



**BOARD OF DIRECTORS  
FEBRUARY 24, 2017**

**ACTION REQUESTED – DISCUSSION/POSSIBLE  
ACTION**

**PROPOSED SANDAG DATA ACCURACY AND MODELING  
WORK PLAN**

File Number 3100900

**Introduction**

The methodology used in the SANDAG Demographic and Economic Forecasting Model (DEFM) currently is under review by SANDAG staff after errors were discovered in the model that inflated wage growth in certain economic sectors over time. Once the errors were discovered, it became clear that they resulted in higher than expected estimations of future taxable retail sales, which in turn have affected the revenue forecasts for future *TransNet* Extension funds and Measure A. (Those revenue forecasts were calculated separately from DEFM but used taxable retail sales data from the model.) As was reported to the Board of Directors at its meeting on December 16, 2016, while DEFM is being updated staff has temporarily substituted in a different forecast model using an alternative methodology to estimate future *TransNet* revenue. The new estimate is arrived at using a consensus of three nationally recognized, independent forecasts.

**Recommendation**

The Board of Directors is asked to provide feedback on the proposed work plan for strengthening accuracy, quality, and transparency in SANDAG data, analytics, and modeling programs.

This report details a recommended work plan that will fully investigate the cause of the errors in DEFM, how and when staff identified the errors, what impacts the errors have had on work products, and how those impacts will be addressed. The proposed work plan also calls for the development of processes and safeguards for consideration by the Board of Directors that can be put in place to ensure similar problems do not occur again, as well as provide transparency to issues of concern that may arise in the future.

**Discussion**

SANDAG uses a variety of forecasting tools to make estimates. The primary role of DEFM is to forecast future population, jobs, and housing in the region. The model, which originally was created in the 1970s and continually has undergone minor updates since then, is used to make a new forecast ahead of the creation of each Regional Transportation Plan (RTP). These forecasts are done in a series, with the most recent being Series 13, and the next in line being Series 14. The Board of Directors adopts each forecast as part of the process of reviewing and approving the RTP.

By its very nature, forecasting is extremely difficult and complex. A forecast is fundamentally an educated guess at what likely will occur. Minor changes to inputs into forecasting models may have

small impacts in the near term, but dramatic impacts when calculations are made 30 or 40 years into the future.

Over the last few years, SANDAG has been engaged in a systematic process to comprehensively update its modeling capabilities. Because of the extremely complex nature of these computer models, the updates are expensive and time consuming. The first model to undergo an update was the Activity Based Model (ABM), which was completed in 2014. DEFM was next on the list. The Board of Directors included funds to start the initial work on this update in the FY 2015 Program Budget. That work is ongoing.

As part of the DEFM update, SANDAG staff planned to address an issue that they had noticed for some time – that the model was estimating the growth of future taxable retail sales in the region at a significantly higher rate in the future than actually had occurred in the past.

However, in October 2016 as election time approached, press reports challenged the validity of the \$18 billion revenue forecast for Measure A. At the direction of management, the modeling and economics teams started investigating DEFM. In November 2016, after weeks of work, staff identified the root cause and concluded that there was an error in the loading of data into DEFM that had caused industry output, and in turn taxable retail sales estimates, to be high. The taxable retail sales numbers had in fact been used in the process of calculating the Measure A revenue forecast, as well as financial capacity estimates used in the *TransNet* Plan of Finance.

SANDAG management and staff have taken several actions since then, including updating the Board of Directors on December 16, 2016. That update included an evaluation of the *TransNet* Program and a presentation on the new, independent forecast for future *TransNet* Extension revenue. In addition, the SANDAG Chief Economist position was consolidated with the Technical Services Director position to integrate oversight of forecasting processes.

Going forward, staff recommends the following seven-part work plan to investigate the error, identify the potential impacts, address any substantive problems that may have resulted with the agency's work products, and put in place policies and safeguards to ensure that similar problems do not occur again and that any concerns that may arise are brought to the attention of the Board.

- **Conduct Detailed Review:** Conduct a detailed review of the nature of the error in DEFM and its root cause. Review and validate input data, transformations, and equations in the Series 13 forecasting model (the most recent series completed using DEFM) to ensure accuracy of the data and integrity of the model results. Present this information to the Board of Directors.
- **Conduct Dependency Analysis:** Identify key SANDAG reports and deliverables that used data from Series 13. Evaluate the significance of the impacts from any potential forecasting errors and the potential effects on findings and policy recommendations.
- **Map Modeling Process Flow:** In preparation for future forecasts, map all data flow from source through databases, models, and outputs to provide transparency and identify areas for improved quality assurance processes. Complete online documentation and visual mapping of interactions in the model, showing all data sources, processes, interactions, and flows.

- **Improve Data Governance:** As a first step toward formal data governance, conduct interviews and document the customer-supplier relationship between SANDAG staff and the SANDAG Technical Services Department. This effort will lead to a better understanding of the type of data that agency staff request from Technical Services and a better understanding of how the data are requested, stored, used, and versioned. This information will be used to develop a data warehouse, standardize data extraction routines, and ensure consistency of data.
- **Review and Oversight:** Validate the new SANDAG population, housing, and economic forecasting model using an independent expert review committee, including convening a panel of experts in economics, demographics, and land use to review the methods, data sources, and assumptions of the new SANDAG forecasting model. The panel will evaluate the efficacy and sufficiency of the proposed Series 14 forecasting model to adequately forecast population, housing, and economic variables for SANDAG planning purposes.
- **Enhance Transparency:** Develop a set of agency methods and standards to ensure data and analytic transparency, including establishing checking points where full disclosure and analysis are provided to ensure that others can see how models were developed, how data was processed, and what assumptions were made along the way.
- **Develop and Formalize Processes:** Understand how staff roles, work flows, and technology (e.g., models, databases, software) contribute to producing key agency deliverables. This information will be used to realign the Technical Services Department, as well as add professional quality assurance staff and a dedicated database administrator. This effort will reduce single points of failure, and increase accountability, visibility, and efficiency. Conduct research and prepare an assessment of the current state of software and database platforms to facilitate a plan to implement industry best practices as they relate to data structures, data quality, database design and development, and database governance.

## **Next Steps**

Upon receiving input and direction, SANDAG staff proposes to implement this work plan and follow up with ongoing progress reports to the Board of Directors and the *TransNet* Independent Taxpayer Oversight Committee. The implementation of this program may require additional staff and consultant resources. Upon direction from the Board, staff will return with proposed program budget amendments to support the work effort.

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