CLAIMS

What is claimed is:

1. A cooperative vehicle-infrastructure processing method, performed by roadside infrastructure in a cooperative vehicle infrastructure system (CVIS), the method comprising:

obtaining longitude and latitude position information and absolute elevation information of a traffic object on a road through the roadside infrastructure, the traffic object comprising at least one of: a road event, a traffic sign, and a traffic participant;

converting the absolute elevation information of the traffic object into a roadside map-based relative elevation representation according to surrounding road network information in a roadside map unit deployed in the roadside infrastructure, the roadside map-based relative elevation representation being used to describe a spatial position relationship between the road where the traffic object is located and a plurality of roads around the roadside infrastructure in the surrounding road network information;

determining, according to the surrounding road network information of the roadside infrastructure, reference longitude and latitude position information and absolute elevation information of a road section reference point on a road section where the roadside infrastructure is located;

converting the absolute elevation information of the road section reference point into a reference roadside map-based relative elevation representation, the road section reference point being used to represent a position of the road section where the roadside infrastructure is located;

calculating a relative position offset of the longitude and latitude position information of the traffic object relative to the reference longitude and latitude position information of the road section reference point, and calculating a relative elevation offset of the roadside map-based relative elevation representation of the traffic object relative to the reference roadside map-based relative elevation representation of the road section reference point; and

generating a roadside notification message and including in the roadside notification message the relative position offset and the relative elevation offset rather than the longitude and latitude position information and the roadside map-based relative elevation representation of the traffic object, and broadcasting the roadside notification message, a broadcast range of the roadside notification message covering at least the plurality of roads around the roadside infrastructure, so that vehicles on the plurality of roads make vehicle safety early warning decisions based on the roadside notification message.

2. The method according to claim 1, wherein before including the relative position offset

and the relative elevation offset in the roadside notification message, the method further comprises:

determining a message type of the roadside notification message according to a cooperative vehicle-infrastructure application scenario, the message type comprising roadside information or a basic safety message; and

generating the roadside notification message matching the message type to include the relative position offset and the relative elevation offset.

3. The method according to claim 1, wherein a perceptual positioning unit and a roadside wireless communication unit are further deployed in the roadside infrastructure; and obtaining the longitude and latitude position information and the absolute elevation information of the traffic object comprises:

perceiving, through the perceptual positioning unit, the traffic object on the road where the roadside infrastructure is located, and obtaining the longitude and latitude position information and the absolute elevation information of the perceived traffic object; and

transmitting the longitude and latitude position information and the absolute elevation information of the perceived traffic object to the roadside wireless communication unit and the roadside map unit respectively, so that the roadside map unit converts the absolute elevation information of the traffic object into the roadside map-based relative elevation representation, and the roadside wireless communication unit generates the roadside notification message according to the longitude and latitude position information and the roadside map-based relative elevation representation of the traffic object, and broadcasts the roadside notification message.

4. A cooperative vehicle-infrastructure processing method, performed by a vehicle in a cooperative vehicle infrastructure system (CVIS), comprising:

receiving a roadside notification message issued by a roadside infrastructure, the roadside notification message being generated by the roadside infrastructure according to but does not directly include longitude and latitude position information and a relative elevation representation of a traffic object, the traffic object comprising at least one of a road event, a traffic sign, and a traffic participant;

obtaining, from the roadside notification message, a relative position offset of the longitude and latitude position information of the traffic object relative to a reference longitude and latitude position information of a road section reference point and a relative elevation offset of the relative elevation representation of the traffic object relative to a reference relative elevation representation of the road section reference point, the road section reference point being on a road section where the roadside infrastructure is located;

restoring the longitude and latitude position information of the traffic object according to the reference longitude and latitude position information and the relative position offset of the road section reference point;

restoring the relative elevation representation of the traffic object according to the reference relative elevation representation and the relative elevation offset of the road section reference point;

obtaining longitude and latitude position information and absolute elevation information of the vehicle; and

making a vehicle safety early warning decision according to the longitude and latitude position information and the absolute elevation information of the vehicle, as well as the restored longitude and latitude position information and the restored relative elevation representation of the traffic object.

5. The method according to claim 4, wherein the making, by the vehicle, the vehicle safety early warning decision according to the longitude and latitude position information and the absolute elevation information of the vehicle, as well as the restored longitude and latitude position information and the restored relative elevation representation of the traffic object comprises:

obtaining a conversion relationship between a roadside map-based relative elevation representation and an on-board map-based relative elevation representation of a same road, the on-board map-based relative elevation representation being obtained according to surrounding road network information in an on-board map unit deployed in the vehicle;

converting the restored relative elevation representation of the traffic object into an on-board map-based relative elevation representation according to the conversion relationship, and determining an approximate absolute elevation information of the traffic object based on the on-board map-based relative elevation representation of the traffic object; and

deciding, according to the longitude and latitude position information and the absolute elevation information of the vehicle, as well as the restored longitude and latitude position information and the approximate absolute elevation information of the traffic object, whether to issue a vehicle safety warning.

6. The method according to claim 5, wherein the determining the approximate absolute elevation information of the traffic object based on the on-board map-based relative elevation representation of the traffic object comprises:

determining a road layer number corresponding to a road where the traffic object is located in the surrounding road network information of the vehicle according to the on-board map-based

relative elevation representation of the traffic object; and

determining the approximate absolute elevation information of the traffic object according to the road layer number and map data corresponding to the surrounding road network information of the vehicle.

7. The method according to claim 5, wherein the conversion relationship is obtained from a map server, and the map server is configured to provide a map data service for the vehicle and maintain the conversion relationship according to communication with the roadside infrastructure.

8. The method according to claim 4, wherein the making the vehicle safety early warning decision according to the longitude and latitude position information and the absolute elevation information of the vehicle, as well as the restored longitude and latitude position information and the restored relative elevation representation of the traffic object comprises:

converting the absolute elevation information of the vehicle into an on-board map-based relative elevation representation according to surrounding road network information in an on-board map unit deployed in the vehicle;

obtaining a conversion relationship between a roadside map-based relative elevation representation and an on-board map-based relative elevation representation of a same road, and converting the on-board map-based relative elevation representation of the vehicle into a roadside map-based relative elevation representation according to the conversion relationship; and

deciding, according to the longitude and latitude position information of the vehicle and the roadside map-based relative elevation representation, and the restored longitude and latitude position information and the restored relative elevation representation of the traffic object, whether to issue a vehicle safety warning.

9. The method according to claim 8, wherein the deciding, according to the longitude and latitude position information of the vehicle and the roadside map-based relative elevation representation, and the restored longitude and latitude position information and the restored relative elevation representation of the traffic object, whether to issue the vehicle safety warning comprises:

obtaining a driving feature of the vehicle in response to determining that the relative elevation representation of the traffic object is different from the roadside map-based relative elevation representation of the vehicle, the driving feature comprising at least one of a vehicle speed and a vehicle course; and

deciding, according to the longitude and latitude position information and the driving

feature of the vehicle, as well as the restored longitude and latitude position information of the traffic object, whether to issue the vehicle safety warning for the vehicle.

10. The method according to claim 8, wherein the conversion relationship is obtained from a map server, and the map server is configured to provide a map data service for the vehicle and maintain the conversion relationship according to communication with the roadside infrastructure.

11. A cooperative vehicle-infrastructure processing apparatus, comprising:

a memory storing a plurality of instructions; and

a processor configured to execute the plurality of instructions, and upon execution of the plurality of instructions, is configured to:

receive a roadside notification message issued by a roadside infrastructure, the roadside notification message being generated by the roadside infrastructure according to but does not directly include longitude and latitude position information and a relative elevation representation of a traffic object, the traffic object comprising at least one of a road event, a traffic sign, and a traffic participant;

obtain, from the roadside notification message, a relative position offset of the longitude and latitude position information of the traffic object relative to a reference longitude and latitude position information of a road section reference point and a relative elevation offset of the relative elevation representation of the traffic object relative to a reference relative elevation representation of the road section reference point, the road section reference point being on a road section where the roadside infrastructure is located;

restore the longitude and latitude position information of the traffic object according to the reference longitude and latitude position information and the relative position offset of the road section reference point;

restore the relative elevation representation of the traffic object according to the reference relative elevation representation and the relative elevation offset of the road section reference point;

obtain longitude and latitude position information and absolute elevation information of a vehicle; and

make a vehicle safety early warning decision according to the longitude and latitude position information and the absolute elevation information of the vehicle, as well as the restored longitude and latitude position information and the restored relative elevation representation of the traffic object.

12. The cooperative vehicle-infrastructure processing apparatus of claim 11, wherein the

processor is further configured to:

obtain a conversion relationship between a roadside map-based relative elevation representation and an on-board map-based relative elevation representation of a same road, the on-board map-based relative elevation representation being obtained according to surrounding road network information in an on-board map unit deployed in the vehicle;

convert the restored relative elevation representation of the traffic object into an on-board map-based relative elevation representation according to the conversion relationship, and determine an approximate absolute elevation information of the traffic object based on the on-board map-based relative elevation representation of the traffic object; and

decide, according to the longitude and latitude position information and the absolute elevation information of the vehicle, as well as the restored longitude and latitude position information and the approximate absolute elevation information of the traffic object, whether to issue a vehicle safety warning.

13. The cooperative vehicle-infrastructure processing apparatus of claim 12, wherein the conversion relationship is obtained from a map server, and the map server is configured to provide a map data service for the vehicle and maintain the conversion relationship according to communication with the roadside infrastructure.

14. The cooperative vehicle-infrastructure processing apparatus of claim 12, wherein the processor is further configured to:

determine a road layer number corresponding to a road where the traffic object is located in the surrounding road network information of the vehicle according to the on-board map-based relative elevation representation of the traffic object; and

determine the approximate absolute elevation information of the traffic object according to the road layer number and map data corresponding to the surrounding road network information of the vehicle.

15. The cooperative vehicle-infrastructure processing apparatus of claim 11, wherein the processor is further configured to:

convert the absolute elevation information of the vehicle into an on-board map-based relative elevation representation according to surrounding road network information in an on-board map unit deployed in the vehicle;

obtain a conversion relationship between a roadside map-based relative elevation representation and an on-board map-based relative elevation representation of a same road, and convert the on-board map-based relative elevation representation of the vehicle into a roadside map-based relative elevation representation according to the conversion relationship; and

decide, according to the longitude and latitude position information of the vehicle and the roadside map-based relative elevation representation, and the restored longitude and latitude position information and the restored relative elevation representation of the traffic object, whether to issue a vehicle safety warning.

16. The cooperative vehicle-infrastructure processing apparatus of claim 15, wherein the conversion relationship is obtained from a map server, and the map server is configured to provide a map data service for the vehicle and maintain the conversion relationship according to communication with the roadside infrastructure.

17. The cooperative vehicle-infrastructure processing apparatus of claim 15, wherein the processor is further configured to:

obtain a driving feature of the vehicle in response to determining that the relative elevation representation of the traffic object is different from the roadside map-based relative elevation representation of the vehicle, the driving feature comprising at least one of a vehicle speed and a vehicle course; and

decide, according to the longitude and latitude position information and the driving feature of the vehicle, as well as the restored longitude and latitude position information of the traffic object, whether to issue the vehicle safety warning for the vehicle.