NX General Packaging

Intelligent tools for automotive mechanical and occupancy packaging

Benefits

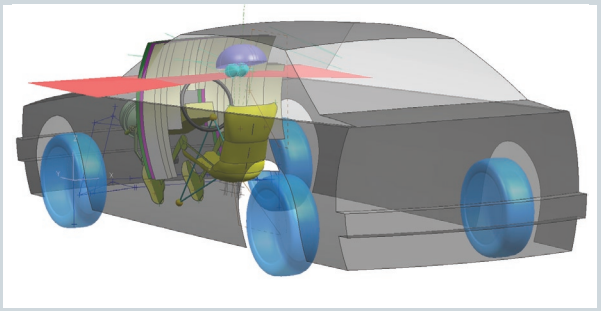
- Industry standards and process knowledge are stored for repeatability and standardization
- All tools are ready to go out of the box with minimal customization costs
- Frees up highly skilled packaging engineers to concentrate on complex packaging problems
- Enables rapid evaluation of alternative designs in a unified design environment
- Leverages integrated analysis to provide fast feedback on design's compliance with established standards

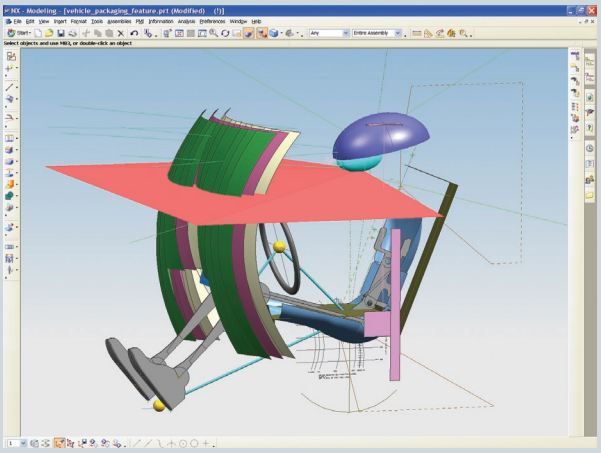
Features

- Automatic geometry creation and integrated compliance checks
- Permits early occupancy and mechanical packaging studies
- Helps establish key vehicle reference points for configuring and measuring aspects of the interior automobile compartment
- Estimates horizontal seat travel for accommodation studies

Summary

NX™ General Packaging is a suite of tools that automates many of the tasks associated with the mechanical and occupancy packaging of an automobile. NX General Packaging provides assistance to certify the vehicle for compliance to SAE standards and a variety of governmental regulations, including those in the US, Europe and Asia. The software helps users assess the accommodations and ergonomic performance of the vehicle.





Vehicle Packaging.

All of the tools in NX General Packaging are written in the style of wizards, and offer step-by-step instructions to complete complex vehicle packaging tasks. In addition, NX General Packaging embeds industry-specific knowledge of the process of vehicle design and certification. Associativity of the output geometry automatically updates analysis results as the design of the vehicle evolves from art to final product.

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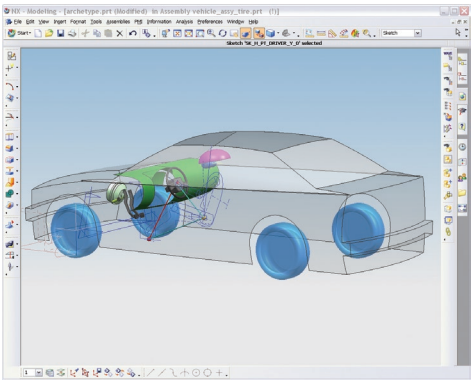
NX General Packaging

Features *continued*

- Determines the anchorage location for vehicle seat belt restraint systems
- Determines maximum reach of drivers in a simulated driving situation
- Represents location of driver's eyes
- Determines visible and nonvisible areas of instrument panel
- Verifies windshield and wiper system performance against established standards
- Analyzes the field of vision of outside and inside rearview mirrors
- Permits early studies of driver's vision angles
- Determines how interior components reflect on the windshield
- Assists in understanding the effect of engine movement on adjacent components
- Creates an envelope representing the full range of a tire's motion



2D Manikin.

NX General Packaging addresses a broad range of packaging tasks, including:

Vehicle Packaging To define overall parameters, NX General Packaging provides wizards for vehicle and occupant packaging. With the Vehicle Packaging wizard, users specify vehicle type (Class A or Class B), transmission type, driver side location and for Class B vehicles, the number of rows and maximum passengers per row. The user can then create occupants for the selected seating positions using the Vehicle Packaging wizard. The wizard guides the user through the specification of seat movement, male/female ratio and type of restraint system. These packaging parameters are associatively linked to the other tools included in NX General Packaging, eliminating the need to re-enter data for specific packaging tasks and providing a single context for all occupancy packaging-related studies for a vehicle.

Hip Point Design The Hip Point Design (HPD) wizard 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 wizard 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 Feb 2004 Standard. The HPD wizard meets the recommendations of SAE J4002 Feb 2004 and applies to Class A vehicles only.

2D Manikin The 2D Manikin wizard in NX General Packaging 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 J826 standard. In addition to occupancy considerations, the manikin can be used for performing basic posture checking with an integrated posture checker.

Seat Lines 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 SAE J1516 and J1517 standards describing where drivers position their adjustable seats.

Seat Belt Anchorage This 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.

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.

This function follows the recommendations of SAE J383 (June 1995) and SAE J1369 (October 1997). 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.

Driver Control Reach This 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 nonreaching 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 (June 1988).

Eyellipse The Eyellipse wizard helps certify vehicles for compliance with various regulatory standards. The wizard 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 General Packaging tools, including Instrument Panel Visibility Assistant, Windshield Vision Zones Assistant and Mirror Certification Assistant. The eyellipse is also integrated within the Hip Point Design and Vehicle Packaging tools.

The Eyellipse wizard creates features that comply with a selection of standards, including SAE J941 (September 2002, June 1997 or October 1985) for eyellipses, SAE J1052 (August 2002 or April 1997) for head position contours and the EEC Vision Points 77/649 standard.

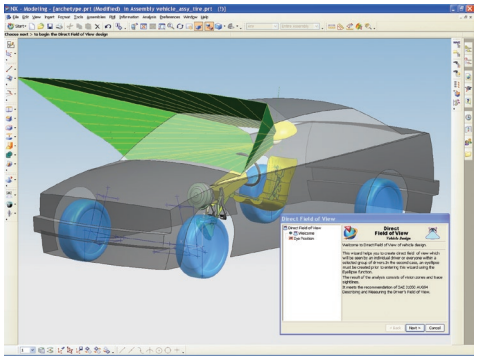
Instrument Panel Visibility The Instrument Panel Visibility wizard lets you calculate the visible and nonvisible areas of an automotive instrument panel which can be limited by the steering wheel and smart switch levers. Designers can use this wizard to determine early in the vehicle development process if 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 wizard can analyze and report steering wheel obstruction, steering wheel vision faces, smart switches/levers obstruction and smart switches/levers vision faces.

Windshield Vision Zones The Windshield Vision Zones wizard 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 and ECE (European) standards. The program creates the actual windshield wiped area and 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 wizard. With this input, the wizard calculates the wiped area and test areas A, B and C and checks whether the results meet the requirements of the standard.

Direct Field of View 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.



Direct Field of View.

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.

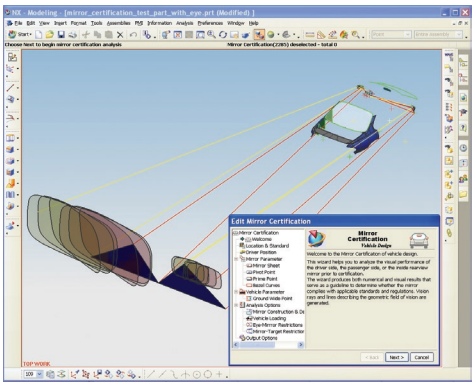
A-Pillar Obscuration American and European automotive standards define the limits by which a driver's field of view may be obscured by the A-pillars of a vehicle. The A-Pillar Obstruction wizard measures this obscuration using the methods recommended by these standards, and reports whether the vehicle 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 Jan 2003 and EEC 77/649. 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.

Glazing Shade Bands NX General Packaging includes a tool that 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 standards SAE J100 January 2005 are supported.

Mirror Certification The Mirror Certification wizard 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 wizard generates vision rays and lines describing



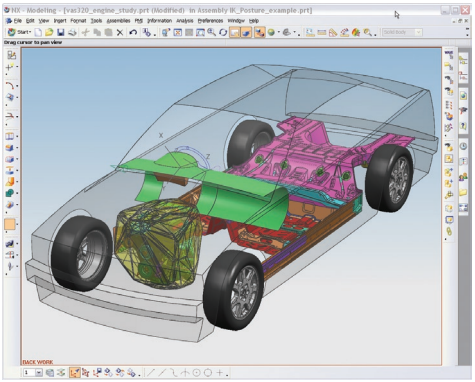
Mirror Certification.

the geometric field of vision of rearview mirrors. These vision rays and lines comply with national standards for inside and outside rearview mirrors for the following countries and regions:

- USA – Canada: FMVSS 111 – CMVSS 111
- Japan: Article 44/TRIAS 29/TRIAS 39
- Europe: 71/127/EEC (European Economic Community) – ECE R46.01 (Economic Commission for Europe)
- Saudi Arabia – Gulf States: SSA 770/771 – GS 421/422
- Australia: ADR 14/02

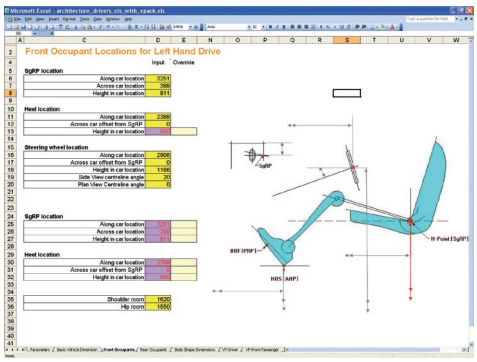
Reflection Data The Reflection Data wizard projects and creates the reflections of points or curves onto a face when viewed from a specific eye position. You can also use reflection data to create trace curves representing the path of the reflected light rays and to simulate reflections on a solid, transparent 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.

Engine Roll The Engine Roll wizard creates a feature envelope containing the full range of an engine's motion. Although the engine in an automobile is generally treated as a stationary object, the mounts do allow the engine to move slightly as a result of acceleration, braking and cornering of the vehicle. This movement may be sufficient to cause collisions with adjacent components.



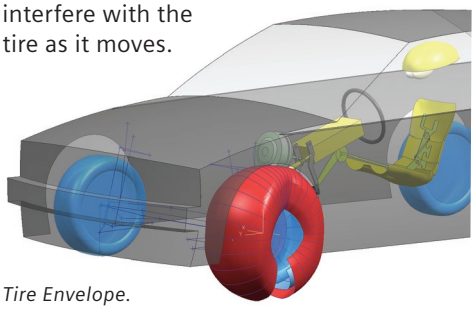
Engine Roll.

Designers can also use the Engine Roll wizard to study interferences between the engine and adjacent components and after the detailed design is complete to verify whether the engine compartment has been packaged correctly.



Functional requirements stored within Microsoft Excel spreadsheets can associatively drive the NX General Packaging tools.

Tire Envelope The Tire Envelope wizard creates a feature envelope that contains the full range of a tire's motion. This is useful during the body design process to ensure that designed parts – for example, BIW, exterior trim or ancillary drivetrain components – do not interfere with the tire as it moves.



Tire Envelope.

The wizard provides step-by-step guidance and comes with standard suspension templates for short long arm (SLA), MacPherson strut and five-link suspension and tire profile templates.

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