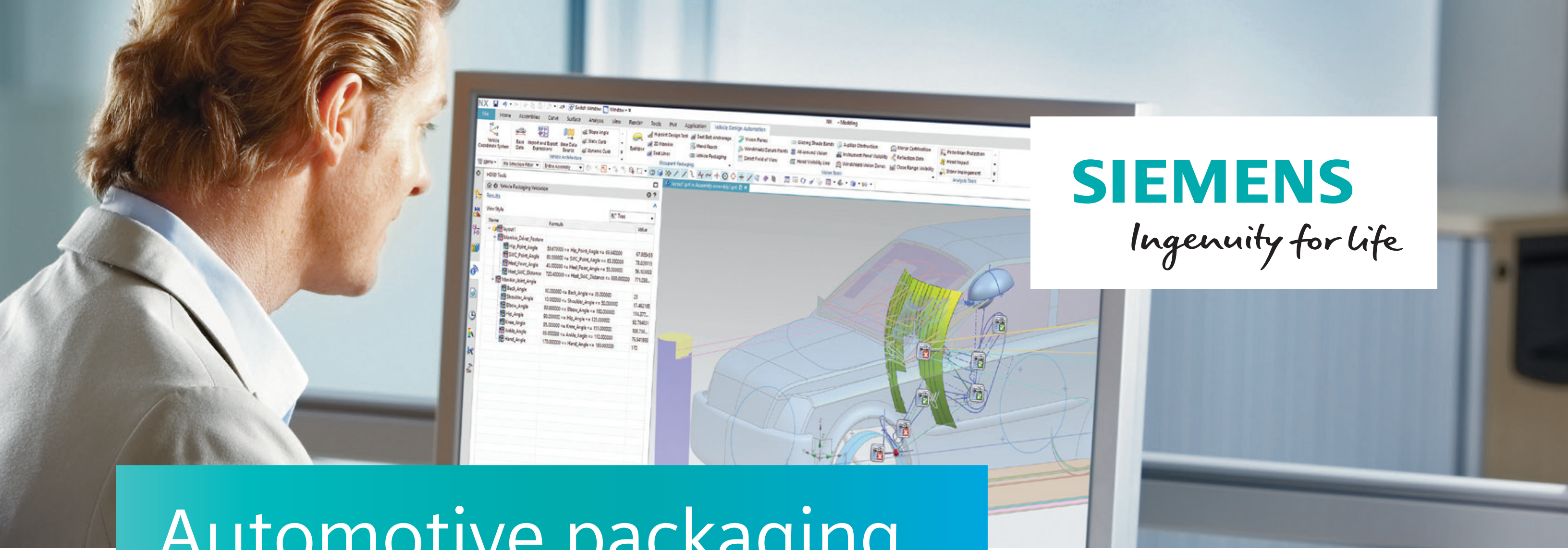


Automotive packaging

Vehicle design automation integrated with NX

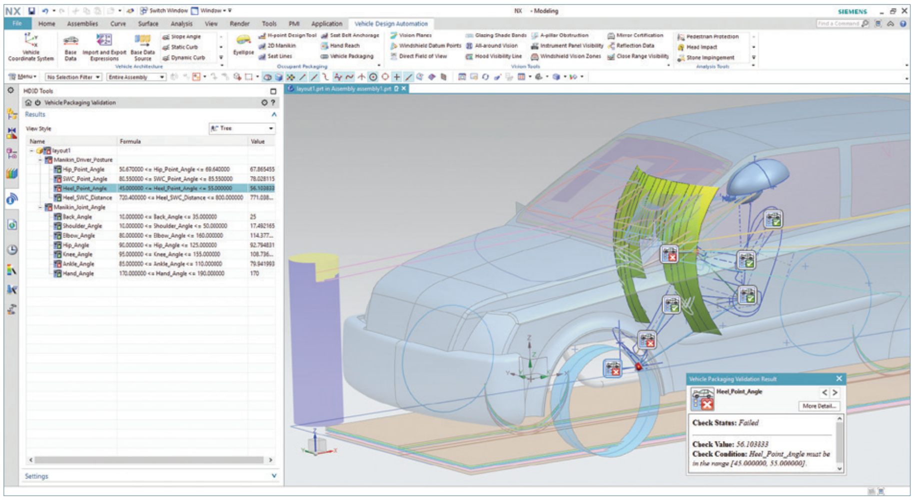
Benefits

- Permits early occupancy and mechanical packaging studies
- Helps establish key vehicle reference points for configuring and measuring aspects of the interior automobile compartment and external components
- Includes international vehicle industry standards and process knowledge database for repeatability and standardization
- Full integration with the NX™ CAD system, ready-to-go and out-of-the-box for minimal customization costs
- Frees up highly skilled packaging engineers to concentrate on complex packaging problems
- Enables rapid evaluation of alternative designs in a unified design environment
- Leverages integrated analysis to provide fast feedback on designs' compliance with established standards

Summary

The vehicle design automation (VDA) software (General Packaging) is a suite of tools within NX™ to aid in the design of vehicles, enabling engineers to validate automotive designs against safety, occupant ergonomics and visibility standards.

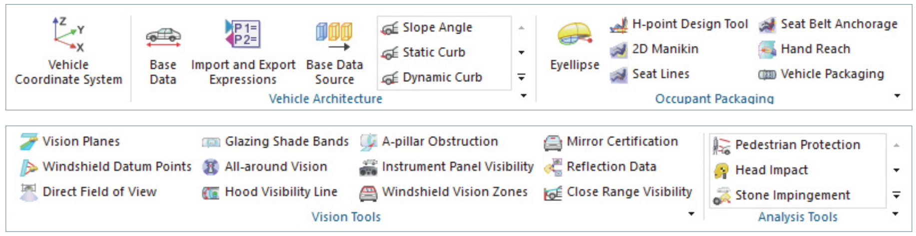
These tools check preliminary concept designs and final detailed geometry designs of cars and trucks against national and international standards. The tools use product geometry and key "base data" dimensions to check design compliance to United Nations Economic Commission for Europe (ECE) and Global Technical Regulations (GTRs), European Economic Community (EEC) and specific country government regulations including Guobiao (GB) standards in China; Society of Automotive Engineers (SAE), Federal Motor Vehicle Safety Standards (FMVSS) and University of Michigan Transportation Research Institute (UMTRI) standards in the U.S., and Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and TRIAS in Japan for topics such as Pedestrian Protection and Close Range Visibility. The embedded knowledge base of more than 60 standards from at least 15 standards bodies provides a reliable and repeatable assessment of vehicle layouts, both for car (Class A) and truck (Class B) regulations, eliminating the need to re-read thousands of technical pages. Associativity of the output geometry automatically updates analysis results as the design of the vehicle evolves from art to final product.



Automotive packaging

Features

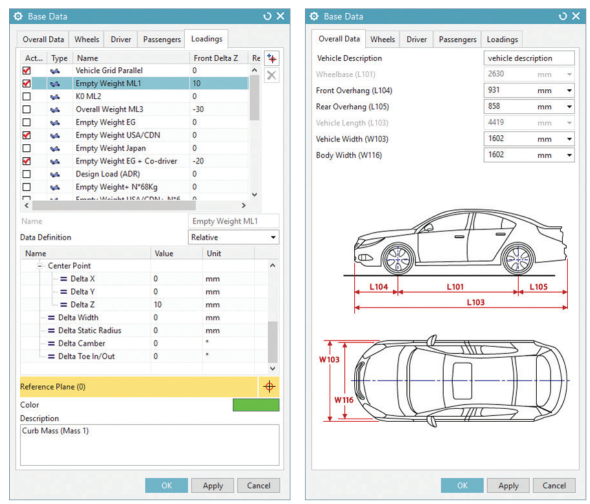
- Incorporates more than 60 standards from more than 15 standards organizations
- Associative update of checks to base dimensions and geometry
- Supports multiple vehicle loadings and human ergonomic profile percentiles
- Works with surface or facet models
- Automatic geometry creation and integrated compliance checks with visual reporting

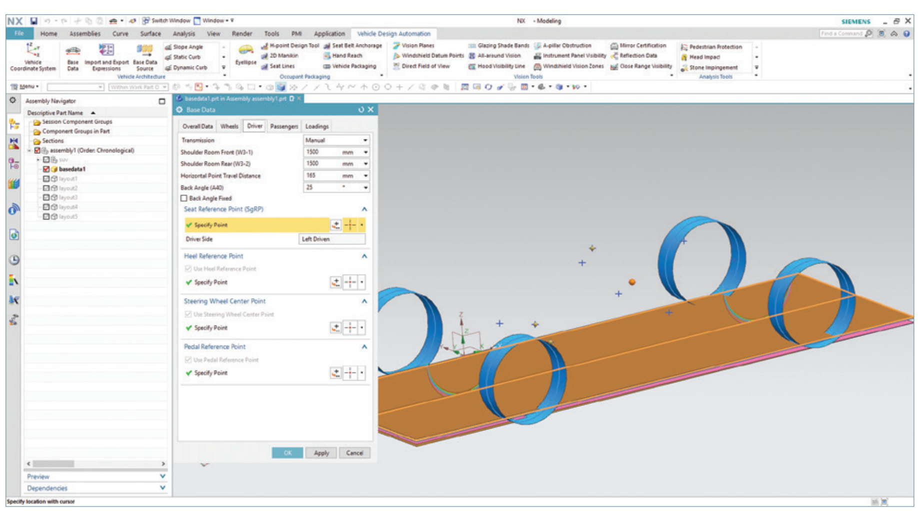


NX Vehicle Design Automation addresses a broad range of packaging tasks, including:

Base data

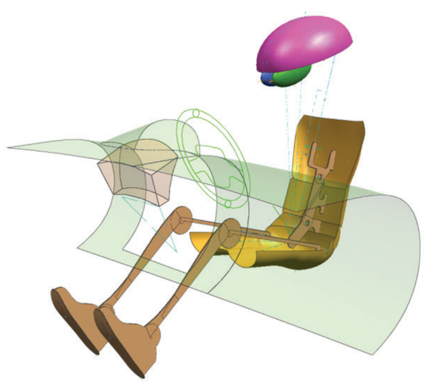
Base data dimensions (based on SAE J1100) such as wheelbase, vehicle length, tire sizes and driver side and seat reference point are used as the starting point for other functions. Different loadings can also be defined such as empty weight or with co-driver or fully loaded with occupant, luggage and fuel, which will be used to adjust the results to reflect the actual position of the driver relative to the ground. These key base values can be referenced by multiple validation functions across an assembly of the product, allowing an easy single point of update if dimensions and positions change. The base data can be updated by the function's own user interface (UI) or by importing from a spreadsheet of values. Base data component template files can also be easily swapped.





Occupant packaging and vehicle architecture analysis

The Hip Point Design (HPD) tool helps establish key vehicle reference points for configuring and measuring aspects of the interior automobile compartment. These points include seating reference points for each occupant position and heel points (accelerator heel point for the driver and floor reference points for passengers). The tool creates the reference points according to the Driver Designated Seating Position Design Procedures and Design Procedures for second- or third-row outboard seating positions in the SAE J4002 standards and creates a simplified CAD version of the H-Point Machine (HPM).

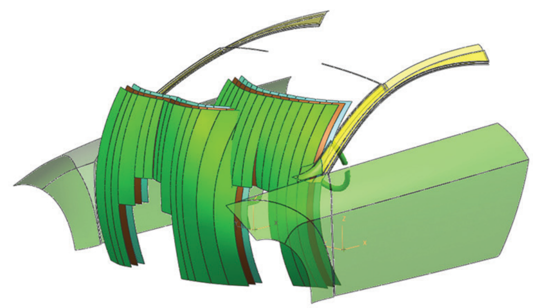


The 2D Manikin of NX vehicle design automation permits occupancy studies early in vehicle development. Leveraging actual human statistical data, the manikin can be sized to represent a wide range of driver and passenger populations on both Class A and Class B vehicles. Represented as contours in a side view, the 2D manikin is created in accordance with the recommendations of the SAE J833 and SAE J826 standards. In addition to occupancy considerations, the manikin can be used for performing basic posture checking with an integrated posture checker referencing occupant percentile values and key points such as seat reference point (SgRP), heel point and steering wheel center.

The Seat Lines assistant is used during early stages of vehicle development to create seat position lines and to determine the length and position of horizontal seat travel. As a design tool, the assistant makes it easy to determine the level of accommodation provided by proposed seat tracks. As a checking tool, it implements the SAE J1516 standard describing where drivers position their adjustable seats.

The Seat Belt Anchorage tool provides design recommendations for determining the anchorage location for vehicle seat belt restraint systems. The option is useful when performing occupant packaging studies to determine anchorage locations for restraint systems that conform to the guidelines of SAE, ISOFIX and ECE R14. Output includes the acceptable anchorage zone for the pelvic restraint system, the upper torso restraint system and the top tether for child restraint devices. The anchorage point for the pelvic restraint can be located on the vehicle structure or on the seat assembly. For SAE J383, it creates a closed curve representing the acceptable zone for the anchorage point of the pelvic restraint system. A closed curve is also created for the acceptable zone of the upper torso restraint system. For SAE J1369, it creates a sheet body representing the enclosed volume in which to locate the anchorage point for the top tether strap of a child restraint system.

The Hand Reach tool can be used to estimate the extent of a driver's hand control reach. Hand control reach is the maximum reach of drivers in a simulated driving situation, with the non-reaching hand on the steering wheel and the right foot on the accelerator pedal. The software creates 3D surfaces forming envelopes representing the hand reach capability for a specified proportion of the driver population and torso restraint system. The function follows the recommendations of SAE J287 and creates data for three-finger, extend finger and full hand reach.



Head Impact defines upper roof zone and head impact data target points and angles to FMVSS 201U on the upper interior components of a vehicle to analyze the impact of a vehicle collision to the heads of occupants.

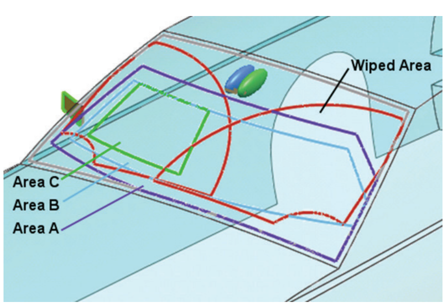
The Architecture Cover and Clearance functions evaluate the vehicle geometry to international and company standards creating geometry and check measurements for slope angle, static curb, dynamic curb, oil pan, wheel fixing, ground clearance, inner angle, wheel covering, bumper and crash barrier.

Visibility analysis and pedestrian safety

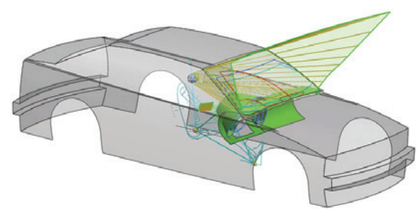
The Eyellipse tool helps certify vehicles for compliance with various regulatory standards. The tool graphically depicts the location of the driver's eyes for specified population percentiles, creating an elliptical model representing driver eye locations in the vehicle, and also creates features representing head contours and EEC vision points. These are used in other NX Vehicle Design Automation tools, including Instrument Panel Visibility Assistant, Windshield Vision Zones Assistant and Mirror Certification Assistant. The Eyellipse tool creates features that comply with a selection of standards, including SAE J941 and UMTRI for eyellipses, SAE J1052 for head position contours and the EEC ECE R125 Vision Points 77/649 standard as well as user-defined head gear profiles.

The Instrument Panel Visibility tool lets you calculate the visible and nonvisible areas of an automotive instrument panel which can be limited by the steering wheel and smart switch levers. Designers can use this tool to determine early in the vehicle development process whether the shape of the steering wheel with its smart switch levers meets the recommendations of SAE J1050a, which describes the driver's view of the instrument panel. Once the designer creates or selects the geometry representing the instrument panel location, steering wheel rim and hub and smart switches, the tool can analyze and report steering wheel obstruction, steering wheel vision faces, smart switches/levers obstruction and smart switches/levers vision faces.

The Windshield Vision Zones tool lets you verify the conformance of a windshield and wiper system design to established vehicle standards. You can generate test areas on a windshield based on SAE J902, SAE J903, SAE J198, SAE J382, ECE 43, ECE R125, FMVSS 104, GB 11556, GB 15085 and UMTRI standards. The program creates the actual windshield wiped area, calculates the percentile of the actual wiped area and checks it against the standard. The designer specifies the vehicle class, eyellipse, hip point, windshield and wiper system details with step-by-step guidance from the tool. With this input, the wiped area and test areas A, B and C are calculated and the tool checks whether the results meet the requirements of the standard.

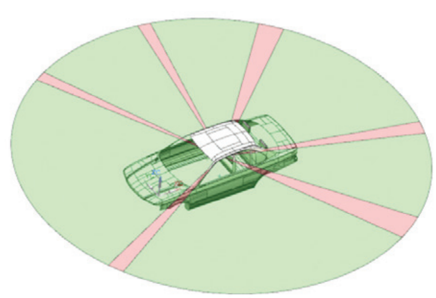


The Direct Field of View function can be used early in the vehicle development process to calculate the ambinocular vision regions of an individual driver or a group of drivers and to evaluate whether the vision angles are within an acceptable range to meet SAE J1050. The user can limit the vision region by either defining the eye/head rotation or by specifying a window boundary. The regions are dependent on the eye points or an eyellipse (the eyellipse takes into account the vehicle type and the driver population percentile). The software creates a geometric feature representing the direct field of view and can also perform quick checks on the up, down, left and right angle values of that field of view.



Vision Planes and Windshield Datum Points create geometry representing the no-obstruction area based on ECE 77/649 and GB 11562 standards.

All-round Vision generates surface or line geometry at the driver's eye-level to represent blocked or visible areas around the vehicle from the driver's position. This aids in the design of the vehicle for safe driving by evaluating the driver's view angles.

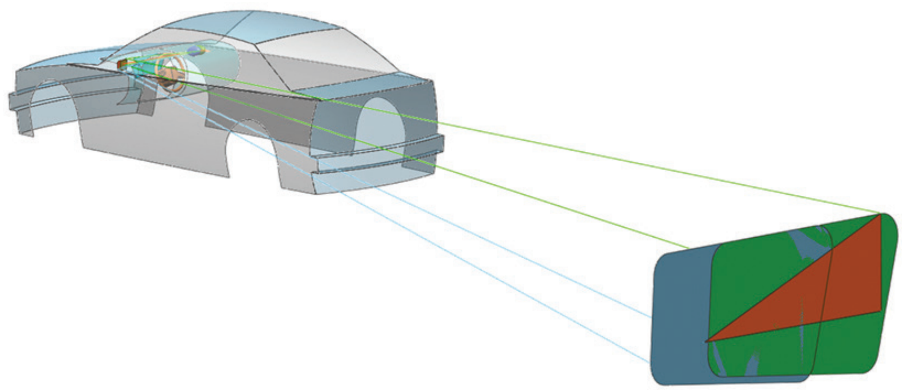


Hood Visibility Line provides a line representing the foremost points on the hood that the driver is able to see within a given view range. This assists in the evaluation of EEC 90/630.

American and European automotive standards define the limits by which a driver's field of view may be obscured by the A-pillars of a vehicle. The A-Pillar Obstruction function measures this obscuration using the methods recommended by these standards, and reports whether the vehicle adheres to the standard or violates it. You can also work in reverse and create criteria geometry (such as sight lines) for an A-pillar, given a target obstruction angle. This function follows the recommendations of SAE J1050, ECE R15 and GB 11562. By using A-Pillar Obstruction during visibility studies, designers can determine the right obstruction angle that conforms to the guidelines of SAE and EEC. The software can generate sight lines given a target obstruction angle and outboard or inboard point of the A-pillar.

The Glazing Shade Bands tool automates the creation of curves defining the driver glazing shade band. It aids in performing visibility design studies for vehicle packaging during automobile development. The output is curves that mark the shading boundaries. A glazing shade band is the area immediately adjacent to and below the top edge of a vehicle's glazing. Light transmission and visibility through the shade band is less than what is required for normal driving. The software provides step-by-step guidance for creating the glazing shade bands. Recommendations in the SAE J100 standards are supported.

The Mirror Certification tool performs analyses on automotive driver- and passenger-side outside and inside rearview mirrors before certification, or certifies the performance of an existing mirror design. The tool generates vision rays and lines, for left and right eye, describing the geometric field of vision of rearview mirrors. These vision rays and lines check compliance with national standards for inside and outside rearview mirrors for the following countries and regions: USA (FMVSS 111), Canada (CMVSS 111), Japan (Article 44/TRIAS 29/TRIAS 39), Europe



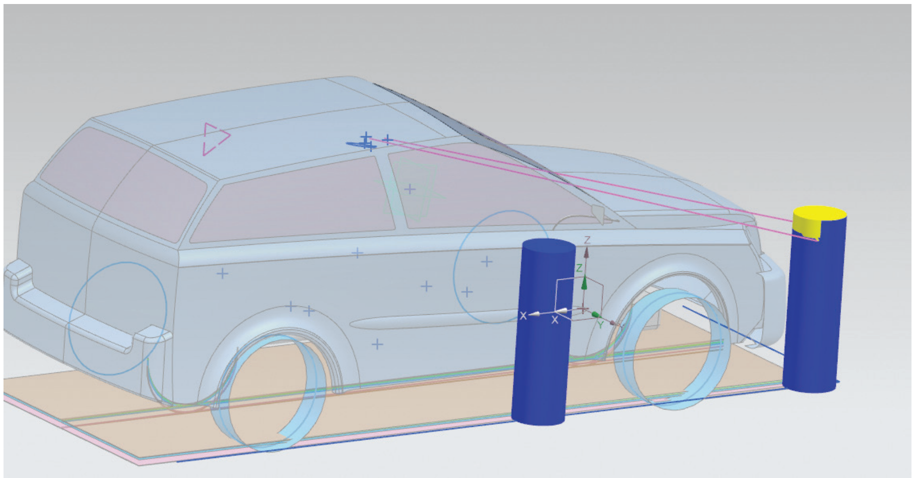
(71/127/EEC, ECE R46), Saudi Arabia (SSA 770/771), Gulf States (GS 421), Australia (ADR 14/02) and China (GB 15084).

The Reflection Data tool projects and creates the reflections of points or curves onto a face when viewed from a specific eye position. You can use reflection data to create trace curves representing the path of the reflected light rays and to simulate reflections on a solid, transparent object, such as a sheet of glass (the refraction of light rays passing through the glass is considered). Automotive designers will find this tool useful to verify the reflection of interior components on the windshield of the automobile. It can also be used in reverse to identify where on the instrument panel a light source should be placed to be seen as a heads-up display.

Close Range Visibility checks the visible volumes for the driver on the side and front of the vehicle. It creates demo cylinders and blind volumes to identify visible range for the driver to Japanese standard MLIT 619M based on direct eye, mirror and cameras vision.

Pedestrian Protection creates head impact and leg impact zone geometry to comply with NCAP (Euro, North America, Japan, China, Korea) and UN GTR 9 regulations. The tool performs extensive interference checks and area calculations and supports passive and active hood systems, different loading configurations and marginal as well as standard head offset values. The tool uses the vehicle geometry (front upper surfaces, windshield, A-pillar, bumper beam) to associatively create wrap-around distance (WAD) lines and calculate bonnet reference lines (BLE, BFRL, BRRL, BRTL, BSRL), corner reference points (CRP), bumper reference lines (UBRL, LBRL), internal bumper reference line and bumper corner points.

NX vehicle design automation provides a rapid method of checking vehicle designs against numerous international standards throughout the product development cycle.



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