

Illinois Carbon Monoxide Screen for Intersection Modeling (COSIM)

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Illinois COSIM, Version 3.0 is a Windows-based screening model that is used by the Illinois Department of Transportation (IDOT) for estimating worst-case, or conservative, carbon monoxide (CO) concentrations at signalized intersections throughout the state. The model uses project-specific traffic and signal information and receptor distances, which are input in a user-friendly model to predict CO levels of proposed highway expansion projects.

If the results of the COSIM pre-screen are within the National Ambient Air Quality Standards (NAAQS) for CO, no further CO modeling is required for the intersection. However, if the results from COSIM indicate that the project may cause a NAAQS violation, a detailed analysis is performed to more accurately evaluate potential CO levels.

COSIM, Version 1.0 was originally developed in 1999 using U.S. Environmental Protection Agency's (USEPA) mobile source emission model, MOBILE5b, and roadway dispersion model, CAL3QHC v 2.0. by researchers at the University of Illinois at Urbana-Champaign. Very conservative worst-case assumptions were incorporated into the model so that modeled CO concentrations would always overestimate project impacts and thus ensure protection of the environment. The conservative nature of COSIM was evaluated as part of the original study using three intersections with ambient CO monitoring data. For each intersection, CO concentrations from COSIM were greater than both the measured concentrations and results using a detailed modeling analysis.

COSIM, Version 2.0 was released in 2003. Version 2.0 incorporated new emission factor (EF) tables developed using USEPA's updated MOBILE model known as MOBILE6. In addition, a new pre-screen feature was added for determining if a full COSIM analysis was necessary. This addition further streamlined the modeling process while maintaining even more conservative modeling results.

The COSIM easy-to-use pre-screen feature allows the user to determine if a complete COSIM analysis is required for a proposed project by entering three simple inputs:

1) county in which the intersection is located; 2) highest traffic approach volume on the busiest leg of the intersection; and 3) closest receptor distance to any one edge of the proposed roadway. After the required information has been input into the model, a one-page report summarizing the results of the pre-screen will be displayed. A "Pass" result on the pre-screen feature does not require any further COSIM analysis. A "Fail" result requires the user to run the complete COSIM analysis to estimate the proposed intersection's impact on ambient CO concentrations.

If a pre-screen fails, a full COSIM analysis requires the user to supply additional inputs such as: 1) intersection surroundings, 2) intersection type (14 intersection types), 3) street names, 4) intersection approach volumes, 5) peak hour approach speed, 6) intersection signal timing, and 7) receptor distances. Once these variables are input into the model, COSIM can be run and within a few seconds the CO results are displayed. A four-page report is then generated for documentation and reporting purposes.

COSIM Version 3.0 was released in June of 2008. The revised model was the product of a research project sponsored by the Illinois Center for Transportation (ICT) for IDOT. Version 3.0

incorporates new emission factors for Illinois' On-board Diagnostics-only vehicle Inspection and Maintenance program, enhancements to the pre-screen feature, and other minor updates. Research Report FHWA-ICT-08-019 provides additional technical information on the updates to Version 3.0, and may be found on ICT's web site at: <http://www.ict.uiuc.edu/Publications.asp>.

In the development of Version 3.0, IDOT set up a Technical Review Panel (TRP) to help guide the final outcome of the model update. The panel members included representatives from the Illinois Environmental Protection Agency (IEPA), FHWA, Illinois Division, IDOT District staff, as well as a representative from the consulting community. The TRP was instrumental in providing key input and guidance which enhanced inter-agency coordination and cooperation, which ultimately led to the successful release of COSIM, Version 3.0.

COSIM has been successfully used by IDOT's environmental staff in the nine statewide Districts, since 1999. CO analyses for IDOT proposed projects are performed for seven different timeframes: existing year (for no-build scenario), time of completion (TOC) (build and no-build scenarios), TOC + 10 years (build and no-build scenarios), and design year (build and no-build scenarios). Countless COSIM runs have been completed by IDOT staff, with all projects showing results below the CO NAAQS.

Prior to the development of COSIM in 1999, performing a CO analysis averaged 2 weeks to complete by running the MOBILE model to obtain emission factors (EF) for the project, then plugging the EF into the CAL3QHC dispersion model. With COSIM, IDOT significantly reduced the turnaround time to complete a CO analysis since COSIM has the Illinois' specific emission factor tables and the CAL3QHC intersection model "built in" for the user. For example, once all traffic data and signal and receptor information is compiled for a proposed project, IDOT staff can run seven different COSIM CO scenarios in 1-2 hours.

This streamlining of CO analysis by IDOT has reduced project delays as well as process delays. The COSIM CO printouts also allow IDOT District staff to easily document the CO results in NEPA documents and move projects forward.

In summary, Illinois COSIM has been a valuable tool for the Illinois Department of Transportation. It has streamlined and simplified IDOT's CO analysis, reduced project costs, streamlined the prediction of worst-case CO levels, and more importantly, it allows IDOT projects to move forward while protecting and enhancing the environment.