

# US Patent & Trademark Office

## Patent Public Search | Text View

United States Patent Application Publication	20250259536
Kind Code	A1
Publication Date	August 14, 2025
Inventor(s)	LU; Kai et al.

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

#### 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.

Inventors:	LU; Kai (Guangzhou, CN), WU; Yaoting (Guangzhou, CN), JIANG; Shuyan (Guangzhou, CN), CHEN; Yanglin (Guangzhou, CN), SHOU; Yanfang (Guangzhou, CN)
Applicant:	SOUTH CHINA UNIVERSITY OF TECHNOLOGY (Guangzhou, Guangdong, CN)
Family ID:	82721831
Assignee:	SOUTH CHINA UNIVERSITY OF TECHNOLOGY (Guangzhou, Guangdong, CN)
Appl. No.:	18/864585
Filed (or PCT Filed):	October 12, 2022
PCT No.:	PCT/CN2022/124945

#### Foreign Application Priority Data

CN	202210506795.8	May. 11, 2022
----	----------------	---------------

#### Publication Classification

Int. Cl.:	G08G1/01 (20060101)
U.S. Cl.:	
CPC	G08G1/0133 (20130101);

#### Background/Summary

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 respectively. 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:

$$[00001] w_{v,v}^V = \frac{t_{f,v}^V}{\text{Math}_{v=1}^{N^v} t_{f,v}^V} = \frac{\text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{v,v}^L} t_{f_l}^L}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f_l}^L} = \frac{\text{Math}_{l \in S_{v,v}^L} t_{f_l}^L}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f_l}^L} = \frac{\text{Math}_{l \in S_{v,v}^L} w_{(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} w_{(v,l)}^V} \quad [0016]$$

wherein  $w_{v,v}^V$  is a traffic weight coefficient of the  $v$ .sup.th vehicle  $V$ .sub.v in the road network;  $t_{f,v}^V$  is an overall free-flow driving time of the vehicle  $V$ .sub.v passing the road network;  $N$ .sup.V is the number of vehicles passing the road network within an evaluation period;  $S$ .sub.V,v.sup.L is a set of lanes through which the vehicle  $V$ .sub.v passes in the road network within the evaluation period;  $t$ .sub.f(v,l).sup.V is a free-flow driving time of the vehicle  $V$ .sub.v passing the  $l$ .sup.th lane  $L$ .sub.l in the road network;  $t$ .sub.fl.sup.L is an average free-flow driving time of the vehicles passing the lane  $L$ .sub.l; and  $w_{(v,l)}^V$  is a traffic weight coefficient of the vehicle  $V$ .sub.v on the lane  $L$ .sub.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  $V$ .sub.v passing the lane  $L$ .sub.l is reckoned as follows:

$$[00002] w_{(v,l)}^V = \frac{t_{f(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V} \quad [0020] \text{ a traffic weight coefficient of the lane } L\text{.sub.l is reckoned as follows:}$$

$$[00003] w_l^L = \frac{\text{Math}_{v \in S_{L,l}^V} t_{f(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V} = \frac{\text{Math}_{v \in S_{L,l}^V} t_{f(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V} = \frac{\text{Math}_{v \in S_{L,l}^V} w_{(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} w_{(v,l)}^V} \quad [0021] \text{ a traffic weight coefficient of a subsection}$$

$U$ .sub.u is reckoned as follows:

$$[00004] w_u^U = \frac{\text{Math}_{l \in S_{u,u}^L} \cdot \text{Math}_{v \in S_{L,l}^V} t_{f(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V} = \frac{\text{Math}_{v \in S_{L,l}^V} t_{f(v,l)}^V}{\text{Math}_{v=1}^{N^v} \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{u,u}^L} w_l^L}{\text{Math}_{l \in S_{u,u}^L} w_l^L} \quad [0022] \text{ a traffic weight coefficient of a section}$$

$S$ .sub.s is reckoned as follows:

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

[0023] a traffic weight coefficient of an intersection I.sub.i is reckoned as follows:

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

is reckoned as follows:

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

follows:

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

L.sub.l; S.sub.L,l.sup.V is a set of vehicles passing the lane L.sub.l within the evaluation period; w.sub.u.sup.U is the traffic weight coefficient of the u.sup.th subsection U.sub.u in the road network; S.sub.U,u.sup.L is a set of lanes contained in the subsection U.sub.u; w.sub.s.sup.S is the traffic weight coefficient of the s.sup.th section S.sub.s in the road network; S.sub.S,s.sup.U is a set of sub-sections contained in the section S.sub.s; S.sub.S,s.sup.L is a set of lanes contained in the section S.sub.s; w.sub.i.sup.I is the traffic weight coefficient of the i.sup.th intersection I.sub.i in the road network; S.sub.I,i.sup.L is a set of lanes contained in the intersection I.sub.i; w.sub.r.sup.R is the traffic weight coefficient of the r.sup.th road R.sub.r in the road network; S.sub.R,r.sup.S is a set of sections contained in the road R.sub.r; S.sub.R,r.sup.I is a set of intersections contained in the road R.sub.r; S.sub.R,r.sup.L is a set of lanes contained in the road R.sub.r; w.sub.z.sup.Z is the traffic weight coefficient of the z.sup.th sub-zone Z.sub.z in the road network; S.sub.Z,z.sup.S is a set of sections contained in the sub-zone Z.sub.z; S.sub.Z,z.sup.I is a set of intersections contained in the sub-zone Z.sub.z; and S.sub.Z,z.sup.L is a set of lanes contained in the sub-zone Z.sub.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:

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

network; N.sup.S is the number of sections in the road network; N.sup.I is the number of intersections in the road network; N.sup.U is the number of sub-sections in the road network; and N.sup.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.sub.v passing the lane L.sub.l is reckoned as follows:

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

[0033] a traffic operation index of the vehicle V.sub.v is reckoned as follows:

$$PI_V^V = \frac{.Math_{.l \in S_{v,v}^L} t_{ff}^V}{.Math_{.l \in S_{v,v}^L} t_{ff}^V} \quad [00011] = \frac{.Math_{.l \in S_{v,v}^L} (PI_{(v,l)}^V \times t_{ff}^V)}{.Math_{.v=1}^V .Math_{.l \in S_{v,v}^L} t_{ff}^V} \times \frac{.Math_{.v=1}^V .Math_{.l \in S_{v,v}^L} t_{ff}^V}{.Math_{.l \in S_{v,v}^L} t_{ff}^V} \quad [0034] \text{ a traffic operation index of the lane L.sub.l is reckoned as follows:}$$

$$= \frac{.Math_{.l \in S_{v,v}^L} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math_{.l \in S_{v,v}^L} w_{(v,l)}^V}$$

$$PI_l^L = \frac{.Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$[00012] = \frac{.Math_{.v \in S_{v,l}^V} t_{ff}^V}{.Math_{.v=1}^V .Math_{.l \in S_{v,v}^L} t_{ff}^V} \times \frac{.Math_{.v=1}^V .Math_{.l \in S_{v,v}^L} t_{ff}^V}{.Math_{.v \in S_{v,l}^V} t_{ff}^V} \quad [0035] \text{ a traffic operation index of a subsection U.sub.u is reckoned as}$$

$$= \frac{.Math_{.v \in S_{v,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math_{.v \in S_{v,l}^V} w_{(v,l)}^V}$$

follows:

$$PI_u^U = \frac{.Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$[00013] = \frac{.Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} w_{(v,l)}^V} \quad [0036] \text{ a traffic operation index of the section S.sub.s is reckoned as follows:}$$

$$= \frac{.Math_{.l \in S_{u,u}^L} (PI_l^L \times w_l^L)}{.Math_{.l \in S_{u,u}^L} w_l^L};$$

$$PI_s^S = \frac{.Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$= \frac{.Math_{.l \in S_{s,s}^U} .Math_{.v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math_{.l \in S_{s,s}^U} .Math_{.v \in S_{l,l}^V} w_{(v,l)}^V}$$

$$[00014] = \frac{.Math_{.l \in S_{s,s}^U} (PI_l^L \times w_l^L)}{.Math_{.l \in S_{s,s}^U} w_l^L} \quad [0037] \text{ a traffic operation index of the intersection I.sub.i is reckoned as follows:}$$

$$= \frac{.Math_{.u \in S_{s,s}^U} (PI_u^U \times w_u^U)}{.Math_{.u \in S_{s,s}^U} w_u^U}$$

$$PI_i^I = \frac{.Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$[00015] = \frac{.Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} w_{(v,l)}^V} \quad [0038] \text{ a traffic operation index of the road R.sub.r is reckoned as follows:}$$

$$= \frac{.Math_{.l \in S_{i,i}^L} (PI_l^L \times w_l^L)}{.Math_{.l \in S_{i,i}^L} w_l^L}$$

$$PI_r^R = \frac{.Math_{.s \in S_{r,r}^S} .Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V + .Math_{.i \in S_{r,r}^S} .Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.s \in S_{r,r}^S} .Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V + .Math_{.i \in S_{r,r}^S} .Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$[00016] = \frac{.Math_{.l \in S_{r,r}^S} .Math_{.v \in S_{l,l}^V} r_{(v,l)}^V}{.Math_{.l \in S_{r,r}^S} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$= \frac{.Math_{.l \in S_{r,r}^S} (PI_l^L \times w_l^L)}{.Math_{.l \in S_{r,r}^S} w_l^L} \quad [0039] \text{ a traffic operation index of a sub-zone Z.sub.z is reckoned as}$$

follows:

$$PI_z^Z = \frac{.Math_{.s \in S_{z,z}^S} .Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V + .Math_{.i \in S_{z,z}^S} .Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.s \in S_{z,z}^S} .Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V + .Math_{.i \in S_{z,z}^S} .Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$[00017] = \frac{.Math_{.l \in S_{z,z}^S} .Math_{.v \in S_{l,l}^V} r_{(v,l)}^V}{.Math_{.l \in S_{z,z}^S} .Math_{.v \in S_{l,l}^V} t_{ff}^V}$$

$$= \frac{.Math_{.l \in S_{z,z}^S} (PI_l^L \times w_l^L)}{.Math_{.l \in S_{z,z}^S} w_l^L}$$

$$[00018] PI^A = \frac{.Math_{.s \in S_A^S} .Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V + .Math_{.i \in S_A^S} .Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.s \in S_A^S} .Math_{.u \in S_{s,s}^U} .Math_{.l \in S_{u,u}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V + .Math_{.i \in S_A^S} .Math_{.l \in S_{i,i}^L} .Math_{.v \in S_{l,l}^V} t_{ff}^V} = \frac{.Math_{.l \in S_A^S} .Math_{.v \in S_{l,l}^V} t_{ff}^V}{.Math_{.l \in S_A^S} .Math_{.v \in S_{l,l}^V} t_{ff}^V} = \frac{.Math_{.l \in S_A^S} (PI_l^L \times w_l^L)}{.Math_{.l \in S_A^S} w_l^L} \quad [0041] \text{ wherein PI.sub.l} \in S_A^L$$

(v,l).sup.V is the traffic operation index of the vehicle V.sub.v on the lane L.sub.l; t.sub.(v,l).sup.V is a travel time of the vehicle V.sub.v passing the lane L.sub.l; PI.sub.v.sup.V, PI.sub.l.sup.L, PI.sub.u.sup.U, PI.sub.s.sup.S, PI.sub.i.sup.I, PI.sub.r.sup.R, PI.sub.z.sup.Z, and PI.sub.A represent traffic operation indexes of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section, S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively; S.sub.A.sup.S is a set of sections contained in the zone; S.sub.A.sup.I is a set of intersections contained in the zone; and S.sub.A.sup.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

[00019]  $DI_{(v,l)}^V = \frac{d_{(v,l)}^V}{t_{f(v,l)}^V}$  [0047] a delay time index of the vehicle V.sub.v is reckoned as follows:

$$[00021]DI_l^L = \frac{.Math_{\cdot v \in S_{v,l}^V} d_{(v,l)}^V}{.Math_{\cdot v \in S_{v,l}^V} t_{(v,l)}^V} = \frac{.Math_{\cdot v \in S_{v,l}^V} d_{(v,l)}^V}{.Math_{\cdot v=1}^V .Math_{\cdot l \in S_{v,v}^L} t_{(v,l)}^V} \times \frac{.Math_{\cdot v=1}^V .Math_{\cdot l \in S_{v,v}^L} t_{(v,l)}^V}{.Math_{\cdot v \in S_{v,l}^V} t_{(v,l)}^V} = \frac{.Math_{\cdot v \in S_{v,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math_{\cdot v \in S_{v,l}^V} w_{(v,l)}^V} \quad [0049] \text{ a delay time index of a}$$

subsection U.sub.u is reckoned as follows:

$$[00023]DI_s^S = \frac{.Math._u \in S_{S,s}^U .Math._l \in S_{L,u}^L .Math._v \in S_{V,l}^V d_{(v,l)}^V}{.Math._u \in S_{S,s}^U .Math._l \in S_{L,u}^L .Math._v \in S_{V,l}^V t_{(v,l)}^V} = \frac{.Math._l \in S_{S,s}^L .Math._v \in S_{L,l}^L (DI_{(v,l)}^V \times w_{(v,l)}^V)}{.Math._l \in S_{S,s}^L .v \in S_{V,l}^V w_{(v,l)}^V} = \frac{.Math._l \in S_{S,s}^L (DI_l^V \times w_l^V)}{.Math._l \in S_{S,s}^L w_l^V} = \frac{.Math._u \in S_{S,s}^U (DI_u^V \times w_u^V)}{.Math._u \in S_{S,s}^U w_u^V} [0051]$$

a delay time index of the intersection I.sub.i is reckoned as follows:

$$[00025] \text{DI}_r^R = \frac{\frac{\text{Math}_s \in S_{R,r}^s \cdot \text{Math}_u \in S_{G,s}^u \cdot \text{Math}_l \in S_{U,u}^l \cdot \text{Math}_v \in S_{L,l}^v \cdot d_{(v,l)}^V}{\text{Math}_i \in S_{R,r}^i \cdot \text{Math}_l \in S_{L,i}^l \cdot \text{Math}_v \in S_{L,i}^v \cdot d_{(v,l)}^V}}{\frac{\text{Math}_s \in S_{R,r}^s \cdot \text{Math}_u \in S_{G,s}^u \cdot \text{Math}_l \in S_{U,u}^l \cdot \text{Math}_v \in S_{L,l}^v \cdot t_{(v,l)}^V}{\text{Math}_i \in S_{R,r}^i \cdot \text{Math}_l \in S_{L,i}^l \cdot \text{Math}_v \in S_{L,i}^v \cdot t_{(v,l)}^V}} = \frac{\text{Math}_l \in S_{R,r}^l \cdot \text{Math}_v \in S_{L,l}^v \cdot d_{(v,l)}^V}{\text{Math}_l \in S_{R,r}^l \cdot \text{Math}_v \in S_{L,l}^v \cdot t_{(v,l)}^V} = \frac{\text{Math}_l \in S_{R,r}^l \cdot (\text{DI}_l^L \cdot w_l^T)}{\text{Math}_l \in S_{R,r}^l \cdot w_l^T} [0053] \text{ a delay time}$$

$$[00027]DI^A = \frac{\begin{matrix} \text{.Math.}_s \in S_A^s & \text{.Math.}_u \in S_{s,s}^u & \text{.Math.}_l \in S_{l,u}^l & \text{.Math.}_v \in S_{v,l}^v & d_{(v,l)}^V + \\ \text{.Math.}_i \in S_A^i & \text{.Math.}_l \in S_{l,i}^l & \text{.Math.}_v \in S_{v,l}^v & d_{(v,l)}^V \end{matrix}}{\begin{matrix} \text{.Math.}_s \in S_A^s & \text{.Math.}_u \in S_{s,s}^u & \text{.Math.}_l \in S_{l,u}^l & \text{.Math.}_v \in S_{v,l}^v & t_{f(v,l)}^V + \\ \text{.Math.}_i \in S_A^i & \text{.Math.}_l \in S_{l,i}^l & \text{.Math.}_v \in S_{v,l}^v & t_{f(v,l)}^V \end{matrix}} = \frac{\text{.Math.}_l \in S_A^l \quad \text{.Math.}_v \in S_{v,l}^v \quad d_{(v,l)}^V}{\text{.Math.}_l \in S_A^l \quad \text{.Math.}_v \in S_{v,l}^v \quad t_{f(v,l)}^V} = \text{.Math.}_{l \in S_A^l} (DI_l^L \times w_l^I) [0055] \text{ wherein } DI.\text{sub.}$$

[00028]  $d_{(v,l)}^V = DI_{(v,l)}^V \times t_{f(v,l)}^V$  [00059] an average delay time of the vehicle V.sub.v is reckoned as follows:

$$[00030]d_l^{-L} = \frac{\text{Math.v in } S_{L,l}^V d_{(v,l)}^V}{N_{L,l}^V} = \frac{\text{Math.v in } S_{L,l}^V d_{(v,l)}^V}{\text{Math.v in } S_{L,l}^V t_{f_{(v,l)}}^V} \times \frac{\text{Math.v in } S_{L,l}^V t_{f_{(v,l)}}^V}{N_{L,l}^V} = \text{DI}_l^L \times t_{f_l}^L \quad [0061] \text{ an average delay time of a subsection U.sub.u is}$$

of the section S.sub.s is reckoned as follows:

an average delay time of the intersection I.sub.i is reckoned as follows:

the road R.sub.r is reckoned as follows:

a sub-zone Z.sub.z is reckoned as follows:

the zone is reckoned as follows:

$$[00036]d^A = \frac{.Math_{.l \in S_A^L} .Math_{.v \in S_{L,l}^V} d_{(v,l)}^V}{N^V} = \frac{.Math_{.l \in S_A^L} .Math_{.v \in S_{L,l}^V} d_{(v,l)}^V}{.Math_{.l \in S_A^L} .Math_{.v \in S_{L,l}^V} t_{(v,l)}^V} \times \frac{.Math_{.l \in S_A^L} .Math_{.v \in S_{L,l}^V} t_{(v,l)}^V}{N^V} = DI^A \times t_f^A \quad [00067] \text{ wherein d.sub.v.sup.V is}$$

the delay time of the vehicle V.sub.v passing the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively; N.sub.L,l.sup.V, N.sub.U,u.sup.V, N.sub.S,s.sup.V, N.sub.I,i.sup.V, N.sub.R,r.sup.V, and N.sub.Z,z.sup.V represent numbers of vehicles passing the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z within the evaluation period respectively; and t.sub.fu.sup.U, t.sub.fs.sup.S, t.sub.fi.sup.I, t.sub.fr.sup.R, t.sub.fz.sup.Z, and t.sub.fsup.A represent the average free-flow driving times of the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.l is reckoned as follows:

[00037]  $HI_{(v,l)}^V = \frac{h_{(v,l)}^V}{t_{f(v,l)}^V}$  [0073] an index of number of times of stopping of the vehicle V.sub.v is reckoned as follows:

$$[00038] \quad HI_v^V = \frac{\text{Math}_l \in S_{v,v}^L h_{(v,l)}^V}{\text{Math}_l \in S_{v,v}^L t_{f_l}^V} = \frac{\text{Math}_l \in S_{v,v}^L (HI_{(v,l)}^V \times t_{f(v,l)}^V)}{\text{Math}_v = 1 \cdot \text{Math}_l \in S_{v,v}^L t_{f_l}^V} \times \frac{\text{Math}_v = 1 \cdot \text{Math}_l \in S_{v,v}^L t_{f_l}^V}{\text{Math}_l \in S_{v,v}^L t_{f_l}^V}$$

$$= \frac{\text{Math}_l \in S_{v,v}^L (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_l \in S_{v,v}^L w_{(v,l)}^V} \quad [0074] \text{ an index of number of times of stopping of the lane}$$

L.sub.l is reckoned as follows:

$$[00039] \quad HI_l^L = \frac{\text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V} = \frac{\text{Math}_l \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_v = 1 \cdot \text{Math}_l \in S_{l,l}^V t_{f(v,l)}^V} \times \frac{\text{Math}_v = 1 \cdot \text{Math}_l \in S_{l,l}^V t_{f(v,l)}^V}{\text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V}$$

$$= \frac{\text{Math}_v \in S_{l,l}^V (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_v \in S_{l,l}^V w_{(v,l)}^V} \quad [0075] \text{ an index of number of times of stopping of the}$$

subsection U.sub.u is reckoned as follows:

$$[00040] \quad HI_u^U = \frac{\text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V} = \frac{\text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V w_{(v,l)}^V} = \frac{\text{Math}_l \in S_{u,u}^L (HI_l^L \times w_l^L)}{\text{Math}_l \in S_{u,u}^L w_l^L} \quad [0076] \text{ an index of number of times of}$$

stopping of the section S.sub.s is reckoned as follows:

$$[00041] \quad HI_s^S = \frac{\text{Math}_u \in S_{s,s}^U \cdot \text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_u \in S_{s,s}^U \cdot \text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V}$$

$$= \frac{\text{Math}_l \in S_{s,s}^L \cdot \text{Math}_v \in S_{l,l}^V (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_l \in S_{s,s}^L \cdot \text{Math}_v \in S_{l,l}^V w_{(v,l)}^V} \quad [0077] \text{ an index of number of times of stopping of the intersection I.sub.i is}$$

$$= \frac{\text{Math}_l \in S_{s,s}^L (HI_l^L \times w_l^L)}{\text{Math}_l \in S_{s,s}^L w_l^L} = \frac{\text{Math}_u \in S_{s,s}^U (HI_u^U \times w_u^U)}{\text{Math}_u \in S_{s,s}^U w_u^U}$$

reckoned as follows:

$$[00042] \quad HI_i^I = \frac{\text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V} = \frac{\text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V w_{(v,l)}^V} = \frac{\text{Math}_l \in S_{i,i}^L (HI_l^L \times w_l^L)}{\text{Math}_l \in S_{i,i}^L w_l^L} \quad [0078] \text{ an index of number of times of}$$

stopping of the road R.sub.r is reckoned as follows:

$$[00043] \quad HI_r^R = \frac{\text{Math}_s \in S_{r,r}^S \cdot \text{Math}_u \in S_{s,s}^U \cdot \text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V + \text{Math}_i \in S_{r,r}^I \cdot \text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_s \in S_{r,r}^S \cdot \text{Math}_u \in S_{s,s}^U \cdot \text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V + \text{Math}_i \in S_{r,r}^I \cdot \text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V}$$

$$= \frac{\text{Math}_l \in S_{r,r}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_l \in S_{r,r}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V}$$

$$= \frac{\text{Math}_l \in S_{r,z}^L (HI_l^L \times w_l^L)}{\text{Math}_l \in S_{r,z}^L w_l^L} \quad [0079] \text{ an index of number of times of stopping of the sub-zone Z.sub.z}$$

is reckoned as follows:

$$[00044] \quad HI_z^Z = \frac{\text{Math}_s \in S_{z,z}^S \cdot \text{Math}_u \in S_{s,s}^U \cdot \text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V + \text{Math}_i \in S_{z,z}^I \cdot \text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_s \in S_{z,z}^S \cdot \text{Math}_u \in S_{s,s}^U \cdot \text{Math}_l \in S_{u,u}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V + \text{Math}_i \in S_{z,z}^I \cdot \text{Math}_l \in S_{i,i}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V}$$

$$= \frac{\text{Math}_l \in S_{z,z}^L \cdot \text{Math}_v \in S_{l,l}^V h_{(v,l)}^V}{\text{Math}_l \in S_{z,z}^L \cdot \text{Math}_v \in S_{l,l}^V t_{f(v,l)}^V}$$

$$= \frac{\text{Math}_l \in S_{z,z}^L (HI_l^L \times w_l^L)}{\text{Math}_l \in S_{z,z}^L w_l^L} \quad [0080] \text{ an index of number of times of stopping of the zone is reckoned}$$

as follows:

$$\begin{aligned}
\text{HI}^A &= \frac{\begin{aligned} &\text{.Math.}_{s \in S_A^s} \text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{L,l}^l} \text{.Math.}_{v \in S_{V,l}^v} h_{(v,l)}^V + \\ &\text{.Math.}_{i \in S_A^i} \text{.Math.}_{l \in S_{L,i}^l} \text{.Math.}_{v \in S_{V,l}^v} h_{(v,l)}^V \end{aligned}}{\begin{aligned} &\text{.Math.}_{s \in S_A^s} \text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{L,l}^l} \text{.Math.}_{v \in S_{V,l}^v} t_{f_{(v,l)}}^V + \\ &\text{.Math.}_{i \in S_A^i} \text{.Math.}_{l \in S_{L,i}^l} \text{.Math.}_{v \in S_{V,l}^v} t_{f_{(v,l)}}^V \end{aligned}} \\
&= \frac{\text{.Math.}_{l \in S_A^l} \text{.Math.}_{v \in S_{V,l}^v} h_{(v,l)}^V}{\text{.Math.}_{l \in S_A^l} \text{.Math.}_{v \in S_{V,l}^v} t_{f_{(v,l)}}^V} \\
&= \text{.Math.}_{l \in S_A^l} (\text{HI}_l^L \times w_l^L)
\end{aligned}$$

[0081] wherein  $\text{HI.sub.v.sup.V}$  is the index of the number of times of

stopping of the vehicle  $V.\text{sub.v}$  on the lane  $L.\text{sub.l}$ ;  $h.\text{sub.v.l.sup.V}$  is the number of times of stopping of the vehicle  $V.\text{sub.v}$  passing the lane  $L.\text{sub.l}$ ; and  $\text{HI.sub.v.sup.V}$ ,  $\text{HI.sub.l.sup.L}$ ,  $\text{HI.sub.u.sup.U}$ ,  $\text{HI.sub.s.sup.S}$ ,  $\text{HI.sub.i.sup.I}$ ,  $\text{HI.sub.r.sup.R}$ ,  $\text{HI.sub.z.sup.Z}$ , and  $\text{HI.sub.A}$  represent the indexes of number of times of stopping of the vehicle  $V.\text{sub.v}$ , the lane  $L.\text{sub.l}$ , the subsection  $U.\text{sub.u}$ , the section  $S.\text{sub.s}$ , the intersection  $I.\text{sub.i}$ , the road  $R.\text{sub.r}$ , the sub-zone  $Z.\text{sub.z}$ , 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  $V.\text{sub.v}$  passing the lane  $L.\text{sub.l}$  is reckoned as follows:

[00046]  $h_{(v,l)}^V = \text{HI}_{(v,l)}^V \times t_{f_{(v,l)}}^V$  [0085] an average number of times of stopping of the vehicle  $V.\text{sub.v}$  is reckoned as follows:

[00047]  $h_v^V = \text{.Math.}_{l \in S_{V,v}^l} h_{(v,l)}^V = \text{HI}_v^V \times \text{.Math.}_{l \in S_{V,v}^l} t_{f_l}^V = \text{HI}_v^V \times t_{f_v}^V$  [0086] an average number of times of stopping of the lane  $L.\text{sub.l}$  is reckoned as follows:

[00048]  $h_l^L = \frac{\text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_{L,l}^V} = \frac{\text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_{L,l}^V} = \text{HI}_l^L \times t_{f_l}^L$  [0087] an average number of times of stopping of the

subsection  $U.\text{sub.u}$  is reckoned as follows:

[00049]  $h_u^U = \frac{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_{U,u}^V} = \frac{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_{U,u}^V} = \text{HI}_u^U \times t_{f_u}^U$  [0088] an average number of

times of stopping of the section  $S.\text{sub.s}$  is reckoned as follows:

[00050]

$h_s^S = \frac{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_{S,s}^V} = \frac{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_{S,s}^V} = \text{HI}_s^S \times t_{f_s}^S$  [0089]

an average number of times of stopping of the intersection  $I.\text{sub.i}$  is reckoned as follows:

[00051]  $h_i^I = \frac{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_{I,i}^V} = \frac{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_{I,i}^V} = \text{HI}_i^I \times t_{f_i}^I$  [0090] an average number of

times of stopping of the road  $R.\text{sub.r}$  is reckoned as follows:

[00052]  $h_r^R = \frac{\text{.Math.}_{l \in S_{R,r}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_{R,r}^V} = \frac{\text{.Math.}_{l \in S_{R,r}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{l \in S_{R,r}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{l \in S_{R,r}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_{R,r}^V} = \text{HI}_r^R \times t_{f_r}^R$  [0091] an average number of

times of stopping of the sub-zone  $Z.\text{sub.z}$  is reckoned as follows:

[00053]  $h_z^Z = \frac{\text{.Math.}_{l \in S_{Z,z}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_{Z,z}^V} = \frac{\text{.Math.}_{l \in S_{Z,z}^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{l \in S_{Z,z}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{l \in S_{Z,z}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_{Z,z}^V} = \text{HI}_z^Z \times t_{f_z}^Z$  [0092] an average number of

times of stopping of the zone is reckoned as follows:

[00054]  $h^A = \frac{\text{.Math.}_{l \in S_A^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{N_A^V} = \frac{\text{.Math.}_{l \in S_A^l} \text{.Math.}_{v \in S_{L,l}^v} h_{(v,l)}^V}{\text{.Math.}_{l \in S_A^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{l \in S_A^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V}{N_A^V} = \text{HI}^A \times t_{f^A}^A$  [0093] wherein  $h.\text{sub.v.sup.V}$  is

the number of times of stopping of the vehicle  $V.\text{sub.v}$ ; and  $h.\text{sub.l.sup.L}$ ,  $h.\text{sub.u.sup.U}$ ,  $h.\text{sub.s.sup.S}$ ,  $h.\text{sub.i.sup.I}$ ,  $h.\text{sub.r.sup.R}$ ,  $h.\text{sub.z.sup.Z}$ , and  $h.\text{sub.A}$  represent the average numbers of times of stopping of the lane  $L.\text{sub.l}$ , the subsection  $U.\text{sub.u}$ , the second  $S.\text{sub.s}$ , the intersection  $I.\text{sub.i}$ , the road  $R.\text{sub.r}$ , the sub-zone  $Z.\text{sub.z}$ , 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  $V.\text{sub.v}$  passing the lane  $L.\text{sub.l}$  is reckoned as follows:

[00055]  $\text{MI}_{(v,l)}^V = \frac{l_{(v,l)}^{c_{(v,l)}}}{t_{f_{(v,l)}}^V}$  [0099] an index of a mileage of a congested road of the vehicle  $V.\text{sub.v}$  is reckoned as follows:

[00056]  $\text{MI}_v^V = \frac{\text{.Math.}_{l \in S_{V,v}^l} l_{(v,l)}^{c_{(v,l)}}}{\text{.Math.}_{l \in S_{V,v}^l} t_{f_l}^V} = \frac{\text{.Math.}_{l \in S_{V,v}^l} (\text{MI}_{(v,l)}^V \times t_{f_{(v,l)}}^V)}{\text{.Math.}_{l \in S_{V,v}^l} t_{f_l}^V} \times \frac{\text{.Math.}_{v=1}^N \text{.Math.}_{l \in S_{V,v}^l} t_{f_l}^V}{\text{.Math.}_{l \in S_{V,v}^l} t_{f_l}^V} = \frac{\text{.Math.}_{l \in S_{V,v}^l} (\text{MI}_{(v,l)}^V \times w_{(v,l)}^V)}{\text{.Math.}_{l \in S_{V,v}^l} w_{(v,l)}^V}$  [0100] an index of a mileage of a

congested road of the lane  $L.\text{sub.l}$  is reckoned as follows:

[00057]  $\text{MI}_l^L = \frac{\text{.Math.}_{v \in S_{L,l}^v} l_{(v,l)}^{c_{(v,l)}}}{\text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} = \frac{\text{.Math.}_{v \in S_{L,l}^v} l_{(v,l)}^{c_{(v,l)}}}{\text{.Math.}_{v=1}^N \text{.Math.}_{l \in S_{L,l}^v} t_{f_{(v,l)}}^V} \times \frac{\text{.Math.}_{v=1}^N \text{.Math.}_{l \in S_{L,l}^v} t_{f_{(v,l)}}^V}{\text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} = \frac{\text{.Math.}_{v \in S_{L,l}^v} (\text{MI}_{(v,l)}^V \times w_{(v,l)}^V)}{\text{.Math.}_{v \in S_{L,l}^v} w_{(v,l)}^V}$  [0101] an index of a mileage of a

congested road of the subsection  $U.\text{sub.u}$  is reckoned as follows:

[00058]  $\text{MI}_u^U = \frac{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} l_{(v,l)}^{c_{(v,l)}}}{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} = \frac{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} (\text{MI}_{(v,l)}^V \times w_{(v,l)}^V)}{\text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} w_{(v,l)}^V} = \frac{\text{.Math.}_{l \in S_{U,u}^l} (\text{MI}_l^L \times w_l^L)}{\text{.Math.}_{l \in S_{U,u}^l} w_l^L}$  [0102] an index of a mileage of a

congested road of the section  $S.\text{sub.s}$  is reckoned as follows:

[00059]  $\text{MI}_s^S = \frac{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} l_{(v,l)}^{c_{(v,l)}}}{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} = \frac{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} (\text{MI}_{(v,l)}^V \times w_{(v,l)}^V)}{\text{.Math.}_{u \in S_{S,s}^u} \text{.Math.}_{l \in S_{U,u}^l} \text{.Math.}_{v \in S_{L,l}^v} w_{(v,l)}^V} = \frac{\text{.Math.}_{u \in S_{S,s}^u} (\text{MI}_l^L \times w_l^L)}{\text{.Math.}_{u \in S_{S,s}^u} w_l^L} = \frac{\text{.Math.}_{u \in S_{S,s}^u} (\text{MI}_u^U \times w_u^U)}{\text{.Math.}_{u \in S_{S,s}^u} w_u^U}$

[0103] an index of a mileage of a congested road of the intersection  $I.\text{sub.i}$  is reckoned as follows:

[00060]  $\text{MI}_i^I = \frac{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} l_{(v,l)}^{c_{(v,l)}}}{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} t_{f_{(v,l)}}^V} = \frac{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} (\text{MI}_{(v,l)}^V \times w_{(v,l)}^V)}{\text{.Math.}_{l \in S_{I,i}^l} \text{.Math.}_{v \in S_{L,l}^v} w_{(v,l)}^V} = \frac{\text{.Math.}_{l \in S_{I,i}^l} (\text{MI}_l^L \times w_l^L)}{\text{.Math.}_{l \in S_{I,i}^l} w_l^L}$  [0104] an index of a mileage of a

congested road of the road R.sub.r is reckoned as follows:

[00061]

$$MI_r^R = \frac{\cdot\text{Math}\cdot s \in S_{R,r}^s \cdot \text{Math}\cdot u \in S_{U,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V + \cdot\text{Math}\cdot i \in S_{R,r}^i \cdot \text{Math}\cdot l \in S_{L,l}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot s \in S_{R,r}^s \cdot \text{Math}\cdot u \in S_{U,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V + \cdot\text{Math}\cdot i \in S_{R,r}^i \cdot \text{Math}\cdot l \in S_{L,l}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{R,r}^l (MI_l^L \times w_l^L)}{\cdot\text{Math}\cdot l \in S_{R,r}^l w_l^L}$$

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

[00062]

$$MI_z^Z = \frac{\cdot\text{Math}\cdot s \in S_{Z,z}^s \cdot \text{Math}\cdot u \in S_{U,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V + \cdot\text{Math}\cdot i \in S_{Z,z}^i \cdot \text{Math}\cdot l \in S_{L,l}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot s \in S_{Z,z}^s \cdot \text{Math}\cdot u \in S_{U,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V + \cdot\text{Math}\cdot i \in S_{Z,z}^i \cdot \text{Math}\cdot l \in S_{L,l}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{Z,z}^l (MI_l^L \times w_l^L)}{\cdot\text{Math}\cdot l \in S_{Z,z}^l w_l^L}$$

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

$$MI^A = \frac{\cdot\text{Math}\cdot s \in S_A^s \cdot \text{Math}\cdot u \in S_{U,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V + \cdot\text{Math}\cdot i \in S_A^i \cdot \text{Math}\cdot l \in S_{L,l}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot s \in S_A^s \cdot \text{Math}\cdot u \in S_{U,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V + \cdot\text{Math}\cdot i \in S_A^i \cdot \text{Math}\cdot l \in S_{L,l}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \quad [0107] \text{ wherein } MI.\text{sub}.(v,l).\text{sup}.V \text{ is}$$

$$= \frac{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} = \frac{\cdot\text{Math}\cdot (MI_l^L \times w_l^L)}{l \in S_A^l}$$

the index of the mileage of the congested road of the vehicle V.sub.v on the lane L.sub.l; l.sub.c(v,l).sup.V is the mileage of the congested road of the vehicle V, passing the lane L.sub.l; and MI.sub.v.sup.V, MI.sub.l.sup.L, MI.sub.u.sup.U, MI.sub.s.sup.S, MI.sub.i.sup.I, MI.sub.r.sup.R, MI.sub.z.sup.Z, and MI.sup.A represent the indexes of the mileages of the congested roads of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.l is reckoned as follows:

[00064]  $m_{(v,l)}^V = \frac{l_{c(v,l)}^V}{l_{(v,l)}^V} = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V} \times \frac{t_{f(v,l)}^V}{l_{(v,l)}^V} = \frac{MI_{(v,l)}^V}{V_{f(v,l)}^V}$  [0111] a proportion of a mileage of a heavily congested road of the vehicle V.sub.v is reckoned as follows:

[00065]  $m_v^V = \frac{\cdot\text{Math}\cdot l \in S_{L,v}^l \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,v}^l \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{L,v}^l \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,v}^l \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot l \in S_{L,v}^l \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,v}^l \cdot l_{(v,l)}^V} = \frac{MI_v^V}{V_v^V}$  [0112] a proportion of a mileage of a heavily congested road of the lane L.sub.l is reckoned as follows:

[00066]  $m_l^L = \frac{\cdot\text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{MI_l^L}{V_l^L}$  [0113] a proportion of a mileage of a heavily congested road of the subsection U.sub.u is reckoned as follows:

[00067]  $m_u^U = \frac{\cdot\text{Math}\cdot l \in S_{L,u}^l \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,u}^l \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{L,u}^l \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,u}^l \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot l \in S_{L,u}^l \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,u}^l \cdot l_{(v,l)}^V} = \frac{MI_u^U}{V_u^U}$  [0114] a proportion of a mileage of a heavily congested road of the section S.sub.s is reckoned as follows:

[00068]  $m_s^S = \frac{\cdot\text{Math}\cdot u \in S_{S,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot u \in S_{S,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot u \in S_{S,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot u \in S_{S,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot u \in S_{S,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot u \in S_{S,s}^u \cdot \text{Math}\cdot l \in S_{L,u}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{MI_s^S}{V_s^S}$

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

[00069]  $m_i^I = \frac{\cdot\text{Math}\cdot l \in S_{L,i}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,i}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{L,i}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,i}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot l \in S_{L,i}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{L,i}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{MI_i^I}{V_i^I}$  [0116] a proportion of a mileage of a heavily congested road of the road R.sub.r is reckoned as follows:

[00070]  $m_r^R = \frac{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{R,r}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{MI_r^R}{V_r^R}$  [0117] a proportion of a mileage of a heavily congested road of the sub-zone Z, is reckoned as follows:

[00071]  $m_z^Z = \frac{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot l \in S_{Z,z}^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{MI_z^Z}{V_z^Z}$  [0118] a proportion of a mileage of a heavily congested road of the zone is reckoned as follows:

[00072]  $M^A = \frac{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{c(v,l)}^V}{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V} \times \frac{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot t_{f(v,l)}^V}{\cdot\text{Math}\cdot l \in S_A^l \cdot \text{Math}\cdot v \in S_{L,l}^v \cdot l_{(v,l)}^V} = \frac{MI^A}{V_f^A}$  [0119] wherein m.sub.(v,l).sup.V is the

proportion of the mileage of the heavily congested road of the vehicle V.sub.v on the lane L.sub.l; l.sub.c(v,l).sup.V is a vehicle mileage of the vehicle V.sub.v passing the lane L.sub.l; V.sub.f(v,l).sup.V is a flow-free driving speed of the vehicle V.sub.v passing the lane L.sub.l; m.sub.v.sup.V, m.sub.l.sup.L, m.sub.u.sup.U, m.sub.s.sup.S, m.sub.i.sup.I, m.sub.r.sup.R, m.sub.z.sup.Z, and m.sup.A represent proportions of mileages of heavily congested roads of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively; and V.sub.fv.sup.V, V.sub.fl.sup.L, V.sub.fu.sup.U, V.sub.fs.sup.S, {circumflex over (V)}.sub.fi.sup.I, Vfr.sup.R, Vfz.sup.Z, and V.sub.f.sup.A represent average flow-free driving speeds of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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 weighing 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.

## Description

### 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.sub.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.sub.1, R.sub.2, and R.sub.3) and three north-south roads (R.sub.4, R.sub.5, and R.sub.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.sub.f(v,l).sup.V of various passing vehicles on different lanes in the road network, the traffic weight coefficients w.sub.(v,l).sup.V of the vehicles V.sub.v in various lanes L.sub.l are calculated, and the traffic weight coefficients w.sub.(v,l).sup.V of the different lanes in the road network belonging to the vehicles V.sub.v are summed, to obtain the traffic weight coefficient w.sub.v.sup.V of the v.sup.th vehicle in the road network as follows:

$$[00073] w_{v}^{V} = \frac{\text{Math.} \frac{t_{f_i}^{V}}{\sum_{l \in S_{v,v}^{L,V}} \text{Math.} \frac{N_{v=1}^{N_v}}{\sum_{l \in S_{v,v}^{L,V}} \text{Math.} \frac{t_{f_i}^{V}}{t_{f_i}^{V}}}}}{\sum_{l \in S_{v,v}^{L,V}} \text{Math.} \frac{N_{v=1}^{N_v}}{\sum_{l \in S_{v,v}^{L,V}} \text{Math.} \frac{t_{f_i}^{V}}{t_{f_i}^{V}}}} = \text{Math.} \frac{w_{(v,l)}^{V}}{\sum_{l \in S_{v,v}^{L,V}} w_{(v,l)}^{V}}$$

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

TABLE-US-00001 TABLE 1 Traffic Weight Coefficients of Vehicles Vehicle number Lane number t.sub.f(v, l).sup.v/s w.sub.(v, l).sup.V w.sub.v.sup.V . . . . . V.sub.46 L.sub.4 35.0 0.00013 0.00067 L.sub.5 37.8 0.00014 L.sub.7 2.4 0.00015 L.sub.11 27.0 0.00010 L.sub.13 2.4 0.00013 L.sub.123 0.7 0.00000 L.sub.200 3.2 0.00001 L.sub.214 3.1 0.00001 V.sub.47 L.sub.21 39.0 0.00014 0.00035 L.sub.25 1.0 0.00000 L.sub.26 2.7 0.00019 L.sub.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.sub.(v,l).sup.V of the vehicle V.sub.v on different lanes L.sub.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.sub.(v,l).sup.V of various passing vehicles V.sub.v on the different lanes L.sub.l in Table 1. Calculation results are shown in Table 2, Table 3, and Table 4.

TABLE-US-00002 TABLE 2 Traffic Weight Coefficients of Lanes Lane q.sub.l.sup.L/ h.sub.l.sup.L/ number (vehicle/h) t.sub.l.sup.L/s d.sub.l.sup.L/s time m.sub.l.sup.L t.sub.f l.sup.L/s w.sub.l.sup.L L.sub.1 452 33.67 1.40 0.02 2.67% 32.27 0.0215 L.sub.2 240 23.77 21.35 0.62 35.92% 2.42 0.0009 L.sub.3 228 31.28 28.83 0.68 42.52% 2.45 0.0008 L.sub.4 312 32.00 0.09 0.00 0.26% 31.91 0.0147 L.sub.5 328 39.32 1.25 0.00 2.64% 38.07 0.0184 L.sub.6 176 6.36 3.70 0.14 8.40% 2.67 0.0007 L.sub.7 152 31.50 28.87 0.82 41.15% 2.63 0.0006 L.sub.8 404 43.36 4.84 0.08 5.87% 38.51 0.0229 L.sub.9 236 23.83 21.31 0.56 35.78% 2.52 0.0009 L.sub.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-US-00003 TABLE 3 Traffic Weight Coefficients of Intersection I.sub.2 Various Entrance Lane Lane q.sub.l.sup.L/ entrances direction attribute number (vehicle/h) t.sub.l.sup.L/s d.sub.l.sup.L/s h.sub.l.sup.L/time m.sub.l.sup.L t.sub.f l.sup.L/s w.sub.l.sup.L w w.sub.i.sup.I North Tapered L.sub.261 80 1.00 0.29 0.00 23.60% 0.72 0.0001 0.0034 0.0118 section Tapered L.sub.262 100 2.32 1.80 0.08 41.66% 0.52 0.0001 section Entrance L.sub.82 200 26.88 24.78 0.80 47.65% 2.10 0.0006 lane Entrance L.sub.83 216 26.19 23.94 0.74 42.90% 2.24 0.0007 lane Left L.sub.227 8 3.50 0.60 0.00 14.56% 2.90 0.0000 turning Straight L.sub.218 180 3.98 0.57 0.00 10.98% 3.41 0.0009 driving Straight L.sub.220 188 3.91 0.50 0.00 16.97% 3.41 0.0009 driving Right L.sub.219 24 2.33 0.48 0.00 9.84% 1.85 0.0001 turning East Tapered L.sub.126 76 1.05 0.26 0.00 16.39% 0.79 0.0001 0.0026 section Tapered L.sub.127 84 2.90 2.26 0.10 28.41% 0.65 0.0001 section Entrance L.sub.12 144 28.61 25.90 0.75 39.75% 2.71 0.0006 lane Entrance L.sub.13 148 24.59 21.93 0.73 39.25% 2.66 0.0006 lane Left L.sub.213 8 2.50 0.25 0.00 7.57% 2.25 0.0000 turning Straight L.sub.214 140 3.60 0.56 0.00 11.98% 3.04 0.0006 driving Straight L.sub.216 128 3.69 0.59 0.00 14.72% 3.09 0.0006 driving Right L.sub.215 12 2.67 0.43 0.00 12.22% 2.23 0.0000 turning South Tapered L.sub.170 44 1.00 0.20 0.00 16.92% 0.80 0.0000 0.0021 section Tapered L.sub.171 60 1.00 0.21 0.00 17.48% 0.79 0.0001 section Entrance L.sub.86 108 25.74 23.41 0.81 40.84% 2.33 0.0004 lane Entrance L.sub.87 124 24.23 21.85 0.68 38.72% 2.38 0.0004 lane Left L.sub.172 8 3.50 0.65 0.00 14.80% 2.85 0.0000 turning Straight L.sub.173 100 4.00 0.57 0.00 10.34% 3.43 0.0005 driving Straight L.sub.175 108 4.07 0.54 0.00 17.16% 3.53 0.0006 driving Right L.sub.174 16 3.25 0.70 0.00 9.78% 2.55 0.0001 turning West Tapered L.sub.124 108 0.53 3.66 0.07 34.79% 0.53 0.0001 0.0037 section Tapered L.sub.125 56 0.49 3.23 0.14 39.20% 0.49 0.0000 section Entrance L.sub.9 236 23.83 21.31 0.56 35.78% 2.52 0.0009 lane Entrance L.sub.10 192 24.17 21.68 0.63 41.11% 2.48 0.0007 lane Left L.sub.205 16 2.58 0.93 0.00 20.41% 2.58 0.0001 turning Straight L.sub.206 220 3.25 0.38 0.00 8.18% 3.25 0.0011 driving Straight L.sub.208 180 3.11 0.51 0.00 5.15% 3.11 0.0008 driving Right L.sub.207 12 1.90 0.10 0.00 10.84% 1.90 0.0000 turning

[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-US-00004 TABLE 4 Traffic Weight Coefficients of Roads Section/ inter- Road section Lane Vehicle w.sub.s.sup.S/ number number number w.sub.(v, l).sup.V w.sub.l.sup.L w.sub.i.sup.I w.sub.r.sup.R R.sub.1 S.sub.1 L.sub.1 V.sub.322 0.000054 0.021 0.021 0.197 V.sub.323 0.000067 V.sub.1885 0.000118 V.sub.1892 0.000112 . . . . . S.sub.2 L.sub.4 . . . 0.015 0.015 I.sub.1 . . . 0.013

R.sub.3 . . . 0.012 S.sub.7 L.sub.17 . . . 0.021 0.021 S.sub.8 L.sub.18 . . . 0.014 0.014 R.sub.2 . . . 0.182 R.sub.3 . . . 0.158 R.sub.4 . . . 0.198 R.sub.5 . . . 0.182 R.sub.6 . . . 0.189

[0137] As shown in FIG. 3, according to the lane composition of the sub-zone Z.sub.1, the traffic weight coefficients w.sub.1.sup.Z of the sub-zone Z.sub.1 is obtained by using the traffic weight coefficients w.sub.(v,l).sup.V of various passing vehicles V.sub.v on the different lanes L.sub.l in Table 1, as follows:

$$[00074]w_1^Z = \sum_{s \in S_{Z,1}^S} \text{Math. } w_s^S + \sum_{l \in S_{Z,1}^L} \text{Math. } w_l^L = \sum_{l \in S_{Z,1}^L} \sum_{v \in S_{L,l}^V} \text{Math. } w_{(v,l)}^V = 0.5274$$

[0138] For the whole road network, the traffic weight coefficients W.sub.A of the road network can also be obtained by summing the traffic weight coefficients w.sub.(v,l).sup.V of various passing vehicles V.sub.v on the different lanes L.sub.l in the road network:

$$[00075]w^A = \sum_{l=1}^{N^L} \text{Math. } w_l^L = \sum_{l \in S_A^L} \sum_{v \in S_{L,l}^V} \text{Math. } w_{(v,l)}^V = \sum_{v=1}^{N^V} \text{Math. } w_v^V = 1 \quad [0139] \text{ Step 3, reckoning traffic operation indexes of various lanes,}$$

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.sub.(v,l).sup.V of various passing vehicles V.sub.v on the different lanes L.sub.l are obtained by using the free-flow driving times t.sub.f(v,l).sup.V and the travel times t.sub.(v,l).sup.V of the vehicles V.sub.v on the lanes L.sub.l in the road network. Further, in combination with the traffic weight coefficients w.sub.(v,l).sup.V various passing vehicles V.sub.v on the different lanes L.sub.l in Table 1, the traffic operation indexes PI.sub.v.sup.V of the vehicles V.sub.v are reckoned.

$$[00076]PI_{(v,l)}^V = \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}; PI_v^V = \frac{\sum_{l \in S_{V,v}^L} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{l \in S_{V,v}^L} w_{(v,l)}^V}$$

[0141] Taking the vehicles V.sub.46 and V.sub.47 as examples, calculation results of PI.sub.(v,l).sup.V and PI.sub.v.sup.V are shown in Table 5.

TABLE-US-00005 TABLE 5 Traffic Operation States of Vehicles Vehicle Lane Operation number number t.sub.(v, l).sup.V/s d.sub.(v, l).sup.V/s h.sub.(v, l).sup.V/time m.sub.(v, l).sup.V PI.sub.(v, l).sup.V DI.sub.(v, l).sup.V HI.sub.(v, l).sup.V/(times/min) MI.sub.(v, l).sup.V/(m/min) condition . . . . . V.sub.46 L.sub.4 35 0.0 0 0.00% 1.00 0.00 0.00 0.00 PI.sub.46.sup.V = 1.68 L.sub.5 38 0.2 0 0.47% 1.01 0.01 0.00 3.89 DI.sub.46.sup.V = 0.68 L.sub.7 41 38.6 1 63.55% 17.08 16.08 25.00 544.17 HI.sub.46.sup.V = 1.08 L.sub.11 27 0.0 0 0.00% 1.00 0.00 0.00 0.00 MI.sub.46.sup.V = 32.91 L.sub.13 37 34.6 1 54.28% 15.42 14.42 25.00 493.22 L.sub.123 1 0.3 0 30.00% 1.43 0.43 0.00 272.06 L.sub.200 4 0.8 0 16.60% 1.25 0.25 0.00 126.30 L.sub.214 4 0.9 0 18.65% 1.29 0.29 0.00 142.34 V.sub.47 L.sub.21 39 0.0 0 0.00% 1.00 0.00 0.00 0.00 PI.sub.47.sup.V = 2.09 L.sub.25 1 0.0 0 0.00% 1.00 0.00 0.00 0.00 DI.sub.47.sup.V = 1.09 L.sub.26 52 49.3 1 40.00% 19.26 18.26 22.22 335.71 HI.sub.47.sup.V = 1.29 L.sub.276 5 1.2 0 18.38% 1.32 0.32 0.00 126.76 MI.sub.47.sup.V = 29.85 . . . . .

[0142] In Table 5, HI.sub.v.sup.V is in a unit of “times/min”, and MI.sub.c.sup.V is in a unit of “m/min”.

[0143] Based on the acquired traffic operation indexes PI.sub.(v,l).sup.V of the vehicles V.sub.v on the lanes L.sub.l, in combination with the traffic weight coefficients w.sub.(v,l).sup.V, acquired in step 1, of various passing vehicles V.sub.v on different lanes L.sub.l in the road network, the traffic operation indexes PI.sub.l.sup.L of various lanes in the road network are calculated:

$$[00077]PI_l^L = \frac{\sum_{v \in S_{L,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0144] Calculation results are shown in Table 6.

TABLE-US-00006 TABLE 6 Traffic Operation States of Lanes Lane HI.sub.l.sup.L/ MI.sub.l.sup.L/ V.sub.f l.sup.L/ number PI.sub.l.sup.L DI.sub.l.sup.L (times/min) (m/min) (m/s) t.sub.f l.sup.L/s d.sub.l.sup.L/s h.sub.l.sup.L/time m.sub.l.sup.L L.sub.1 1.04 0.04 0.03 21.69 13.54 32.27 1.40 0.02 2.67% L.sub.2 9.81 15.28 288.87 13.40 2.42 21.35 0.62 35.92% L.sub.3 12.74 11.74 16.73 340.75 13.36 2.45 28.83 0.68 42.52% L.sub.4 1.00 0.00 0.00 2.22 14.01 31.91 0.09 0.00 0.26% L.sub.5 1.03 0.03 0.00 21.41 13.53 38.07 1.25 0.00 2.64% L.sub.6 2.39 1.39 3.07 67.62 13.42 2.67 3.70 0.14 8.40% L.sub.7 11.99 10.99 18.64 351.95 14.26 2.63 28.87 0.82 41.15% L.sub.8 1.13 0.13 0.12 47.57 13.51 38.51 4.84 0.08 5.87% L.sub.9 9.47 8.47 13.33 282.27 13.15 2.52 21.31 0.56 35.78% L.sub.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.sub.l.sup.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:

$$[00078]PI_i^I = \frac{\sum_{l \in S_{I,i}^L} (PI_l^L \times w_l^L)}{\sum_{l \in S_{I,i}^L} w_l^L}; PI_r^R = \frac{\sum_{l \in S_{k,r}^R} (PI_l^L \times w_l^L)}{\sum_{l \in S_{k,r}^R} w_l^L}$$

[0146] In the embodiment, taking the intersection I.sub.2 as an example, calculation results of the traffic operation indexes P.sub.2.sup.1, of the intersection I.sub.2 are shown in Table 7; and calculation results of the traffic operation indexes PI.sub.r.sup.R of various roads in the road network are shown in Table 8.

TABLE-US-00007 TABLE 7 Traffic Operation States of Intersection I.sub.2 Entrance Lane Lane Various Whole direction attribute number PI.sub.l.sup.L DI.sub.l.sup.L HI.sub.l.sup.L/(times/min) MI.sub.l.sup.L/(m/min) V.sub.f l.sup.L/(m/s) t.sub.f l.sup.L/s entrances intersection North Tapered L.sub.261 1.40 0.40 0.00 206.58 14.59 0.72 PI = 5.51 PI.sub.2.sup.I = 5.15 section DI = 4.51 DI.sub.2.sup.I = 4.15 Tapered L.sub.262 4.43 3.43 9.16 383.99 15.36 0.52 HI = 8.42 HI.sub.2.sup.I = 7.43 section MI = 204.01 MI.sub.2.sup.I = 192.40 Entrance L.sub.82 12.82 11.82 22.90 395.55 13.84 2.10 d = 25.35 t.sub.f = 5.86 lane h = 0.79 V.sub.f = 13.23 Entrance L.sub.83 11.69 10.69 19.83 349.30 13.57 2.24 m = 25.50% d = 24.30 lane h = 0.73 Left L.sub.227 1.21 0.21 0.00 108.26 12.39 2.90 m = 24.23% turning Straight L.sub.218 1.17 0.17 0.00 84.25 12.79 3.41 driving Straight L.sub.220 1.15 0.15 0.00 77.69 13.16 3.41 driving Right L.sub.219 1.26 0.26 0.00 127.49 12.52 1.85 turning East Tapered L.sub.126 1.32 0.32 0.00 135.52 13.78 0.79 PI = 5.16 section DI = 4.16 Tapered L.sub.127 4.49 3.49 8.82 243.44 14.28 0.65 HI = 7.62 section MI = 202.46 Entrance L.sub.12 10.56 9.56 16.62 328.03 13.75 2.71 d = 25.16 lane h = 0.77 Entrance L.sub.13 9.24 8.24 16.45 326.78 13.88 2.66 m = 25.47% lane Left L.sub.213 1.11 0.11 0.00 60.96 13.42 2.25 turning Straight L.sub.214 1.19 0.19 0.00 92.71 12.90 3.04 driving Straight L.sub.216 1.19 0.19 0.00 90.59 12.36 3.09 driving Right L.sub.215 1.19 0.19 0.00 104.44 11.83 2.23 turning South Tapered L.sub.170 1.25 0.25 0.00 139.49 13.74 0.80 PI = 4.80 section DI = 3.80 Tapered L.sub.171 1.26 0.26 0.00 152.38 14.53 0.79 HI = 7.28 section MI = 180.95 Entrance L.sub.86 11.05 10.05 20.99 341.04 13.92 2.33 d = 23.24 lane h = 0.74 Entrance L.sub.87 10.18 9.18 17.07 322.86 13.90 2.38 m = 22.76% lane Left L.sub.172 1.23 0.23 0.00 110.92 12.49 2.85 turning Straight L.sub.173 1.17 0.17 0.00 77.99 12.57 3.43 driving Straight L.sub.175 1.15 0.15 0.00 75.63 12.89 3.53 driving Right L.sub.174 1.27 0.27 0.00 124.32 12.08 2.55 turning West Tapered L.sub.124 7.90 6.90 8.39 282.64 13.54 0.53 PI = 4.99 section DI = 3.99 Tapered L.sub.125 7.65 6.65 17.65 347.13 14.76 0.49 HI = 6.45 section MI = 180.92 Entrance L.sub.9 9.47 8.47 13.33 282.27 13.15

2.52 d = 23.27 lane h = 2.63 turning Straight L.sub.10 9.73 8.73 15.10 331.45 13.44 2.48 m = 22.98% lane Left L.sub.205 1.36 0.36 0.00 153.98 12.58 2.58 turning Straight L.sub.206 1.12 0.12 0.00 63.45 12.92 3.25 driving Straight L.sub.208 1.17 0.17 0.00 84.73 13.02 3.11 driving Right L.sub.207 1.05 0.05 0.00 38.01 12.30 1.90 turning

TABLE-US-00008 TABLE 8 Calculation Results of Traffic Operation States of Roads Road number Number w PI DI HI/(times/min) MI/(m/min) PI.sub.r.sup.R DI.sub.r.sup.R HI.sub.r.sup.R/(times/min) MI.sub.r.sup.R/(m/min) R.sub.1 s S.sub.R, 1.sup.S.sup.— 0.160 1.05 0.05 0.04 26.38 1.90 0.90 1.39 56.67 I.sub.1 0.013 5.57 4.57 7.08 182.38 I.sub.2 0.012 5.15 4.15 7.43 192.40 I.sub.3 0.012 6.19 5.19 7.63 195.87 R.sub.2 s S.sub.R, 2.sup.S.sup.— 0.146 1.09 0.09 0.08 31.81 2.09 1.09 1.44 62.24 I.sub.4 0.013 4.97 3.97 6.77 176.75 I.sub.5 0.012 6.21 5.21 6.43 180.54 I.sub.6 0.011 7.45 6.45 7.71 201.07 R.sub.3 s S.sub.R, 3.sup.S.sup.— 0.125 1.09 0.09 0.10 33.64 2.27 1.27 1.47 63.29 I.sub.7 0.011 6.49 5.49 7.00 181.83 I.sub.8 0.011 6.99 5.99 5.88 160.93 I.sub.9 0.011 6.82 5.82 7.08 185.10 R.sub.4 s S.sub.R, 4.sup.S.sup.— 0.161 1.10 0.10 0.14 30.43 1.95 0.95 1.41 58.40 I.sub.1 0.013 5.57 4.57 7.08 182.38 I.sub.4 0.013 4.97 3.97 6.77 176.75 I.sub.7 0.011 6.49 5.49 7.00 181.83 R.sub.5 s S.sub.R, 5.sup.S.sup.— 0.148 1.10 0.10 0.14 29.93 2.04 1.04 1.36 57.93 I.sub.2 0.012 5.15 4.15 7.43 192.40 I.sub.5 0.012 6.21 5.21 6.43 180.54 I.sub.8 0.011 6.99 5.99 5.88 160.93 R.sub.6 s S.sub.R, 6.sup.S.sup.— 0.155 1.10 0.10 0.12 30.75 2.12 1.12 1.45 60.10 I.sub.3 0.012 6.19 5.19 7.63 195.87 I.sub.6 0.011 7.45 6.45 7.71 201.07 I.sub.9 0.011 6.82 5.82 7.08 185.10

[0147] Taking the sub-zone Z.sub.1 as an example, the traffic operation indexes PI.sub.1.sup.Z of the sub-zone Z.sub.1 are obtained by using the acquired traffic weight coefficients w.sub.1.sup.L and the traffic operation indexes PI.sub.1.sup.L of various lanes in the road network:

$$[00079]PI_1^Z = \frac{\text{Math}_{l \in S_{Z,z}^L} (PI_l^L \times w_l^L)}{\text{Math}_{l \in S_{Z,z}^L} w_l^L} = 1.51$$

[0148] For the whole road network, the traffic operation indexes PI.sub.A of the road network can also be calculated by using the acquired traffic weight coefficients w and traffic operation indexes PI.sub.1.sup.L of various lanes in the road network. Calculation results are shown in Table 6.

$$[00080]PI^A = \text{Math}_{l \in S_A^L} (PI_l^L \times w_l^L) = 1.62$$

[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.sub.v on the different lanes L.sub.l are obtained by using the free-flow driving times t.sub.f(v,l).sup.V and the delay times d.sub.(v,l).sup.V of the vehicles V.sub.v on the lanes L.sub.l in the road network. Further, in combination with the traffic weight coefficients w.sub.(v,l).sup.V of various passing vehicles V.sub.v on the different lanes L.sub.l in Table 1, the delay time indexes DI.sub.v.sup.V of the vehicles V.sub.v are reckoned.

$$[00081]DI_{(v,l)}^V = \frac{d_{(v,l)}^V}{t_{f(v,l)}^V}; DI_v^V = \frac{\text{Math}_{l \in S_{V,v}^L} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{V,v}^L} w_{(v,l)}^V}$$

[0151] Taking the vehicles V.sub.46 and V.sub.47 as examples, calculation results of DI.sub.(v,l).sup.V and DI.sub.v.sup.V are shown in Table 5.

[0152] Based on the acquired delay time indexes DI.sub.(v,l).sup.V of the vehicles V.sub.v on the lanes L.sub.l, in combination with the traffic weight coefficients w.sub.(v,l).sup.V, acquired in step 1, of various passing vehicles V.sub.v on different lanes L.sub.l in the road network, the delay time indexes DI.sub.l.sup.L of various lanes in the road network are calculated:

$$[00082]DI_l^L = \frac{\text{Math}_{v \in S_{L,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{v \in S_{L,l}^V} w_{(v,l)}^V}$$

[0153] Calculation results are shown in Table 6.

[0154] Further, according to the acquired delay time indexes DI.sub.l.sup.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:

$$[00083]DI_i^I = \frac{\text{Math}_{l \in S_{I,i}^L} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{I,i}^L} w_l^L}; DI_r^R = \frac{\text{Math}_{l \in S_{R,r}^L} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{R,r}^L} w_l^L}$$

[0155] In the embodiment, taking the intersection I.sub.2 as an example, calculation results of the delay time indexes DI.sub.2.sup.1 of the intersection I.sub.2 are shown in Table 7; and calculation results of the delay time indexes DI.sub.r.sup.R of various roads in the road network are shown in Table 8.

[0156] Taking the sub-zone Z.sub.1 as an example, the delay time indexes DI.sub.1.sup.Z of the sub-zone Z.sub.1 are obtained by using the acquired traffic weight coefficients w.sub.1.sup.L and delay time indexes DI.sub.1.sup.L of various lanes in the road network:

$$[00084]DI_1^Z = \frac{\text{Math}_{l \in S_{Z,z}^L} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{Z,z}^L} w_l^L} = 0.51$$

[0157] For the whole road network, the delay time indexes DI.sub.A of the road network can also be calculated by using the acquired traffic weight coefficients w.sub.1.sup.L and delay time indexes DI.sub.1.sup.L of various lanes in the road network. Calculation results are shown in Table 6.

$$[00085]DI^A = \text{Math}_{l \in S_A^L} (DI_l^L \times w_l^L) = 0.62$$

[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-US-00009 TABLE 9 Traffic Operation State Characteristic Indexes of Roads Road number Number t.sub.f/s V.sub.f/(m/s) d/s h/time m t.sub.f r.sup.R/s V.sub.f r.sup.R/(m/s) d.sub.r.sup.R/s h.sub.r.sup.R/time m.sub.r.sup.R R.sub.1 s S.sub.R, 1.sup.S.sup.— 103.84 13.59 5.62 0.06 3.23% 42.31 13.54 38.18 0.98 6.98% I.sub.1 5.70 13.34 26.05 0.67 22.79% I.sub.2 5.81 13.23 24.09 0.72 24.23% I.sub.3 5.93 13.28 30.79 0.75 24.59% R.sub.2 s S.sub.R, 2.sup.S.sup.— 94.44 13.74 8.31 0.13 3.86% 39.10 13.65 42.49 0.94 7.60% I.sub.4 6.46 13.34 25.65 0.73 22.09% I.sub.5 5.78 13.26 30.12 0.62 22.70% I.sub.6 5.64 13.34 36.34 0.72 25.12% R.sub.3 s S.sub.R, 3.sup.S.sup.— 80.78 13.64 7.37 0.13 4.11% 33.89 13.57 43.19 0.83 7.78% I.sub.7 5.70 13.32 31.26 0.66 22.74% I.sub.8 6.03 13.19 36.16 0.59 20.33% I.sub.9 5.85 13.32 34.00 0.69 23.16% R.sub.4 s S.sub.R, 4.sup.S.sup.— 104.05 13.95 10.53 0.24 3.64% 42.49 13.83 40.22 1.00 7.04% I.sub.1 5.70 13.34 26.05 0.67 22.79% I.sub.4 6.46 13.34 25.65 0.73 22.09% I.sub.7 5.70 13.32 31.26 0.66 22.74% R.sub.5 s S.sub.R, 5.sup.S.sup.— 95.80 13.71 9.43 0.23 3.64% 39.21 13.62 40.86 0.89 7.09% I.sub.2 5.81 13.23 24.09 0.72 24.23% I.sub.5 5.78 13.26 30.12

0.62 22.70% I.sub.6 6.03 13.28 30.79 0.75 24.59% I.sub.6 5.64 13.34 36.34 0.72 25.12% I.sub.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  $HI_{(v,l).sup.V}$  of various passing vehicles  $V_{sub.v}$  on the different lanes  $L_{sub.l}$  are obtained by using the free-flow driving times  $t_{sub.f(v,l).sup.V}$  and the numbers of times of stopping  $h_{sub.(v,l).sup.V}$  of the vehicles  $V_{sub.v}$  on the lanes  $L_{sub.l}$  in the road network. Further, in combination with the traffic weight coefficients  $w_{sub.(v,l).sup.V}$  of various passing vehicles  $V_{sub.v}$  on the different lanes  $L_{sub.l}$  in Table 1, the indexes of the numbers of times of stopping  $HI_{sub.v.sup.V}$  of the vehicles  $V_{sub.v}$  are reckoned.

$$[00086] HI_{(v,l)}^V = \frac{h_{(v,l)}^V}{t_{f(v,l)}^V}; HI_V^V = \frac{\text{Math}_{l \in S_{v,v}^L} (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{v,v}^L} w_{(v,l)}^V}$$

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

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

$$[00087] HI_l^L = \frac{\text{Math}_{v \in S_{l,l}^V} (HI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{v \in S_{l,l}^V} w_{(v,l)}^V}$$

[0163] Calculation results are shown in Table 6.

[0164] Further, according to the acquired indexes of the numbers of times of stopping  $HI_{sub.l.sup.L}$  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:

$$[00088] HI_i^I = \frac{\text{Math}_{l \in S_{i,l}^L} (HI_l^L \times w_l^L)}{\text{Math}_{l \in S_{i,l}^L} w_l^L}; HI_r^R = \frac{\text{Math}_{l \in S_{r,r}^L} (HI_l^L \times w_l^L)}{\text{Math}_{l \in S_{r,r}^L} w_l^L}$$

[0165] In the embodiment, taking the intersection  $I_{sub.2}$  as an example, calculation results of the indexes of the numbers of times of stopping  $HI_{sub.2.sup.1}$  of the intersection  $I_{sub.2}$  are shown in Table 7; and calculation results of the indexes of the numbers of times of stopping  $HI_{sub.r.sup.R}$  of various roads in the road network are shown in Table 8.

[0166] Taking the sub-zone  $Z_{sub.1}$  as an example, the indexes of the numbers of times of stopping  $HI_{sub.1.sup.Z}$  of the sub-zone  $Z$  are obtained by using the acquired traffic weight coefficients  $w_{sub.l.sup.L}$  and indexes of the numbers of times of stopping  $HI_{sub.l.sup.L}$  of various lanes in the road network:

$$[00089] HI_i^Z = \frac{\text{Math}_{l \in S_{i,z}^L} (HI_l^L \times w_l^L)}{\text{Math}_{l \in S_{i,z}^L} w_l^L} = 0.75 \text{times / min}$$

[0167] For the whole road network, the indexes of the numbers of times of stopping  $HI_{sup.A}$  of the road network can also be calculated by using the acquired traffic weight coefficients  $w_{sub.l.sup.L}$  and indexes of the numbers of times of stopping  $HI_{sub.l.sup.L}$  of various lanes in the road network. Calculation results are shown in Table 6.

$$[00090] HI^A = \frac{\text{Math}_{l \in S_A^L} (HI_l^L \times w_l^L)}{\text{Math}_{l \in S_A^L} w_l^L} = 0.83 \text{times / min}$$

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

$$[00091] MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V}; MI_V^V = \frac{\text{Math}_{l \in S_{v,v}^L} (MI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{v,v}^L} w_{(v,l)}^V}$$

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

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

$$[00092] MI_l^L = \frac{\text{Math}_{v \in S_{l,l}^V} (MI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{v \in S_{l,l}^V} w_{(v,l)}^V}$$

[0173] Calculation results are shown in Table 6.

[0174] Further, according to the acquired indexes of the mileages of the congested roads  $MI_{sub.l.sup.L}$  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:

$$[00093] MI_i^I = \frac{\text{Math}_{l \in S_{i,l}^L} (MI_l^L \times w_l^L)}{\text{Math}_{l \in S_{i,l}^L} w_l^L}; MI_r^R = \frac{\text{Math}_{l \in S_{r,r}^L} (MI_l^L \times w_l^L)}{\text{Math}_{l \in S_{r,r}^L} w_l^L}$$

[0175] In the embodiment, taking the intersection  $I_{sub.2}$  as an example, calculation results of the indexes of the mileages of the congested

roads MI.sub.2.sup.1 of the intersection I.sub.2 are shown in Table 7; and calculation results of the indexes of the mileages of the congested roads MI.sub.r.sup.R of various roads in the road network are shown in Table 8.

[0176] Taking the sub-zone Z.sub.1 as an example, the indexes of the mileages of the congested roads MI.sub.1.sup.Z of the sub-zone Z.sub.1 are obtained by using the acquired traffic weight coefficients w.sub.1.sup.L and the indexes of the mileages of the congested roads MI.sub.1.sup.L of various lanes in the road network:

$$[00094]MI_1^Z = \frac{\text{Math. } (MI_l^L \times w_l^L)}{\sum_{l \in S_{Z,z}^L} \text{Math. } w_l^L} = 46.62m / \min$$

[0177] For the whole road network, the indexes of the mileages of the congested roads MI.sup.A of the road network can also be calculated by using the acquired traffic weight coefficients w.sub.1.sup.L and indexes of the mileages of the congested roads MI.sub.1.sup.L of various lanes in the road network. Calculation results are shown in Table 6.

$$[00095]MI^A = \sum_{l \in S_A^L} \text{Math. } (MI_l^L \times w_l^L) = 46.53m / \min$$

[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.

## Claims

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:

$$w_v^V = \frac{t_{v,v}^{\text{sub.fv}}}{t_{v,v}^{\text{sub.fv}} + t_{v,v}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{v,v}^{\text{sub.fv}}}{t_{v,v}^{\text{sub.fv}} + t_{v,v}^{\text{sub.fl}}} = \frac{t_{v,v}^{\text{sub.fv}}}{t_{v,v}^{\text{sub.fv}} + t_{v,v}^{\text{sub.fl}}} \quad \text{wherein, } w_{(n,l)}^{\text{sub.v}} \text{ is a traffic weight coefficient of the } v \text{ sup.th}$$

vehicle V.sub.v, in the road network; t.sub.fv.sup.V is an overall free-flow driving time of the vehicle V.sub.v passing the road network; N.sup.V is the number of vehicles passing the road network within an evaluation period; S.sub.V,v.sup.L is a set of lanes through which the vehicle V.sub.v passes in the road network within the evaluation period; t.sub.f(v,l).sup.V is a free-flow driving time of the vehicle V.sub.v passing the l.sup.th lane L.sub.l in the road network; t.sub.fl.sup.L is an average free-flow driving time of the vehicles passing the lane L.sub.l; and w.sub.(v,l).sup.V is a traffic weight coefficient of the vehicle V.sub.v on the lane L.sub.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 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: a traffic weight coefficient of the vehicle V.sub.v passing the lane L.sub.l is reckoned as follows:

$w_{(v,l)}^V = \frac{t_{v,l}^{\text{sub.fv}}}{t_{v,l}^{\text{sub.fv}} + t_{v,l}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{v,l}^{\text{sub.fv}}}{t_{v,l}^{\text{sub.fv}} + t_{v,l}^{\text{sub.fl}}} = \frac{t_{v,l}^{\text{sub.fv}}}{t_{v,l}^{\text{sub.fv}} + t_{v,l}^{\text{sub.fl}}}$  a traffic weight coefficient of the passing lane L.sub.l is reckoned as follows:

$$w_l^L = \frac{t_{l,l}^{\text{sub.fl}}}{t_{l,l}^{\text{sub.fl}} + t_{l,l}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{l,l}^{\text{sub.fl}}}{t_{l,l}^{\text{sub.fl}} + t_{l,l}^{\text{sub.fl}}} = \frac{t_{l,l}^{\text{sub.fl}}}{t_{l,l}^{\text{sub.fl}} + t_{l,l}^{\text{sub.fl}}} \quad \text{a traffic weight coefficient of a subsection U.sub.u is reckoned as follows:}$$

$$w_u^U = \frac{t_{u,u}^{\text{sub.fl}}}{t_{u,u}^{\text{sub.fl}} + t_{u,u}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{u,u}^{\text{sub.fl}}}{t_{u,u}^{\text{sub.fl}} + t_{u,u}^{\text{sub.fl}}} = \frac{t_{u,u}^{\text{sub.fl}}}{t_{u,u}^{\text{sub.fl}} + t_{u,u}^{\text{sub.fl}}} \quad \text{a traffic weight coefficient of a section S.sub.s is reckoned as follows:}$$

$$w_s^S = \frac{t_{s,s}^{\text{sub.fl}}}{t_{s,s}^{\text{sub.fl}} + t_{s,s}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{s,s}^{\text{sub.fl}}}{t_{s,s}^{\text{sub.fl}} + t_{s,s}^{\text{sub.fl}}} = \frac{t_{s,s}^{\text{sub.fl}}}{t_{s,s}^{\text{sub.fl}} + t_{s,s}^{\text{sub.fl}}} \quad \text{a traffic weight coefficient of an intersection I.sub.i is reckoned as follows:}$$

$$w_i^I = \frac{t_{i,i}^{\text{sub.fl}}}{t_{i,i}^{\text{sub.fl}} + t_{i,i}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{i,i}^{\text{sub.fl}}}{t_{i,i}^{\text{sub.fl}} + t_{i,i}^{\text{sub.fl}}} = \frac{t_{i,i}^{\text{sub.fl}}}{t_{i,i}^{\text{sub.fl}} + t_{i,i}^{\text{sub.fl}}} \quad \text{a traffic weight coefficient of a road R.sub.r is reckoned as follows:}$$

$$w_r^R = \frac{t_{r,r}^{\text{sub.fl}}}{t_{r,r}^{\text{sub.fl}} + t_{r,r}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{r,r}^{\text{sub.fl}}}{t_{r,r}^{\text{sub.fl}} + t_{r,r}^{\text{sub.fl}}} = \frac{t_{r,r}^{\text{sub.fl}}}{t_{r,r}^{\text{sub.fl}} + t_{r,r}^{\text{sub.fl}}} \quad \text{a traffic weight coefficient of a sub-zone Z.sub.z is reckoned}$$

$$\text{as follows: } w_z^Z = \frac{t_{z,z}^{\text{sub.fl}}}{t_{z,z}^{\text{sub.fl}} + t_{z,z}^{\text{sub.fl}}} \quad \text{Math. } \frac{t_{z,z}^{\text{sub.fl}}}{t_{z,z}^{\text{sub.fl}} + t_{z,z}^{\text{sub.fl}}} = \frac{t_{z,z}^{\text{sub.fl}}}{t_{z,z}^{\text{sub.fl}} + t_{z,z}^{\text{sub.fl}}} \quad \text{wherein } w_{(v,l)}^{\text{sub.v}} \text{ is the traffic weight}$$

coefficient of the lane L.sub.l; S.sub.L,l.sup.V is a set of vehicles passing the lane L.sub.l within the evaluation period; w.sub.u.sup.U is the

traffic weight coefficient of the u.sup.th section S.sub.u in the road network; S.sub.U,u.sup.L is a set of lanes contained in the subsection U.sub.u; w.sub.s.sup.S is the traffic weight coefficient of the s.sup.th section S.sub.s in the road network; S.sub.S,s.sup.U is a set of sub-sections contained in the section S.sub.s; S.sub.S,s.sup.L is a set of lanes contained in the section S.sub.s; w.sub.i.sup.I is the traffic weight coefficient of the i.sup.th intersection I.sub.i in the road network; S.sub.I,i.sup.L is a set of lanes contained in the intersection I.sub.i; w.sub.r.sup.R is the traffic weight coefficient of the r.sup.th road R.sub.r in the road network; S.sub.R,r.sup.S is a set of sections contained in the road R.sub.r; S.sub.R,r.sup.I is a set of intersections contained in the road R.sub.r; S.sub.R,r.sup.L is a set of lanes contained in the road R.sub.r; w.sub.z.sup.Z is the traffic weight coefficient of the z.sup.th sub-zone Z.sub.z in the road network; S.sub.Z,z.sup.S is a set of sections contained in the sub-zone Z.sub.z; S.sub.Z,z.sup.I is a set of intersections contained in the sub-zone Z.sub.z; and S.sub.Z,z.sup.L is a set of lanes contained in the sub-zone Z.sub.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:

$$w^A = \sum_{s=1}^{N^S} w_s^S + \sum_{i=1}^{N^I} w_i^I = \sum_{u=1}^{N^U} w_u^U + \sum_{l=1}^{N^L} w_l^L = \sum_{v=1}^{N^V} w_v^V = 1$$

$$w^A = 1$$

wherein w.sup.A is the overall traffic weight coefficient of the road network; N.sup.S is the number of sections in the road network; N.sup.I is the number of in intersections in the road network; N.sup.U is the number of sub-sections in the road network; and N.sup.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.sub.v passing the lane L.sub.l is reckoned as follows:  $PI_{(v,l)}^V = \frac{t_{(v,l)}^V}{t_{f(v,l)}^V} \times PI_{(v,l)}^V = \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}$

a traffic operation index of the vehicle V.sub.v is reckoned as follows:  $PI_v^V = \frac{t_v^V}{t_{f(v)}^V} \times PI_v^V = \frac{t_v^V}{t_{f(v)}^V}$  a

traffic operation index of the lane L.sub.l is reckoned as follows:  $PI_l^L = \frac{t_l^L}{t_{f(l)}^L} \times PI_l^L = \frac{t_l^L}{t_{f(l)}^L}$  a traffic operation index of a

subsection U.sub.u is reckoned as follows:  $PI_u^U = \frac{\sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}}{\sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}} = \frac{\sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} w_{(v,l)}^V} \times \frac{\sum_{l \in S_{u,u}^L} (PI_l^L \times w_l^L)}{\sum_{l \in S_{u,u}^L} w_l^L}$  a

traffic operation index of the section S.sub.s is reckoned as follows:

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

operation index of the intersection I.sub.i is reckoned as follows:

$$PI_i^I = \frac{\sum_{l \in S_{i,i}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}}{\sum_{l \in S_{i,i}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}} = \frac{\sum_{l \in S_{i,i}^L} \sum_{v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{l \in S_{i,i}^L} \sum_{v \in S_{l,l}^V} w_{(v,l)}^V} = \frac{\sum_{l \in S_{i,i}^L} (PI_l^L \times w_l^L)}{\sum_{l \in S_{i,i}^L} w_l^L}$$
 a traffic operation index of the road R.sub.r is

reckoned as follows:  $PI_r^R = \frac{\sum_{s \in S_{r,r}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}}{\sum_{s \in S_{r,r}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}} = \frac{\sum_{s \in S_{r,r}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{s \in S_{r,r}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} w_{(v,l)}^V} = \frac{\sum_{s \in S_{r,r}^S} (PI_s^S \times w_s^S)}{\sum_{s \in S_{r,r}^S} w_s^S}$  a traffic

operation index of a sub-zone Z.sub.z is reckoned as follows:

$$PI_z^Z = \frac{\sum_{s \in S_{z,z}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}}{\sum_{s \in S_{z,z}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}} = \frac{\sum_{s \in S_{z,z}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{s \in S_{z,z}^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} w_{(v,l)}^V} = \frac{\sum_{s \in S_{z,z}^S} (PI_s^S \times w_s^S)}{\sum_{s \in S_{z,z}^S} w_s^S}$$
 a traffic operation index of a

zone is reckoned as follows:

$$PI^A = \frac{\sum_{s \in S_A^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}}{\sum_{s \in S_A^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} \frac{t_{(v,l)}^V}{t_{f(v,l)}^V}} = \frac{\sum_{s \in S_A^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} (PI_{(v,l)}^V \times w_{(v,l)}^V)}{\sum_{s \in S_A^S} \sum_{u \in S_{s,s}^U} \sum_{l \in S_{u,u}^L} \sum_{v \in S_{l,l}^V} w_{(v,l)}^V} = \sum_{s \in S_A^S} (PI_s^S \times w_s^S)$$
 where PI.sub.(v,l).sup.V is

the traffic operation index of the vehicle V.sub.v on the lane L.sub.l; t.sub.(v,l).sup.V is a travel time of the vehicle V.sub.v passing the lane

L.sub.l; PI.sub.v.sup.V, PI.sub.u.sup.U, PI.sub.s.sup.S, PI.sub.i.sup.I, PI.sub.r.sup.R, PI.sub.z.sup.Z, and PI.sub.A represent traffic operation indexes of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section, S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively; S.sub.A.sup.S is a set of sections contained in the zone; S.sub.A.sup.I is a set of intersections contained in the zone; and S.sub.A.sup.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.sub.v passing the lane L.sub.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.sub.v is reckoned as follows:  $DI_V^V = \frac{\text{Math}_{l \in S_{v,v}^L} d_{(v,l)}^V}{\text{Math}_{l \in S_{v,v}^L} t_{f(l)}^V} = \frac{\text{Math}_{l \in S_{v,v}^L} (DI_{(v,l)}^V \times t_{f(l)}^V)}{\text{Math}_{v=1}^V \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(l)}^V} \times \frac{\text{Math}_{v=1}^V \cdot \text{Math}_{l \in S_{v,v}^L} t_{f(l)}^V}{\text{Math}_{l \in S_{v,v}^L} t_{f(l)}^V} = \frac{\text{Math}_{l \in S_{v,v}^L} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{v,v}^L} w_{(v,l)}^V}$  a delay

time index of the lane L.sub.l is reckoned as follows:

$DI_l^L = \frac{\text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{v=1}^V \cdot \text{Math}_{l \in S_{l,l}^V} t_{f(v,l)}^V} \times \frac{\text{Math}_{v=1}^V \cdot \text{Math}_{l \in S_{l,l}^V} t_{f(v,l)}^V}{\text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{v \in S_{l,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{v \in S_{l,l}^V} w_{(v,l)}^V}$  a delay time index of a subsection

U.sub.u is reckoned as follows:  $DI_u^U = \frac{\text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} w_{(v,l)}^V} \times \frac{\text{Math}_{l \in S_{l,u}^U} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{l,u}^U} w_l^L}$  a delay time

index of the section S.sub.s is reckoned as follows:

$DI_s^S = \frac{\text{Math}_{u \in S_{s,s}^U} \cdot \text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{u \in S_{s,s}^U} \cdot \text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{s,s}^L} \cdot \text{Math}_{v \in S_{l,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{s,s}^L} \cdot \text{Math}_{v \in S_{l,l}^V} w_{(v,l)}^V} = \frac{\text{Math}_{l \in S_{s,s}^L} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{s,s}^L} w_l^L} = \frac{\text{Math}_{u \in S_{s,s}^U} (DI_u^U \times w_u^U)}{\text{Math}_{u \in S_{s,s}^U} w_u^U}$  a delay time

index of the intersection I.sub.i is reckoned as follows:

$DI_i^I = \frac{\text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} (DI_{(v,l)}^V \times w_{(v,l)}^V)}{\text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} w_{(v,l)}^V} = \frac{\text{Math}_{l \in S_{l,i}^L} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{l,i}^L} w_l^L}$  a delay time index of the road R.sub.r is reckoned

as follows:  $DI_r^R = \frac{\text{Math}_{i \in S_{r,r}^I} \cdot \text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{i \in S_{r,r}^I} \cdot \text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{i \in S_{r,r}^I} \cdot \text{Math}_{l \in S_{l,i}^L} (DI_l^L \times w_l^L)}{\text{Math}_{i \in S_{r,r}^I} \cdot \text{Math}_{l \in S_{l,i}^L} w_l^L}$  a delay time index

of a sub-zone Z.sub.z is reckoned as follows:

$DI_z^Z = \frac{\text{Math}_{s \in S_{z,z}^S} \cdot \text{Math}_{u \in S_{l,u}^U} \cdot \text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{s \in S_{z,z}^S} \cdot \text{Math}_{u \in S_{l,u}^U} \cdot \text{Math}_{l \in S_{l,u}^U} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{z,z}^L} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{l \in S_{z,z}^L} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_{z,z}^L} (DI_l^L \times w_l^L)}{\text{Math}_{l \in S_{z,z}^L} w_l^L}$  a delay time index of a zone is

reckoned as follows:  $DI^A = \frac{\text{Math}_{i \in S_A^I} \cdot \text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{i \in S_A^I} \cdot \text{Math}_{l \in S_{l,i}^L} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \frac{\text{Math}_{l \in S_A^L} \cdot \text{Math}_{v \in S_{l,l}^V} d_{(v,l)}^V}{\text{Math}_{l \in S_A^L} \cdot \text{Math}_{v \in S_{l,l}^V} t_{f(v,l)}^V} = \text{Math}_{l \in S_A^L} (DI_l^L \times w_l^L)$

wherein DI.sub.(v,l).sup.V is the delay time index of the vehicle V.sub.v on the lane L.sub.l; d.sub.(v,l).sup.V is the delay time of the vehicle V.sub.v passing the lane L.sub.l; and DI.sub.v.sup.V, DI.sub.l.sup.L, DI.sub.u.sup.U, DI.sub.s.sup.S, DI.sub.i.sup.I, DI.sub.r.sup.R, DI.sub.z.sup.Z, and DI.sub.A represent the delay time indexes of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the road S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.l is reckoned as follows:  $d_{(v,l)}^V = DI_{(v,l)}^V \times t_{f(v,l)}^V$   $d_{(v,l)}^V = DI_{(v,l)}^V \times t_{f(v,l)}^V$  ? ? indicates text missing or illegible when filed an average delay time of the vehicle V.sub.v is reckoned as follows:  $d_v^V = \text{Math}_{l \in S_{v,v}^L} d_{(v,l)}^V = DI_v^V \times \text{Math}_{l \in S_{v,v}^L} t_{f(l)}^V = DI_v^V \times t_{f_v}^V$

$d_v^V = \text{Math}_{l \in S_{v,v}^L} d_{(v,l)}^V = DI_v^V \times \text{Math}_{l \in S_{v,v}^L} t_{f(l)}^V = DI_v^V \times t_{f_v}^V$  an average delay time of the lane L.sub.l is reckoned as follows:  $\bar{d}_l^L = \frac{vS_{L,l}^L d_{(v,l)}^V}{N_{L,l}^L} = \frac{vS_{L,l}^L d_{(v,l)}^V}{vS_{L,l}^L t_{f(v,l)}^V \cdot N_{L,l}^L} = DI_l^L \times t_{f_l}^L$  ? indicates text missing or illegible when filed an average delay time of a subsection U.sub.u is reckoned as

follows:  $\bar{d}_u^U = \frac{vS_{u,u}^U d_{(v,l)}^V}{N_{u,u}^U} = \frac{vS_{u,u}^U d_{(v,l)}^V}{vS_{u,u}^U t_{f(v,l)}^V \cdot N_{u,u}^U} = DI_u^U \times t_{f_u}^U$  ? indicates text missing or illegible when filed an average delay time of the section S.sub.s is reckoned as

follows:  $\bar{d}_s^S = \frac{vS_{s,s}^S d_{(v,l)}^V}{N_{s,s}^S} = \frac{vS_{s,s}^S d_{(v,l)}^V}{vS_{s,s}^S t_{f(v,l)}^V \cdot N_{s,s}^S} = DI_s^S \times t_{f_s}^S$  ? indicates text missing or illegible when filed an average delay time of the intersection I.sub.i is reckoned

as follows:  $\bar{d}_i^I = \frac{vS_{i,i}^I d_{(v,l)}^V}{N_{i,i}^I} = \frac{vS_{i,i}^I d_{(v,l)}^V}{vS_{i,i}^I t_{f(v,l)}^V \cdot N_{i,i}^I} = DI_i^I \times t_{f_i}^I$  ? indicates text missing or illegible when filed an average delay time of the road R.sub.r is reckoned as

follows:  $\bar{d}_r^R = \frac{vS_{r,r}^R d_{(v,l)}^V}{N_{r,r}^R} = \frac{vS_{r,r}^R d_{(v,l)}^V}{vS_{r,r}^R t_{f(v,l)}^V \cdot N_{r,r}^R} = DI_r^R \times t_{f_r}^R$  ? indicates text missing or illegible when filed an average delay time of a sub-zone Z.sub.z is reckoned as

follows:  $\bar{d}_z^Z = \frac{vS_{z,z}^Z d_{(v,l)}^V}{N_{z,z}^Z} = \frac{vS_{z,z}^Z d_{(v,l)}^V}{vS_{z,z}^Z t_{f(v,l)}^V \cdot N_{z,z}^Z} = DI_z^Z \times t_{f_z}^Z$  ? indicates text missing or illegible when filed an average delay time of the zone is reckoned as follows:

$\bar{d}^A = \frac{vS_A^A d_{(v,l)}^V}{N_A^A} = \frac{vS_A^A d_{(v,l)}^V}{vS_A^A t_{f(v,l)}^V \cdot N_A^A} = DI^A \times t_{f_A}^A$  ? indicates text missing or illegible when filed wherein d.sub.v.sup.V is the delay time of the vehicle V.sub.v; d.sub.l.sup.L, d.sub.u.sup.U, d.sub.s.sup.S, d.sub.i.sup.I, d.sub.r.sup.R, d.sub.z.sup.Z, and d.sub.A represent the average delay times of the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively; N.sub.L,l.sup.V, N.sub.U,u.sup.V, Y, N.sub.S,s.sup.V, N.sub.I,i.sup.V, N.sub.R,r.sup.V, and N.sub.Z,z.sup.V represent numbers of vehicles passing the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z within the evaluation period respectively; and t.sub.fu.sup.U, t.sub.fs.sup.S, t.sub.fi.sup.I, t.sub.fr.sup.R, t.sub.fz.sup.Z, and t.sub.f.sup.A represent the average free-flow driving times of the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.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.sub.v is reckoned as

follows:  $HI_V^V = \frac{h_V^V}{t_{f(v,l)}^V} HI_V^V = \frac{h_V^V}{t_{f(v,l)}^V}$  an index of number of times of stopping of the lane L.sub.l is reckoned as follows:  $HI_L^L = \frac{h_L^L}{t_{f(v,l)}^L} HI_L^L = \frac{h_L^L}{t_{f(v,l)}^L}$  an index of number of times of stopping of the subsection U.sub.u is reckoned as follows:  $HI_U^U = \frac{h_U^U}{t_{f(v,l)}^U} HI_U^U = \frac{h_U^U}{t_{f(v,l)}^U}$  an index of number of times of stopping of the section S.sub.s is reckoned as follows:  $HI_S^S = \frac{h_S^S}{t_{f(v,l)}^S} HI_S^S = \frac{h_S^S}{t_{f(v,l)}^S}$  an index of number of times of stopping of the intersection I.sub.i is reckoned as follows:  $HI_I^I = \frac{h_I^I}{t_{f(v,l)}^I} HI_I^I = \frac{h_I^I}{t_{f(v,l)}^I}$  an index of number of times of stopping of the road R.sub.r is reckoned as follows:  $HI_R^R = \frac{h_R^R}{t_{f(v,l)}^R} HI_R^R = \frac{h_R^R}{t_{f(v,l)}^R}$  an index of number of times of stopping of the sub-zone Z.sub.z is reckoned as follows:  $HI_Z^Z = \frac{h_Z^Z}{t_{f(v,l)}^Z} HI_Z^Z = \frac{h_Z^Z}{t_{f(v,l)}^Z}$  an index of number of times of stopping of the zone is reckoned as follows:  $HI^A = \frac{h^A}{t_{f(v,l)}^A} HI^A = \frac{h^A}{t_{f(v,l)}^A}$  wherein  $HI_{(v,l)}^{sup.V}$  is the index of the number of times of stopping of the vehicle V.sub.v on the lane L.sub.l;  $h_{(v,l)}^{sup.V}$  is the number of times of stopping of the vehicle V.sub.v passing the lane L.sub.l; and  $HI_{(v,l)}^{sup.V}$ ,  $HI_{(v,l)}^{sup.L}$ ,  $HI_{(v,l)}^{sup.U}$ ,  $HI_{(v,l)}^{sup.S}$ ,  $HI_{(v,l)}^{sup.I}$ ,  $HI_{(v,l)}^{sup.R}$ ,  $HI_{(v,l)}^{sup.Z}$ , and  $HI_{(v,l)}^{sup.A}$  represent the indexes of number of times of stopping of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.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.sub.v is reckoned as follows:  $h_V^V = \text{Math. } ? h_{(v,l)}^V = HI_V^V \times t_{f(v,l)}^V$  an average number of times of stopping of the lane L.sub.l is reckoned as follows:  $h_L^L = \frac{h_L^L}{t_{f(v,l)}^L} HI_L^L \times t_{f(v,l)}^L$  an average number of times of stopping of the subsection U.sub.u is reckoned as follows:  $h_U^U = \frac{h_U^U}{t_{f(v,l)}^U} HI_U^U \times t_{f(v,l)}^U$  an average number of times of stopping of the section S.sub.s is reckoned as follows:  $h_S^S = \frac{h_S^S}{t_{f(v,l)}^S} HI_S^S \times t_{f(v,l)}^S$

an average number of times of stopping of the intersection I.sub.i is reckoned as follows:  $h_I^I = \frac{h_I^I}{t_{f(v,l)}^I} HI_I^I \times t_{f(v,l)}^I$  an average number of times of stopping of the road R.sub.r is reckoned as follows:  $h_R^R = \frac{h_R^R}{t_{f(v,l)}^R} HI_R^R \times t_{f(v,l)}^R$  an average number of times of stopping of the sub-zone Z.sub.z is reckoned as follows:  $h_Z^Z = \frac{h_Z^Z}{t_{f(v,l)}^Z} HI_Z^Z \times t_{f(v,l)}^Z$  an average number of times of stopping of the zone is reckoned as follows:  $h^A = \frac{h^A}{t_{f(v,l)}^A} HI^A \times t_{f(v,l)}^A$  wherein  $h_{(v,l)}^{sup.V}$  is the number of times of stopping of the vehicle V.sub.v; and  $h_{(v,l)}^{sup.L}$ ,  $h_{(v,l)}^{sup.U}$ ,  $h_{(v,l)}^{sup.S}$ ,  $h_{(v,l)}^{sup.I}$ ,  $h_{(v,l)}^{sup.R}$ ,  $h_{(v,l)}^{sup.Z}$ , and  $h_{(v,l)}^{sup.A}$  represent the average numbers of times of stopping of the lane L.sub.l, the subsection U.sub.u, the second S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.l is reckoned as follows:  $MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V} MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V}$  an index of a mileage of a congested road of the vehicle V.sub.v is reckoned as follows:  $MI_V^V = \frac{l_V^V}{t_{f(v,l)}^V} MI_V^V = \frac{l_V^V}{t_{f(v,l)}^V}$  an index of a mileage of a congested road of the lane L.sub.l is reckoned as follows:  $MI_L^L = \frac{l_L^L}{t_{f(v,l)}^L} MI_L^L = \frac{l_L^L}{t_{f(v,l)}^L}$  an index of a mileage of a congested road of the subsection U.sub.u is reckoned as follows:  $MI_U^U = \frac{l_U^U}{t_{f(v,l)}^U} MI_U^U = \frac{l_U^U}{t_{f(v,l)}^U}$  an index of a mileage of a congested road of the section S.sub.s is reckoned as follows:  $MI_S^S = \frac{l_S^S}{t_{f(v,l)}^S} MI_S^S = \frac{l_S^S}{t_{f(v,l)}^S}$  an index of a mileage of a congested road of the intersection I.sub.i is reckoned as follows:  $MI_I^I = \frac{l_I^I}{t_{f(v,l)}^I} MI_I^I = \frac{l_I^I}{t_{f(v,l)}^I}$  an index of a mileage of a congested road of the road R.sub.r is reckoned as follows:  $MI_R^R = \frac{l_R^R}{t_{f(v,l)}^R} MI_R^R = \frac{l_R^R}{t_{f(v,l)}^R}$  an index of a mileage of a congested road of the sub-zone Z.sub.z is reckoned as follows:  $MI_Z^Z = \frac{l_Z^Z}{t_{f(v,l)}^Z} MI_Z^Z = \frac{l_Z^Z}{t_{f(v,l)}^Z}$  an index of a mileage of a congested road of the zone is reckoned as follows:  $MI^A = \frac{l^A}{t_{f(v,l)}^A} MI^A = \frac{l^A}{t_{f(v,l)}^A}$  wherein  $l_{(v,l)}^{sup.V}$  is the mileage of a congested road of the vehicle V.sub.v; and  $l_{(v,l)}^{sup.L}$ ,  $l_{(v,l)}^{sup.U}$ ,  $l_{(v,l)}^{sup.S}$ ,  $l_{(v,l)}^{sup.I}$ ,  $l_{(v,l)}^{sup.R}$ ,  $l_{(v,l)}^{sup.Z}$ , and  $l_{(v,l)}^{sup.A}$  represent the mileages of a congested road of the lane L.sub.l, the subsection U.sub.u, the second S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively.

an index of a mileage of a congested road of the vehicle V.sub.v passing the lane L.sub.l is reckoned as follows:  $MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V} MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V}$  an index of a mileage of a congested road of the vehicle V.sub.v is reckoned as follows:  $MI_V^V = \frac{l_V^V}{t_{f(v,l)}^V} MI_V^V = \frac{l_V^V}{t_{f(v,l)}^V}$  an index of a mileage of a congested road of the lane L.sub.l is reckoned as follows:  $MI_L^L = \frac{l_L^L}{t_{f(v,l)}^L} MI_L^L = \frac{l_L^L}{t_{f(v,l)}^L}$  an index of a mileage of a congested road of the subsection U.sub.u is reckoned as follows:  $MI_U^U = \frac{l_U^U}{t_{f(v,l)}^U} MI_U^U = \frac{l_U^U}{t_{f(v,l)}^U}$  an index of a mileage of a congested road of the section S.sub.s is reckoned as follows:  $MI_S^S = \frac{l_S^S}{t_{f(v,l)}^S} MI_S^S = \frac{l_S^S}{t_{f(v,l)}^S}$  an index of a mileage of a congested road of the intersection I.sub.i is reckoned as follows:  $MI_I^I = \frac{l_I^I}{t_{f(v,l)}^I} MI_I^I = \frac{l_I^I}{t_{f(v,l)}^I}$  an index of a mileage of a congested road of the road R.sub.r is reckoned as follows:  $MI_R^R = \frac{l_R^R}{t_{f(v,l)}^R} MI_R^R = \frac{l_R^R}{t_{f(v,l)}^R}$  an index of a mileage of a congested road of the sub-zone Z.sub.z is reckoned as follows:  $MI_Z^Z = \frac{l_Z^Z}{t_{f(v,l)}^Z} MI_Z^Z = \frac{l_Z^Z}{t_{f(v,l)}^Z}$  an index of a mileage of a congested road of the zone is reckoned as follows:  $MI^A = \frac{l^A}{t_{f(v,l)}^A} MI^A = \frac{l^A}{t_{f(v,l)}^A}$  wherein  $l_{(v,l)}^{sup.V}$  is the mileage of a congested road of the vehicle V.sub.v; and  $l_{(v,l)}^{sup.L}$ ,  $l_{(v,l)}^{sup.U}$ ,  $l_{(v,l)}^{sup.S}$ ,  $l_{(v,l)}^{sup.I}$ ,  $l_{(v,l)}^{sup.R}$ ,  $l_{(v,l)}^{sup.Z}$ , and  $l_{(v,l)}^{sup.A}$  represent the mileages of a congested road of the lane L.sub.l, the subsection U.sub.u, the second S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively.

an index of a mileage of a congested road of the vehicle V.sub.v passing the lane L.sub.l is reckoned as follows:  $MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V} MI_{(v,l)}^V = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V}$  an index of a mileage of a congested road of the vehicle V.sub.v is reckoned as follows:  $MI_V^V = \frac{l_V^V}{t_{f(v,l)}^V} MI_V^V = \frac{l_V^V}{t_{f(v,l)}^V}$  an index of a mileage of a congested road of the lane L.sub.l is reckoned as follows:  $MI_L^L = \frac{l_L^L}{t_{f(v,l)}^L} MI_L^L = \frac{l_L^L}{t_{f(v,l)}^L}$  an index of a mileage of a congested road of the subsection U.sub.u is reckoned as follows:  $MI_U^U = \frac{l_U^U}{t_{f(v,l)}^U} MI_U^U = \frac{l_U^U}{t_{f(v,l)}^U}$  an index of a mileage of a congested road of the section S.sub.s is reckoned as follows:  $MI_S^S = \frac{l_S^S}{t_{f(v,l)}^S} MI_S^S = \frac{l_S^S}{t_{f(v,l)}^S}$  an index of a mileage of a congested road of the intersection I.sub.i is reckoned as follows:  $MI_I^I = \frac{l_I^I}{t_{f(v,l)}^I} MI_I^I = \frac{l_I^I}{t_{f(v,l)}^I}$  an index of a mileage of a congested road of the road R.sub.r is reckoned as follows:  $MI_R^R = \frac{l_R^R}{t_{f(v,l)}^R} MI_R^R = \frac{l_R^R}{t_{f(v,l)}^R}$  an index of a mileage of a congested road of the sub-zone Z.sub.z is reckoned as follows:  $MI_Z^Z = \frac{l_Z^Z}{t_{f(v,l)}^Z} MI_Z^Z = \frac{l_Z^Z}{t_{f(v,l)}^Z}$  an index of a mileage of a congested road of the zone is reckoned as follows:  $MI^A = \frac{l^A}{t_{f(v,l)}^A} MI^A = \frac{l^A}{t_{f(v,l)}^A}$  wherein  $l_{(v,l)}^{sup.V}$  is the mileage of a congested road of the vehicle V.sub.v; and  $l_{(v,l)}^{sup.L}$ ,  $l_{(v,l)}^{sup.U}$ ,  $l_{(v,l)}^{sup.S}$ ,  $l_{(v,l)}^{sup.I}$ ,  $l_{(v,l)}^{sup.R}$ ,  $l_{(v,l)}^{sup.Z}$ , and  $l_{(v,l)}^{sup.A}$  represent the mileages of a congested road of the lane L.sub.l, the subsection U.sub.u, the second S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively.

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



$$MI_z^Z = \frac{? \cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_s \in S_{Z,z}^S \cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot t_{f(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot t_{f(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{Z,z}^L \cdot (? \times w_l^L)}{\cdot \text{Math}_l \in S_{Z,z}^L \cdot w_l^L} MI_z^Z = ? = ? = ?$$

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

$$MI^A = \frac{? \cdot \text{Math}_s \in S_A^S \cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{? \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot t_{f(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot t_{f(v,l)}^V} = \cdot \text{Math}_l \in S_A^L (MI_l^L \times w_l^L) MI^A = ? = ? = (?)$$

? indicates text missing or illegible when filed wherein  $MI_{\text{sub.v(l).sup.V}}$  is the index of the mileage of the congested road of the vehicle V.sub.v on the lane L.sub.l;  $l_{\text{sub.c(v,l).sup.V}}$  is the mileage of the congested road of the vehicle V.sub.v passing the lane L.sub.l; and  $MI_{\text{sub.v.sup.V}}$ ,  $MI_{\text{sub.l.sup.L}}$ ,  $MI_{\text{sub.u.sup.U}}$ ,  $MI_{\text{sub.s.sup.S}}$ ,  $MI_{\text{sub.i.sup.I}}$ ,  $MI_{\text{sub.r.sup.R}}$ ,  $MI_{\text{sub.z.sup.Z}}$ , and  $MI_{\text{sup.A}}$  represent the indexes of the mileages of the congested roads of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.sub.v passing the lane L.sub.l is reckoned as follows:  $m_{(v,l)}^V = ? = \frac{?}{t_{f(v,l)}^V} \times ? = ? m_{(v,l)}^V = \frac{l_{c(v,l)}^V}{l_{(v,l)}^V} = \frac{l_{c(v,l)}^V}{t_{f(v,l)}^V} \cdot \frac{t_{f(v,l)}^V}{l_{(v,l)}^V} = \frac{MI_{(v,l)}^V}{V_{f(v,l)}^V}$  ? indicates text missing or illegible when filed a proportion of a mileage of a heavily congested

road of the vehicle V.sub.v is reckoned as follows:  $m_v^V = \frac{?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot ?} \times \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot l_{(v,l)}^V} = \frac{MI_v^V}{V_{f_v}^V} m_v^V = ? = ? = \frac{MI_v^V}{V_{f_v}^V}$

? indicates text missing or illegible when filed a proportion of a mileage of a heavily congested road of the lane L.sub.l is reckoned as follows:

$$m_l^L = \frac{\cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI_l^L}{V_{f_l}^L} m_l^L = ? = ? = \frac{MI_l^L}{V_{f_l}^L}$$
 ? indicates text missing or illegible when filed a proportion of a mileage of a heavily

congested road of the subsection U.sub.u is reckoned as follows:

$$m_u^U = \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI_u^U}{V_{f_u}^U} m_u^U = ? = ? = \frac{MI_u^U}{V_{f_u}^U}$$
 ? indicates text missing or illegible when filed a

proportion of a mileage of a heavily congested road of the section S.sub.s is reckoned as follows:

$$m_s^S = \frac{\cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_u \in S_{S,s}^U \cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI_s^S}{V_{f_s}^S}$$

$m_s^S = ? = ? = \frac{MI_s^S}{V_{f_s}^S}$  ? indicates text missing or illegible when filed a proportion of a mileage of a heavily congested road of the intersection I.sub.i is reckoned as

$$\text{follows: } m_i^I = \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{L,l}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI_i^I}{V_{f_i}^I} m_i^I = ? = ? = \frac{MI_i^I}{V_{f_i}^I}$$
 ? indicates text missing or illegible when filed a

proportion of a mileage of a heavily congested road of the road R.sub.r is reckoned as follows:

$$m_r^R = \frac{\cdot \text{Math}_l \in S_{R,r}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{R,r}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{R,r}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{R,r}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_l \in S_{R,r}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{R,r}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI_r^R}{V_{f_r}^R} m_r^R = ? = ? = \frac{MI_r^R}{V_{f_r}^R}$$
 ? indicates text missing or illegible when filed a

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

$$m_z^Z = \frac{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_{Z,z}^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI_z^Z}{V_{f_z}^Z} m_z^Z = ? = ? = \frac{MI_z^Z}{V_{f_z}^Z}$$
 ? indicates text missing or illegible when filed a

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

$$m^A = \frac{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?} \times \frac{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot ?}{\cdot \text{Math}_l \in S_A^L \cdot \text{Math}_v \in S_{L,l}^V \cdot l_{(v,l)}^V} = \frac{MI^A}{V_f^A} m^A = ? = ? = \frac{MI^A}{V_f^A}$$
 ? indicates text missing or illegible when filed wherein

$m_{\text{sub.v(l).sup.V}}$  is the proportion of the mileage of the heavily congested road of the vehicle V.sub.v on the lane L.sub.l;  $l_{\text{sub.v(l).sup.V}}$  is a vehicle mileage of the vehicle V.sub.v passing the lane L;  $V_{\text{sub.f(v,l).sup.V}}$  is a flow-free driving speed of the vehicle V.sub.v passing the lane L.sub.l;  $m_{\text{sub.v.sup.V}}$ ,  $m_{\text{sub.l.sup.L}}$ ,  $m_{\text{sub.u.sup.U}}$ ,  $m_{\text{sub.s.sup.S}}$ ,  $m_{\text{sub.i.sup.I}}$ ,  $m_{\text{sub.r.sup.R}}$ ,  $m_{\text{sub.z.sup.Z}}$ , and  $m_{\text{sup.A}}$  represent proportions of mileages of heavily congested roads of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.z, and the zone respectively; and  $V_{\text{sub.fv.sup.V}}$ ,  $V_{\text{sub.fl.sup.L}}$ ,  $V_{\text{sub.fu.sup.U}}$ ,  $V_{\text{sub.fs.sup.S}}$ ,  $V_{\text{sub.fi.sup.I}}$ ,  $V_{\text{sub.fr.sup.R}}$ ,  $V_{\text{sub.fz.sup.Z}}$ , and  $V_{\text{sub.f.sup.A}}$  represent average flow-free driving speeds of the vehicle V.sub.v, the lane L.sub.l, the subsection U.sub.u, the section S.sub.s, the intersection I.sub.i, the road R.sub.r, the sub-zone Z.sub.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.