Metropolitan Transit System

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Policies and Procedures No. 38

SUBJECT: **Board Approval:** 4/29/04

OUT-OF-DIRECTION BUS ROUTINGS

PURPOSE:

To establish a procedure for evaluating the effectiveness of existing or proposed fixed-route bus segments that have out-of-direction (OOD) segments.

BACKGROUND:

Definition. OOD travel is a deviation off the main line of a fixed-route bus service. An OOD segment is the portion of the route that makes the deviation.

OOD routings are normally used to serve generators or areas that are located close to but not directly on a bus route. Such routings benefit riders who wish to travel to and from places along the OOD segment. However, "through" riders are inconvenienced as a result of the longer travel time caused by detouring through the segment.

Objective. The intent of the methodology contained in this policy is to balance considerations of speed and directness with service penetration. Thus, the aim is to have the most direct routing to maximize both the efficiency and effectiveness of the Metropolitan Transit System (MTS) bus network.

Contents. This policy establishes a systematic procedure to evaluate OOD segments that are either currently in service or requested. The evaluation produces a quantitative measure to help the Board decide the benefits of retention, modification, or deletion of an existing OOD segment and the acceptance or rejection of a new OOD request.

PROCEDURES:

38.1 Method

The evaluation method consists of three steps:

a. The first step is to rate OOD segments on the basis of time delay to through passengers.

b. The second is to determine whether bus-operator resources could be saved by not operating an OOD segment.

c. The third step is to analyze the operating cost and effectiveness with and without the OOD.

These steps should be taken in sequence as shown in the figure on the next page.

38.2 Out-of Direction (OOD) Impact Index: Definition

The first step in the OOD analysis is to develop a measure of the trade-off between the time inconvenience of OOD deviations on through passengers and the benefit of the deviation to OOD riders. An OOD "impact index" measures the trade-off in this relationship. The index is a measure of the extra travel time that through passengers face for each OOD passenger.

For existing routes with OOD segments, the OOD Impact Index is expressed as:

$$\text{OOD Index} = \frac{\text{Through Ridership} * \text{OOD Travel Time}}{\text{OOD Ridership}}$$

Where:

- OOD Index is a weighted measure of time and may be expressed in minutes.
- Through ridership is the difference between the number of passengers onboard the bus prior to the OOD segment and the number of passengers alighting on the OOD segment.
- OOD travel time is the net increase in travel time that is required to operate the OOD segment.
- OOD ridership includes all boardings and alightings, which occur on the OOD segment beyond 1/4-mile from the main line. Passengers boarding and alighting within 1/4-mile of the main line are considered to be served by that line whether or not the OOD segment is operated.

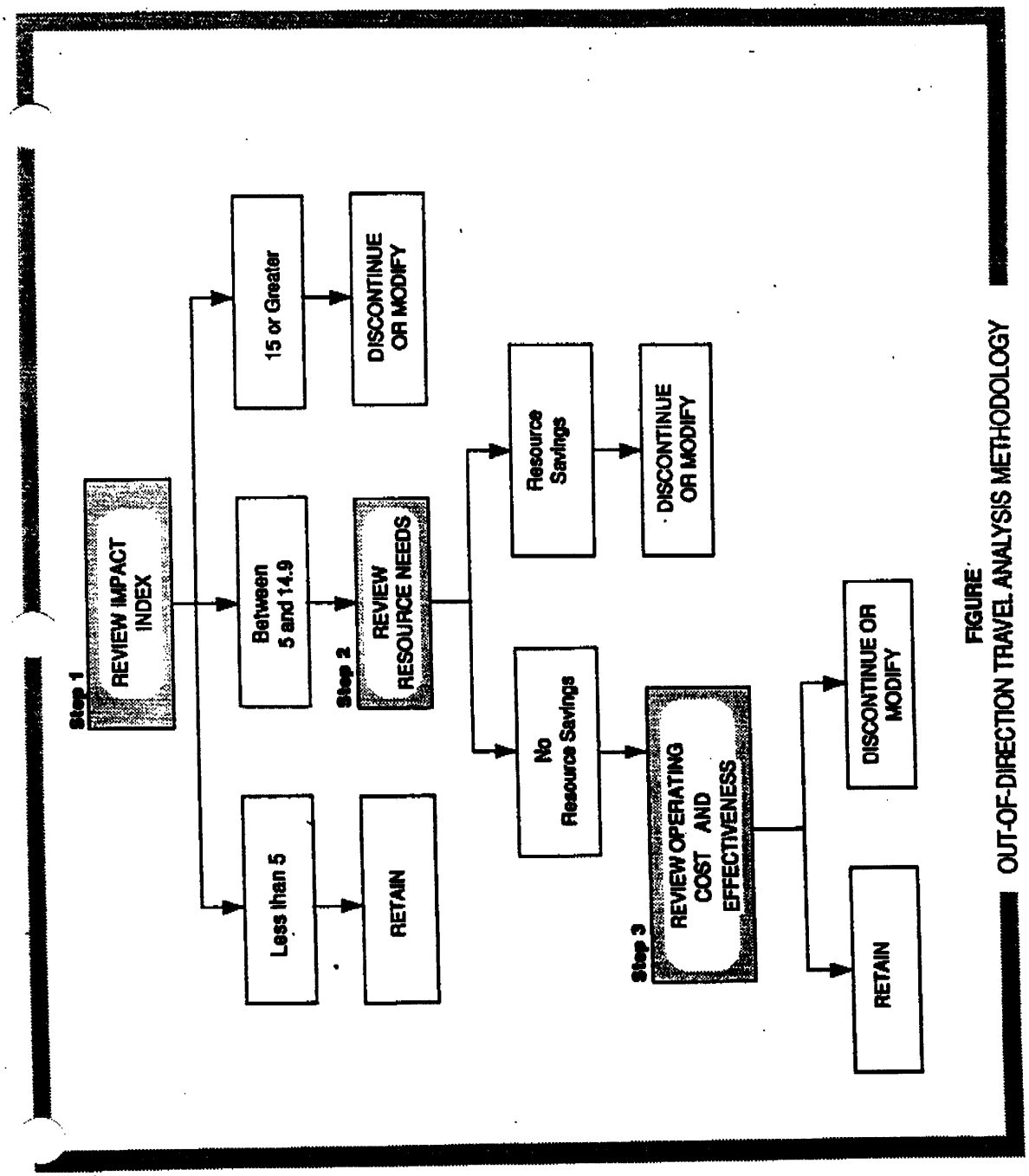

FIGURE
OUT-OF-DIRECTION TRAVEL ANALYSIS METHODOLOGY

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38.3 Interpretation of Index Values

- Index Values 0-4.9. An index value in this range indicates that the number of OOD passengers is large compared with the number of through passengers or that the diversion time is small or both. Segments with indexes of 4.9 or less are not likely to deter through ridership.

- OOD Index Between 5.0-14.9. An index value in this range indicates some inconvenience to through passengers that may impact through ridership.

- OOD Index 15.0 and Above. An index value above 15.0 indicates that the OOD deviation is an inconvenience to through passengers and has an adverse impact on through ridership.

Segments with indexes up to 4.9 are probably well justified for continued service, while segments with indexes of 15.0 or greater should be discontinued or modified. Within the range of 5.0 to 14.9, other factors should be considered in the determination, such as resource savings, cost, and effectiveness. In this case, the analysis should proceed to Step 2 outlined in Section 38.5.

38.4 Use of the Index for Evaluating Proposed OOD Segments.

Where a new OOD segment is being evaluated, potential OOD ridership is an unknown. In this case, the formula is calculated to determine how much ridership is needed to justify implementation of the OOD segment. Since an OOD Impact Index value of 4.9 represents the upper limit for an OOD segment that clearly does not deter through ridership, the formula for determining that ridership level can be calculated as follows:

$$\text{OOD Ridership Needed} = \frac{\text{Through Ridership} * \text{OOD Travel Time}}{4.9\ (\text{OOD Impact Index Value})}$$

If the resulting OOD ridership level can reasonably be expected to be achieved within one year after the OOD segment is implemented, implementation of the OOD segment should be considered. If this ridership level cannot be achieved, the OOD segment should not be added.

38.5 Evaluating Resource Needs

A review of resource needs is the second step in the OOD evaluation process. The purpose is to determine whether or not there are resource savings associated with the OOD segment. Transit routes require a certain number of vehicle and operator "resources" to provide service. Calculation of the resource saving is accomplished by determining the route running time with and without the OOD and then determining whether the running time savings is sufficient to reduce the bus operator requirement.

There are three circumstances where bus operator reductions are likely to occur:

- lengthy OOD segments on routes with a 30-minute service frequency or more;
- eliminating several OOD segments on the same route so that the combined running time savings can reduce the resource requirement; and/or
- routes with excess recovery time.

In addition, even a small time savings can provide an extra running time margin that can be used to improve on-time performance, to schedule time transfers, or to extend the route. If resources can be saved, the segment should be discontinued or modified. If resources cannot be saved, the analysis proceeds to Step 3 (outlined in Section 38.6), the review of cost and effectiveness.

38.6 Evaluating Operating Cost and Effectiveness

A comparison of the operating cost and effectiveness with and without the OOD is the third step in the evaluation process. OOD segments, which have an Impact Index of 5.0 to 14.9 and do not yield resource savings, would be evaluated according to these criteria.

38.6.1 Operating Cost. The operating cost of the route without the OOD segment should be determined by calculating the annual operating miles saved and multiplying the value by the marginal mileage operating cost. Marginal operating cost should include the "out-of-pocket" cost related exclusively to miles operated: fuel, lubricants, tires, and maintenance. Deducting the marginal operating cost for the OOD segment from the route as a whole gives the route operating cost without the OOD segment.

38.6.2 Effectiveness. Effectiveness is assessed by measuring route productivity with and without the OOD segment. Passengers per revenue mile is the measure of effectiveness and should be calculated as follows:

$$\text{Passengers Per Revenue Mile (with OOD)} = \frac{\text{OOD Segment Existing Annual Boarding Passengers}}{\text{Annual Revenue Miles for OOD Segment}}$$

$$\text{Passengers Per Revenue Mile (without OOD)} = \frac{\text{Existing Route Annual Boarding Passengers} - \text{OOD Segment Annual Boarding Passengers} + \text{Direct Routing Annual Boarding Passengers} + \text{Annual Additional Through Riders Due to Travel Time Savings}}{\text{Existing Route Annual Revenue Miles} - \text{OOD Segment Annual Revenue Miles} + \text{Direct Routing Annual Revenue Miles}}$$

Passenger volumes without the OOD segment are based on passenger gains and losses resulting from discontinuing the OOD segment.

- New ridership on the direct route that replaced the OOD segment.
- Ridership loss from discontinuing the OOD segment per existing ride-check data.
- Through ridership gain by reducing travel time.

Through ridership on the main line is likely to increase due to travel time savings. The amount of the increase can be estimated using the following travel time/demand elasticity formula:

$$\text{Additional Through Ridership} = \frac{\text{Difference in Travel Time (Minutes) between OOD Segment and Direct Routing} * \text{Through Ridership} * \text{0.30 Elasticity Factor}}{\text{Average Passenger Trip Length per Entire Route (Minutes)}}$$

An elasticity coefficient of 0.30 is used, meaning that the percent increase in through ridership is equal to 0.30 times the percent decrease in travel time. For example, a 25 percent decrease in travel time would produce a 7.5 percent increase in ridership.

DGunn/SChamp/JGarde
POLICY.38.OUT OF DIRECTION BUS ROUTINGS
7/17/06

Attachment: OOD Travel Analysis Methodology

Original Policy approved on 8/23/90.
(updated 3/15/00 into MTS format)
Policy revised on 4/29/04.