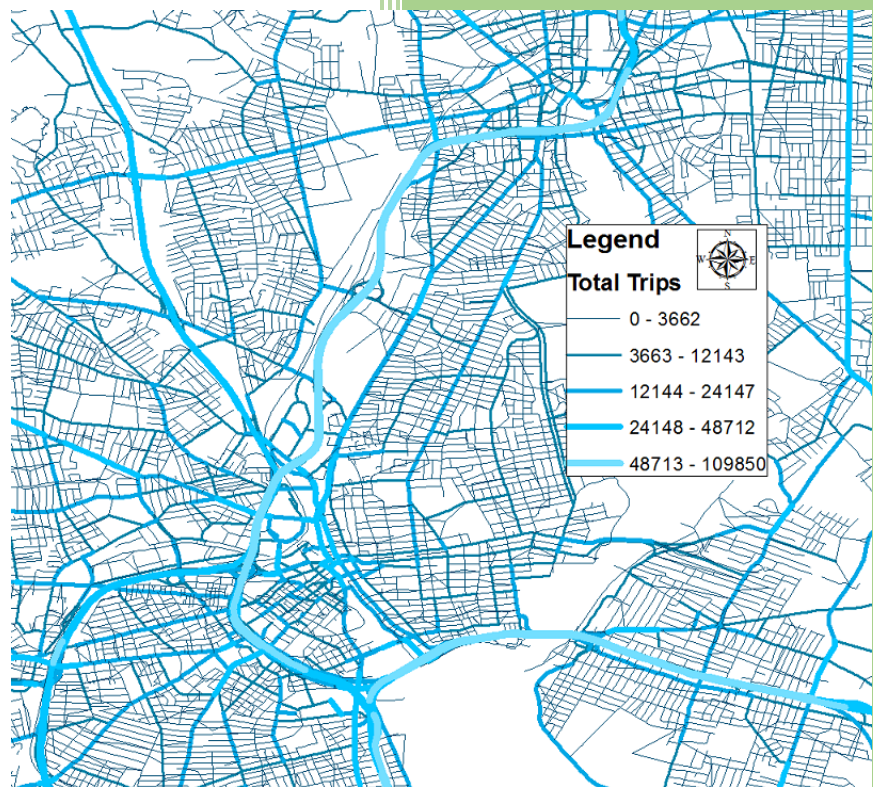


RISM Model Maintenance Plan: 2017-2027



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Executive Summary

The Rhode Island Statewide Model (RISM) has a long history and a great theoretical power to aid the transportation planning process, but has been undermined by data issues, usability issues, and a lack of institutional knowledge. These broad problems are linked and must be tackled holistically. This plan is intended to help build institutional knowledge and understanding within state government, and to provide direction for policy in the Division of Planning (The Division) by describing the model's current condition, pinpointing the needs the model is required to fill, and then describing a plan for moving from where the model is to where it needs to be. The primary audience of this plan is current and future RISM project managers, as well as the supervisors of, and stakeholders in, the RISM project.

As is described in the "Background" section of this plan, The RISM is a four step, gravimetric Travel Demand Model (TDM) that is based in the TransCAD GIS environment. The model has been in existence since 2003, though the State of Rhode Island has had some form of model since 1966. Though the State has made investments beyond the minimal requirement, changes have occurred in both the wider regulatory environment and in terms of the internal expectations of the model that mean that the model does not meet current needs. The technical aspects of this are discussed in the section "RISM: Current Status." As an additional complication, the producers of the data that feeds into the model, and many of its potential users, work for agencies other than The Division. As a result, maintaining and improving the RISM is an increasingly urgent need, and doing so requires the coordination of an inter-agency set of stakeholders.

Due to the current status of the model, there are three types of priorities that this plan must fulfill. As described in the "Priorities" section, the RISM needs to meet the needs articulated by its stakeholders, the accuracy demands required to emulate the state of best practice in the modeling industry, and the needs for communications and training held by the human capital assets of the state. After meeting with stakeholders, The Division formed these priorities into the contents of the "Goals" section. Each goal is described in this section with a set of actions, upgrades, deliverables, and program measures to guide the implementation of this goal over the plan period. These items can also be seen in the appendix of this document in a prioritized format.

The plan as laid out will be implemented using three key sets of tools. These are the Annual Updates, the Model Upgrades, and the Communications and Training Curriculum. The annual updates will see minor improvements be made to the model on a yearly basis, resulting in small upgrades in accuracy and usability. Equally important, these updates will see the creation of annual reports that will help The Division communicate to Stakeholders the kind of data which is included in the model and how it can be accessed. The model upgrades will be more substantial upgrades to the architecture of the model itself which will result in large improvements to the model's performance, but which will require additional funding to complete during the planning period. The communications and training curriculum has laid out a training program for substantially upgrading the human capital of the state, as it relates to the model, over the next few years. The curriculum includes the goal of having five core model users within the first year of the planning period, and with a systematic series of classes planned each year to help train the RISM's stakeholders and make the data it produces relevant for their work. By pursuing these steps, the RISM will be able to achieve its full potential as part of the transportation planning process within the next five to ten years.

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Background

The Division of Statewide Planning (The Division) recently rebid the contract for the maintenance and development of the Rhode Island Statewide Model (RISM), a Travel Demand Model (TDM) used to develop data for the transportation planning process in the state of Rhode Island. As a result of this process, a new consultant was chosen for the first time in fourteen years, namely AECOM. In addition to the time spent bidding the contract, the previous three years (2013-2016) had been absorbed in the incorporation of data from the 2010 Decennial Census and the implementation of some key upgrades. Despite these upgrades, input was received from several sister agencies who were unable to utilize the model in ways that they felt proper. Given the start of a new contract and the received input, The Division felt keenly the need to undertake a comprehensive review of the RISM and its role in the wider transportation planning context. This Model Maintenance Plan was the result of that effort, and is intended to guide work on and with the RISM during the current contract (2017-2021) and beyond. In particular, the plan seeks to outline the current state of the model, describe a reasonable set of expectations for the model, and identify strategies for moving the model from where it is now to where the State needs it to be.

The RISM in Context: History and Policy

The use of data to predict travel demand is as old as transportation planning, but it was only with the advent of computers that the vast quantities of data required could be systematically processed and analyzed. The very first TDM was created in Detroit as part of the Detroit Metropolitan Area Traffic Study, published in 1956. This model was a gravimetric four step model, which used an understanding of population and employment to model travel behaviors over a transportation network. This model is thus the ancestor of most models in use down to the present day, including the RISM.

The passage of the Clean Air Act of 1963, and its subsequent amendments in 1967, 1970, 1977, and 1990, encouraged the widespread adoption of TDMs by urban planning agencies across the country. Though TDMs have a very wide set of potential applications in the transportation planning process, the air quality models required for the satisfaction of Clean Air Act regulations are direct consumers of a major subset of TDM data. Though this data can be produced in a variety of ways, TDMs are generally felt to be the most cost effective and accurate source. This has, in effect, required regional planning agencies with air quality concerns to maintain TDMs in order to satisfy the needs of other, required planning process that occur “downstream.” The fact that the data produced by TDMs had valuable functions for non-mandated downstream applications undoubtedly made the creation of TDMs easier to explain.

For its part, Rhode Island has been engaged in travel demand modeling in some form since 1966, with the publication of “Technical Paper 5: Development and Testing of a Gravity Model for the Providence Metropolitan Area.” The model was expanded in the 1970s, and regularly updated until 1989. Sometime in the 1990s, modeling activities were moved onto a personal computer, but this process was not well documented, and changes in software design has meant that little evidence of this period of modeling in Rhode Island remains.

The development of the current form of the model was begun in 2003, utilizing the TransCAD software package in a well-documented effort. This appears to also be the first time a consultant was used for the development of a TDM in Rhode Island, in this case the civil engineering firm Vanasse Hangen Brustlin,

Inc. All evidence suggests that the previous model, if it still existed by 2003, was not a large factor in the development of this newer, more modern model. By 2006 this project was complete and the RISM as it exists today was substantially established. It was updated and expanded several times, with a new effort to add a bus mode undertaken and completed in 2006, and a much larger effort to incorporate decennial census data in the years 2013-2016. With the completion of this work in 2016, the State rebid the maintenance contract for the RISM in a competitive process that resulted (in 2017) in a five-year contract with a new consultant, AECOM, to aid in the maintenance of, and limited upgrades to, the current model.

Given this history, the RISM as it currently exists can be described as the product of three major factors. First, the model is built on a basic four step gravimetric architecture that has been in use since the 1950s. Second, the RISM was developed in a policy environment that required the use of modeling primarily to plan for air quality impacts. Third, the RISM is a product of the local resources and efforts put into it by the State of Rhode Island.

Four Step Model

Four step gravimetric models, generally referred to only as “four step models,” are the most popular kind of TDM in the United States. In brief, these models work by using demographic data, filtered through a number of sub-models, to determine the number of likely trips, where they are likely to go, and what mode they are likely to use. These trips are then forced through the existing transportation infrastructure using an algorithm based loosely on that used by Sir Isaac Newton’s Theory of Gravity to show the attraction of the traveler to the destination. Though other, newer, model architectures exist, the four-step model has several benefits that have helped it remain the most popular model type in the United States. First, though it may seem extremely technical to those unfamiliar with models, at a basic level the model and its component parts are conceptually simple for those who utilize them. Because of this simplicity, the requirements of these models for resources, in terms of human capital, data, and computing power, are relatively low. This means that someone with limited experience can set up a model with limited data on an average desktop computer, and the model will successfully provide an output. On the other hand, the four step models are extremely scalable. Depending on the desired uses of the model, very large quantities of data can be utilized, involving more and more sub models to get extremely granular and accurate outputs that will permit very powerful analyses. The adaptability of the four-step model was a direct result of the computing limitations of the first generations, but it has remained a winning formula for modern planning agencies. The combination of limited requirements for initial investments, with high end scalability, have ensured that the four-step models remained relevant.

Federal Policy

The unique benefits of four-step models have been particularly noteworthy considering the post-war federal policy environment. As discussed earlier, Federal Clean Air Act regulations have, in practice, made the use of TDMs nearly ubiquitous in urban areas. These regulations function by requiring transportation agencies to justify the air quality impacts of major transportation projects to receive funding through the federal highway program. These regulations do not generally provide much additional funding to cover the costs of the planning analysis tasks demanded. The agencies affected, the Metropolitan Planning Organizations, have become the key agencies used by the Federal Highway Administration to build transportation infrastructure, despite generally lacking powers of direct legislation and taxation.

An unintended consequence of this policy environment, from the point of view of transportation planning, is that TDMs are often deployed only to meet the requirements of the Clean Air Act. Though potentially powerful tools with vast potential to help MPOs properly utilize scarce resources, the kind of models required for developing data for an air quality model are less rigorous than those for other purposes. Though the four-step model structure is the same, a model intended to create air quality data only needs to produce data accurate on a regional level. As is often the case when discussing statistics, it is much easier to produce accurate results in larger geographies with larger sample sizes, and so a model with a regional focus can be built from much less data than that required for models built for other purposes. Unfortunately, such models have a limited application beyond the generation of gross regional statistics, and in some particularly unfortunate historical cases the data from such models was inappropriately used to justify bad decisions.

The Rhode Island Policy Environment

Rhode Island has been involved in the use of TDMs almost since the beginning, but as a small state and as an MPO with many duties, the resources devoted to the model have fluctuated over the years. While modeling was pursued energetically in the 60s, 70s, and 80s, investment in the model seems to have lagged in the 90s. Thus, the model created starting in 2003 was an entirely new model. As the model was being built from scratch, and given the goal of satisfying air quality requirements, the resulting model was not top of the line, but it served its purpose well, and was maintained with energy by those responsible for its creation. The State appreciated the more widespread potential of modeling, and regularly devoted resources to the gradual improvement and expansion of the model. During the 14-year life of the current RISM, efforts were made to add detail, update data, add the bus mode, and, most recently, the train mode. The resulting model is much more than the minimum required by the standards of air quality modeling, and has the potential to become something the State can be proud of.

At the same time, the regulatory requirements for the model, and the expectations that the State justly has for the model, have not stood still. Though the State has invested in model improvements, the ongoing shift of the EPA regulatory apparatus from the MOBILE air quality model to the MOVES air quality model has meant that the current version of the RISM can no longer provide the key inputs for air quality analysis without significant additional off-model statistical work. More broadly, the State is faced with the need to maintain and improve the current transportation system with resources that have lagged far behind needs. The RISM has the potential to help resolve some of this burden by helping policy makers prioritize and coordinate their investments, but only if the model achieves additional accuracy and resolution.

The RISM, then, is a comparatively old model which has great potential for rebirth. Based on tried and tested architecture, the current form of the model is 14 years old. Things are now being asked of the model for which it was not designed, but there is no reason that the current tried and tested architecture cannot meet these challenges if given the proper resources. If properly targeted, the resources applied to the model can start delivering new value quickly, and that value will grow with each new improvement. The goal of The Division is to have the model achieve a standard of basic usability within ten years.

Achieving this goal requires three things. First, a basic standard of usability must be established. It has been many years since a comprehensive review of the model has been conducted. While the State maintains an institutional understanding of the model's technical capabilities, the needs that the model

should theoretically be filling have not been determined. Finding those needs, and articulating them as goals and standards is thus the first step, and requires reaching out to the stakeholders of the model, many of whom have generously provided their time, encouragement, and data to the model over the last 14 years.

Second, an assessment must be made of what will be required to attain those goals. This will require intensive discussion with the current consultant, as well as reaching out to those with experience outside of the State. Work will need to be done to ensure that the resources required are reasonably within the capability of the State.

Third, a roadmap must be created for the maintenance and expansion of the model, prioritizing the changes needed, and ideally helping to find the resources necessary to undertake the effort. This roadmap will constitute the main deliverables of this model maintenance plan.

RISM: Current Status

This plan is not intended as either a primer on modeling nor a full technical description of the RISM. Those with interest in the latter should look to Technical Paper 166: RI Statewide Model Technical Update (2016). Nonetheless, some description of the technical features of the RISM is necessary to understand the current circumstances, and determine the path forward. It is also necessary to understand the human and contractual restraints under which the current model will be worked upon. This section will first describe the technical parameters of the model, and then discuss the current contract under which the RISM is being maintained and updated.

RISM Technical Parameters

As discussed previously, the RISM is a four-step gravimetric model created in the TransCAD GIS environment. This type of model uses a network of Transportation Analysis Zones (TAZs), a transportation network (consisting of roads, bus routes, and train routes), travel counts, demographic inputs, and demographic forecasts, to first statistically represent the current transportation system, and then forecast travel demand to future years. While a full list of input data is beyond the scope of this section, the current demographic inputs and future year demographic forecasts are key to the accuracy of a model. The demographic data in RISM is based on data from the US Census, the US Bureau of Labor Statistics, and the Rhode Island Department of Labor and Training. Staff of The Division ensured that this data was available at the Census Tract geographic level, and then used a spreadsheet based methodology to forecast the data to the years 2015, 2020, 2025, 2030, 2035, and 2040.

The travel forecasts represent travel in the State at the level of trips, which are one way movements from one location to another by generic individuals. The individuals are not tracked beyond each trip, though efforts are made to ensure that the number of trips into and out of an area roughly balance. These trips can originate at, and go to, home, work, or other. To be clear, “other” represents everything that is not an individual’s home or place of employment, including school, shopping, recreation, social calls, etc. “Other” trips make up the majority of travel in the United States.

The model is an annual average daily model. This means that the model represents travel on an average day in an average month. All morning and afternoon peaks, differences between weekends and week days, and seasonal variations are subsumed in this presentation.

The model contains three modes: Auto, Bus, and Train. Non-motorized trips are not represented in the RISM at the current time. Bus and Train modes represent trips made using the public transportation systems operated by RIPTA and RIDOT, respectively, and do not include private busses, shuttles, or Amtrak. The Auto mode represents all other travel in the State, and does not differentiate between single occupancy automobiles, shared rides, tractor trailers, taxis, private busses, or any other conceivable on-road travel method.

Calibration and Validation is the process by which the model's outputs are compared to real world observations to determine the model's accuracy. As such, the data used for calibration and validation, counts of travel on the current system, are the second most important type of data used in the modeling process. The current travel counts used in the model derive from several sources. RIPTA and RIDOT provided ridership counts with boarding and alighting at the route and station level. RIDOT also provides the count data used for the auto mode. The counts conducted as part of RIDOT's normal operations are used to create the data for the State's submission to the Highway Performance Management System (HPMS), which RIDOT maintains as a GIS layer. This layer is a primary level of calibration for the model. The HPMS data set utilizes outputs from the model in informing some of its own internal analysis. Also used in the past was data extracted from the INRIX GPS probe data set available to the State through the 95 Corridor Coalition. This calibration data is currently used in the model, though the State has lost access to this data set.

Current Contract

The scope of the current contract will frame much of what is done with the RISM during the short and medium term. The contract is fairly open ended, but purchasing rules may constrain actions during the life of the contract to only those activities already scoped during the bidding process. This section will not cover all aspects of the contract in detail, but the current scope of work will be included in the appendix materials. The appendix will also include the scope of the proposed, unfunded add-ons.

Due to some unique circumstances during the bidding process, the current contract is structured with base contract coverage and model upgrades that the State had the option to pay for a-la-carte upon the selection of the contractor. There were eight such upgrades in the Request For Proposals, and the State chose to fund two for budgetary reasons. Within current purchasing rules, the State has the option of amending the current contract at will to bring the un-funded upgrades into the contract, should funding become available.

It is unclear if current purchasing rules will allow entirely new upgrades to be brought into the contract without a new bidding process. Despite this uncertainty, the base contract contains a large amount of leeway for model improvements even without additional funding. Core to this aspect of the contract is the "Annual Update."

The annual update is a new innovation for RISM and the State. The contract stipulates that the State and the contractor engage in an effort once per year to input new data into the model. While the contract stipulates that the updates focus on a limited number of basic inputs, there is a wide leeway for improvement of the model under this effort. In particular, there is the opportunity to make changes to the model that will make such updates easier in future years, a requirement that the model be recalibrated after every update, and that the model base year be brought to as current a year as data will allow. Utilizing these opportunities, the State and the contractor have the ability within the current

contract to make small incremental improvements to the model structure, its background data, and the calibration accuracy of the model. The State's goal is to focus each year on a different input element, with the end goal of bringing the model base year up to 2015 and with the option of making significant upgrades to the demographic inputs by 2018. How accurate the model can be made will depend heavily on the availability of quality input and calibration data.

Changes to the way the model interacts with the stakeholders will be intimately tied to the annual update process. The contract stipulates that some form of documentation be created for each update. Though the technical requirements of the contract will be fulfilled by a simple memo appended to Technical Paper 166, the State plans to undertake the production of additional annual model reports. These reports will help communicate to stakeholders the current condition of the model and its potential value for their work.

Loosely tied to the annual update process is the training section of the contract. The contract budgets \$23,913.00 worth of contractor hours for the training of State staff, and additional funding may be available from other sources over the course of the five-year contract. This has long been a feature of contracts for the RISM, but has not always been consistently utilized. It is hoped that the formulation of a coherent curriculum for the training of staff and stakeholders will allow the State to best understand and use the model.

The current plan represents the most comprehensive review of the model and its goals that has been undertaken in many years. The fact that this review is taking place after the signing of the current contract may present difficulties, but these are not insurmountable, and the current contract permits great flexibility in the attainment of the State's modeling goals. In addition, upgrades that prove impractical during the five-year span of the current contract may be integrated into the subsequent contract, which will be put out for bid in late 2021. An update to this plan will be a key part of the preparation for that bidding process.

Setting Priorities

To efficiently upgrade the RISM it is necessary to set priorities. Having an explicit set of goals in mind allows the State to plan the upgrades and improvements necessary to move towards that goal while avoiding duplicated work and wasted effort. Setting these priorities requires an understanding of three sets of issues: the needs the model is seeking to fulfill for stakeholders, the technical requirements for the model to properly function, and the human capital needs of the state to fully utilize the model. Realistically the issues are not mutually exclusive, but the different areas of focus will establish different priorities. The stakeholder needs will tend to focus on producing outputs suited to current institutional priorities, something which is vital to ensuring that the RISM produces value for the State. Technical priorities will tend to focus on the accuracy and coherence of the model itself, without which none of the products desired will be reliable.

Stakeholders and Needs

Any effort to comprehensively plan the development of a tool like the RISM must take account of the needs of the tool's various stakeholders. For the RISM there are four ways a stakeholder might interact with the model: "Core Users" who directly interact with the model, "Primary Consumers" who have an extant or potential need for model data, "Data Suppliers" who help feed inputs to the model, and then

everyone else who in some way interact with the transportation planning process in the State of Rhode Island. While this may seem an overly broad conception of the potential stakeholders in such a technical project, and while it is recognized that many of these groups overlap extensively, previous experience has shown that relying only on the input of those who currently have the technical knowledge to appreciate the RISM leads to dissatisfaction with, and underutilization of, the model.

While drawing in representatives of the full scope of stakeholders would have been unwieldy, gathering a diversity of input from those in the State government with an interest in transportation planning was felt to be vital to efforts to truly understand the modeling needs of the State. As a result, The Division of Planning held a meeting on May 25, 2017, with representatives from The Division, the Rhode Island Department of Transportation (RIDOT), the Rhode Island Department of Environmental Management (RIDEM), the Rhode Island Department of Health (RIDOH), and the Rhode Island Public Transit Authority (RIPTA). Also present was the project manager from AECOM, the current consultant for the maintenance of the model, and a representative of the Southeast Regional Planning & Economic Development District (SRPEDD), a Metropolitan Planning Organization in Massachusetts which borders Rhode Island. Representatives from Commerce RI, the state economic development agency, were unable to attend, but provided input in at a meeting of the Transportation Advisory Committee (TAC) later that night. Dr. Judith Drew, the TAC representative Governor's Commission on Disabilities, also gave input in that forum.

The stakeholder agencies are a very diverse group, but there is a shared conviction that a data-driven approach to transportation planning will result in more positive outcomes for the residents of Rhode Island. The stakeholders were asked what their current and future transportation related projects are, and how data from the model could help. The Stakeholders were asked for input on contents and presentation of the planned annual reports, and on the planned training program. While the areas of interest were as diverse as the group itself, the data needs for the model can be summarized in a few broad areas:

- **Transit:** RIPTA and RIDOT are very interested in using the model to help in their planning processes for bus and rail, respectively. Both agencies need data for route planning, station location planning, the identification of potential customers, and transit demand forecasts. There is concern that the accuracy improvements needed by the model to allow this kind of data usage will take too long to be of use in the projects that the agencies are expecting in the short and medium term. Closer coordination with The Division at the project creation stage may help alleviate this problem in future projects. In the long term the implementation of a traffic simulation model may help with the specific needs articulated by these agencies.
- **Air Quality:** RIDEM will be a user of data produced by RISM. The model currently does not divide non-transit motorized travel into different vehicle types. Such a subdivision is required to generate appropriate inputs for the MOVES air quality modeling tool mandated by federal regulations. Also concerned about the air quality potential of the RISM is RIPTA, which has made commitments to help the State reduce greenhouse gasses by 10%. These efforts are likely to feed analyses of air quality hotspots, which may be of interest to RIDOH in their work on environmental justice.
- **Public Health:** RIDOH works closely with local neighborhood groups and advocates on environmental justice issues. Beyond the impact of air quality, RIDOH is very interested in encouraging non-motorized transportation, which has been tied to declines in chronic illnesses.

Data that would help identify infrastructure gaps for non-motorized transportation is of high interest. Similarly, any data that would help identify concentrations of non-motorized transportation usage, or ways to encourage such usage, would be of value. RIPTA is also very interested in using the model to identify vulnerable system users who may be expected to rely on public transportation, and gauge what programs or system changes might help meet their needs.

- **Economic Development:** Transportation has a direct impact on economic development, though RISM is not itself an economic development model. The travel times of customers, employees, and freight are of interest to businesses hoping to locate in Rhode Island. The lack of any kind of freight model in the current version of RISM is a concern for Commerce RI. There is also concern that the modeled travel times are not reliable enough to help with business location decisions. Dr. Drew suggested that the inclusion of disabled populations in the model could help target transportation assistance to those communities, and thus contribute to the economic development of rural communities.
- **Data Sharing:** There was widespread interest in data sharing, both in terms of the use of model output data and in the provision of input data to aid model accuracy. RIDOT has been and will continue to be a major contributor of input data, and is the primary user of direct and downstream model output data. RIDOT expressed interest in finding ways to acquire data for the model more cheaply. RIPTA is also willing and able to help increase the quality of transit related data inputs. RIDOH suggested that their Health Equity Zones could contribute useful data, if not to the model itself then to the immediate analysis of the outputs. SRPEDD, the neighboring MPO most energetic in their cooperation with Rhode Island's transportation planning efforts, represents an important peer and external stakeholder. Beyond the minimum, federally required exchanges of data, SRPEDD has been generous in their willingness to share expertise and experience, something Rhode Island has been only too happy to reciprocate. As SRPEDD is in the process of an update to their TDM, as well as a related Land Use Model, the value of this relationship will only grow over the course of the plan years. This cross-border cooperation is likely to be increasingly important as the State of Massachusetts continues their planned expansions of rail service into Fall River and beyond.
- **Planning Efforts:** The Division, RIPTA, and RIDOT are involved in several planning efforts which could benefit from the use of the RISM. The major projects currently underway are the Long Range Transportation Plan, the Bicycle Master Plan, the Transit Master Plan, the Transportation Improvement Plan, the Coordinated Human Services Transportation Plan. In all these cases, it would be desirable to use the RISM to identify gaps in the current transportation system, find concentrations of potential users, and scenario test policies. The Division is also going to be updating the State Comprehensive Outdoor Recreation Plan, and there is interest in using the RISM to conduct a gap analysis of transportation to recreational facilities.

In addition to the above broad areas of concern, advice was offered on the annual reports and the planned training program. In general, it was suggested that the reports focus on graphics and narrative over data tables. The narrative should focus on success stories and data interpretation. The use of ESRI story maps to help in this process was suggested. For the training program, it was suggested that a one size fits all curriculum might not be the best fit for all agencies. While some overarching training might

be beneficial, meetings with smaller groups from agencies working on related projects might produce better value for stakeholders.

Two related stakeholders were not present at either the stakeholder meeting or the TAC meeting, but deserve mention in this plan. Municipal governments and members of the general public are vital to the transportation planning process, the former as vital partners, the latter as the ultimate customers of any planning effort. The Cities and Towns of Rhode Island are government entities most responsible for the planning, maintenance, and construction of the vast majority of the transportation assets in the State. Despite this major responsibility, these agencies are often less well supplied with planning resources than state agencies. It is the long-standing policy of The Division to help, whenever possible, our partners in the cities and towns of Rhode Island in their planning efforts by sharing expertise and data. While the RISM represents a technical product far beyond the capacities of most municipal agencies, the data it produces will be of vital interest to municipal planners. Finding ways to make this data available must be a key goal of this plan, and in the out years of the current contract it would be beneficial to begin involving municipal planners more directly in the model.

Members of the public will, for the most part, lack the ability or the interest to make use of most capabilities of the RISM. That said, their safety, prosperity, and happiness is and must be the only logical goal of transportation planning. Efforts must be made as part of this plan to be as transparent as possible about what the RISM is, how it is used, and how it benefits the public. While the provision of technical information is more likely to confuse than enlighten, efforts must be made to ensure the public can have confidence in how the data that underpins the State's transportation planning efforts is created. Meeting stakeholders suggested that communications to the public relating to the model should focus on telling stories that show how the model benefits the planning process. In particular, the use of ESRI story maps was suggested to aid this communication.

Technical Priority Areas

While a renewed focus on stakeholders is vital for the future of the RISM, it is important to ensure that the model achieves the professional standards of accuracy necessary to deliver trustworthy outputs. These priority areas may not produce outputs with direct relevance to the work being done by the various state agencies, but without them investment in other priorities would be wasted. Conceptually there are four broad technical priority areas of concern for the future of the RISM: "Input Data Maintenance," "Model Architectural Upgrades," "Calibration Data Maintenance," and the model's "Data Ecosystem."

- **Input Data Maintenance:** As with all models, the RISM is only as good as the data used as inputs. The truism "garbage in, garbage out" is a succinct summary of this issue. The recent funding environment has sometimes made it hard to prioritize the acquisition of quality data, but great strides have been made in the State recently to reorganize and refocus on this issue, given the vital role such data plays in planning efforts and the key role reporting plays in securing federal funding. RIDOT's ongoing focus on an asset management system warehoused in a GIS environment has made a wealth of data available for the RISM, and efforts to bring this data into the model are obvious low hanging fruit for the maintenance of the model.

While this data is important, land use forecasts represent the most vital single piece of input data in a model. Land use forecasts have a potentially confusing name. From the point of view of

a travel demand model, the key data here are the demographics of the population, where they live, and what kind of work they do. Currently this data is presented in terms of Population, Households, Retail Jobs, and Non-Retail Jobs. This data is derived from census geography, in-house population forecasting, and spreadsheet based work to bring larger populations into smaller geographies. The forecasting done, while acceptable under current professional standards, has room for improvement, and will likely require greater rigor as more demographic details are added in model upgrades. The use of a Land Use Model in conjunction with a Travel Demand Model is rapidly becoming the industry standard, due to the influence that travel demand has on real estate development, and vice versa. Work in this area has been undertaken by the Division's colleagues at SRPEDD, and so there is likely to be a great advantage in learning from their experience.

- **Model Architectural Upgrades:** Though the current RISM architecture is acceptable, there is room for improvement in two areas: model usability and model granularity. Model usability relates to the interface between the model itself and the primary users who interact with it regularly. For obvious reasons, having a model that is difficult to use, even for the small number of people who actually use it, makes the maintenance and use of the model more difficult. In particular, the difficulty of inputting data to, and exporting it from, the model, makes it more expensive and time consuming to make sure the data that forms the basis of the model is up to date, understand how the model functions, and then produce accurate results for the end users of that data. The model environment presents difficulties here. TransCAD, while a top of the line modeling platform, is natively more focused on computational potential than on user friendliness, and does not seamlessly integrate with the rest of the State's data ecosystem. That said, TransCAD comes built with the potential to use computational scripts to expand user friendliness in the proprietary models of each planning agency. Utilizing this potential to ease the usability concerns of the RISM will result in clear benefits.

The RISM, despite its complexity, is currently a fairly simple model. By way of comparison, the RISM contains three modes, while the model for the Boston MPO contains six main modes, each of which contains a handful of sub-modes. While this level of complexity is neither supportable nor needed in Rhode Island, it must be recognized that the integration of additional variables with the model will improve model accuracy by better representing travel behavior. Many of the efforts to add granularity will directly benefit specific stakeholders. As an example, the effort to add route assignment to the transit mode will have accuracy benefits for all users, but is obviously a key concern for the transit operations agencies RIPTA and RIDOT. Other improvements, however, have more abstract benefits. For example, adding a time of day model will make the entire model more accurate, by subdividing travel into peak and off-peak periods. This is now an industry standard feature for most models, but will not produce benefits specific to any stakeholder. Unfortunately, some of these upgrades, despite a lack of a clear stakeholder, are expensive. For example, the creation of a comprehensive statewide travel survey would help the model at many levels, but would more than double the five year budget of the model.

- **Calibration Data Maintenance and Accuracy Standards:** The second most important piece of data for the model is the data used for validation and calibration. Validation and calibration is

the process whereby the model is first checked against real world observations, and is then tweaked to bring it more in line with those observations. While a seemingly straightforward idea, such a process requires data that is at least as good as the input data. The data required is primarily count data, or real world observations of travel in each mode on as much of the network as possible. Also important is origin and destination data (also known as “OD Pairs”), which shows where people travel from and to. If this data is not gathered systematically or is inaccurate it can create problems. If the data is inconsistent, it may prove impossible to close the gap between the modeled outputs and the observations. If the data is inaccurate, the model may appear to be very accurate, but will in fact be a faithful depiction of a fiction. Rigorous quality control measures are needed to reveal when these issues are present to prevent the inappropriate use of model data.

Once quality data is secured, there are many ways to measure accuracy in a model. Historically, model results were calibrated for the model as a whole and the R^2 test¹ was not always utilized for the analysis of model results. Increasingly the use of the R^2 test is considered to be standard, and it is ideally used to examine many disaggregate features of the model. It should be noted, however, that the standards of statistical accuracy required for models are generally much lower than the general public is accustomed to. While scientific and medical journals consistently demand R^2 results with 95% accuracy or greater in published studies, such levels of rigor are simply unobtainable in the study of the complex systems studied in the social sciences, and are likely unnecessary given the way the data is used. The industry standard for R^2 accuracy on a model roadway is generally 70%, and so this should be taken as the threshold goal of minimal accuracy for the State’s modeling efforts. Currently this threshold is only being met for the state interstate and freeway systems. It is important that ways be found to communicate the level of accuracy being achieved by the model to the data end-users, and that efforts be made to give stakeholders the tools to understand such measures. While one would ideally not provide results with unsatisfactory accuracy levels, sometimes such results can be included in larger data sets which are overall up to the set standards. This data is ultimately a planning tool, and is not intended for an analysis of operations.

- Data Ecosystem: Like many large organizations, the State is often inconsistent in the quality of the data that is developed and how well it is shared amongst sister agencies. While not in any way an intentional process, the result can create problems downstream as agencies attempt to use available data for analysis. While fully centralizing all State data sets is highly impractical, efforts to ensure data awareness and consistent collection across agencies is key to the proper execution of all State functions, including the maintenance of RISM. Building awareness of how other agencies are using data products can help avoid unintentionally undermining the efforts of our colleagues. The creation of some systemization of the State’s data ecosystem is therefore desirable on many levels. For the RISM, the maintenance and expansion of several priority inputs is required for the model’s continued existence, as has been discussed in previous sections. Almost equally relevant, it is vital to make model outputs available for potential users, something that will require cataloguing, indexing, processing, and publishing data relevant to

¹ The R^2 test is a measure of how closely one data set matches another data set. In this case, it would describe how well the model outputs match the observed data of the traffic counts and the OD Pairs. While extremely useful, the R^2 test is not a definitive proof of accuracy to the real world, only accuracy to the calibration data.

the model. Some avenues exist for this effort already, such as RIGIS and the state enterprise server, while other ongoing initiatives, like the previously mentioned GIS based asset management system at RIDOT, offer great promise for sharing data, at least within the transportation planning community.

Communications and Training

There are two needs that a training program can help resolve. The first is the building up of human capital in terms of the abilities of staff members to directly use and/or understand the model and its outputs. This is the kind of activity most often implied by the term “Training.” An ancillary benefit to this kind of activity, however, might be termed “Communications,” and involves the building of awareness and enthusiasm for the model amongst stakeholders.

While training and communications are often separate concerns, in the case of the RISM they are intimately related. While it is always true that a potential stakeholder needs to understand something in order to utilize it fully, the very technical nature of travel demand modeling means that the difference between a training session and a thorough marketing presentation will blur. This is not to say that all stakeholders for the model require dozens of hours of expensive training in order to get value from the model; there are still variations in user interaction with the model that will imply differing levels of rigor in training. Rather, because of these different training needs, it is extremely important for proper promotion of the model to the stakeholders that a systemic process be used to identify those who would benefit from training and match them with the appropriate training regimen.

Current Assets

Training has long been an aspect of contracts for the maintenance of the RISM for the obvious reason that if one is paying to build a piece of proprietary software, one would want to have someone who knows how to use it. Nonetheless, the application of these funds as part of a larger effort to build the human capital of the State has not been systematic. Instead, classes and tutoring sessions were conducted as needed by circumstances, or were used as part of sporadic efforts by the State to promote the model internally.

As a result, the current level of development of the human capital of the State is fairly limited. There is a wide stakeholder group that is aware of the model but which, for the most part, lacks information about what the model is currently capable of or how it works. This group does contain a number of individuals with the data background and technical aptitude to engage in more thorough training should it be available.

Within The Division, there is one staff member with the experience and training to directly manage the model contract, but who does currently require the aid of a consultant for many tasks. In the event that this staff member became unavailable, there is one other staff member with a background in modeling, who at one time served as the model contract manager. This individual has, however, not worked with the model in at least four years, and as such would require significant consultant assistance to be brought up to speed. Another staff member at The Division has undergone some training in travel demand modeling, but has never worked with the RISM.

The current five-year contract contains a budget of \$23,913.00 for all training expenses over that period. It should be noted, however, that this budget only applies to training organized and led by AECOM. The Division and the RISM stakeholder agencies have a separate training budget that may be applied to trainings conducted by other actors. It is unclear how much of this kind of funding will be available.

The RISM operates in a computer environment called TransCAD, which is developed and licensed by the Caliper Corporation. The State currently pays for one license, which can only be installed and used on one computer at a time. This technical situation presents a barrier to any attempt to expand the number of core users in the State, because users will never

TransCAD License Schedule	Stand Alone	Networked
One Standard License	\$12,000.00	+ \$6,000.00
Second Standard License	+ \$9,000.00	+ \$4,500.00
Third Standard License	+ \$9,000.00	+ \$4,500.00
Fourth Standard License	+ \$9,000.00	+ \$4,500.00
Fifth Standard License	+ \$9,000.00	+ \$4,500.00

Table 1: This table shows the cost structure of TransCAD licensing. The state currently maintains one standalone license. The listed prices are charged each year. Costs are cumulative, and are totaled in Table 2.

become fully competent in the use of the RISM without the ability to work with it in a hands-on manner, and such work in the current situation would require the current model manager to surrender his computer for multiple hours. Resolving this technical issue has been stymied by the high cost of

License Costs to State	Stand Alone	Networked
One Standard License	\$12,000.00	\$18,000.00
Second Standard License	\$21,000.00	\$31,500.00
Third Standard License	\$30,000.00	\$45,000.00
Fourth Standard License	\$39,000.00	\$58,500.00
Fifth Standard License	\$48,000.00	\$72,000.00

Table 2: As shown in Table 1, license costs are cumulative, with a 50% charge for networked licenses. Bulk rates apply for additional licenses.

licensing. A second license would cost the State \$9,000.00. Moving the current license to a networked infrastructure, which would allow the license to be used on multiple computers, would cost \$6,000.00. On a more positive note, the training materials that come with the TransCAD software package are more than

sufficient to allow a user with aptitude in GIS to be trained without outside assistance, and Caliper has offered to provide free short term licenses for training purposes.

User Groups

Given the highly technical nature of the RISM, the many hours of training that this implies, the expense of licensing, and the large number of stakeholders, it is not advisable that all stakeholders have direct hands on training with the model. Instead this section seeks to outline the potential user groups, describe the level of training that they require, and describe the level of training sufficiency desirable in each group for the State.

- **Core Users:** This group consists of the model contract manager and anyone else who is felt to need a level of technical expertise which would allow direct hands on use of the model. In the experience of the current RISM management staff, three criteria must be met to allow a person to function as a core user. The individual must first have an aptitude, interest, and background in data analysis, ideally with a focus on Geographic Information Systems (GIS). Second, the individual must be given a basic training in TransCAD, the GIS environment in which the RISM operates. Finally, the individual must be trained and familiarized with the RISM itself.

The current work load for core users interacting with the RISM can be met by one well trained State staff member, namely the RISM project manager. This position receives all model data requests, and determines whether additional assistance from the consultant, AECOM, is required. On average, there is one data request per month. Most data requests are minor and can be resolved in-house. Around one request per quarter requires a more substantial amount of work, and these requests require input from the consultant about half of the time. The ideal would be for all data requests to be handled in-house, with the consultant only needed for technical support and answering minor questions. The base rate of pay for the consultant is much higher than that of Division staff, and their time is better spent on upgrading the model, for which they have skills beyond the need of in-house staff. In-house staff also oversee the upgrading process, but mostly function to gather data, deliver it to the consultant, and make clear the needs of the State for the model. To summarize, there is currently a workload for the RISM such that one employee can meet current needs. That employee handles the majority of minor data requests, and about half of the more extensive data requests, without using the consultant. The employee also oversees the consultant's primary work, which is upgrading the model.

There are four reasons to not be fully satisfied with the current level of human capital investment in the RISM. First, there is a lack of redundancy. There is currently only one person who is fully ready to handle data requests, which would leave the State extremely dependent on the consultant if that person were unavailable for an extended period. The second issue is one of potential future growth in the model. As the model is improved, it will become more valuable to the stakeholders. More data requests may be made, and the State may need a second staff member to handle the work. Third, doing more work in-house will save the State a large amount of money. Building an in-house staff that can do more of the advanced model work themselves will make the State less dependent on outside assistance, meaning more resources will be available for improving the RISM. Fourth and finally, The Division is currently the only agency with the ability to work with the RISM. While it is desirable that The Division remain the focus of model development, due to their experience and long range planning responsibilities, building competence within the stakeholder agencies can only improve the relevance of the RISM for those stakeholders.

For these reasons, it would be desirable in the long term to have a core user group of around five individuals. Two or three individuals at The Division would give the agency the ability to manage and expand the model resiliently and with an efficiency of resources. Having one staff member each at RIDOT and RIPTA with modeling capabilities would help ensure the long term relevance of the model and aid those agencies in understanding and utilizing the RISM.

- **Primary Consumers:** The primary consumer user group will primarily be users of data outputs of the model, which will in turn be used for both direct analysis work and for modeling efforts further down the data food chain. This group will also contain those who supply data to the model. Though not having a need for hands on use of the model, it is important for this group to understand how model data is produced, how it can best be used, and what data is available. The members of this group will likely need an aptitude for data analysis and GIS, and a basic

training in the theory of travel demand modeling. Materials documenting the available data sets in the RISM, and their level of accuracy, should be made available to this group as a part of any training that they receive.

Between The Division and the other stakeholder agencies, there are twenty to thirty individuals who currently utilize direct model outputs, who would potentially benefit from doing so, or who supply input data to the model. This group would benefit the most from training, and the costs of giving this training are fairly low. As a result, this group will be the main focus of the training curriculum outlined in this plan. The conception of this group as described in this plan is focused on staff members of the State, but it should be understood that, if resources are available, municipal planners would also benefit from this training.

- **Secondary Consumers:** These users will not generally be required to do primary analysis of data either from or for the RISM, but they will make use of analysis done by the other user groups. This group will likely lack aptitude with GIS, but will be interested in making use of the value provided by the model in their planning efforts. These users should be given a basic understanding of how modeling works and should be made aware of whom in the State they can come to for data analysis services.

This user group theoretically contains all other individuals who are part of the transportation planning process in the State of Rhode Island. Some members of this group will benefit from involvement in agency and project specific trainings. The conception of this group as described in this plan is focused on staff members of the State, but it should be understood that, if resources are available, municipal planners would also benefit from this training.

- **Members of the public:** Members of the public will not be involved with the production or analysis of RISM data, but are the key customers of the transportation planning process. For reasons of public trust and transparency it is important to make some information available to the public which explains the model, how it works, and its importance in the planning process.

Types of Training

Caliper Hosted Basic TransCAD Training

Cost: \$1,500.00 Per Person for a three-day training program, travel to Newton, MA, Staff time.

Funding Source: Agency Training Budget

Rigor: Medium

Appropriate User Groups: Core Users

Caliper technicians will go through the travel demand model creation process with the users in the Caliper headquarters. Users will be given a generic understanding of how TransCAD works, how TDMs are put together, some of the potential applications of TransCAD, and will get some personal attention from Caliper Technicians.

Due to the expense and the limited number of core users, only one or two trainings at this level are required during the five-year life of the current contract. This training session has been proven to be

effective by staff of The Division, but it is not sufficient for fully training a core user. Moreover, the training sessions are comparatively expensive, and the costs must come out of the general training budget of The Division rather than coming from the contract training budget. Finally, it is worth noting that the curriculum of these sessions is entirely contained in the tutorials included in the TransCAD manual, which is included for free with each copy of TransCAD. If funding is available, this kind of training can be useful, but is probably not necessary to the achievement of the goals outlined in this plan.

AECOM Hosted Basic TransCAD Training

Cost: \$1,478.00 per day, Staff time.

Funding Source: Agency Training Budget

Rigor: Medium

Appropriate User Groups: Core Users

AECOM project lead will go through the travel demand model creation process with the users via webinar. Users will be given a generic understanding of how TransCAD works, how TDMs are put together, some of the potential applications of TransCAD, and will get personal attention from AECOM project lead.

Due to the expense and the limited number of core users, only one or two trainings at this level are required during the five-year life of the current contract. This session will be created in imitation of the Caliper version, but will be cheaper and more flexible for state employees. In addition to being cheaper in absolute terms, this training session can be paid for from the contract training budget, making it much easier to fund from an institutional perspective. It is unknown at this time how effective this session will be, but it is possible that this will present a useful alternative to the Caliper hosted session in future years. Despite these advantages, this is not the cheapest TransCAD training option available.

In-House Basic TransCAD Training

Cost: Staff time.

Funding Source: Free

Rigor: Medium

Appropriate User Groups: Core Users

Agency staff, in consultation with AECOM and Caliper, will use their experience, available educational materials, and the tutorial materials included in with TransCAD, to organize a three-day training program for their colleagues. This training will primarily consist of assigned reading, and the use of the step-by-step tutorial materials included in every copy of TransCAD. Users will get a theoretical understanding of how travel demand modeling is conducted, a generic understanding of how TransCAD works, how TDMs are put together in TransCAD, and some of the potential applications of TransCAD. More experienced staff colleagues and AECOM consultants will be available to answer questions if needed, but the course will mostly be self-taught.

Due to the limited number of core users, only one or two trainings at this level are required during the five-year life of the current contract. This self-led basic training is effectively free. The other options may provide benefits due to the availability of instructors, but anecdotally this may not be as important to this training level as it is to others. Core users will not get advantages out of any kind of basic training without the more advanced classes, and so it is considered preferable, at least as an experiment, to save the resources of The Division for the more advanced training level.

Caliper Hosted Custom Training

Cost: \$1,600.00 Per Day, travel to Newton, MA, staff time.

Funding Source: Agency training budget

Rigor: High

Appropriate User Groups: Core users

A highly rigorous and effective training session, Caliper will go through the RISM with the users in the Caliper headquarters. Skilled Caliper technicians will help the user understand how the model is put together, the data that goes into it, answer questions, and provide personal attention. Caliper technicians will help the user understand the strengths and weaknesses of the model by comparing it with other, similar models. Staff will help the user experiment with the TransCAD environment to better understand the model's possibilities. Basic TransCAD training is a prerequisite.

Due to the expense and the limited number of core users, only one or two trainings at this level are required during the five-year life of the current contract. This training session has been proven to be extremely useful by staff of The Division, but it is also very expensive. Compounding the cost, the money for this training session would need to come from the general training fund of The Division, rather than the current RISM contract. If funding is available, this kind of training is highly recommended, but is probably not necessary to the achievement of the goals outlined in this plan.

AECOM Hosted Custom Training

Cost: \$316.00 base price plus \$1,478.00 per day, staff time.

Funding Source: Contract training budget

Rigor: High

Appropriate User Groups: Core users and potential core users

A highly rigorous training session, AECOM project leaders will go through the RISM with the users at the offices of The Division, using TransCAD training licenses provided by Caliper. Users will benefit from the years of experience held by the AECOM project manager, who will help the user understand how the model is put together, the data that goes into it, answer questions, and provide personal attention. The AECOM project lead will help the user understand the strengths and weaknesses of the model, and help the user experiment with the TransCAD environment to better understand the model's possibilities. Current core users will be trained in a hands-on manner, but because the training session is a flat rate, other interested parties may audit relevant portions of the training. Basic TransCAD training is a prerequisite for core user pupils.

Due to the expense and the limited number of core users, only one or two trainings at this level are required during the five-year life of the current contract. This session will be created in imitation of the Caliper version, but will be cheaper and more flexible for state employees. In addition to being cheaper in absolute terms, this training session can be paid for from the contract training budget, making it much easier to fund from an institutional perspective. It is unknown at this time how effective this session will be, but it is hoped that this will present a useful alternative to the Caliper hosted session in future years. This training session is the preferred option for the core user advanced training.

Primary Consumer Training in RISM

Cost: \$185.00 per hour, Staff time.

Funding Source: Contract Training Budget

Rigor: Medium

Appropriate User Groups: Primary consumers

A short hybrid webinar class hosted by AECOM project lead and the project manager from The Division. This class is intended to give primary consumers a basic understanding of the current capabilities of the RISM. Topics covered will include the basic theory of travel demand modeling as represented in RISM, the key input and output data sets, how they can be used by the primary consumers, and a generic coverage of the current capabilities of TransCAD and RISM.

This level of training will be one of the main tools for the training of the primary consumer user group. One such training session should be held in each fiscal year after the completion of the annual update, as some of the key training materials will come from the annual update. After the first two years it may be beneficial to begin inviting municipal planners. Agency specific training should only occur after the basic training session, due to the increased theoretical emphasis of the basic training. It is desirable that the classes gathered for the agency specific trainings include a scattering of individuals with this theoretical knowledge to help staff translate the theoretical basis of the model into potential sources of value for their agency. These sessions will be paid for by the model contract training budget, and is considered vital for the future success of the state's transportation planning efforts. Variations to the basic curriculum and format will be likely with experience, and this could affect the costs over time.

Agency Specific Training in RISM

Cost: \$185.00 per hour, Staff time.

Funding Source: Contract Training Budget

Rigor: Medium

Appropriate User Groups: Primary Consumers, Other Users

A hybrid webinar class hosted by AECOM project lead and the project manager from The Division. Class is intended to give primary consumers a basic understanding of the current capabilities of the RISM and how it can help them on their projects. Primary Consumer Basic Training in RISM is a prerequisite for Primary Consumers in the class, but those without a data background will not need this advanced theoretical background. The class will very briefly explain travel demand modeling theory, before

moving on to a more in depth discussion of the RISM’s current capabilities, key input and output data sets, and how they can be used by the stakeholder agency in their work.

This level of training will be one the most common session type in the curriculum. One such training session should be held in each fiscal year for each main stakeholder group, depending on level of interest and the creation of new projects. Agency specific training should only occur after the basic training session, due to the increased theoretical emphasis of the basic training. It is desirable that the classes gathered for the agency specific trainings include a scattering of individuals with this theoretical knowledge to help staff translate the theoretical basis of the model into potential sources of value for their agency. These sessions will be paid for by the model contract training budget, and is considered vital for the future success of the state’s transportation planning efforts. Variations to the basic curriculum and format will be likely with experience, and this could affect the costs over time. If necessary for budgetary reasons, some of these sessions can be conducted by staff of The Division without assistance from AECOM.

Training Costs by Class Type					
Training Type	Cost	Sessions	Yearly Cost	Total Cost	Funding Source
Caliper Hosted Custom Training	\$3,200.00	0.4	\$1,280.00	\$6,400.00	Agency
AECOM Hosted Custom Training	\$2,533.00	0.4	\$1,013.20	\$5,066.00	Contract
Caliper Hosted Basic TransCAD Training	\$7,500.00	0.4	\$3,000.00	\$15,000.00	Agency
AECOM Hosted Basic TransCAD Training	\$4,434.00	0.4	\$1,773.60	\$8,868.00	Contract
Basic TransCAD Training	\$0.00	0.4	\$0.00	\$0.00	Agency
Primary Consumer Basic Training in RISM	\$555.00	1	\$555.00	\$2,775.00	Contract
Agency Specific Training in RISM	\$370.00	5	\$1,850.00	\$9,250.00	Contract

Training Curriculum

Given the current contract training budget, and limited wider training resources for the State, it is likely that preference will be given to classes hosted by AECOM, or created in-house. While the efficacy of these training sessions is yet to be seen, utilizing these lower cost options will allow the State to conduct the full desired spread of different types of training while still having enough left in the contract training budget to cover unforeseen expenses. If outside funding becomes available in the training budget of The Division or the other stakeholder agencies, the option is still open to utilize the more formal Caliper hosted training sessions should they prove preferable. At the same time, other model priorities may see alternative training priorities arise which would be preferable uses of such budgetary opportunities. For example, training in the use of one of the many Land Use Models coming onto the market could be beneficial.

After the first year or two, when some of the basic training goals have been met, some separation will be possible between the communications and training aspects of this section. Once the majority of relevant State staff have been trained, it would be advisable to form a RISM User Group to maintain communications with these users. The presence of a consultant at these sessions will probably not be strictly necessary, and so the sessions are being considered as effectively free for planning purposes. At

the same time, The Division should ideally continue to host training sessions for new staff members and municipal planners. During this phase of the curriculum, work on the model should be sufficiently advanced to allow The Division to compose a story map for the project web site to help communicate the value of the RISM to the public.

Tentative Chosen Curriculum					
Training Type	Cost	Sessions	Yearly Cost	Total Cost	Funding Source
AECOM Hosted Custom Training	\$2,533.00	0.4	\$1,013.20	\$5,066.00	Contract
Basic TransCAD Training	\$0.00	0.4	\$0.00	\$0.00	Agency
Primary Consumer Basic Training in RISM	\$555.00	1	\$555.00	\$2,775.00	Contract
Agency Specific Training in RISM	\$370.00	5	\$1,850.00	\$9,250.00	Contract
User Group Session	\$0.00	1	\$0.00	\$0.00	Agency
Story Map	\$0.00	0.2	\$0.00	\$0.00	Agency
Available Contract Budget			\$4,782.60	23,913.00	
Total Cost			\$3,418.20	\$17,091.00	
Remaining Budget			\$1,364.40	\$6,822.00	

Goal Areas

This section presents the goals that the staff of The Division have determined best describe the needs the state has for the model over the ten-year scope of this plan, based on their technical assessments and their discussion with the stakeholders. The “Key Goal” is the real guiding vision for the project, to which the other goal areas strive. Usability goals will set direction for the technical and workflow changes required to make the model more user friendly. The technical goals will set the basic acceptable standards of accuracy and data delivery to which The Division should strive. The communications and training goals will spell out the way the State should work to improve its human capital as it relates to the RISM. All goals, actions, upgrades, deliverables, and performance measures are available in table form in the plan appendices. The actions, upgrades, and deliverables are presented in the appendices in priority order.

Key Goal

Model should be able to produce clear benefits for state agencies, municipalities, and the public, while maintaining a level of accuracy which is up to professional standards.

It is desirable that the data outputs from the model produce genuine, concrete benefits for the transportation planning process of the State of Rhode Island with minimal additional contracting. While the outputs of a TDM will always require interpretation, and while the State is unlikely to have resources sufficient to allow modeling for major projects to happen entirely without the provision of additional data and resolution to the model, it is reasonable to expect the model to provide data sufficient for the purposes of high level planning and early stage project analysis using only State resources. Attaining this

goal will require upgrades both to the software capacities of the model itself, as well as the human capital and data ecosystem of the model.

Guiding Strategy:

Make numerous incremental changes to improve model resolution, applicability, and accuracy, while allowing model data to be accessible for data requests. Smaller changes can be incorporated into annual updates and the current five-year contract. More large scale changes should be included in the scope for the next five years of the model.

Usability Goals

Make the RISM easier to use for all users, with an emphasis on data delivery.

As it stands, the model requires consultant assistance for even minor upgrades and for many mundane data acquisitions. While it is desirable for fiscal reasons to reduce this reliance on consultants, such a situation also directly reduces the usefulness of the model to the State. As it stands, stakeholders must contact The Division with questions or data requests, and in many cases The Division's reply is delayed by the amount of time required to reach out to the consultant. While improvements in the human capital of The Division will obviously do much to improve the situation, the reality is that the model is complicated and hard to conceptualize. Pulling data from the model can be time consuming, and data inputs to the model often require manual work which then must be manually checked for quality. In its current form, it is not easy for everyone to use the RISM. Often outside consultants, even ones with years of modeling experience, are confused by the model when attempting to use it for the analysis of large projects. This in turn requires additional assistance from The Division or The Division's consultants. While travel demand analysis will always be inaccessible to some stakeholders, the situation can be improved by streamlining the processes required to input data to, and extract data from, the model.

Actions:

Catalogue data inputs and outputs

Identify and resolve key areas of difficulty for inputs and outputs

Identify and preposition key data outputs based on pertinence to stakeholders

Upgrades:

Incorporate SQL queries and macros to make basic model easier to update as part of annual updates.

Deliverables:

Usability upgrades to the process for input of road networks and demographic data.

Usability upgrades to help with the creation and modeling of scenarios.

Usability upgrades allowing the cataloging and easy extraction of data held in the model.

Model Data Catalogue

Performance Measure

75% or more of individual data requests handled in-house by staff of The Division.

Model always in a state of full usability.

During the most recent upgrade (2013-16), the travel demand model was effectively only semi-usable. While the old model remained available, anyone who contacted The Division with a data request had to be told that the data in the model dated back to the year 2000 decennial census, and that numerous paid-for and completed upgrades were not yet accessible. This arrangement, while possibly more efficient in terms of work hours, was found to be highly unsatisfactory to the RISM's stakeholders. While some time will always be required for a model upgrade, it will help stakeholders see the benefits of upgrades if they come on line as they are completed, rather than in one chunk at the end of a long process. This is particularly key given the way resources are being allocated to the RISM. Having resources made available to the model over time makes the incremental upgrade of the model much more plausible, and will allow it to fit in to the long-term planning process of the State of Rhode Island. If this incremental improvement process resulted in the model being effectively static for the next five years, stakeholder patience with the process would be unjustifiably tested.

Actions:

Changes incorporated into model on a rolling basis, not in one large update that takes three years.

Upgrades:

Deliverables:

Model which is always up to date with the latest available data, within the reasonable constraints of the work needed to implement changes.

Performance Measure

Stakeholders not required to wait more than six months for data from a model upgrade which is actively in process.

Technical Standards

Model accuracy meets industry standards and stakeholder needs

Industry standards for accuracy have become more stringent over time, and stakeholder requests often require a level of accuracy greater than the industry standard. In the short term it is important to clarify what level of accuracy is being attained in model outputs, and communicate accuracy concerns to stakeholders. Over the long term it is important to meet the accuracy needs of a plurality of model stakeholders without the addition of new data for each request. This will require great improvements to model accuracy, which will require upgrades to the model architecture and to the model input and calibration data. At the same time, the utilization of industry standards for the assessment of model accuracy should be continued and expanded. For this iteration of the model maintenance plan it must be recognized that the satisfaction of a majority of requests would be an achievement.

Initial Actions:

Implement multistage calibration in model updates, including not only calibration of the gross model results, but calibration of the different facility types, calibration of the RISM's sub-models, and calibration of the different output classes.

Utilize R² tests in calibration of model data

Find ways to communicate accuracy estimates to model end users

Identify and implement upgrades that can be conducted as part of annual updates

Fund already contracted model upgrades

Seek to include high priority upgrades in unfunded part of current contract

Upgrades:

Acquire a cellphone or GPS probe data set accurate for at least the arterial system with included origins and destinations

Incorporate RIPTA ridership survey

Incorporate RIDOT ridership survey

Bus speed model

Time of day model

Diversify trip purpose (may require several upgrades)

Stratify model by demographic characteristics

T.F. Green model

Long distance interstate external station model

Land use model

Household Survey

Seasonal model

Deliverables:

Include a discussion of accuracy in annual reports and/or documentation memo

Upgrades

Performance Measure

Model calibration meets industry accuracy standards for R² tests of 70% for roads functionally classified as Arterials, for all data at the county level, and for 50% of municipalities.

Model accuracy sufficient to allow direct satisfaction of 50% or more of stakeholder data requests without the addition of new data or off-model analysis. Of requests that require new data or analysis, 50% should be achievable in-house.

Establish a method for testing model forecasts longitudinally during non-forecast years to track model forecast accuracy.

Model structurally capable of fulfilling stakeholder data needs.

As model accuracy improves, there will still be the issue of the model not producing the types of data requested by stakeholders. TDMs are generally assumed to be part of a larger data development process, but they should be expected to produce data with sufficient detail to allow for required downstream analysis. In other words, the RISM cannot be expected to be all things to all users, but the

RISM should be expected to produce data sufficient to satisfy such needs as are core state priorities. So, while the RISM may not itself be an economic development model, it should nonetheless be able to provide much of the transportation data needed by such a model. While some of the data needed for such down-stream projects can be produced in off-model statistical processing, having such processing be done natively in-model will make the results more accurate and reliable. It will also allow data requests to be fulfilled more rapidly.

Initial Actions:

Identify upgrades that can be conducted as part of annual updates
Fund already contracted model upgrades
Seek to include high priority upgrades in unfunded part of current contract
Ultimately, all upgrades with significant stakeholder interest should be undertaken if it can be done accurately.

Upgrades

Transit route assignment
Truck model
Diversified trip purpose
Stratify model by demographic characteristics
Bus speed model
Freight model
Land use model
Area traffic simulation
Non-motorized mode
Amtrak mode
Taxi/ demand response/ autonomous vehicle mode

Deliverables:

Upgrades

Performance Measure

Complete model upgrades with the highest priority level during contract period.
50% or more of key stakeholder data requests handled in-house by staff of The Division without off-model processing of more than two hours.

Systematize Data Ecosystem of Model

Many key usability and accuracy issues of the RISM stem from the data inputs to the model. Like many large organizations, the State is often inconsistent in the quality of the data that is developed and how well it is shared amongst sister agencies. While not in any way an intentional process, the result can be problems downstream as agencies attempt to use available data for analysis. While fully centralizing all State data sets is impractical, efforts to ensure data awareness and consistent collection across agencies is key to proper execution of all State functions, including the maintenance of RISM. The creation of some coordination of the State's data ecosystem is therefore desirable on many levels. For the RISM,

the maintenance and expansion of several priority inputs is relevant to the continued existence, and expanded relevance, of the model. At the same time, more energetic efforts by The Division to make accurate data from the model itself accessible to stakeholders must be part of wider efforts to systematize the State's data ecosystem. The Division is not immune to the wider forces at work in state government, and more can always be done to provide accurate and timely data to the model's stakeholders. Many of these stakeholders provide time, encouragement, and data inputs to the RISM, and the least that can be done to reward their efforts is the provision of relevant data for their projects. The generosity of spirit shown by the stakeholders of the RISM, and the members of the transportation planning community generally in state government, is a key asset whose value for institutional effectiveness cannot be overstated, and which must be nurtured.

Initial Actions:

- Identify ways to coordinate the data ecosystem of the State
- Maintain and enhance the accuracy of data in the RISM
- Catalogue data inputs and outputs
- Identify and preposition key data outputs
- Implement annual update reports based on suggestions in body text
- Implement training curriculum outlined in body text

Upgrades:

See upgrades relating to usability, accuracy concerns, and stakeholder priorities

Deliverables:

- RISM
- Annual update
- Annual update report
- Training sessions
- Data Catalogue
- Updates and supplements to Technical Paper 166
- Output shapefiles shared to RIGIS

Performance Measure

- See sections on accuracy sufficiency
- Validate data inputs against other sources and include in technical reports
- Number of data products shared

Communication and Training Goals

Training should focus on building a broad understanding amongst the stakeholders, while maintaining and expanding the key human capital assets of the State.

There are two key training needs within the State as it pertains to the RISM. The bench of core users of the RISM, those who directly interact with the model, should be expanded and improved for reasons of fiscal responsibility and long term institutional resiliency. At the same time, there is a vital need to train the data users of the RISM in its capabilities in order to allow those users and potential users to

understand and utilize the model's value. By creating a systematic training curriculum, it will be possible to ensure that both the core users of the RISM and the primary consumers are adequately trained.

As is outlined in the training section of this paper, there is an initial group of between twenty and thirty state staff whose positions would make it beneficial for the State to provide them the training needed to function as primary consumers of model data. There are between two and five potential core users who would benefit from a higher level of training. Secondary users of model data could benefit from some training as well, if they are involved in relevant transportation-related planning projects. The available contracted budget for training, along with the offer of free, temporary training licenses from Caliper, should allow the number of training classes required in each year to train this talent pool. In the medium term it will be advisable to set up a RISM user group, and begin training municipal planners. In the long term, it may become advisable to acquire more TransCAD licenses, or ones with more flexibility.

Initial Actions:

Create materials necessary for training curriculum.
Implement training curriculum outlined in body text.

Deliverables:

Training materials
Training sessions
Regular user group meetings once the majority of stakeholders have been trained

Performance Measure

At least one core user basic training session during the contract period
At least one core user RISM training session during the contract period
Six stakeholder training sessions per year of varying types
Maintenance of at least two fully capable core users, with up to three other core users receiving the recommended training.
Improved stakeholder satisfaction with, and awareness of, model, as determined by a short annual survey.
Increased usage of model

Annual Update Reports should allow stakeholders to understand what data is available and how it can be of use.

Usable data outputs will be vital to the use of the RISM by stakeholders, but before the stakeholders take possession of the data they must be aware of the data's existence. This is the main goal of the annual reports. Based on the preferences expressed by the stakeholders in the body of the text, as well as internal goals of The Division, it is envisioned that each annual update report shall:

- Explore between two and four data outputs in the Annual Update Report core narrative
- Include numerous infographics and maps, and will focus on a narrative that describes either changes in the model or unpacks data of interest to stakeholders
- Be no more than ten pages, not including data catalogue
- Include no tables of more than one page in length, not including the data catalogue

- Include a section with updates of performance measures
- Include a catalogue of all data available from the model

Initial Actions:

Catalogue data inputs and outputs

Identify and preposition key data outputs based on pertinence to stakeholders

Implement annual update reports based on suggestions in body text

Deliverables:

Annual Data Reports

Performance Measure

Improved stakeholder satisfaction with, and awareness of, model, as determined by short annual survey

Increased usage of model

Develop a “Public Face” for the model.

The RISM is inherently technical, but The Division should work to communicate the value of the model to those outside the State and municipal governments. The stakeholders suggested the use of an ESRI story map for this purpose, and that tool would indeed be a good method for communicating the importance of the RISM. Whatever tool or set of tools is used, focus should be on providing members of the public with transparency as to the model’s function and value.

Initial Actions:

Develop an ESRI story map describing the RISM and its value for the State, and keep up to date.

Deliverables:

ESRI story map hosted on The Division’s website

Performance Measure

Track visitors to story map if possible.

Implementation

Implementation of the goals described in the previous section will require effort and support from the entirety of the stakeholders of the RISM. Beyond the concerted efforts of the core project team, management at The Division will be asked to continue to provide the resources, advice, and encouragement that has been so important in the past. Stakeholders will be required to continue to provide data as inputs to the model, and new effort and attention will be asked as The Division works to help them understand the model outputs. The State has at its disposal three key tools for implementation which have already been mentioned several times in this document, namely, the annual

updates, the model upgrades, and the communications and training curriculum. This section aims to bring together the use of these tools with the goals discussed in the previous section.

Annual Updates

The Annual Updates will consist of two interrelated parts, the actual updates to the model architecture, and the accompanying reports. These two aspects of the updates will allow the delivery of long term incremental upgrades to both the model itself and the human capital which allows it to function. Implementation will require close work between The Division, AECOM, and the stakeholders. The short-term rewards may not be clear, but it can be expected that over time the impact will have a great cumulative affect.

Architectural Updates

The actual annual updates will consist of tweaks to the model architecture and the underlying input and calibration data to deliver improvements over time. This aspect of the annual update process will most directly impact the core model users, who will see usability upgrades and accuracy improvements. It is desirable, however, to link this work to the annual update reports in ways that will convey the benefits of these efforts to management and stakeholders.

Implementation of these updates will vary from year to year depending on the priorities and opportunities from year to year, and will require close work with stakeholders at RIDOT and RIPTA. The 2017 update is currently in process and is focusing on improvements to the road network of the model. Some work in this area may be required in 2018, due to the ongoing efforts of RIDOT on their Roads and Highways system. It is also hoped that in 2018 a cell phone probe data set will be available for model calibration. Starting in 2018, The Division will start to work with AECOM to identify ways to upgrade the demographic forecasts of the RISM, though this work may not be complete until the 2019 update.

Annual Update Reports

The annual update reports will be a key way to communicate the value of the model with those not directly involved in its creation and maintenance. Following the suggestions of the stakeholders, it has been decided to keep the content of the reports focused. With a program of the complexity and power of the RISM there will be no way to fully summarize the current state of the model in a report short enough and readable enough to convey meaningful information to most readers, and so the reports will contain short narratives focusing on one important data output. The reports will also contain a section updating stakeholders on the status of the model in terms of the performance measures described in the goals section. Finally, the reports will describe the data sets contained in the model, with information about how they can be attained.

Executing the annual reports will require a substantial amount of work in the first year. The template for the reports will need to be set, and the background work of cataloguing and organizing the data sets in the model will in itself be a substantial task. This work will also inevitably result in the identification of missing output data sets, which will then need to be created. The additional task of identifying, analyzing, and describing two or three of these data sets may be beyond the staffing levels of the project team in the first year, given the other requirements. Nonetheless, some narrative must be included to make the report meaningful to the stakeholders.

In subsequent years, the annual update reports will not require as much effort. The main narrative will consist of highlighting particularly interesting data sets, but the data catalogue and performance

measurements will only need minor updates. Two other aspects of this effort must be kept in mind, however. As part of the annual update report effort, The Division and AECOM agreed in the current contract to create update memos to Technical Paper 166 every time the model is fully calibrated. These short, highly technical memos will be inserted into the technical paper, and will not be intended for non-technical stakeholders. Nonetheless, these memos will likely form an important part of the background work on the annual reports, particularly in terms of edits to the catalogue, performance measures, and the identification of interesting data sets. More broadly, the number of appendix updates on Technical Paper 166 has made the already unwieldy document even more hard to work with. It is important that efforts be made to keep this document usable by the technically minded. It is hoped that this will not require a complete re-write before the five year update, but the possibility cannot be discounted.

Model Upgrades

Though conceptually the simplest of the three tools at the disposal of the division, model upgrades will require the most additional resources. Put simply, model upgrades are improvements to the model, which will help the model meet the state's goals, that require separate line items in the contract and which require substantial work by AECOM to execute. Though two such upgrades have been funded, all others have not, and the importance of these improvements can be seen in their costs. In an environment of fiscal restraint, it may prove difficult to secure these resources. This is part of the reason this plan has placed such an emphasis on building the state's reliance on comparatively cheaper in-house staff.

At the same time, creative solutions exist to this problem. Because of the pertinence of the model to other state planning efforts, there is the potential to include model upgrades into the scope of future projects. If short term projects are required which would benefit from expanded modeling, such an expansion can be written into the RFP for that project. This would turn the short-term investment in the project into a long-term data asset for the state. Such a way forward will require the continued awareness and support of management and stakeholders, something which makes the communications tools in this plan especially crucial to the ongoing forward progress of the RISM. If, in 2021, it is found that a substantial number of the upgrades have not been executed, The Division will need to take that into account when scoping the budget for the next model upgrade.

Communications and Training Curriculum

The communications and training curriculum will be the main tool for improving the human capital of the state as it relates to the RISM. The curriculum described in the body text aims to build state resiliency by training five state employees as core users, able to work with the model hands on. A larger group of stakeholders will be invited to attend classes that describe the model theoretically, its capabilities, and how it can impact their work specifically. In the long term the communications and training aspects of the plan will grow more separate, as those stakeholders who have already been trained will be invited to join the RISM user group, while more staff from outside state government will gradually be trained to utilize model data.

Though a substantial and ambitious plan, the scoped training sessions are tailored to the current financial environment, and will make use of the interagency cooperation which is such a strong element of the state government of Rhode Island. The training budget, beyond staff time, will entirely consist of funds already included in the contract budget. In the long term, the State will need to consider

investments in a new TransCAD licensing structure, or else consider the possibility of migrating the RISM to a less expensive platform.

Conclusion

The RISM is a tool with great potential, but delivering the value expected by the stakeholders will require changes to the technical structure of the model, the data environment of the model, and the human capital that uses the model. These changes will be implemented incrementally, utilizing the annual update process to both technically improve the model and to provide the data stakeholders need to appreciate the RISM's potential. The training and communications curriculum will focus on providing stakeholders with the tools they need to utilize the model in a way that best fits their needs and aptitude, while also building up the resilience and potential of the core user group of the State.

Implementing these action items can be done, in many cases, with existing resources. Some areas, however, will require additional investments. Only two major model upgrades are currently funded. Even within the scope of the current contract, many more will need to be funded to meet the reasonable expectations of the stakeholder group. In the long term, much larger investments will be needed to meet the State's commitments on subjects like non-motorized transportation.

None of the above investments are outside the scope of the State's current resources. If carefully and creatively managed, the RISM has the potential to quickly become a model able to meet the highest national standards and a key asset to the transportation planning process in Rhode Island. Key to this ongoing progress will be the active and enthusiastic interagency cooperation which has been such a hallmark of successful transportation planning in Rhode Island.

Appendix I: Goals

Key Goal: Model should be able to produce clear benefits for state agencies, municipalities, and the public, while maintaining a level of accuracy which is up to professional standards

Usability

- U1. Make the RISM easier to use for all users, with an emphasis on data delivery
- U2. Model always in a state of full usability

Technical Standards

- T1. Model accuracy meets industry standards and stakeholder needs
- T2. Model structurally capable of fulfilling stakeholder data needs
- T3. Systematize data ecosystem of the State

Communications and Training

- C1. Training should focus on building a broad understanding amongst the stakeholders, while maintaining and expanding the key human capital assets of the State
- C2. Annual Update Reports should allow stakeholders to understand what data is available and how it can be of use
- C3. Develop a “Public Face” for the model

Appendix III: Actions

Priority Rank	Action	Relevant Goals	Stakeholder	Accuracy	Effort	Timeframe
1	Identify upgrades that can be conducted as part of annual updates	3	4	4	4	Short
2	Catalogue data inputs and outputs	3	5	2	3	Short
3	Create materials necessary for training curriculum.	2	4	2	4	Short
4	Identify and preposition key data outputs based on pertinence to stakeholders	3	3	1	4	Short
5	Implement annual update reports based on suggestions in body text	2	4	4	3	Short
6	Implement training curriculum outlined in body text.	3	5	1	3	Short
7	Utilize R ² tests in calibration of model data.	3	1	4	3	Short
8	Identify and resolve key areas of difficulty for inputs and outputs	1	3	3	3	Short
9	Implement multistage calibration in model updates, including not only calibration of the gross model results, but calibration of the different facility types, calibration of the RISM's sub-models, and calibration of the different output classes.	3	1	5	2	Short
10	Fund already contracted model upgrades.	2	5	4	2	Medium
11	Find ways to communicate accuracy estimates to model end-users.	2	3	3	2	Short
12	Changes incorporated into model on a rolling basis, not in one large update that takes three years.	2	5	1	5	Long
13	Identify ways to coordinate the data ecosystem of the state	2	3	4	2	Medium
14	Develop an ESRI story map describing the RISM and its value for the State, and keep up to date.	1	3	1	3	Medium
15	Seek to include high priority upgrades in unfunded part of current contract.	2	3	3	1	Medium
16	Ultimately, all upgrades with significant stakeholder interest should be undertaken if it can be done accurately.	2	4	2	2	Long

Appendix III: Updates

Priority Rank	Updates	Cost	Funded	Maintenance	Stakeholder	Accuracy	Effort
1	Incorporate RIPTA ridership survey	\$35,309.00	Y	N	4	3	4
2	Transit route assignment	\$29,755.00	Y	N	4	4	3
3	T.F. Greene model	n/a	N	Y	1	3	5
4	Incorporate SQL queries and macros to make basic model easier to update as part of Annual Updates.	n/a	N	Y	3	3	4
5	Bus speed model	\$25,549.00	N	N	4	4	4
6	Incorporate RIDOT ridership survey	\$21,461.00	N	N	4	3	4
7	Stratify model by demographic characteristics	\$26,312.00	N	N	4	5	3
8	Time of Day Model	\$31,065.00	N	N	2	5	3
9	Truck model	\$42,295.00	N	N	4	4	3
10	Diversify trip purpose (may require several upgrades)	\$26,248.00	N	N	2	5	2
11	Acquire a cellphone or GPS probe data set accurate for at least the arterial system with included origins and destinations	\$200,000.00	N	N	3	5	4
12	Long distance interstate external station model	TBD	N	N	2	4	4
13	Freight model	TBD	N	N	4	3	3
14	Amtrak mode	TBD	N	N	3	3	3
15	Seasonal model	TBD	N	N	3	4	2
16	Non-motorized mode	TBD	N	N	5	4	1
17	Taxi/ demand response/ autonomous vehicle mode	TBD	N	N	4	3	2
18	Land Use Model	TBD	N	N	3	5	1
19	Area traffic simulation	TBD	N	N	4	2	1
20	Household Survey	\$400,000.00	N	N	3	3	2

Appendix IV: Deliverables

Priority Rank	Deliverables	Relevant Goals	Stakeholder	Accuracy	Effort	Timeframe
1	RISM	9	5	5	4	Short
2	Model Data Catalogue	3	5	2	4	Short
3	Annual updates	5	4	2	3	Short
4	Training materials	2	4	1	4	Short
5	Annual updates report	3	4	2	3	Short
6	Usability upgrade allowing the cataloging and easy extraction of data held in the model.	1	4	3	3	Short
7	Model which is always up to date with the latest available data, within the reasonable constraints of the work needed to implement changes.	1	5	2	3	Short
8	Training sessions	2	4	1	3	Short
9	Updates and supplements to Technical Paper 157	1	3	3	3	Short
10	Output shapefiles shared to RIGIS.	2	4	1	4	Medium
11	Organize regular user group meetings once the majority of stakeholders have been trained	1	3	3	4	Medium
12	Include a discussion of accuracy in Annual Report and/or Documentation Memo.	1	3	3	2	Short
13	Usability upgrades to help with the creation and execution of scenarios.	1	3	3	3	Medium
14	Usability upgrades relating to inputs of road networks and demographic data.	1	1	4	3	Medium

Appendix V: Performance Measures

- 75% or more of individual data requests handled in-house by staff of The Division.
- Stakeholders not required to wait more than six months for data from a model upgrade which is actively in process.
- Model calibration meets industry accuracy standards for R² tests of 70% for roads functionally classified as Arterials, for all data at the county level, and for 50% of municipalities.
- Model accuracy sufficient to allow direct satisfaction of 50% or more of stakeholder data requests without the addition of new data. Of requests that require new data, 50% should be achievable in-house.
- Utilize R² test to check model forecast accuracy during non-forecast years.
- Complete model upgrades with the highest priority level
- 50% or more of key stakeholder data requests handled in-house by staff of The Division without off-model processing of more than two hours.
- Validate data inputs against other sources and include in technical report
- Number of data products shared.
- At least one core user basic training session during the contract period
- At least one core user RISM training session during the contract period
- Six stakeholder training sessions per year
- Maintenance of at least two fully capable core users, with up to three other core users receiving the recommended training.
- Improved stakeholder satisfaction with, and awareness of, model, as determined by short annual survey.
- Increased usage of model
- Track visitors to story map if possible.

Model Maintenance Timeline

Taken from the rough draft of the project sheet. Clearly it was too detailed for the UPWP but this helped me get down and organize how I see the full project shaping up. My timeline is on top, and the timeline from the Scope of work as prepared by AECOM follows.

FY 18 tasks by quarter

Quarter 1

- Begin first (FY 18) annual update
- Begin model data catalogue
- Begin work on incorporation of RIPTA ridership survey
- Begin work on transit assignment

Quarter 2

- Complete first (FY 18) annual update
- Complete incorporation of RIPTA ridership survey
- Complete transit assignment
- Complete model data catalogue
- Using model data catalogue, identify missing data outputs
- Establish annual update report template
- Create training session materials
- First core user training session
- Determine interest in agency specific training sessions, begin to schedule sessions
- Begin tracking performance measures

Quarter 3

- Produce annual update report
- Update to appendix section for Technical Paper 166 - Statewide Travel Model Update explaining usability updates, transit assignment and RIPTA ridership survey alterations, and laying out future update process.
- Share report data to RIGIS
- First primary consumer training session
- First agency specific training sessions
- Informational presentation to TAC, Technical Committee, and/ or State Planning Council on the Model Maintenance Plan first annual update, and recent upgrades.
- Begin work on truck model upgrade

Quarter 4

- Gather data and identify specific upgrades for FY 19 annual update
 - Tentatively, finalize connection to RIDOT's asset management system, incorporate remaining transportation data with a focus on calibration data, examine potential upgrades to demographic inputs
- Identify priority upgrades for FY 19 UPWP
 - Identify process for adding upgrades to current contract
- Hold final training sessions for FY 18
- Hold information exchange with regional MPOs on the process of adopting a Land Use Model
- Complete truck model upgrade

FY 19 tasks by quarter

Quarter 1

- Implement FY 19 annual update.
- Craft update memo describing annual update for inclusion in appendix of Technical Paper 166 - Statewide Travel Model Update, including truck model upgrade
- Produce annual update report
- Share report data to RIGIS
- Update RISM website in preparation for the creation of a story map
- Update training materials
- If funding becomes available, continue work on unfunded upgrades

Quarter 2

- Create draft story map
- Hold annual primary consumer training session
- Determine interest and begin scheduling agency specific training sessions
- If funding becomes available, continue work on unfunded upgrades

Quarter 3

- Informational presentation to TAC on RISM status
- Organize first meeting with RISM user group.
- Survey stakeholders on model progress
- Hold agency specific training sessions
- If funding becomes available, continue work on unfunded upgrades

Quarter 4

- Gather data and identify specific upgrades for FY 20 annual update
 - Tentatively, update demographic forecasts to bring model up to base year 2015
- Hold final agency specific training sessions for FY 19
- If funding becomes available, continue work on unfunded upgrades

FY 20 tasks by quarter

Quarter 1

- Implement FY 20 annual update.
- Craft update memo describing annual update for inclusion in appendix of Technical Paper 166 - Statewide Travel Model Update
- Produce annual update report
- Share report data to RIGIS
- Update training materials
- Update story map
- If funding becomes available, continue work on unfunded upgrades

Quarter 2

- Hold annual primary consumer training session
- Determine interest and begin scheduling agency specific training sessions
- If funding becomes available, continue work on unfunded upgrades

Quarter 3

- Informational presentation to TAC on RISM status
- Organize meeting with RISM user group.
- Survey stakeholders on model progress
- Hold agency specific training sessions
- If funding becomes available, continue work on unfunded upgrades
- Begin Model Maintenance Plan Update
 - Determine needs
 - Meet with stakeholders
 - Discuss with industry experts
 - Discuss with neighboring MPOs
 - Determine timeline for availability of decennial census data
 - Discuss theoretical costs with industry experts, notably staff at Caliper
 - Identify reasonable budget for model contract
 - Assess 2016-2017 purchasing process in discussion with purchasing
 - Determine whether all remaining needs can be fulfilled by a single contract

Quarter 4

- Complete Model Maintenance Plan Update
- Gather data and identify specific upgrades for FY 21 annual update
 - Tentatively, five year update tasks to bring model up to base year 2020
- Hold final agency specific training sessions for FY 20
- If funding becomes available, complete work on unfunded upgrades
- Begin creation of RFP for model contract years 2022-2027

FY 21 tasks by quarter

Quarter 1

- Begin implementation of five-year model update
- Issue RFP for contract years 2022-2027

Quarter 2

- Complete implementation of five-year model update
- Replace Technical Paper 166 - Statewide Travel Model Update with a new technical paper describing the function of RISM
 - Include Data Catalogue
 - Focus on user experience
 - Include an appendix of assumptions with an explanation of their origins
 - Update report data sets from annual reports 2018-2020 and share to RIGIS
 - Issue a report in the style of an annual report to update stakeholders on five-year update changes
- In necessary, extend current contract to allow completion of five-year update

Quarter 3

- Complete any unfinished contract work remaining on current contract
- Complete bidding process
- Sign RISM maintenance and/or update contract
- Organize meeting with RISM user group.
- If necessary, update Model Maintenance Plan

Quarter 4

- Gather data and identify specific upgrades for FY 22 annual update