[Fig. 7] Fig. 7 is a diagram illustrating an example of a network model of a plurality of routes.

[Fig. 8] Fig. 8 is a diagram illustrating an example of a troubled section and a transferable point in the network model of the plurality of routes.

[Fig. 9] Fig. 9 is a diagram illustrating an example of a detour route in the network model of the plurality of routes.

[Fig. 10] Fig. 10 is a diagram illustrating an example of a minimum vehicle operation increasable section in the network model of the plurality of routes.

[Fig. 11] Fig. 11 is a diagram illustrating an example in which a planned operation schedule of the minimum vehicle operation increasable section is displayed on an output unit.

[Fig. 12] Fig. 12 is a diagram illustrating an example of an actual operation schedule in a peak time zone of the minimum vehicle operation increasable section.

[Fig. 13] Fig. 13 is a diagram illustrating an example of a planned operation schedule in a target time zone for increasing a transportation capacity in the minimum vehicle operation increasable section.

[Fig. 14] Fig. 14 is a diagram illustrating an example in which the troubled section, the minimum vehicle operation increasable section, and a target vehicle operation increase rate are displayed on an output unit overlaid on a route map.

[Fig. 15] Fig. 15 is a functional block diagram of a

transport capacity adjusting system according to a second example of the invention.

[Fig. 16] Fig. 16 is a diagram illustrating an example in which a troubled section, a minimum vehicle operation increasable section, a target vehicle operation increase rate, and an actual operation increase rate are displayed on an output unit overlaid on a route map.

[Fig. 17] Fig. 17 is a functional block diagram of a transport capacity adjusting system according to a third example of the invention.

Description of Embodiments

[0010]

Hereinafter, embodiments of the invention will be described with reference to the drawings.

First Example

[0011]

Fig. 1 illustrates a functional block diagram of a transport capacity adjusting system according to a first example of the invention. This transport capacity adjusting system is used for transport capacity adjustment by adjusting the number of trains, which are transportation vehicles running on a plurality of railway lines sharing a transfer station. In the specification, the term “station” includes a point where passengers can get on and off, as well as a point (for example,

processing unit 1301 described below to function as a planning unit 135 (Fig. 3). Further, the storage unit 134 stores transportation plan information J1 and operation record information J2 acquired from the transport planning device 110 through the communication unit 133. Further, the storage unit 134 stores movement demand forecasting information J3 acquired from the movement demand forecasting device 120 through the communication unit 133.

[0020]

Fig. 4 is a diagram illustrating an example of the transportation plan information J1. The transportation plan information J1 is created for each operating vehicle service 108 of the train. The transportation plan information J1 includes a name 101 of the operating vehicle service 108, a maximum transportation amount 102 which is the transportable amount by the operating vehicle service 108, and a transportation facility 103 (for example, “train”, “bus”, and the like) which is the type of the transport vehicle in the operating vehicle service 108. Further, the transportation plan information J1 includes the number of points 104 (for example, station names) at which the operating vehicle service 108 stops, arrival times 105 at the points 104, and departure times 106 from the point 104, as many as the number of points 104 where the operating vehicle service 108 stops. The operation record information J2 has the same configuration as

the target increasing vehicle operation number in the minimum vehicle operation increasable section within a range not exceeding the upper limit value of the minimum vehicle operation increasable section. By doing so, since the movement demand is assigned to the detour route based on the movement utility, it is possible to increase the transportation capacity that appropriately covers the detour behavior of the movement demand.

[0030]

The planning unit 135 displays a route map 1321 which illustrates the troubled section and the minimum vehicle operation increasable section in the output unit 132 in an identifiable manner (Fig. 14). In the example of Fig. 14, the troubled section is shaded and the minimum vehicle operation increasable section is shown by the dashed line. Further, the planning unit 135 displays a target vehicle operation increase rate 1322 as information related to the target increasing vehicle operation number in the minimum vehicle operation increasable section on the output unit 132. By doing so, it is possible to visually grasp the troubled section and the minimum vehicle operation increasable section.

[0031]

Fig. 6 is a flowchart of the transport capacity adjustment process. The transportation adjustment process performed by the planning unit 135 will be described with

reference to the flowchart of Fig. 6.

[0032]

For example, based on the information entered in the input unit 131 or the information notified through the communication unit 133, when it is detected that a troubled section occurs on the route R1 of a plurality of routes (referred to as railway routes R1, R2, and R3 in this embodiment), as illustrated in Fig. 7, the planning unit 135 creates a network model of the plurality of routes R1, R2, and R3 (S201). The route R1 is indicated by a solid line arrow, the route R2 is indicated by a dashed arrow, and the route R3 is indicated by a two-dot chain arrow. A network model may be created in advance and stored in the storage unit 134. In this embodiment, the route R1 as one route connects A station → B station → G station → H station → E station. The route R2 as another route connects A station → B station → C station → D station → E station. The route R3, which is another route, connects F station → G station → I station → J station → E station. The troubled section is a section between G station and E station on the route R1.

[0033]

Next, the planning unit 135 acquires transferable points before and after the troubled section on the route R1 (S202). Specifically, a first transfer station shared with the route R2 and R3 and included in the section from A station, which

the actual vehicle operation increase rate indicating the actual increase rate of the vehicle operations may be displayed on the output unit 132. Further, instead of the target vehicle operation increase rate, the target increasing vehicle operation number may be displayed. The actual vehicle operation increase rate is calculated based on the latest operation record information J2. In this example, the target vehicle operation increase rate 1322 is the ratio of the target increasing vehicle operation number to the number of operating vehicle services (planned value) in the target time zone. The same applies to the actual vehicle operation increase rate. Then, the processing of the flowchart illustrated in Fig. 6 is finished.

[0040]

As described above, according to the transport capacity adjusting device 130 of the example, the minimum vehicle operation increasable section of another route (route R2, R3) running in parallel with the troubled section generated on one route (route R1) is specified, and based on the maximum number of vehicle operations that can be increased in this minimum vehicle operation increasable section and the movement demand in the troubled section, the target increasing vehicle operation number in the minimum vehicle operation increasable section is determined. From this, it is possible to determine the number of vehicle operations to be increased according to

operation increase rate (information related to the target increasing vehicle operation number) in the minimum vehicle operation increasable section determined in other transport capacity adjusting devices and the actual vehicle operation increase rate (information related to the actual increasing vehicle operation number). By doing so, the status of increased vehicle operations can be shared among a plurality of railway companies and the status of other routes can be grasped more accurately.

[0043]

As illustrated in Fig. 16 as an example, the transport capacity adjusting devices 130A to 130C make the output unit 132 display the target vehicle operation increase rate 1322 and the actual vehicle operation increase rate 1323 acquired from another transport capacity adjusting device by the state update unit 141.

Third Example

[0044]

Fig. 17 illustrates a functional block diagram of the transport capacity adjusting system according to a third example of the invention. This transport capacity adjusting system includes a transport planning device 110, a movement demand forecasting device 120, a transport capacity adjusting device 130, a passenger terminal device 150, and a route search device 160. Those are connected to each other by a wired or

CLAIMS

[Claim 1]

A transport capacity adjusting device for adjusting the number of operations of transport vehicles running on a plurality of routes which share a transfer station, comprising:

a route calculation unit which extracts a detour route connecting a first transfer station, which is included in a section from one end station on one route to a start station of a troubled section, and a second transfer station, which is included in a section from the other end station on one route to an end station of the troubled section, by another route different from one route when there is the troubled section where the transport vehicles cannot operate on one route included in the plurality of routes;

an adjustable range calculation unit which specifies a section of another route connecting a first turnaround station, which has a track record of turnaround of the transport vehicles included in a section from one end station to the first transfer station on the other route, and a second turnaround station, which has a track record of turnaround of the transport vehicles included in a section from the other end station to the second transfer station on the other route, as a minimum vehicle operation increasable section and calculates an upper limit value of the number of vehicle operations that can be increased

in the minimum vehicle operation increasable section based on an operating vehicle service that has a track record of running at least a part of the minimum vehicle operation increasable section by considering that a running section of an operating vehicle service that runs only the part of the minimum vehicle operation can be extended to the entire minimum vehicle operation increasable section; and

an adjustment amount determination unit which determines a target increasing vehicle operation number in the minimum vehicle operation increasable section based on the upper limit value of the minimum vehicle operation increasable section and a movement demand of the troubled section.

[Claim 2]

The transport capacity adjusting device according to Claim 1, wherein

the adjustable range calculation unit calculates the upper limit value based on an operation record in the minimum vehicle operation increasable section.

[Claim 3]

The transport capacity adjusting device according to Claim 2, wherein

the adjustable range calculation unit calculates the upper limit value based on an operation record in a time zone

when the number of operating vehicle services in the minimum incrementable section is maximum.

[Claim 4]

The transport capacity adjusting device according to Claim 1, wherein

when it is proceed from the end station of the troubled section toward the other end station of one route and detects a transfer station shared with other route, if it is possible to reach the transfer station included in a section from one end station on one route to the start station of the troubled section by passing through the other route from the transfer station, the route calculation unit sets the former transfer station as the second transfer station, sets the latter transfer station as the first transfer station and extracts a section connecting the first transfer station and the second transfer station on the other route as a detour route.

[Claim 5]

The transport capacity adjusting device according to Claim 1, wherein

the adjustment amount determination unit allocates the movement demand of the troubled section to the detour route based on movement utility of the detour route and determines a target increasing vehicle operation number in the minimum

vehicle operation increasable section within a range not exceeding the upper limit value of the minimum vehicle operation increasable section.

[Claim 6]

The transport capacity adjusting device according to Claim 1, further comprising:

an output unit which displays a route map which illustrates the troubled section and the minimum vehicle operation increasable section in an identifiable manner.

[Claim 7]

The transport capacity adjusting device according to Claim 6, wherein

the output unit displays information related to the target increasing vehicle operation number in the minimum vehicle operation increasable section.

[Claim 8]

A transport capacity adjusting system comprising a plurality of transport capacity adjusting devices according to Claim 7, wherein

the transport capacity adjusting device comprises a state update unit which acquires at least one of information related to a target increasing vehicle operation number in the

minimum vehicle operation increasable section determined in another transport capacity adjusting device and information related to an actual number of vehicle operations increased in the minimum vehicle operation increasable section.

[Claim 9]

A transport capacity adjusting system comprising the transport capacity adjusting device according to any one of Claims 1 to 7 and a route search device which performs a route search based on a search condition input from a passenger terminal device, wherein

the route search device acquires information related to a target increasing vehicle operation number in the minimum vehicle operation increasable section from the transport capacity adjusting device and transmits information related to a target increasing vehicle operation number in the minimum vehicle operation increasable section transmitted from the transport capacity adjusting device together with a result of the route search to the passenger terminal device.

[Claim 10]

A transport capacity adjusting method for adjusting the number of operations of transport vehicles running on a plurality of routes which share a transfer station, comprising:

extracting a detour route connecting a first transfer

station, which is included in a section from one end station on one route to a start station of a troubled section, and a second transfer station, which is included in a section from the other end station on one route to an end station of the troubled section, by another route different from one route when there is the troubled section where the transport vehicles cannot operate on one route included in the plurality of routes;

specifying a section of another route connecting a first turnaround station, which has a track record of turnaround of the transport vehicles included in a section from one end station to the first transfer station on the other route, and a second turnaround station, which has a track record of turnaround of the transport vehicles included in a section from the other end station to the second transfer station on the other route, as a minimum vehicle operation increasable section and calculating an upper limit value of the number of vehicle operations that can be increased in the minimum vehicle operation increasable section based on an operating vehicle service that has a track record of running at least a part of the minimum vehicle operation increasable section by considering that a running section of an operating vehicle service that runs only the part of the minimum vehicle operation can be extended to the entire minimum vehicle operation increasable section; and

determining a target increasing vehicle operation number

in the minimum vehicle operation increasable section based on the upper limit value of the minimum vehicle operation increasable section and a movement demand of the troubled section.