respective positions and the train-car formation information on the respective trains 50 that is acquired from the operation management system 20 or the like.

[0014] The predicted run curve generating unit 12 is configured to, based on the positional information and the speed information that are acquired from the input unit 11, detect whether there is any one of the trains 50 stopping at each station (train-stopping station that is equipped with a traffic signal or train-halting station that is not equipped with the traffic signal, for example) on the track R and whether there are any of the trains 50 on the track within a range in which communication with an access point installed in each station is possible. A range in which communication with each station is possible is a range in which a time length sufficient for a train to acquire data properly can be secured even when the train passes the station site at the highest permitted speed. Each of the trains 50 thus detected is hereinafter referred to as a controlled train.

[0015] Based on the most recent control diagrams acquired from the operation management system 20, the predicted run curve generating unit 12 specifies one or more trains (second trains) that are each likely to, while the controlled train (first train) is running between stations to stop at, be a preceding train or a following train with respect to the controlled train.

[0016] The preceding train is one of the trains 50 that is likely to influence the controlled train because it is running, ahead of the controlled train, in the same direction and on the same track as the controlled train. Herein, the influence includes abrupt deceleration of the controlled train that occurs upon action of the safety brake (not illustrated) or the like of the controlled train if the preceding train and the controlled train become excessively close to each other when the preceding train

train can be treated in the similar manner as the preceding train thereof, and the train to be overtaken that has already been overtaken by the controlled train can be treated in the similar manner as the following train thereof.

[0033] With reference to FIGS. 6A and 6B, description is given of a method for calculating a preceding target position and a preceding~~following~~ target time when the train to be overtaken has yet to be overtaken by the controlled train. In FIGS. 6A and 6B, the controlled train and the train to be overtaken are assigned reference numerals 51 and 54, respectively. While FIG. 6A illustrates a state where the train-to-be-overtaken 54 is entering a subsidiary main track of a train-stopping station 61 so as to stop on the subsidiary main track, FIG. 6B illustrates a state where the controlled train 51 is entering a main track of the train-stopping station 61 in order to overtake the train-to-be-overtaken 54.

[0034] Here, this is presumed to be a case where, until the rear-end of the train-to-be-overtaken 54 passes a fifth position X5, the front-end of the controlled train 51 is not allowed to enter a sixth position X6 behind the fifth position X5. That is, this is presumed to be a case where, if the front-end of the controlled train 51 approaches the sixth position X6 before the rear-end of the train-to-be-overtaken 54 passes the fifth position X5, the controlled train 51 inevitably starts a stopping operation in response to signal indication according to the on-track position of the train-to-be-overtaken 54.

[0035] To avoid the controlled train 51 from starting a stopping operation in this case, the run target calculating unit 13 is configured to: calculate the sixth position X6 as the preceding target position; and calculate the

train or the train to be overtaken that has yet to be overtaken, and the respective points X16 and T2~~1~~ in FIG. 9 represent the preceding target position and the preceding target time that are attributable to the presence of the preceding train or the train to be overtaken that has already been overtaken.

[0046] As illustrated in FIG. 9, the second run curve (refer to the solid curve) according to the embodiment represents that, while the position X15 is passed before the time T1, the position X16 is passed after the time T2. Unlike the comparative run curve (refer to the dotted curve) having a shape including a part corresponding to abrupt deceleration before the arrival at the position X16 followed by a long stop at the position X16, the second run curve according to the embodiment has a shape not including any part corresponding to abrupt deceleration. Consequently, operating the controlled train in accordance with the second run curve enables the controlled train to be smoothly operated without influencing and being influenced by the preceding train, the following train, and the train to be overtaken.

[0047] Here, examples of the method for generating the second run curve are described in further detail with reference to FIG. 10A to FIG. 10G.

[0048] At the start, as illustrated in FIG. 10A, the run curve generating unit 14 calculates, as candidate solutions for the second run curve, run curves corresponding to all patterns of driving manner that are available when the notches of a master controller of the controlled train are switched in a certain cycle in various manners. Although FIG. 10A illustrates an example in which the notches are switchable between three stages of the first to the third notches, the notches may be switchable between four or more

the station to stop at even by running in the fastest possible manner from the position and time that correspond to the end point P4.

[0054] FIG. 10F is a diagram illustrating an example of pruning based on whether conditions of the target position and the target time for a case when a preceding train or a train to be overtaken that has yet to be overtaken is present are satisfied. In FIG. 10F, while X17 indicates the target position, T3 indicates the target time. The solid curve in FIG. 10F represents an example of the candidate solution for the second run curve. The candidate solution illustrated in FIG. 10F here is excluded from the candidate solutions because it constitutes a run curve such that the controlled train arrives at the target position X17 earlier than the target time T3.

[0055] FIG. 10G is a diagram illustrating an example of pruning based on whether conditions of the target position and the target time for a case when a following train or a train to be overtaken that has already been overtaken is present are satisfied. In FIG. 10G, while X18 indicates the target position, T4 indicates the target time. The solid curve in FIG. 10G represents an example of the candidate solution for the second run curve. The candidate solution illustrated in FIG. 10G here is excluded from the candidate solutions because it constitutes a run curve such that the controlled train does not arrive at the target position X18 by the target time T4.

[0056] For example, the run curve generating unit 14 is configured to: calculate power consumption of individual candidate solutions to select the least power-consuming solution from the candidate solutions having been obtained by the narrowing down through the above-described pruning; and thereby generate the second run curve that works as a solution. As illustrated in FIG. 2, the run curve