

## MULTI-MODAL DEMAND ADJUSTMENT IN EMME2

This article addresses the problem of adjusting a multimodal origin-destination (O-D) matrix using EMME2. The purpose of such adjustment is to create an adjusted multimodal trip table generating a multimodal traffic assignment that assigns volumes by each transportation mode to links closely matching observed flows.

EMME2 has a well-established one-mode “Demand Adjustment” procedure developed by Heinz Spiess<sup>1</sup>. This procedure has been implemented by Heinz Spiess in his macro “Demadj22.mac,” that gives full control to a user, and reliably produces good practical results. However, there is no multi-modal adjustment procedure readily available in the EMME2 environment.

This paper presents a practical approach for EMME2 users to produce multi-modal trip table adjustments based on the standard one-mode adjusting procedure available in EMME2 (Heinz Spiess’ macro “Demadj22.mac”). The algorithm used for this purpose, is a “by-coordinate descent” – “diagonalized” approximation of the multidimensional Gradient Method.

This approach was effectively used in a large-scale Travel Demand Modeling project where two transportation modes (Auto and Truck.) were considered.

As a result of using this approach, much better calibration statistics was achieved.

Particularly the “Root Mean Square Error” (RMSE), the measure of matching assigned traffic volumes to observed flows, was significantly improved for all links with counts, as well as for the links with observed traffic volumes above 500 vehicles. Marked improvement was also demonstrated in statistical measures for “screen line” analysis.

Another useful measure is a magnitude of deviation of trip tables from their initial status. “R-Square” (“R<sup>2</sup>”) criterion has been used to measure the tables’ deviation. As a result of this multimodal adjustment, “R<sup>2</sup>” between the initial and final tables were the same or better on different runs of the model.

This means that, due to the described multi-modal approach, traffic assignment (by each transportation mode) matches observed traffic flows significantly better with the same or smaller deviation from the original trip tables.

In addition, the article addresses several important questions affecting efficiency of the application of this multimodal optimization algorithm.

First, it discusses the criteria used to measure the efficiency of trip table adjusting algorithms. It also discusses such questions as: 1) how complete should one-mode intermediate optimization be at each step, 2) what should be initial conditions at each step within the same iteration, and 3) how many iterations are necessary to run.

In the end, the author discusses some practical advantage of using the by-coordinate approximation of Gradient method as opposed to using the “ideal theoretically correct” multi-variable Gradient method of optimization with adjusting multi-modal trip tables.

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<sup>1</sup> Heinz Spiess (1990). “A GRADIENT APPROACH FOR THE O-D MATRIX ADJUSTMENT PROBLEM.”

INRO Technical Support – to download “Demadj22.mac” macro.

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