}^{N^V} w_v^V = 1$$

[0139] Step 3, reckoning traffic operation indexes of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average travel time, the free-flow driving times, and the traffic weight coefficients of the vehicles.

[0140] In the embodiment, the traffic operation indexes $PI_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l are obtained by using the free-flow driving times $t_{f(v,l)}^V$ and the travel times $t_{(v,l)}^V$ of the vehicles V_v on the lanes L_l in the road network. Further, in combination with the traffic weight coefficients $w_{(v,l)}^V$ various passing vehicles V_v on the different lanes L_l in Table 1, the traffic operation indexes PI_v^V of the vehicles V_v are reckoned.

$$PI_{(v,l)}^V = \frac{t_{(v,l)}^V}{t_{f(v,l)}^V};\ PI_v^V = \frac{\sum l\in S_{V,v}^L \left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{V,v}^L} w_{(v,l)}^V}$$

[0141] Taking the vehicles V_{46} and V_{47} as examples, calculation results of $PI_{(v,l)}^V$ and PI_v^V are shown in Table 5.

TABLE 5

Traffic Operation States of Vehicles

Vehicle number	Lane number	$t_{(v,l)}^V$/s	$d_{(v,l)}^V$/s	$h_{(v,l)}^V$/time	$m_{(v,l)}^V$	$PI_{(v,l)}^V$	$DI_{(v,l)}^V$	$HI_{(v,l)}^V$/(times/min)	$MI_{(v,l)}^V$/(m/min)	Operation condition
...	...	...	...	...	...	...	...	...	...	...
V_{46}	L_4	35	0.0	0	0.00%	1.00	0.00	0.00	0.00	$PI_{46}^V = 1.68$
	L_5	38	0.2	0	0.47%	1.01	0.01	0.00	3.89	$DI_{46}^V = 0.68$
	L_7	41	38.6	1	63.55%	17.08	16.08	25.00	544.17	$HI_{46}^V = 1.08$
	L_{11}	27	0.0	0	0.00%	1.00	0.00	0.00	0.00	$MI_{46}^V = 32.91$
	L_{13}	37	34.6	1	54.28%	15.42	14.42	25.00	493.22	
	L_{123}	1	0.3	0	30.00%	1.43	0.43	0.00	272.06	
	L_{200}	4	0.8	0	16.60%	1.25	0.25	0.00	126.30	
	L_{214}	4	0.9	0	18.65%	1.29	0.29	0.00	142.34	
V_{47}	L_{21}	39	0.0	0	0.00%	1.00	0.00	0.00	0.00	$PI_{47}^V = 2.09$
	L_{25}	1	0.0	0	0.00%	1.00	0.00	0.00	0.00	$DI_{47}^V = 1.09$
	L_{26}	52	49.3	1	40.00%	19.26	18.26	22.22	335.71	$HI_{47}^V = 1.29$
	L_{276}	5	1.2	0	18.38%	1.32	0.32	0.00	126.76	$MI_{47}^V = 29.85$
...	...	...	...	...	...	...	...	...	...	...

[0142] In Table 5, HI_v^V is in a unit of "times/min", and MI_c^V is in a unit of "m/min".

[0143] Based on the acquired traffic operation indexes $PI_{(v,l)}^V$ of the vehicles V_v on the lanes L_l, in combination with the traffic weight coefficients $w_{(v,l)}^V$, acquired in step 1, of various passing vehicles V_v on different lanes L_l in the road network, the traffic operation indexes PI_l^L of various lanes in the road network are calculated:

$$PI_l^L = \frac{\sum_{v \in S_{L,l}^V} \left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0144] Calculation results are shown in Table 6.

TABLE 6

Traffic Operation States of Lanes

Lane number	PI_l^L	DI_l^L	HI_l^L/ (times/min)	MI_l^L/ (m/min)	$\nabla_{f\,l}^L$/ (m/s)	$t_{f\,l}^L$/s	$\bar{d}_l^L$/s	$\bar{h}_l^L$/time	m_l^L
L_1	1.04	0.04	0.03	21.69	13.54	32.27	1.40	0.02	2.67%
L_2	9.81	8.81	15.28	288.87	13.40	2.42	21.35	0.62	35.92%
L_3	12.74	11.74	16.73	340.75	13.36	2.45	28.83	0.68	42.52%
L_4	1.00	0.00	0.00	2.22	14.01	31.91	0.09	0.00	0.26%
L_5	1.03	0.03	0.00	21.41	13.53	38.07	1.25	0.00	2.64%
L_6	2.39	1.39	3.07	67.62	13.42	2.67	3.70	0.14	8.40%
L_7	11.99	10.99	18.64	351.95	14.26	2.63	28.87	0.82	41.15%
L_8	1.13	0.13	0.12	47.57	13.51	38.51	4.84	0.08	5.87%
L_9	9.47	8.47	13.33	282.27	13.15	2.52	21.31	0.56	35.78%
L_{10}	9.73	8.73	15.10	331.45	13.44	2.48	21.68	0.63	41.11%
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Total	1.62	0.62	0.83	46.53	13.72	128.02	79.68	1.77	5.65%

[0145] Further, according to the acquired traffic operation indexes PI_l^L T of the lanes, in combination with the traffic weight coefficients, obtained in step 2, of various lanes, various intersections, and various roads, the traffic operation indexes of various intersections and various roads in the road network are calculated:

$$PI_i^I = \frac{\sum_{l \in S_{I,i}^L} \left(PI_l^L \times w_l^L\right)}{\sum_{l \in S_{I,i}^L} w_l^L}; PI_r^R = \frac{\sum_{l \in S_{R,r}^L} \left(PI_l^L \times w_l^L\right)}{\sum_{l \in S_{R,r}^L} w_l^L}$$

[0146] In the embodiment, taking the intersection I_2 as an example, calculation results of the traffic operation indexes P_2^1, of the intersection I_2 are shown in Table 7; and calculation results of the traffic operation indexes PI_r^R of various roads in the road network are shown in Table 8.

TABLE 7

Traffic Operation States of Intersection I_2

Entrance direction	Lane attribute	Lane number	PI_l^L	DI_l^L	HI_l^L/(times/min)	MI_l^L/(m/min)	$\nabla_{f\,l}^L$/(m/s)	$t_{f\,l}^L$/s	Various entrances	Whole intersection
North	Tapered section	L_{261}	1.40	0.40	0.00	206.58	14.59	0.72	PI = 5.51 DI = 4.51	PI_2' = 5.15 DI_2' = 4.15
	Tapered section	L_{262}	4.43	3.43	9.16	383.99	15.36	0.52	HI = 8.42 MI = 204.01	HI_2' = 7.43 MI_2' = 192.40
	Entrance lane	L_{82}	12.82	11.82	22.90	395.55	13.84	2.10	$\bar{d}$ = 25.35 $\bar{h}$ = 0.79	t_f = 5.86 ∇_f = 13.23
	Entrance lane	L_{83}	11.69	10.69	19.83	349.30	13.57	2.24	m = 25.50%	$\bar{d}$ = 24.30 $\bar{h}$ = 0.73
	Left turning	L_{227}	1.21	0.21	0.00	108.26	12.39	2.90		m = 24.23%
	Straight driving	L_{218}	1.17	0.17	0.00	84.25	12.79	3.41		
	Straight driving	L_{220}	1.15	0.15	0.00	77.69	13.16	3.41		
	Right turning	L_{219}	1.26	0.26	0.00	127.49	12.52	1.85		

TABLE 7-continued

Traffic Operation States of Intersection I_2

Entrance direction	Lane attribute	Lane number	PI_l^L	DI_l^L	HI_l^L/(times/min)	MI_l^L/(m/min)	$\nabla_{f\,l}^{L}$/(m/s)	$t_{f\,l}^{L}$/s	Various entrances	Whole intersection
East	Tapered section	L_{126}	1.32	0.32	0.00	135.52	13.78	0.79	PI = 5.16 DI = 4.16	
	Tapered section	L_{127}	4.49	3.49	8.82	243.44	14.28	0.65	HI = 7.62 MI = 202.46	
	Entrance lane	L_{12}	10.56	9.56	16.62	328.03	13.75	2.71	$\bar{d}$ = 25.16 $\bar{h}$ = 0.77	
	Entrance lane	L_{13}	9.24	8.24	16.45	326.78	13.88	2.66	m = 25.47%	
	Left turning	L_{213}	1.11	0.11	0.00	60.96	13.42	2.25		
	Straight driving	L_{214}	1.19	0.19	0.00	92.71	12.90	3.04		
	Straight driving	L_{216}	1.19	0.19	0.00	90.59	12.36	3.09		
	Right turning	L_{215}	1.19	0.19	0.00	104.44	11.83	2.23		
South	Tapered section	L_{170}	1.25	0.25	0.00	139.49	13.74	0.80	PI = 4.80 DI = 3.80	
	Tapered section	L_{171}	1.26	0.26	0.00	152.38	14.53	0.79	HI = 7.28 MI = 180.95	
	Entrance lane	L_{86}	11.05	10.05	20.99	341.04	13.92	2.33	$\bar{d}$ = 23.24 $\bar{h}$ = 0.74	
	Entrance lane	L_{87}	10.18	9.18	17.07	322.86	13.90	2.38	m = 22.76%	
	Left turning	L_{172}	1.23	0.23	0.00	110.92	12.49	2.85		
	Straight driving	L_{173}	1.17	0.17	0.00	77.99	12.57	3.43		
	Straight driving	L_{175}	1.15	0.15	0.00	75.63	12.89	3.53		
	Right turning	L_{174}	1.27	0.27	0.00	124.32	12.08	2.55		
West	Tapered section	L_{124}	7.90	6.90	8.39	282.64	13.54	0.53	PI = 4.99 DI = 3.99	
	Tapered section	L_{125}	7.65	6.65	17.65	347.13	14.76	0.49	HI = 6.45 MI = 180.92	
	Entrance lane	L_9	9.47	8.47	13.33	282.27	13.15	2.52	$\bar{d}$ = 23.27 $\bar{h}$ = 0.63	
	Entrance lane	L_{10}	9.73	8.73	15.10	331.45	13.44	2.48	m = 22.98%	
	Left turning	L_{205}	1.36	0.36	0.00	153.98	12.58	2.58		
	Straight driving	L_{206}	1.12	0.12	0.00	63.45	12.92	3.25		
	Straight driving	L_{208}	1.17	0.17	0.00	84.73	13.02	3.11		
	Right turning	L_{207}	1.05	0.05	0.00	38.01	12.30	1.90		

TABLE 8

Calculation Results of Traffic Operation States of Roads

Road number	Number	w	PI	DI	HI/(times/min)	MI/(m/min)	PI_r^R	DI_r^R	HI_r^R/(times/min)	MI_r^R/(m/min)
R_1	s $S_{R,1}^{S-}$	0.160	1.05	0.05	0.04	26.38	1.90	0.90	1.39	56.67
	I_1	0.013	5.57	4.57	7.08	182.38				
	I_2	0.012	5.15	4.15	7.43	192.40				
	I_3	0.012	6.19	5.19	7.63	195.87				
R_2	s $S_{R,2}^{S-}$	0.146	1.09	0.09	0.08	31.81	2.09	1.09	1.44	62.24
	I_4	0.013	4.97	3.97	6.77	176.75				
	I_5	0.012	6.21	5.21	6.43	180.54				
	I_6	0.011	7.45	6.45	7.71	201.07				
R_3	s $S_{R,3}^{S-}$	0.125	1.09	0.09	0.10	33.64	2.27	1.27	1.47	63.29
	I_7	0.011	6.49	5.49	7.00	181.83				
	I_8	0.011	6.99	5.99	5.88	160.93				
	I_9	0.011	6.82	5.82	7.08	185.10				

TABLE 8-continued

Calculation Results of Traffic Operation States of Roads

Road number	Number	w	PI	DI	HI/(times/min)	MI/(m/min)	PI_r^R	DI_r^R	HI_r^R/(times/min)	MI_r^R/(m/min)
R_4	s $S_{R,4}^{S-}$	0.161	1.10	0.10	0.14	30.43	1.95	0.95	1.41	58.40
	I_1	0.013	5.57	4.57	7.08	182.38				
	I_4	0.013	4.97	3.97	6.77	176.75				
	I_7	0.011	6.49	5.49	7.00	181.83				
R_5	s $S_{R,5}^{S-}$	0.148	1.10	0.10	0.14	29.93	2.04	1.04	1.36	57.93
	I_2	0.012	5.15	4.15	7.43	192.40				
	I_5	0.012	6.21	5.21	6.43	180.54				
	I_8	0.011	6.99	5.99	5.88	160.93				
R_6	s $S_{R,6}^{S-}$	0.155	1.10	0.10	0.12	30.75	2.12	1.12	1.45	60.10
	I_3	0.012	6.19	5.19	7.63	195.87				
	I_6	0.011	7.45	6.45	7.71	201.07				
	I_9	0.011	6.82	5.82	7.08	185.10				

[0147] Taking the sub-zone Z_1 as an example, the traffic operation indexes PI_1^Z of the sub-zone Z_1 are obtained by using the acquired traffic weight coefficients w_l^L and the traffic operation indexes PI_l^L of various lanes in the road network:

$$PI_1^Z = \frac{\sum_{l \in S_{Z,z}^L} (PI_l^L \times w_l^L)}{\sum_{l \in S_{Z,z}^L} w_l^L} = 1.51$$

[0148] For the whole road network, the traffic operation indexes PI^A of the road network can also be calculated by using the acquired traffic weight coefficients w and traffic operation indexes PI_l^L of various lanes in the road network. Calculation results are shown in Table 6.

$$PI^A = \sum_{l \in S_A^L} (PI_l^L \times w_l^L) = 1.62$$

[0149] Step 4, reckoning delay time indexes of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average delay time, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating average delay times of various evaluation objects at the different spatial scales in combination with the free-flow driving times of the vehicles.

[0150] In the embodiment, the delay time indexes DI (v,l) of various passing vehicles V_v on the different lanes L_l are obtained by using the free-flow driving times $t_{f(v,l)}^V$ and the delay times $d_{(v,l)}^V$ of the vehicles V_v on the lanes L_l in the road network. Further, in combination with the traffic weight coefficients $w_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l in Table 1, the delay time indexes DI_v^V of the vehicles V_v are reckoned.

$$DI_{(v,l)}^V = \frac{d_{(v,l)}^V}{t_{f(v,l)}^V};\ DI_v^V = \frac{\sum_{l \in S_{V,v}^L} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{l \in S_{V,v}^L} w_{(v,l)}^V}$$

[0151] Taking the vehicles V_{46} and V_{47} as examples, calculation results of $DI_{(v,l)}^V$ and DI_v^V are shown in Table 5.

[0152] Based on the acquired delay time indexes $DI_{(v,l)}^V$ of the vehicles V_v on the lanes L_l, in combination with the traffic weight coefficients $w_{(v,l)}^V$, acquired in step 1, of various passing vehicles V_v on different lanes L_l in the road network, the delay time indexes DI_l^L of various lanes in the road network are calculated:

$$DI_l^L = \frac{\sum_{v \in S_{L,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0153] Calculation results are shown in Table 6.

[0154] Further, according to the acquired delay time indexes DI_l^L of the lanes, in combination with the traffic weight coefficients, obtained in step 2, of various lanes, various intersections, and various roads, the delay time indexes of various intersections and various roads in the road network are calculated:

$$DI_i^I = \frac{\sum_{l \in S_{I,i}^L} (DI_l^L \times w_l^L)}{\sum_{l \in S_{I,i}^L} w_l^L};\ DI_r^R = \frac{\sum_{l \in S_{R,r}^L} (DI_l^L \times w_l^L)}{\sum_{l \in S_{R,r}^L} w_l^L}$$

[0155] In the embodiment, taking the intersection I_2 as an example, calculation results of the delay time indexes DI_2^1 of the intersection I_2 are shown in Table 7; and calculation results of the delay time indexes DI_r^R of various roads in the road network are shown in Table 8.

[0156] Taking the sub-zone Z_1 as an example, the delay time indexes DI_1^Z of the sub-zone Z_1 are obtained by using the acquired traffic weight coefficients w_l^L and delay time indexes DI_l^L of various lanes in the road network:

$$DI_1^Z = \frac{\sum_{l \in S_{Z,z}^L} (DI_l^L \times w_l^L)}{\sum_{l \in S_{Z,z}^L} w_l^L} = 0.51$$

[0157] For the whole road network, the delay time indexes DI^A of the road network can also be calculated by using the acquired traffic weight coefficients w_l^L and delay time indexes DI_l^L of various lanes in the road network. Calculation results are shown in Table 6.

$$DI^A = \sum_{l \in S_A^L} \left(DI_l^L \times w_l^L \right) = 0.62$$

[0158] Further, by calculating products of the delay time indexes of various lanes, various sections, various intersections, and various roads in the road network and the road network, and corresponding average free-flow driving times, the average delay times of various evaluation objects can be obtained, as shown in Table 6, Table 7, and Table 9. The average delay times calculated by using the delay time indexes of various evaluation objects are consistent with results actually calculated by a definition of an average delay time.

TABLE 9

Traffic Operation State Characteristic Indexes of Roads

Road number	Number	t_f/s	$\overline{V}_f$/(m/s)	$\overline{d}$/s	$\overline{h}$/time	m	$t_{f\,r}^R$/s	$\overline{V}_{f\,r}^R$/(m/s)	$\overline{d}_r^R$/s	$\overline{h}_r^R$/time	m_r^R
R_1	s $S_{R,\,1}^{S-}$	103.84	13.59	5.62	0.06	3.23%	42.31	13.54	38.18	0.98	6.98%
	I_1	5.70	13.34	26.05	0.67	22.79%					
	I_2	5.81	13.23	24.09	0.72	24.23%					
	I_3	5.93	13.28	30.79	0.75	24.59%					
R_2	s $S_{R,\,2}^{S-}$	94.44	13.74	8.31	0.13	3.86%	39.10	13.65	42.49	0.94	7.60%
	I_4	6.46	13.34	25.65	0.73	22.09%					
	I_5	5.78	13.26	30.12	0.62	22.70%					
	I_6	5.64	13.34	36.34	0.72	25.12%					
R_3	s $S_{R,\,3}^{S-}$	80.78	13.64	7.37	0.13	4.11%	33.89	13.57	43.19	0.83	7.78%
	I_7	5.70	13.32	31.26	0.66	22.74%					
	I_8	6.03	13.19	36.16	0.59	20.33%					
	I_9	5.85	13.32	34.00	0.69	23.16%					
R_4	s $S_{R,\,4}^{S-}$	104.05	13.95	10.53	0.24	3.64%	42.49	13.83	40.22	1.00	7.04%
	I_1	5.70	13.34	26.05	0.67	22.79%					
	I_4	6.46	13.34	25.65	0.73	22.09%					
	I_7	5.70	13.32	31.26	0.66	22.74%					
R_5	s $S_{R,\,5}^{S-}$	95.80	13.71	9.43	0.23	3.64%	39.21	13.62	40.86	0.89	7.09%
	I_2	5.81	13.23	24.09	0.72	24.23%					
	I_5	5.78	13.26	30.12	0.62	22.70%					
	I_8	6.03	13.19	36.16	0.59	20.33%					
R_6	s $S_{R,\,6}^{S-}$	100.35	13.94	10.02	0.21	3.68%	40.62	13.83	45.66	0.98	7.24%
	I_3	5.93	13.28	30.79	0.75	24.59%					
	I_6	5.64	13.34	36.34	0.72	25.12%					
	I_9	5.85	13.32	34.00	0.69	23.16%					

[0159] Step 5, reckoning indexes of the numbers of times of stopping of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average number of times of stopping, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating average numbers of times of stopping of various evaluation objects at the different spatial scales in combination with the free-flow driving times of the vehicles.

[0160] In the embodiment, the indexes of the numbers of times of stopping $HI_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l are obtained by using the free-flow driving times $t_{f(v,l)}^V$ and the numbers of times of stopping $h_{(v,l)}^V$ of the vehicles V_v on the lanes L_l in the road network. Further, in combination with the traffic weight coefficients $w_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l in Table 1, the indexes of the numbers of times of stopping HI_v^V of the vehicles V_v are reckoned.

$$HI_{(v,l)}^V = \frac{h_{(v,l)}^V}{t_{f(v,l)}^V};\ HI_v^V = \frac{\sum_{l \in S_{V,v}^L} \left(HI_{(v,l)}^V \times w_{(v,l)}^V \right)}{\sum_{l \in S_{V,v}^L} w_{(v,l)}^V}$$

[0161] Taking the vehicles V_{46} and V_{47} as examples, calculation results of $HI_{(v,l)}^V$ and HI_v^V are shown in Table 5.

[0162] Based on the acquired indexes of the numbers of times of stopping $HI_{(v,l)}^V$ of the vehicles V_v on the lanes L_l in combination with the traffic weight coefficients $w_{(v,l)}^V$, acquired in step 1, of various passing vehicles V_v on different lanes L_l in the road network, the indexes of the numbers of times of stopping HIT of various lanes in the road network are calculated:

$$HI_l^L = \frac{\sum_{v \in S_{L,l}^V} \left(HI_{(v,l)}^V \times w_{(v,l)}^V \right)}{\sum_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0163] Calculation results are shown in Table 6.

[0164] Further, according to the acquired indexes of the numbers of times of stopping HI_l^L of the lanes, in combination with the traffic weight coefficients, obtained in step 2, of various lanes, various intersections, and various roads, the indexes of the numbers of times of stopping of various intersections and various roads in the road network are calculated:

$$HI_i^I = \frac{\sum_{l \in S_{I,i}^L} (HI_l^L \times w_l^L)}{\sum_{l \in S_{I,i}^L} w_l^L}; HI_r^R = \frac{\sum_{l \in S_{R,r}^L} (HI_l^L \times w_l^L)}{\sum_{l \in S_{R,r}^L} w_l^L}$$

[0165] In the embodiment, taking the intersection I_2 as an example, calculation results of the indexes of the numbers of times of stopping HI_2^1 of the intersection I_2 are shown in Table 7; and calculation results of the indexes of the numbers of times of stopping HI_r^R of various roads in the road network are shown in Table 8.

[0166] Taking the sub-zone Z_1 as an example, the indexes of the numbers of times of stopping HI_1^Z of the sub-zone Z are obtained by using the acquired traffic weight coefficients w_l^L and indexes of the numbers of times of stopping HI_l^L of various lanes in the road network:

$$HI_i^Z = \frac{\sum_{l \in S_{Z,z}^L} (HI_l^L \times w_l^L)}{\sum_{l \in S_{Z,z}^L} w_l^L} = 0.75 \text{ times/min}$$

[0167] For the whole road network, the indexes of the numbers of times of stopping HI^A of the road network can also be calculated by using the acquired traffic weight coefficients w_l^L and indexes of the numbers of times of stopping HI_l^L of various lanes in the road network. Calculation results are shown in Table 6.

$$HI^A = \sum_{l \in S_A^L} (HI_l^L \times w_l^L) = 0.83 \text{ times/min}$$

[0168] Further, by calculating products of the indexes of the numbers of times of stopping of various lanes, various sections, various intersections, and various roads in the road network and the road network, and corresponding average free-flow driving times, the average numbers of times of stopping of various evaluation objects can be obtained, as shown in Table 6, Table 7, and Table 9. The average numbers of times of stopping calculated by using the indexes of the numbers of times of stopping of various evaluation objects are consistent with results actually calculated by a definition of the average number of times of stopping.

[0169] Step 6, reckoning indexes of mileages of congested roads of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using mileages of heavily congested roads, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating proportions of the mileages of the heavily congested roads of various evaluation objects at the different spatial scales in combination with free-flow driving speeds of the vehicles.

[0170] In the embodiment, the indexes of the mileages of the congested roads $MI_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l are obtained by using the free-flow driving times $t_{f(v,l)}^V$ and overall mileages of the congested roads $l_{c(v,l)}^V$ of the vehicles V_v on the lanes L_l in the road network. Further, in combination with the traffic weight coefficients $w_{(v,l)}^V$ of various passing vehicles V_v on the different lanes L_l in Table 1, the indexes of the mileages of the congested roads MI_v^V of the vehicles V_v are reckoned.

$$MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V}; MI_v^V = \frac{\sum_{l \in S_{V,v}^L} (MI_{(v,l)}^L \times w_{(v,l)}^V)}{\sum_{l \in S_{V,v}^L} w_{(v,l)}^V}$$

[0171] Taking the vehicles V_{46} and V_{47} as examples, calculation results of $MI_{(v,l)}^V$ and MI_v^V are shown in Table 5.

[0172] Based on the acquired indexes of the mileages of the congested roads $MI_{(v,l)}^V$ of the vehicles V_v on the lanes L_l, in combination with the traffic weight coefficients $w_{(v,l)}^V$, acquired in step 1, of various passing vehicles V_v on different lanes L_l in the road network, the indexes of the mileages of the congested roads MI_l^L of various lanes in the road network are calculated:

$$MI_l^L = \frac{\sum_{v \in S_{L,l}^V} (MI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0173] Calculation results are shown in Table 6.

[0174] Further, according to the acquired indexes of the mileages of the congested roads MI_l^L of the lanes, in combination with the traffic weight coefficients, obtained in step 2, of various lanes, various intersections, and various roads, the indexes of the mileages of the congested roads of various intersections and various roads in the road network are calculated:

$$MI_i^I = \frac{\sum_{l \in S_{I,i}^L} (MI_l^L \times w_l^L)}{\sum_{l \in S_{I,i}^L} w_l^L}; MI_r^R = \frac{\sum_{l \in S_{R,r}^L} (MI_l^L \times w_l^L)}{\sum_{l \in S_{R,r}^L} w_l^L}$$

[0175] In the embodiment, taking the intersection I_2 as an example, calculation results of the indexes of the mileages of the congested roads MI_2^1 of the intersection I_2 are shown in Table 7; and calculation results of the indexes of the mileages of the congested roads MI_r^R of various roads in the road network are shown in Table 8.

[0176] Taking the sub-zone Z_1 as an example, the indexes of the mileages of the congested roads MI_1^Z of the sub-zone Z_1 are obtained by using the acquired traffic weight coefficients w_l^L and the indexes of the mileages of the congested roads MI_l^L of various lanes in the road network:

$$MI_1^Z = \frac{\sum_{l \in S_{Z,z}^L} (MI_l^L \times w_l^L)}{\sum_{l \in S_{Z,z}^L} w_l^L} = 46.62 \ m/\text{min}$$

[0177] For the whole road network, the indexes of the mileages of the congested roads MI^A of the road network can also be calculated by using the acquired traffic weight coefficients w_l^L and indexes of the mileages of the congested roads MI_l^L of various lanes in the road network. Calculation results are shown in Table 6.

$$MI^A = \sum_{l \in S_A^L} \left(MI_l^L \times w_l^L\right) = 46.53\ m/\mathrm{min}$$

[0178] Further, by calculating products of the indexes of the mileages of the congested roads of various lanes, various sections, various intersections, and various roads in the road network and the road network, and corresponding average free-flow driving speeds, the proportions of the mileages of the heavily congested roads of various evaluation objects can be obtained, as shown in Table 6, Table 7, and Table 9. The proportions of the mileages of the heavily congested roads calculated by using the indexes of the mileages of the congested roads of various evaluation objects are consistent with results actually calculated by a definition of the proportion of the mileage of the heavily congested road.

[0179] It should be noted that the evaluation indexes used in the specific embodiments of the present invention are the traffic operation index, the delay time index, the index of the number of times of stopping, and the index of the mileage of the congested road, which collectively constitute a new method for calculating a characteristic index system for traffic operation state evaluation. The larger the traffic operation index, the delay time index, the index of the number of times of stopping, and the index of the mileage of the congested road are, the worse the traffic operation state is, that is, the more congested the road traffic is.

[0180] The above embodiments are preferred implementations of the present invention, which are not limited by the above embodiments. Other changes, modifications, replacements, combinations, and simplification made without departing from the spirit and the principle of the present invention should all be equivalent permutations, and fall within the scope of protection of the present invention.

1. A digital road network traffic state reckoning method based on multi-scale calculation, comprising the following steps:

S1, acquiring traffic weight coefficients of vehicles according to free-flow driving times of the vehicles and an overall free-flow driving time of a road network, wherein the traffic weight coefficient of each vehicle is a ratio of the overall free-flow driving time of a certain passing vehicle in the road network to the overall free-flow driving time of all vehicles in the road network, which is obtained by summing the traffic weight coefficients of the vehicle on various through lanes in the road network, and reflects a proportion of the certain passing vehicle occupying an overall road time-space resource of the road network; and a formula of traffic weight coefficient is as follows:

$$w_v^V = \frac{?}{?} = \frac{?}{?} = \frac{?}{?} = \sum ? \frac{?}{?} =$$

$$\sum\nolimits_{l \in S_{V,v}^L} w_{(n,l)}^V ? \frac{?}{?} = \frac{?}{?} = \frac{?}{?} = \frac{?}{?} = ????$$

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wherein, w_v^V is a traffic weight coefficient of the v^{th} vehicle V_v, in the raid network; t_{fv}^V is an overall free-flow driving time of the vehicle V_v passing the road network; N^V is the number of vehicles passing the road network within an evaluation period; $S_{V,v}^L$ is a set of lanes through which the vehicle V_v passes in the road network within the evaluation period; $t_{f(v,l)}^V$ is a free-flow driving time of the vehicle V_v passing the l^{th} lane L_l in the road network; t_{fl}^L is an average free-flow driving time of the vehicles passing the lane L_l; and $w_{(v,l)}^V$ is a traffic weight coefficient of the vehicle V_v on the lane L_l;

S2, calculating traffic weight coefficients of evaluation objects in the road network at different spatial scales level by level in combination with the traffic weight coefficients of the vehicles and a composition structure of the road network, which is specifically as follows;

according to a definition of the for the traffic weight coefficient, for the traffic weight coefficients of each evaluation object in the road network at the different spatial scales, each value is a ration of the overall free-flow driving time of all the passing vehicles within a period of time to the overall free-flow driving time of all the vehicles in the whole road network for each evaluation object, and the traffic weight coefficients of all compostions belonging to one evaluation object at a same spatial scale are summed to obtain the traffic weight coefficient of the evaluation object, which is specifically as follows:

a traffic weight coefficient of the vehicle V_v passing the lane L_l is reckoned as follows:

$$w_{(v,l)}^V = \frac{?}{?} = \frac{?}{?} = \frac{?}{?} ??$$

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a traffic weight coefficient of the passing lane L_l is reckoned as follows:

$$w_l^L = \frac{?}{?} = \sum ? \frac{?}{?} = \sum ??$$

$$w_l^L = \frac{?}{?} = \frac{?}{?} = ??$$

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a traffic weight coefficient of a subsection U_u is reckoned as follows:

$$w_u^U = \frac{?}{?} = \sum ? \frac{?}{?} = \sum ??$$

$$w_u^U = \frac{?}{?} = \frac{?}{?} = ??$$

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a traffic weight coefficient of a section S_s is reckoned as follows:

$$w_s^S = \frac{?}{?} = \sum ? \frac{?}{?} = \sum ? w_u^U =$$

$$\sum ? w_l^L = \frac{?}{?} = \frac{?}{?} = ? = ?$$

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a traffic weight coefficient of an intersection I_i reckoned as follows:

$$w_i^I = \frac{?}{?} = \sum ? \frac{?}{?} = \sum ? w_l^L$$

$$w_i^I = \frac{?}{?} = \frac{?}{?} = ??$$

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a traffic weight coefficient of a road R_r is reckoned as follows:

$$w_r^R = \frac{?}{?} = \sum ? w_s^S + \sum ? w_i^I = \sum ? w_l^L$$

$$w_r^R = \frac{?}{?} = ???$$

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a traffic weight coefficient of a sub-zone Z_z is reckoned as follows:

$$w_z^Z = \frac{?}{?} = \sum ? w_s^S + \sum ? w_i^I = \sum ? w_l^L$$

$$w_r^R = \frac{?}{?} = ???$$

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wherein w_l^L is the traffic weight coefficient of the lane L_l; $S_{L,l}^V$ is a set of vehicles passing the lane L_l within the evaluation period; w_u^U is the traffic weight coefficient of the u^{th} subsection U_u in the road network; $S_{U,u}^L$ is a set of lanes contained in the subsection U_u; w_s^S is the traffic weight coefficient of the s^{th} section S_s in the road network; $S_{S,s}^U$ is a set sub-sections contained in the section S_s; $S_{S,s}^L$ is a set of lanes contained in the section S_s; w_i^I is the traffic weight coefficient of the i^{th} intersection I_i in the road network; $S_{I,i}^L$ is a set of lanes contained in the intersection I_i; w_r^R is the traffic weight coefficient of the r^{th} road R_r in the road network; $S_{R,r}^S$ is a set of sections contained in the road R_r; $S_{R,r}^I$ is a set of intersections contained in the road R_r; $S_{R,r}^L$ is a set of lanes contained in the road R_r; w_z^Z is the traffic weight coefficient of the z^{th} sub-zone Z_z in the road network; $S_{Z,z}^S$ is a set of sections contained in the sub-zone Z_z; $S_{Z,z}^I$ is a set of intersections contained in the sub-zone Z_z; and $S_{Z,z}^L$ is a set of lanes contained in the sub-zone Z_z; and

according to the definition of the traffic weight coefficient of the road network, the traffic weight coefficients of all the vehicles, lanes, road sections, and intersections in the road network are summed respectively, with each sum being 1; and a formula is as follows:

$$w^A = \frac{?}{?} = \sum_{s=1}^{N^S} w_s^S + \sum_{i=1}^{N^I} w_i^I = \sum_{u=1}^{N^U} w_u^U + \sum_{i=1}^{N^I} w_i^I = \sum_{l=1}^{N^L} w_l^L = \sum_{v=1}^{N^V} w_i^I = \sum ? \sum ? w_{(v,l)}^V = 1$$

$$w^A = \frac{?}{?} ?????$$

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wherein w^A is the overall traffic weight coefficient of the road network; N^S is the number of sections in the road network; N^I is the number of in intersections in the road network: N^U is the number of sub-sections in the road network; and N^L is the number of lanes in the road network;

S3, reckoning traffic operation indexes of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average travel time, the free-flow driving times, and the traffic weight coefficients of the vehicles;

S4, reckoning delay time indexes of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average delay time, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating average delay times of various evaluation objects at the different spatial scales in combination with the free-flow driving times of the vehicles;

S5, reckoning indexes of numbers of times of stopping of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using an average number of times of stopping, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating average numbers of times of stopping of various evaluation objects at the different spatial scales in combination with the free-flow driving times of the vehicles; and

S6, reckoning indexes of mileages of congested roads of various lanes, various sub-sections, various sections, various intersections, various roads, various sub-zones, and the road network by using mileages of heavily congested roads, the free-flow driving times, and the traffic weight coefficients of the vehicles, and calculating proportions of the mileages of the heavily congested roads of various evaluation objects at the different spatial scales in combination with free-flow driving speeds of the vehicles.

2.-3. (canceled)

4. The digital road network traffic state reckoning method based on multi-scale calculation according to 1, wherein step S3 is specifically as follows:

the traffic operation index of each evaluation object in the road network is a ratio of an overall travel time of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average travel time of all the passing vehicles in a distance corresponding to a unit free-flow driving time; and

the traffic operation index of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the traffic operation indexes of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the traffic operation index is dimensionless, specifically as follows:

a traffic operation index of the vehicle V_v passing the lane L_l is reckoned as follows:

$$PI_{(v,l)}^V = \frac{t_{(v,l)}^V}{t_{f(v,l)}^V} ? PI_{(v,l)}^V = ? \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}$$

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a traffic operation index of the vehicle V_v is reckoned as follows:

$$PI_v^V = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} \times \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$$PI_v^V = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$\textcircled{?}$ indicates text missing or illegible when filed

a traffic operation index of the lane L_l is reckoned as follows:

$$PI_l^L = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} \times \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$$PI_l^L = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$\textcircled{?}$ indicates text missing or illegible when filed

a traffic operation index of a subsection U_u is reckoned as follows:

$$PI_u^U = \frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} \times \frac{\sum_{l\in S_{U,u}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{U,u}^L} w_l^L}$$

a traffic operation index of the section S_s is reckoned as follows:

$$PI_s^S = \frac{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{S,s}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l\in S_{S,s}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{S,s}^L} w_l^L} = \frac{\sum_{u\in S_{S,s}^U}\left(PI_u^U \times w_u^U\right)}{\sum_{u\in S_{S,s}^U} w_u^U}$$

a traffic operation index of the intersection I_i is reckoned as follows:

$$PI_i^I = \frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V}\left(PI_{(v,l)}^V \times w_{(v,l)}^V\right)}{\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} w_{(v,l)}^V} = \frac{\sum_{l\in S_{I,i}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{I,i}^L} w_l^L}$$

a traffic operation index of the road R_r is reckoned as follows:

$$PI_r^R = \frac{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V + \sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{s\in S_{R,r}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V + \sum_{i\in S_{R,r}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_{R,r}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{R,r}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{R,r}^L} w_l^L}$$

a traffic operation index of a sub-zone Z_z is reckoned as follows:

$$PI_z^Z = \frac{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V + \sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{s\in S_{Z,z}^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V + \sum_{i\in S_{Z,z}^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_{Z,z}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_{Z,z}^L}\left(PI_l^L \times w_l^L\right)}{\sum_{l\in S_{Z,z}^L} w_l^L}$$

a traffic operation index of a zone is reckoned as follows:

$$PI^A = \frac{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V + \sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V + \sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \sum_{l\in S_A^L}\left(PI_l^L \times w_l^L\right)$$

where $PI_{(v,l)}^V$ is the traffic operation index of the vehicle V_v on the lane L_l; $t_{(v,l)}^V$ is a travel time of the vehicle V_v passing the lane L_l; PI_v^V, PI_l^L, PI_u^U, PI_s^S, PI_i^I, PI_r^R, PI_z^Z, and PI^A represent traffic operation indexes of the vehicle V_v, the lane L_l, the subsection U_u, the section, S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; S_A^S is a set of sections contained in the zone; S_A^I is a set of intersections contained in the zone; and S_A^L is a set of lanes contained in the zone.

5. The digital road network traffic state reckoning method based on multi-scale calculation according to 1, wherein step S4 specifically comprises:

S401, reckoning the delay time indexes of various evaluation objects at multiple spatial scales, wherein

the delay time index of each evaluation object in the road network is a ratio of an overall delay time of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average delay time of all the passing vehicles in the distance corresponding to the unit free-flow driving time; and

the delay time index of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the delay time indexes of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the traffic operation index is dimensionless, having an ability to further calculate the average delay time, specifically as follows:

a delay time index of the vehicle V_v passing the lane L_l is reckoned as follows:

$$DI_{(v,l)}^{V} = \frac{d_{(v,l)}^{V}}{t_{f_{(v,l)}}^{V}}$$

a delay time index of the vehicle V_v is reckoned as follows:

$$DI_{v}^{V} = \frac{\sum_{l\in S_{V,v}^{L}} d_{(v,l)}^{V}}{\sum_{l\in S_{V,v}^{L}} t_{f_l}^{L}} = \frac{\sum_{l\in S_{V,v}^{L}} \left(DI_{(v,l)}^{V}\times t_{f_{(v,l)}}^{V}\right)}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^{L}} t_{f_l}^{L}} \times \frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^{L}} t_{f_l}^{L}}{\sum_{l\in S_{V,v}^{L}} t_{f_l}^{L}} = \frac{\sum_{l\in S_{V,v}^{L}} \left(DI_{(v,l)}^{V}\times w_{(v,l)}^{V}\right)}{\sum_{l\in S_{V,v}^{L}} w_{(v,l)}^{V}}$$

a delay time index of the lane L_l is reckoned as follows:

$$DI_{l}^{L} = \frac{\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^{L}} t_{f_{(v,l)}}^{V}} \times \frac{\sum_{v=1}^{N^V}\sum_{l\in S_{V,v}^{L}} t_{f_{(v,l)}}^{V}}{\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{v\in S_{L,l}^{V}} \left(DI_{(v,l)}^{V}\times w_{(v,l)}^{V}\right)}{\sum_{v\in S_{L,l}^{V}} w_{(v,l)}^{V}}$$

a delay time index of a subsection U_u is reckoned as follows:

$$DI_{u}^{U} = \frac{\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} \left(DI_{(v,l)}^{V}\times w_{(v,l)}^{V}\right)}{\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} w_{(v,l)}^{V}} \times \frac{\sum_{l\in S_{U,u}^{L}} \left(DI_{l}^{L}\times w_{l}^{V}\right)}{\sum_{l\in S_{U,u}^{L}} w_{l}^{V}}$$

a delay time index of the section S_s is reckoned as follows:

$$DI_{s}^{S} = \frac{\sum_{u\in S_{S,s}^{U}}\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{u\in S_{S,s}^{U}}\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{S,s}^{L}}\sum_{v\in S_{L,l}^{V}} \left(DI_{(v,l)}^{V}\times w_{(v,l)}^{V}\right)}{\sum_{l\in S_{S,s}^{L}}\sum_{v\in S_{L,l}^{V}} w_{(v,l)}^{V}} = \frac{\sum_{l\in S_{S,s}^{L}} \left(DI_{l}^{L}\times w_{l}^{L}\right)}{\sum_{l\in S_{S,s}^{L}} w_{l}^{L}} = \frac{\sum_{u\in S_{S,s}^{U}} \left(DI_{u}^{U}\times w_{u}^{U}\right)}{\sum_{u\in S_{S,s}^{U}} w_{u}^{U}}$$

a delay time index of the intersection I_i is reckoned as follows:

$$DI_{i}^{I} = \frac{\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} \left(DI_{(v,l)}^{V}\times w_{(v,l)}^{V}\right)}{\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} w_{(v,l)}^{V}} = \frac{\sum_{l\in S_{I,i}^{L}} \left(DI_{l}^{L}\times w_{l}^{L}\right)}{\sum_{l\in S_{I,i}^{L}} w_{l}^{L}}$$

a delay time index of the road R_r is reckoned as follows:

$$DI_{r}^{R} = \frac{\sum_{s\in S_{R,r}^{S}}\sum_{u\in S_{S,s}^{U}}\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V} + \sum_{i\in S_{R,r}^{I}}\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{s\in S_{R,r}^{S}}\sum_{u\in S_{S,s}^{U}}\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V} + \sum_{i\in S_{R,r}^{I}}\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{R,r}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{l\in S_{R,r}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{R,r}^{L}} \left(DI_{l}^{L}\times w_{l}^{L}\right)}{\sum_{l\in S_{R,r}^{L}} w_{l}^{L}}$$

a delay time index of a sub-zone Z_z is reckoned as follows:

$$DI_{z}^{Z} = \frac{\sum_{s\in S_{Z,z}^{S}}\sum_{u\in S_{S,s}^{U}}\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V} + \sum_{i\in S_{Z,z}^{I}}\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{s\in S_{Z,z}^{S}}\sum_{u\in S_{S,s}^{U}}\sum_{l\in S_{U,u}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V} + \sum_{i\in S_{Z,z}^{I}}\sum_{l\in S_{I,i}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{Z,z}^{L}}\sum_{v\in S_{L,l}^{V}} d_{(v,l)}^{V}}{\sum_{l\in S_{Z,z}^{L}}\sum_{v\in S_{L,l}^{V}} t_{f_{(v,l)}}^{V}} = \frac{\sum_{l\in S_{Z,z}^{L}} \left(DI_{l}^{L}\times w_{l}^{L}\right)}{\sum_{l\in S_{Z,z}^{L}} w_{l}^{L}}$$

a delay time index of a zone is reckoned as follows:

$$DI^A = \frac{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V + \sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{s\in S_A^S}\sum_{u\in S_{S,s}^U}\sum_{l\in S_{U,u}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V + \sum_{i\in S_A^I}\sum_{l\in S_{I,i}^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \frac{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} d_{(v,l)}^V}{\sum_{l\in S_A^L}\sum_{v\in S_{L,l}^V} t_{f(v,l)}^V} = \sum_{l\in S_A^L}\left(DI_l^L \times w_l^L\right)$$

wherein $DI_{(v,l)}^V$ is the delay time index of the vehicle V_v on the lane L_l; $d_{(v,l)}^V$ is the delay time of the vehicle V_v passing the lane L_l; and DI_v^V, DI_l^L, DI_u^U, DI_s^S, DI_i^I, DI_r^R, DI_z^Z, and DI^A represent the delay time indexes of the vehicle V_v, the lane L_l, the subsection U_u, the road S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and

S402, calculating the average delay times of various evaluation objects, wherein

according to the acquired delay time indexes of the different evaluation objects at the multiple spatial scales, the average delay time of each evaluation object is calculated, which is specifically as follows:

an average delay time of the vehicle V_v passing the lane L_l is reckoned as follows:

$$d_{(v,l)}^V = DI_{(v,l)}^V \times t_{f_{(v,l)}}^V \; d_{(v,l)}^V = DI_{(v,l)}^V ⓘ t_{f(v,l)}^V ⓘ$$

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an average delay time of the vehicle V_v is reckoned as follows:

$$d_v^V = \sum ⓘ d_{(v,l)}^V = DI_v^V \times \sum ⓘ t_l^L = DI_v^V \times t_{f_l}^L = DI_v^V \times t_{f_v}^V$$

$$d_v^V = ⓘ = ⓘⓘⓘ = D_v^V ⓘ t_{fv}^V$$

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an average delay time of the lane L_l is reckoned as follows:

$$\overline{d}_l^L = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI_l^L \times t_{f_l}^L$$

$$\overline{d}_l^L = \frac{v\,S_{L,l}^V\; d_{(v,l)}^V ⌉}{N_{L,l}^V} = \frac{v\,S_{L,l}^V\; d_{(v,l)}^V ⌉}{v\,S_{L,l}^V\; t_{f(v,l)}^V ⌉}, \frac{v\,S_{L,l}^V\; t_{f(v,l)}^V ⌉}{N_{L,l}^V} = DI_l^L ⓘ t_{fl}^L$$

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an average delay time of a subsection U_u is reckoned as follows:

$$\overline{d}_u^U = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI_u^U \times t_{fu}^U$$

$$\overline{d}_u^U = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = DI_u^U ⓘ t_{fu}^U$$

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an average delay time of the section S_s is reckoned as follows:

$$\overline{d}_s^S = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI_s^S \times t_{fs}^S$$

$$\overline{d}_s^S = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = DI_s^S ⓘ t_{fs}^S$$

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an average delay time of the intersection I_i is reckoned as follows:

$$\overline{d}_i^I = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI_i^I \times t_{fi}^I$$

$$\overline{d}_i^I = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = DI_i^I ⓘ t_{fi}^I$$

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an average delay time of the road R_r is reckoned as follows:

$$\overline{d}_r^R = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI_r^R \times t_{fr}^R$$

$$\overline{d}_r^R = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = DI_r^R ⓘ t_{fr}^R$$

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an average delay time of a sub-zone Z_z is reckoned as follows:

$$\overline{d}_z^Z = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI_z^Z \times t_{fz}^Z$$

$$\overline{d}_z^Z = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = DI_z^Z ⓘ t_{fz}^Z$$

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an average delay time of the zone is reckoned as follows:

$$\overline{d}^A = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} \times \frac{ⓘ}{ⓘ} = DI^A \times t_f^A$$

$$\overline{d}^A = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = DI^A ⓘ t_f^A$$

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wherein d_v^V is the delay time of the vehicle V_v; $\overline{d}_l^L$, $\overline{d}_u^U$, $\overline{d}_s^S$, $\overline{d}_i^I$, $\overline{d}_r^R$, $\overline{d}_z^Z$, and $\overline{d}^A$ represent the average delay times of the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; $N_{L,l}^V$, $N_{U,u}^V$, Y, $N_{S,s}^V$, $N_{I,i}^V$, $N_{R,r}^V$, and $N_{Z,z}^V$ represent numbers of vehicles passing the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z within the evaluation period respectively; and t_{fu}^U, t_{fs}^S, t_{fi}^I, t_{fr}^R, t_{fz}^Z, and t_f^A represent the average free-flow driving times of the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively.

6. The digital road network traffic state reckoning method based on multi-scale calculation according to 1, wherein step S5 specifically comprises:

S501, reckoning the indexes of the numbers of times of stopping of various evaluation objects at the multiple spatial scales, wherein

the index of the number of times of stopping of each evaluation object in the road network is a ratio of an overall number of times of stopping of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average number of times of stopping of all the passing vehicles in the distance corresponding to the unit free-flow driving time; and

the index of the number of times of stopping of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the indexes of the numbers of times of stopping of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the index of the number of times of stopping is in a unit of "times/min", having an ability to further calculate the average number of times of stopping, specifically as follows:

an index of number of times of stopping of the vehicle V_v passing the lane L_l is reckoned as follows:

$$HI_{(v,l)}^V = \frac{h_{(v,l)}^V}{t_{f(v,l)}^V} HI_{(v,l)}^V = \frac{h_{(v,l)}^V}{t_{f(v,l)}^V}$$

an index of number of times of stopping of the vehicle V_v is reckoned as follows:

$$HI_v^V = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = \frac{?}{?}$$

$$HI_v^V = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the lane L_l is reckoned as follows:

$$HI_l^L = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = \frac{?}{?}$$

$$HI_l^L = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the subsection U_u is reckoned as follows:

$$HI_u^U = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

$$HI_u^U = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the section S_s is reckoned as follows:

$$HI_s^S = \frac{?}{?} = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

$$HI_s^S = \frac{?}{?} = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the intersection I_i is reckoned as follows:

$$HI_i^I = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

$$HI_i^I = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the road R_r is reckoned as follows:

$$HI_r^R = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

$$HI_r^R = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the sub-zone Z_z is reckoned as follows:

$$HI_z^Z = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

$$HI_z^Z = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$$

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an index of number of times of stopping of the zone is reckoned as follows:

$$HI^A = \frac{?}{?} = \frac{?}{?} = \sum ? \left(HI_l^L \times w_l^L\right)$$

$$HI^A = \frac{?}{?} = \frac{?}{?} = (??)$$

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wherein $HI_{(v,l)}^V$ is the index of the number of times of stopping of the vehicle V_v on the lane L_l; $h_{(v,l)}^V$ is the number of times of stopping of the vehicle V_v passing the lane L_l; and HI_v^V, HI_l^L, HI_u^U, HI_s^S, HI_i^I, HI_r^R, HI_z^Z, and HI^A represent the indexes of number of times of stopping of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and

S502, calculating the average numbers of times of stopping of various evaluation objects, wherein

according to the acquired indexes of number of times of stopping of the different evaluation objects at the multiple spatial scales, the average numbers of times of stopping of various evaluation objects are calculated, which are specifically as follows:

an average number of times of stopping of the vehicle V_v passing the lane L_l is reckoned as follows:

$$h_{(v,l)}^V = HI_{(v,l)}^V \times t_{f_{(v,l)}^V}$$

an average number of times of stopping of the vehicle V_v is reckoned as follows:

$$h_v^V = \sum ? h_{(v,l)}^V = HI_v^V \times \sum ? t_{f_l^L} = HI_v^V \times t_{f_v^V}$$

$$h_v^V = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the lane L_l is reckoned as follows:

$$\bar{h}_l^L = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI_l^L \times t_{f_l^L}$$

$$\bar{h}_l^L = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the subsection U_u is reckoned as follows:

$$\bar{h}_u^U = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI_u^U \times t_{f_u^U}$$

$$\bar{h}_u^U = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the section S_s is reckoned as follows:

$$\bar{h}_s^S = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI_s^S \times t_{f_s^S}$$

$$\bar{h}_s^S = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the intersection I_i is reckoned as follows:

$$\bar{h}_i^I = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI_s^S \times t_{f_s^S}$$

$$\bar{h}_i^I = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the road R_r is reckoned as follows:

$$\bar{h}_r^R = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI_r^R \times t_{f_r^R}$$

$$\bar{h}_r^R = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the sub-zone Z_z is reckoned as follows:

$$\bar{h}_z^Z = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI_z^Z \times t_{f_z^Z}$$

$$\bar{h}_z^Z = \frac{?}{?} = \frac{?}{?} = ??$$

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an average number of times of stopping of the zone is reckoned as follows:

$$\bar{h}^A = \frac{?}{?} = \frac{?}{?} \times \frac{?}{?} = HI^A \times t_{f^A}$$

$$\bar{h}^A = \frac{?}{?} = \frac{?}{?} = ??$$

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wherein h_v^V is the number of times of stopping of the vehicle V_v; and $\bar{h}_l^L$, $\bar{h}_u^U$, $\bar{h}_s^S$, $\bar{h}_l^L$, $\bar{h}_r^R$, $\bar{h}_z^Z$, and $\bar{h}^A$ represent the average numbers of times of stopping of the lane L_l, the subsection U_u, the second S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively.

7. The digital road network traffic state reckoning method based on multi-scale calculation according to 1, wherein step S6 specifically comprises:

S601, reckoning the indexes of the mileages of the congested roads of various evaluation objects at the multiple spatial scales, wherein

the index of the mileage of the congested roads of each evaluation object in the road network is a ratio of an overall mileage of a heavily congested road of all the passing vehicles in each evaluation object to the overall free-flow driving time, that is, an average mileage of a heavily congested road of all the passing vehicles in the distance corresponding to the unit free-flow driving time; and

the index of the mileage of the congested road of each evaluation object may be obtained by weighted summation of the traffic weight coefficients and the indexes of the mileages of the congested roads of the vehicles, the lanes, the sub-sections, the sections, and the intersections belonging to the evaluation object, and the index of the mileage of the congested road is in a unit of "m/min", having an ability to further calculate the proportion of the mileage of the heavily congested road, specifically as follows:

an index of a mileage of a congested road of the vehicle V_v passing the lane L_l is reckoned as follows:

$$MI^V_{(v,l)} = \frac{l_{C^V_{(v,l)}}}{t_{f^V_{(v,l)}}} MI^V_{(v,l)} = \frac{l^V_{c(v,l)}}{t^V_{f(v,l)}}$$

an index of a mileage of a congested road of the vehicle V_v is reckoned as follows:

$$MI^V_v = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} \times \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$$MI^V_v = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

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an index of a mileage of a congested road of the lane L_l is reckoned as follows:

$$MI^L_l = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} \times \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$$MI^L_l = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

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an index of a mileage of a congested road of the subsection U_u is reckoned as follows:

$$MI^U_u = \frac{\sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} = \frac{\sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} (\textcircled{?} \times \textcircled{?})}{\sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} \textcircled{?}} = \frac{\sum_{l \in S^L_{U,u}} (\textcircled{?} \times \textcircled{?})}{\sum_{l \in S^L_{U,u}} \textcircled{?}}$$

$$MI^U_u = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

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an index of a mileage of a congested road of the section S_s is reckoned as follows:

$$MI^S_s = \frac{\sum_{u \in S^U_{S,s}} \sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{u \in S^U_{S,s}} \sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} =$$

$$\frac{\sum_{l \in S^L_{S,s}} \sum_{v \in S^V_{L,l}} (\textcircled{?} \times w^V_{(v,l)})}{\sum_{l \in S^L_{S,s}} \sum_{v \in S^V_{L,l}} w^V_{(v,l)}} = \frac{\sum_{l \in S^L_{S,s}} (\textcircled{?} \times w^L_l)}{\sum_{l \in S^L_{S,s}} w^L_l} = \frac{\sum_{u \in S^U_{S,s}} (\textcircled{?} \times w^U_u)}{\sum_{u \in S^U_{S,s}} w^U_u}$$

$$MI^S_s = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

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an index of a mileage of a congested road of the intersection I_i is reckoned as follows:

$$MI^I_i = \frac{\sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} = \frac{\sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} (\textcircled{?} \times w^V_{(v,l)})}{\sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} w^V_{(v,l)}} = \frac{\sum_{l \in S^L_{I,i}} (\textcircled{?} \times w^L_l)}{\sum_{l \in S^L_{I,i}} w^L_l}$$

$$MI^I_i = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

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an index of a mileage of a congested road of the road R_r is reckoned as follows:

$$MI^R_r = \frac{\sum_{s \in S^S_{R,r}} \sum_{u \in S^U_{S,s}} \sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} \textcircled{?} + \textcircled{?} \sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{s \in S^S_{R,r}} \sum_{u \in S^U_{S,s}} \sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)} + \textcircled{?} \sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} =$$

$$\frac{\sum_{l \in S^L_{R,r}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{l \in S^L_{R,r}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} = \frac{\sum_{l \in S^L_{R,r}} (\textcircled{?} \times w^L_l)}{\sum_{l \in S^L_{R,r}} w^L_l}$$

$$MI^R_r = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

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an index of a mileage of a congested road of the sub-zone Z_z is reckoned as follows:

$$MI^Z_z = \frac{\sum_{s \in S^S_{Z,z}} \sum_{u \in S^U_{S,s}} \sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} \textcircled{?} + \textcircled{?} \sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{s \in S^S_{Z,z}} \sum_{u \in S^U_{S,s}} \sum_{l \in S^L_{U,u}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)} + \textcircled{?} \sum_{l \in S^L_{I,i}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} =$$

$$\frac{\sum_{l \in S^L_{Z,z}} \sum_{v \in S^V_{L,l}} \textcircled{?}}{\sum_{l \in S^L_{Z,z}} \sum_{v \in S^V_{L,l}} t^V_{f(v,l)}} = \frac{\sum_{l \in S^L_{Z,z}} (\textcircled{?} \times w^L_l)}{\sum_{l \in S^L_{Z,z}} w^L_l}$$

$$MI^Z_z = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}} = \frac{\textcircled{?}}{\textcircled{?}}$$

$\textcircled{?}$ indicates text missing or illegible when filed an index of a mileage of a congested road of the zone is reckoned as follows:

$$MI^A = \frac{\sum_{s \in S_A^S} \sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ + ⓘ \sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{s \in S_A^S} \sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} t_{f(v,l)}^V + ⓘ \sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} t_{f(v,l)}^V} =$$

$$\frac{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} t_{f(v,l)}^V} = \sum_{l \in S_A^L} \left(MI_l^L \times w_l^L\right)$$

$$MI^A = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = (ⓘ)$$

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wherein $MI_{(v,l)}^V$ is the index of the mileage of the congested road of the vehicle V_v on the lane L_l; $l_{c(v,l)}^V$ is the mileage of the congested road of the vehicle V_v passing the lane L_l; and MI_v^V, MI_l^L, MI_u^U, MI_s^S, MI_i^I, MI_r^R, MI_z^Z, and MI^A represent the indexes of the mileages of the congested roads of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and

S602, calculating the proportions of the mileages of the heavily congested roads of various evaluation objects, wherein

according to the acquired index of the mileage of the congested road of the different evaluation objects at the multiple spatial scales, the proportion of the mileage of the heavily congested road of each evaluation object is calculated, which is specifically as follows:

a proportion of a mileage of a heavily congested road of the vehicle V_v passing the lane L_l is reckoned as follows:

$$m_{(v,l)}^V = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{t_{f(v,l)}^V} \times \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} m_{(v,l)}^V = \frac{l_{c(v,l)}^V}{l_{(v,l)}^V} = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V} ⓘ \frac{t_{f(v,l)}^V}{l_{(v,l)}^V} = \frac{MI_{(v,l)}^V}{V_{f(v,l)}^V}$$

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a proportion of a mileage of a heavily congested road of the vehicle V_v is reckoned as follows:

$$m_v^V = \frac{ⓘ}{\sum_{l \in S_{V,v}^L} l_{(v,l)}^V} = \frac{\sum_{l \in S_{V,v}^L} ⓘ}{\sum_{l \in S_{V,v}^L} ⓘ} \times \frac{\sum_{l \in S_{V,v}^L} ⓘ}{\sum_{l \in S_{V,v}^L} l_{(v,l)}^V} = \frac{MI_v^V}{V_{f_v}^V}$$

$$m_v^V = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_v^V}{V_{f_v}^V}$$

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a proportion of a mileage of a heavily congested road of the lane L_l is reckoned as follows:

$$m_l^L = \frac{\sum_{v \in S_{L,l}^V} ⓘ}{\sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{\sum_{v \in S_{L,l}^V} ⓘ}{\sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{v \in S_{L,l}^V} ⓘ}{\sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI_l^L}{V_{f_l}^L}$$

$$m_l^L = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_l^L}{V_{f_l}^L}$$

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a proportion of a mileage of a heavily congested road of the subsection U_u is reckoned as follows:

$$m_u^U = \frac{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} =$$

$$\frac{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI_u^U}{V_{f_u}^U}$$

$$m_u^U = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_u^U}{V_{f_u}^U}$$

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a proportion of a mileage of a heavily congested road of the section S_s is reckoned as follows:

$$m_s^S = \frac{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} =$$

$$\frac{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{u \in S_{S,s}^U} \sum_{l \in S_{U,u}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI_s^S}{V_{f_s}^S}$$

$$m_s^S = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_s^S}{V_{f_s}^S}$$

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a proportion of a mileage of a heavily congested road of the intersection I_i is reckoned as follows:

$$m_i^I =$$

$$\frac{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{I,i}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI_i^I}{V_{f_i}^I}$$

$$m_i^I = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_i^I}{V_{f_i}^I}$$

ⓘ indicates text missing or illegible when filed a proportion of a mileage of a heavily congested road of the road R_r is reckoned as follows:

$$m_r^R = \frac{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} =$$

$$\frac{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{R,r}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI_r^R}{\overline{V_f}_r^R}$$

$$m_r^R = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_r^R}{\overline{V_f}_r^R}$$

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a proportion of a mileage of a heavily congested road of the sub-zone Z_z is reckoned as follows:

$$m_z^Z = \frac{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} =$$

$$\frac{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_{Z,z}^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI_z^Z}{\overline{V_f}_z^Z}$$

$$m_z^Z = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI_z^Z}{\overline{V_f}_z^Z}$$

ⓘ indicates text missing or illegible when filed

a proportion of a mileage of a heavily congested road of the zone is reckoned as follows:

$$m^A =$$

$$\frac{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} ⓘ} \times \frac{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} ⓘ}{\sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} l_{(v,l)}^V} = \frac{MI^A}{\overline{V_f}^A}$$

$$m^A = \frac{ⓘ}{ⓘ} = \frac{ⓘ}{ⓘ} = \frac{MI^A}{\overline{V_f}^A}$$

ⓘ indicates text missing or illegible when filed

wherein $m_{(v,l)}^V$ is the proportion of the mileage of the heavily congested road of the vehicle V_v on the lane L_l; $l_{(v,l)}^V$ is a vehicle mileage of the vehicle V_v passing the lane Lt; $V_{f(v,l)}^V$ is a flow-free driving speed of the vehicle V_v passing the lane L_l; m_v^V, m_l^L, m_u^U, m_s^S, m_i^I, m_r^R, m_z^Z, and m^A represent proportions of mileages of heavily congested roads of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively; and $\overline{V}_{fv}^V$, $\overline{V}_{fl}^L$, $\overline{V}_{fu}^U$, $\overline{V}_{fs}^S$, $\overline{V}_{fi}^I$, $\overline{V}_{fr}^R$, $\overline{V}_{fz}^Z$, and $\overline{V}_f^A$ represent average flow-free driving speeds of the vehicle V_v, the lane L_l, the subsection U_u, the section S_s, the intersection I_i, the road R_r, the sub-zone Z_z, and the zone respectively.

8. The digital road network traffic state reckoning method based on multi-scale calculation according to 1, wherein a new method for calculating traffic operation state evaluation characteristic indexes is formed collectively by four indexes: the traffic operation index, the delay time index, the index of the number of times of stopping, and the index of the mileage of the congested road, wherein the larger the traffic operation index, the delay time index, the index of the number of times of stopping, and the index of the mileage of the congested road are, the worse the traffic operation state is, that is, the more congested the road traffic is.

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