

**LARSA Inc**

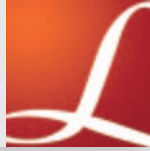
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LARSA 4D

LARSA 4D is software for the analysis and design of cable, curved, and skew bridges, domes, and other advanced structures. With already an established ten-year record on projects throughout the world, LARSA 4D is only the latest in a long line of structural analysis software developed by LARSA, Inc. over the last two decades. The LARSA 4D software package consists of an analysis engine with the latest capabilities learned from engineering and software research, a sophisticated user interface for pre- and post-processing, a cross-section analysis and design tool called LARSA Section Composer, and other design tools such as for steel plate girder bridges. The nonlinear analysis engine at the heart of LARSA 4D provides the most trusted answers for cable-stay, suspension, stressed-ribbon, curved, skewed and other bridge forms, as well as other structures requiring geometric or material nonlinearity or a staged analysis.

Innovation in Analysis

LARSA 4D provides the latest in structural engineering technology and has lead the field in staged construction analysis, live loading, and other complex design needs.

Staged construction analysis --- which models the changes to a structure over time including the construction or deconstruction of elements, the application of loading, and time-varying material properties such as creep and shrinkage --- is the core of LARSA 4D's analysis. Developed for the rigorous needs of segmental construction and cable-supported structures, LARSA 4D goes beyond basic construction activities. Load class tracking of forces is possible for even the more advanced activities of support removal, element removal, and other constraint changes. Staged construction also includes "analysis scenarios", where another analysis type such as live load, dynamic, or pushover analysis is performed at an intermediate state of construction.

The program's Steel Plate Girder Bridge Module is an AASHTO LRFD design code tool intended for bridges with curve or skew, large displacements, nonlinear behavior, haunches, or unusual modeling requirements. The module combines the modeling and analysis strengths of LARSA 4D with a complete implementation of design code requirements. A parametric approach to creating bridge models is provided by the module, but if the structure calls for unusual geometry, loading conditions, or construction order, the generated model can be revised in LARSA 4D by the user before moving on to code check. Code check uses the forces and stresses computed on the full 3D model by LARSA 4D's nonlinear staged construction analysis. This provides greater flexibility than a 2D grillage analysis because model curvature, soil-structure interaction and bearings, post-tensioning, and other advanced factors will have an effect on the results of the code check.



Phu My Bridge, Ho Chi Minh City, Vietnam. Tony Gee and Partners. Main span 380m.

Other innovative tools for bridge analysis have been invented for LARSA 4D. Live load results are based on LARSA 4D's influence surface analysis, which was one of the first influence surface modules developed before widespread adoption of this analysis technique. Bridge path coordinate systems define the bridge alignment so that geometry can be specified in terms of station and transverse location rather than x and y. Finally, form finding tools are available to automatically compute cable initial or jacking forces and camber in order to arrive at the designed bridge geometry --- even in a complete staged construction analysis.

Innovation in Support

Innovation comes in many forms when structural analysis is coupled with the latest computing technology. But let us not forget that there is more to innovation in engineering software than the speed of its solver and the numerical accuracy of its elements. Innovation applies to a company's support services, and LARSA has several unique ways that it services its clients: Macro integration with Excel has caught on lately with engineers that have some programming background. LARSA's support team helps clients program macros that automate repetitive tasks like model generation and result extraction. The newest support system is called "Features On Demand" where LARSA 4D can extend itself with new tools created on the spot by LARSA's support team, bypassing the normal software release cycle.

These support tools complement the other ways the LARSA support team regularly provides assistance to its clients, such as with desktop-sharing so both parties can see the same screen, webinars for training over the web, and on-site training.

Engineers feel comfortable with LARSA 4D because LARSA developers and support personnel work closely with clients to develop the tools they need to make their work more efficient and effective. LARSA worked with Figg Engineering to develop time-dependent material effects including creep, shrinkage, and relaxation for the Staged Construction Analysis and cooperation with HDR has been a part of the development of AASHTO LRFD tools for bridge code check. That may be why LARSA's software has become a company standard at Figg, HDR, International Bridge Technologies, Parsons Brinkerhoff, Parsons Transportation Group, and T.Y. Lin International. The software will soon be available in multiple languages. 