BEFORE THE METRO CONTRACT REVIEW BOARD

FOR A SOLE SOURCE CONTRACT, NOT TO EXCEED $200,000, WITH S. H. PUTMAN ASSOCIATES OF PHILADELPHIA TO SIGNIFICANTLY ENHANCE THE DRAM/EMPAL LAND USE FORECASTING MODEL FOR USE IN THE PORTLAND METROPOLITAN AREA AND TO CARRY OUT AN INVESTIGATION OF MODEL RESPONSE AND STABILITY WHEN INTEGRATED WITH THE METRO TRANSPORTATION MODEL	RESOLUTION NO. 93-1798A Introduced by Rena Cusma, Executive Officer

WHEREAS, Metro needs an enhanced implementation of DRAM/EMPAL for policy evaluation of future growth options and the ability to analyze the indirect effects of transportation infrastructure on air quality; and

WHEREAS, The Federal Highway Administration (FHWA) desires to carry out an evaluation of the practical use of linked land use and travel forecasting models using current state-of-practice procedures; and

WHEREAS, Both Metro and FHWA need an analysis of the impact of the size of growth change and the size of infrastructure investment that is of sufficient magnitude to change the linked model output enough to change the environmental outputs; and

WHEREAS, Metro has, installed and accessible, current state-of-the-practice models and a database that is suitable for the desired evaluation; and

WHEREAS, The desired evaluation is an extension and expansion of work already started in the LUTRAQ (1000 Friends of Oregon) study funded in part by FHWA, EPA and Metro; and

WHEREAS, The analysis will require modification of proprietary software (DRAM/EMPAL), the property of S.H. Putman Associates of Philadelphia; and

WHEREAS, The desired evaluation is a continuation of current research being pursued by S.H. Putman; now, therefore,

BE IT RESOLVED,

That the Metro Council authorize a sole source contract with S.H. Putman Associates of Philadelphia to carry out the tasks described in the staff report.

ADOPTED by the Metro Contract Review Board this 13th day of May, 1993.

Judy Wyers, Presiding Officer

TKL:GR:lmk
93-1798A.RES
4-28-93

STAFF REPORT

CONSIDERATION OF RESOLUTION NO. 93-1798A FOR A SOLE SOURCE CONTRACT, NOT TO EXCEED $200,000, WITH S.H. PUTMAN ASSOCIATES OF PHILADELPHIA TO SIGNIFICANTLY ENHANCE THE DRAM/EMPAL LAND USE FORECASTING MODEL FOR USE IN THE PORTLAND METROPOLITAN AREA AND TO CARRY OUT AN INVESTIGATION OF MODEL RESPONSE AND STABILITY WHEN INTEGRATED WITH THE METRO TRANSPORTATION MODEL

Date: April 14, 1993 Presented by: Andrew Cotugno

PROPOSED ACTION

This resolution will result in further development of an integrated transportation and land use modeling process for the Portland area, analysis and evaluation of the difficulties of calibrating and using combined models, and an evaluation of the size of change in highway investment or growth scenario for which combined models are appropriate and should be required, which is of significance in the national scene.

FACTUAL BACKGROUND AND ANALYSIS

Metro has a well established set of transportation models that are used to test and evaluate ad-hoc land use scenarios (e.g., the 2010 Regional Transportation Plan). There is a growing need to evaluate the mutual interaction of transportation and land use in order to include the impacts of transportation decisions on the development of land and on household and employment location decisions and for the analysis of the "secondary impacts" of highway expansion on air quality. To this end EPA, FHWA and Metro funded a part of the 1000 Friends of Oregon "LUTRAQ" project to evaluate available land use forecasting models and to recommend and install the recommended package. DRAM/EMPAL was chosen.

FHWA and Metro want to carry out an exhaustive evaluation of the stability, sensitivity and responsiveness of an integrated land use/transportation model to determine when it is appropriate to use this complex procedure. Metro also has a need for model improvements to make the model sensitive to policy variables important in the context of the Oregon planning process (UGB effect, urban growth management through supply constraints, etc.) for use in the 2040 project.

Model improvements will necessitate significant reprogramming of the DRAM/EMPAL software, a task which can only be carried out by the owners of the software (Putman Associates). Further, the issues of linked model stability for models of the EMME/2 and DRAM/EMPAL structure is an area of Professor Putman's primary research (ongoing). He is a leading expert in this field and is well (and recently) published on this issue. It is probable that sofware changes will be necessary to complete this evaluation.

This work is an extension of the model stability experiments recently completed by Professor Putman and that there will be no "learning curve" costs on startup.

Because of the nature of the work and the integral position of DRAM-EMPAL, any competing contractor would, in fact, have to sub-contract with Putman Associates for the bulk of the work. In the interests of both efficiency and cost, it is therefore requested that this contract be executed as a sole-source contract. The FHWA monitor on this project, Dr. Fred Ducca, concurs with this recommendation.

The Scope of Work for this contract is Attachment A to this report.

SOURCE OF FUNDS

This is entirely funded with a discretionary FHWA grant (LAND000(002)).

EXECUTIVE OFFICER'S RECOMMENDATION

The Executive Officer recommends approval of Resolution No. 93-1798A.

TKL:GR:lmk
93-1798A.RES
4-28-93

ATTACHMENT A

Metro Land Use/Transportation Feedback Project: Land Use - Transportation Model Linkage Work Program

EQUILIBRIUM CONDITIONS IN TRAVEL FORECASTING

BACKGROUND

With the passage of the Clean Air Act Amendments of 1990 and the Intermodal Surface Transportation Efficiency Act of 1991, the questions asked of the traditional travel forecasting process have increased in complexity and impact. In particular, the process now must answer questions regarding air quality, land use, demand management and the impact of new infrastructure. Many of the questions currently posed to the process had not been previously asked.

The consistency requirements of both acts explicitly recognize the interrelatedness of transportation and land use, and assume the need for a proper representation of those linkages between land use and transportation phenomena which can significantly alter long-range forecast results. Much of the discussion in transportation and land use planning practice, when it does acknowledge the potential importance of these interactions, addresses this issue in terms of requirements for equilibrium solutions. What is not clearly known is: a) whether such solutions are computationally practical; b) whether they will differ significantly from solutions achieved in the absence of formal linkages between the two forecasting activities; and c) whether they will actually be better forecasts of the future land use and transportation reality.

Due to the increased complexity of current issues, the modeling process must examine issues of internal consistency which in the past had not been critical or had been ignored. In particular these questions include consistency and equilibrium issues within the travel forecasting process. Examples of these issues are:

- The travel times resulting from the assignment process are often not the same times as those used in the mode choice procedure. This can raise problems when, for example, a new highway is analyzed in the modeling process. The highway might initially draw trips from transit, but the congestion generated by trips drawn from transit could have a secondary impact of removing trips from the highway network at a later date.

- The travel times used in trip distribution differ from those which result from the final trip assignment. Trip distribution is normally done on a congested network, then a new facility inserted into the network prior to assignment in order to estimate its impact. This method of analysis estimates the impact of route shifts but does not allow for new capacity to affect destination choice.

- The linkages between land use and transportation are often overlooked. Transportation planning and travel forecasting are commonly done in response to land use changes rather than looking at the interactive effects of land use and transportation.

The above issues are typical of most modeling efforts. However, having stated that these are issues in modeling, the criticality of the issues has not been defined. Would addressing these consistency issues in a modeling process significantly change the results of a forecast? Are there network or economic conditions under which these issues are critical or not critical? If the issues are critical, can methods of appropriately addressing them be identified?

Even in the earliest development of procedures for integrating transportation and land use models, one of the recurring issues was that of equilibrium solutions. Several early attempts were made to develop

procedures which would yield an equilibrium between models or, as it will be called here, an inter-model equilibrium solution.

It has been shown that a simple and straightforward procedure for calculating convex combinations of link flows is the key to a rather robust inter-model equilibrium solution process (Putman, 1992). This approach works for complex model structures and full scale data sets. There are embedded issues of system wide calibration, but generally speaking, the development of an algorithm for calculating an inter-model equilibrium is no longer an issue.

What remains unknown is the extent to which the solutions produced by this process are sensitive to the components of the overall model system, to the ways in which they are linked, and to the assumptions made about the definition of equilibrium. Along with these questions is the rather basic one of whether an equilibrium solution constitutes a good forecast. There is, in addition, a further set of issues regarding the process of solving for intra-model equilibrium, and the extent to which inter-model equilibrium solutions and intra-model equilibrium solutions should be combined. Within both the land use (employment location, household location, and land consumption) models and the transportation (generation, distribution, mode split, and assignment) models, for example, there are still unresolved questions regarding equilibrium. Some of these questions will be answered here as part of the general investigation of consistency and sensitivity, but other such questions will remain as long-term theoretical research issues.

PURPOSE

In order to address the above issues, and improve its current forecasting processes, Metro, in cooperation with the Oregon Department of Transportation (ODOT) and the Federal Highway Administration (FHWA), proposes to perform a comprehensive series of tests to determine the criticality of the consistency issue, identify conditions under which it must be addressed, and make technical recommendations for methodologies to modify existing procedures. It is expected that the results of this study will have implications not only for Metro but nationally for other users of the travel demand process.

Metro is seeking:

A Contractor to:

1. Work with Metro in the further calibration of DRAM/EMPAL, the integration of a Metro (or other) user-friendly interface, and closer linkage with EMME/2.

2. To identify and perform a series of tests which will address the above issues.

3. Perform an evaluation of the criticality of integration issues. With particular attention to the applicability and transferability of these results in the national context.

4. Document the results for a national audience. This project will be of importance in providing guidance to USDOT and to other jurisdictions on the scale at which such analysis is appropriate and will help uncover, and where possible solve, technical difficulties with the process.

Metro MODEL SET

Metro has two major components to its model set . The first is a travel demand process consisting of trip generation, distribution, mode choice and assignment. This model set has been implemented within

the EMME/2 travel forecasting system. The second component to the modeling system is the DRAM and EMPAL land use forecasting models. In the current technical process outputs from DRAM and EMPAL are in ASCII text, which is in turn read by the EMME/2 package.

The current implementation of DRAM/EMPAL has not been completely calibrated for this region in such a way as to yield consistent and credible forecasts. For Metro ` s needs, a formulation derived from time series data showing the relationship of incremental change in location of housing and jobs to both transportation supply and an enhanced set of amenity or attractiveness variables will be necessary.

TASKS TO BE PERFORMED

There are three basic task groups to be completed:

A. Improve the current tools in use to make them more efficient in use for both this project's second task group, and for Metro's use in multiple long range scenario tests for the Region 2040 project.

B. To run a series if iteratively looped forecasting scenarios, together with ordinary sequential model applications with the same scenarios, in order to determine the impact of these refinements in application. While Metro carries out many long range forecasting projects, frequently Metro is asked to perform analyses of a short term nature. These analyses involve the travel forecasting process without a land use component. The research to be proposed will therefore include the travel demand models integrated with land use models and the travel demand models operating in a stand alone mode.

C. Document the application of the integrated models, together with the evaluation of stability issues, and the scale of change/infrastructure investment at which application of integrated models is appropriate. This documentation is to be aimed at a national audience.

A. Model Improvement

Task 1. Calibration Experiments

i) Add new variables to the input data sets for the estimation/calibration of DRAM and EMPAL, both change variables and situational or amenity variables.

ii) Re-calibrate and examine the results to determine the success of the experiments.

Task 2. Enhance the DRAM/EMPAL Forecast Procedure

i) If the experiments are successful, make revisions to DRAM/EMPAL to incorporate application with the extended variable set developed in Task 1.

ii) Develop a menu structure I-O interface for the operation of DRAM/EMPAL, using a spreadsheet as the tool. Could be adapted from an existing Metro-built interface or from an application elsewhere.

iii) Develop a mapping program link for display of input and results. (Arc-Info, Mapinfo, Atlas, etc.).

Task 3. EMME/2 I-O Interface

1) Improve the interface between the two models so as to be as transparent as possible.

B. Evaluation of Feedback Responsiveness, Sensitivity and Stability In The Model System

It is clear that given all the many unanswered questions regarding the solutions of linked transportation and land use model systems, it is impossible to solve the problem by a simple attempt to run all the possible interaction tests and thus completely determine what loops are the most critical in producing the most reliable forecasts of transportation and land use. Even a very limited agenda of tests would, using such a brute force approach, require hundreds of model test runs. What is more, many important questions would go unexamined, and potentially important interactions might not be examined at all.

In order to derive useful results from this proposed project, it will be necessary to follow a decision tree form of experimental design for the many numerical experiments which must be conducted. The complete form of the experimental design cannot be determined in advance. It will be necessary to do some initial numerical experiments (model runs) and then to determine the next ones to be done. This procedure will be followed throughout, with the questions which are answered, or not, determining which runs should be done next, all within the context of the overall study design.

Task 4. Literature Review and Linkage Specification

This will be a review of current and recent literature on the impact of feedback loops in the travel forecasting process. The review will identify results obtained from previous tests and methods of linking the model chain together. The review is not to be an exhaustive search but is to be sufficiently thorough that previous work is not duplicated. At the end of the review the contractor shall make recommendations for one or more methods of linking the models to address the consistency issue. The contractor shall also specify a series of initial computer runs to test the viability of the linkages.

As part of task 4, the contractor shall also identify criteria for evaluation of the process. These criteria shall include both criteria for convergence to a consistent solution and criteria for comparing one series of tests with another. Some

examples of criteria include VHT, VMT, PHT, PMT, Land Use, speed, analysis of selected links, and speed of convergence.

Task 5. Review of Model Tests Completed at Metro Prior to this Project

The work will begin with a summary of the various model runs which have been done by Metro using all or parts of the fully integrated system. These runs, done without the DRAM/EMPAL models or their integration with the EMME/2 package, can provide useful insight into the problems and successes which have been achieved up to the time of the commencement of this new project. In particular, there are issues of the zone and network geography used in modeling the Portland region to date. Some of the work has been done with the use of a 100 Zone aggregated network, while other work has been done with a more detailed 1189 Zone network. There were differences in the results obtained from these two different geographies which must be understood in order to be aware of their potential effects on the sensitivity/consistency tests to be done for this project. It may be necessary to run some tests of the integrated system both using the 100 Zone and the 1189 Zone geographies to determine if some sensitivity/consistency issues are more or less geography sensitive as well. Even so, our intent is to perform the majority of the tests using the 100 Zone geography.

Task 6. Initial Testing

The first set of model tests would involve two sets of simple, without integration, model runs from 1990 to 2040 in 5 year increments. These runs would provide the *baseline (Baseline a)* against which all subsequent runs would be compared. It should be noted that, for the purposes of these sensitivity/consistency test, the forecasts need not be extremely accurate. So long as the forecasts appear reasonable, they can provide a basis for comparison to the other model configuration runs.

Task 7. First Linked Inter-Model Tests

The second set of model tests would involve connecting the DRAM/EMPAL models to the EMME/2 package, with the inclusion of the appropriate convex combinations of link flows algorithm to assure convergence of the linked model set. This integrated package, solving for an inter-model equilibrium, would provide an *integrated model baseline (Baseline b)* for comparison with *Baseline a* as well as for comparison with other configurations of the integrated model set. The extent to which *Baseline a* differs from *Baseline b* will depend in part on the level of congestion on the Portland region's transportation networks. It is at this point that it may be necessary to go back and examine the geography issue, as it is possible that the degree of aggregation of the zone system, the load nodes, and the network links will confound or obscure the congestion effects. The results of the comparison of *Baseline a* and *b* will be determine which tests are to be done next.

Task 8. Steering Group Meeting

The results of Tasks 1 through 3 will be presented to a steering group composed of members from FHWA, ODOT, Metro and other invited parties. The contractor shall provide an initial report to the group of the results from tasks 6 and 7. The steering group shall comment on the progress to date and make recommendations for changes. the contractor shall incorporate these changes into the test plan. The steering group is meant to function in an oversight role and will eliminate the need for monthly progress reports.

Task 9. Perform Sub-Loop Tests

The third set of tests, contingent upon the above comparison results will involve examination of intermediate loops and intra-model equilibrium issues. While the initial comparison of *Baselines a* and

b will have given some indications of the potential sensitivity of long range forecasts to the consistency requirement, there are many more questions to be examined. First, there are questions of additional loops within the model sets, transportation, or land use. Within the transportation models, additional loops between any of the components, generation, distribution, mode split or assignment, must be considered. Some of these can be examined rather easily, taking a set of inputs from one of the Baselines, and simply doing a few model steps or iterations. Here, it could probably be assumed that significant changes, or the lack thereof, would also be present with these additional loops within a fully integrated model configuration. Similarly, in the land use models, loops within models or between EMPAL and DRAM could be investigated in a like manner. The precise number of these partial or internal tests cannot be determined until the project has begun and some of the above mentioned runs have been done and compared. Even so, this is an important phase of the work, one that will determine which inner loops seem likely to be of importance, and then take the steps necessary to incorporate them in the overall system.

Task 10. Equilibrium Efficiency Tests

A fourth set of tests will focus on the question of equilibrium solutions vs. equilibrium-oriented adjustment procedures. We are rather confident that after the completion of the above tests, we will be able to include all the modifications which are justified, and then run the full model system to an equilibrium solution. It remains to be examined as to whether this equilibrium solution is the best forecast. It is now generally accepted that urban transportation and land use systems rarely achieve an equilibrium state. This being the case, it is worth considering whether a model system which achieves an equilibrium solution is a proper forecast. A better set of forecasts will, quite possibly, be obtained by allowing the model system to adjust towards equilibrium, but to terminate the iterative process before an equilibrium is actually achieved. This opens up a number of additional questions, some of which are long term research issues that are not suitable for this particular project. It does, however, allow the investigation in this project of the possibility of using just a few model iterations, joined with a convex combinations algorithm to assist in convergence, prior to terminating the process and producing a forecast. If this were shown to be an effective approach, it would greatly simplify the modeling requirements for agencies attempting to meet the consistency requirements of the acts.

Task 11. Perform Tests

A series of attractive growth scenarios will be tested to determine the scale effects of high growth on the linked model system. This will include an evaluation of equilibrium and convergence properties within the model system, a description of the types of conditions under which the feedback loops have an impact and under which they don't, and a description of the level of magnitude of the impact of various conditions. It is anticipated that this task will consist of thirty to forty runs of the model system.

Task 12. Steering Group Meeting

A second meeting of the steering group will be held to review the results of task 7. The contractor shall provide the group an draft copy of a report describing the results. The group shall review the results and make recommendations for a final series of tests.

Task 13. Final Tests

A final series of tests, estimated to be between ten and twenty, shall be performed. It is anticipated that these tests will cover areas not fully addressed in the first series, or areas in which the first series left questions.

C. Documentation

Task 14. Preparation of Draft Report

A draft report shall be prepared covering the results of the entire project. The report shall be in two sections; a summary written in layman's terms which can be understood by those with a limited background in travel forecasting, and a technical appendix , oriented toward the practitioner, which covers a detailed description of results as well as a description of how any procedures identified can be implemented.

The draft report shall be reviewed by FHWA, ODOT, Metro and members of the Steering Group. Comments shall be provided to the contractor within 60 days and shall be incorporated into the final report.

Task 15. Final Report

The contractor shall provide a final report. Fifty copies will be provided as well as two camera ready copies suitable for reproduction.

OTHER

Metro, ODOT and FHWA intend to work closely with the contractor on this project. Even where not explicitly stated, reports will be required at the end of each task and approval by Metro will be required prior to starting each task. Progress reports will not be required, the task reports will serve instead. Innovative approaches to this request for proposal are highly encouraged. The outline of tasks is a suggested outline and offeror may deviate from it if a more appropriate approach can be identified.

CONTRACT COSTS, BUDGET AND DISBURSEMENT

1. The total cost of this contract shall not exceed $200,000.00 (two hundred thousand dollars).

2. The contractor shall specify pay rates, fringe and overhead and profit margin for each person working on this project, subject to negotiation with Metro and FHWA.

3. Personnel costs shall be documented by hours worked by person by task and billed by task.

4. The contractor shall be paid on a task by task basis upon satisfactory completion of that task.

5. The contractor should budget for up to 5 visits to Portland, travel, reasonable lodging and meal costs will be reimbursed at cost. Some of the project review meetings may take place in Washington DC or Philadelphia if this will reduce the total travel costs of participants.

6. The contractor should explicitly budget for off-site computer costs and telecommunication costs to run the Metro software on Metro computers from off-site when appropriate.

FHWALU3.DOC
April 4, 1993/bc/tkl

PLANNING COMMITTEE REPORT

CONSIDERATION OF RESOLUTION NO. 93-1798, FOR A SOLE SOURCE CONTRACT, NOT TO EXCEED $200,000, WITH S.H. PUTNAM ASSOCIATES OF PHILADELPHIA TO SIGNIFICANTLY ENHANCE THE DRAM/EMPAL LAND USE FORECASTING MODEL FOR USE IN THE PORTLAND METROPOLITAN AREA AND TO CARRY OUT AN INVESTIGATION OF MODEL RESPONSE AND STABILITY WHEN INTEGRATED WITH THE METRO TRANSPORTATION MODEL

Date: May 1, 1993 Presented by: Councilor Moore

Committee Recommendation: At the April 27 meeting, the Planning Committee voted unanimously to recommend Council adoption of Resolution No. 93-1798. Voting in favor: Councilors Van Bergen, Kvistad, Devlin, Gates, and Moore. Excused: Councilor Monroe.

Committee Issues/Discussion: Keith Lawton, Manager, Technical Services Division, presented the staff report. He explained that this resolution is for a sole-source contract with S.H. Putnam Associates, which is the originator of DRAM/EMPAL. There are some problems with the programs in terms of use specifications which currently render the programs useless for the Region 2040 project. Much of the code will need to be rewritten.

Also, the Federal Highway Administration is very interested in this model, in response to the new environmental requirements for air quality and transportation infrastructure investment. They are particularly interested in "when" this type of program needs to be used. More specifically - at what point is the change in land use large enough to require revisiting a land use allocation model? They are interested in the model for its national application.

For this purpose, the FHWA is providing all of the money allocated to this contract, plus some additional moneys to Metro for tests for the model stabilizers. The reason they are interested in doing this in Portland is because this region has a good transportation model that is already linked with DRAM/EMPAL. This makes the region possibly the best test site in the country.

The reason for a sole-source contract is that all of the software has been written by Putnam and Associates or by INRO Consultants. If a standard competitive bid contract were used, all bidders would eventually have to hire Putnam as a subcontractor. The scope of work, while detailed, still allows flexibility for Metro to guide the research.

The contract for this part of the project is "not to exceed $200,000". The total amount furnished by FHWA is $293,000; up to $10,000 to integrate the software; and $83,000 to Metro for computer costs and staff time. Approximately $30-40,000 of the work is work we need done to improve the model set. Also, we share

the FHWA's interest in when is the best time to use the software. This allows us a test without having to do the actual work. We then benefit from the results without further stretching our staff resources.

Councilor Moore, referencing the third paragraph of the staff report, asked whether the model can determine what, other than freeways, can alter land use drastically (e.g. changing a three lane to a five lane road). Lawton explained that a base-future forecasting uses the model to determine the effect of land use changes. This is where it is important to know "when" to do the modeling to determine whether the project is big enough to make an appreciable difference to the land use allocation. Projects must be of significant size though to register in the model.

Councilor Devlin asked whether the widening of Highway 99, west of Highway 217, would be an example for not using the model. The model would more likely be used for Western Bypass Study alternatives with a multitude of project. Mr. Lawton indicated yes.

Councilor Moore asked that the resolution title be amended to reflect the amount of the contract and the location of the contractor. The committee agreed to include within the title "not to exceed $200,000" and identify the location of the contractor as "Philadelphia".

BEFORE THE METRO CONTRACT REVIEW BOARD

FOR A SOLE SOURCE CONTRACT, NOT TO EXCEED $200,000, WITH S. H. PUTMAN ASSOCIATES OF PHILADELPHIA TO SIGNIFICANTLY ENHANCE THE DRAM/EMPAL LAND USE FORECASTING MODEL FOR USE IN THE PORTLAND METROPOLITAN AREA AND TO CARRY OUT AN INVESTIGATION OF MODEL RESPONSE AND STABILITY WHEN INTEGRATED WITH THE METRO TRANSPORTATION MODEL	RESOLUTION NO. 93-1798A Introduced by Rena Cusma, Executive Officer

WHEREAS, Metro needs an enhanced implementation of DRAM/EMPAL for policy evaluation of future growth options and the ability to analyze the indirect effects of transportation infrastructure on air quality; and

WHEREAS, The Federal Highway Administration (FHWA) desires to carry out an evaluation of the practical use of linked land use and travel forecasting models using current state-of-practice procedures; and

WHEREAS, Both Metro and FHWA need an analysis of the impact of the size of growth change and the size of infrastructure investment that is of sufficient magnitude to change the linked model output enough to change the environmental outputs; and

WHEREAS, Metro has, installed and accessible, current state-of-the-practice models and a database that is suitable for the desired evaluation; and

WHEREAS, The desired evaluation is an extension and expansion of work already started in the LUTRAQ (1000 Friends of Oregon) study funded in part by FHWA, EPA and Metro; and

WHEREAS, The analysis will require modification of

proprietary software (DRAM/EMPAL), the property of S.H. Putman Associates of Philadelphia; and

WHEREAS, The desired evaluation is a continuation of current research being pursued by S.H. Putman; now, therefore,

BE IT RESOLVED,

That the Metro Council authorize a sole source contract with S.H. Putman Associates of Philadelphia to carry out the tasks described in the staff report.

ADOPTED by the Metro Contract Review Board on the _____ day of April, 1993.

Judy Wyers, Presiding Officer

TKL:GR:lmk
93-1798A.RES
4-28-93