

Development of CITY aimed at Advanced Proud Sedan

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ABSTRACT

The CITY was developed with the aim of setting a new standard for small sedans that are in high demand, particularly in emerging countries.

The concept during the development process was to create an automobile that purchasing customers could take pride in owning and also be proud of themselves.

One aspect of building a small sedan is that it is based on an earlier hatchback model, and the CITY was similarly based on the 2008 model year FIT (JAZZ).

All aspects of the CITY small sedan were developed toward achieving the concept of an Advanced Proud Sedan, and the results have been favorably received in every country where it is sold. An automobile that delights customers around the world has been created.

1. Introduction

The CITY was first sold in 1996 as an Asia-only model. The nations marketing it have since increased, and today it is manufactured at six locations in Asia, including Thailand, China and India, as well as in Brazil, making it a truly global car.

In addition to adding locally required specifications and equipment to the development tasks, the development team spent many hours listening to the opinions of customers of small sedans.

Additionally, for the interior and exterior styling and packaging development process, meetings with customers in the key nation of Thailand were held in order to check the model.

Simultaneously, the team also met customers from other countries at the same time and worked to reflect their valued opinions in the model.

Also, to confirm cruising performance, driving tests were conducted in urban high-traffic areas, on expressways and ordinary suburban roads in Thailand and India to focus the direction for CITY tuning.

This was the background to the development concept for the CITY.

The “base model” in this paper is the 2008 model year FIT (JAZZ).

2. Development Concept

During development of the CITY, the team interviewed numerous individuals in the model’s markets to determine their sense of values. The results indicated that people are always thinking of moving up and that they value being seen as successful, being recognized by others, and taking pride in themselves. What people want from the automobiles they own is a sense of being advanced, to receive recognition from their families as well as others, and to take pride in using their automobile for a variety of purposes.

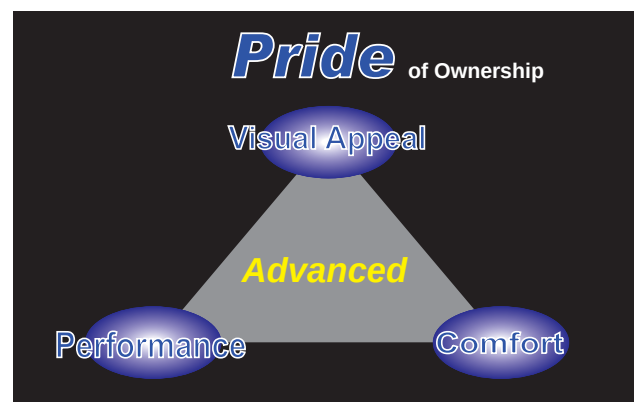


Fig. 1 Grand concept : Advanced Proud Sedan

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Table 1 3 dimensions and wheelbase

	Previous CITY	Newly developed CITY	FIT (JAZZ) 2008 year model
Overall length (mm)	4390	4395	3900
Overall width (mm)	1690	1695	1695
Overall height (mm)	1485	1470	1525
Wheelbase (mm)	2450	2550	2500

The grand concept determined for the CITY was to develop an “Advanced Proud Sedan” (Fig. 1), an automobile with the visual appeal that makes the owner proud just to look at it, the performance and comfort that make the owner proud to use it, and a sense of being advanced.

3. Strong Styling

3.1. ARROW SHOT FORM

As the studies progressed in each of the regions, the result that emerged was that the common expectation from a small sedan is visual appeal with strength. However, if cabin comfort is solely enhanced in order to reflect this value in the styling design of the model, this becomes clearly apparent in the external view and detracts from the visual appeal. The team therefore conceived of the “ARROW SHOT FORM,” a styling theme to provide the required visual appeal as well as comfort.

The form expresses comfort wrapped in powerful visual appeal, an effect made possible by exterior styling that captures the dynamic motion of an archer drawing a bow, and a cabin area that also expresses the pent-up energy of the drawn bow (Fig. 2).

3.2. Packaging and Exterior Styling

Most small sedans are shaped like the hatchbacks on which they are based, with the addition of a trunk. Some models are indistinguishable from the hatchback model when seen from the front. The project decided to take a different approach when it developed the CITY, aiming to create clear differences in the external view. In post-

sale market surveys, customers responded favorably to the strong original styling.

3.2.1. Three dimensions and wheelbase

While maintaining the good maneuverability of the previous CITY, the increase in length and width was limited to 5 mm. The team reviewed how to lower the automobile height as much as possible, while using the same floor panel and the front seat frame as the base model. As a result, a height 15 mm lower than the previous CITY was achieved. This necessitated changing the driving position relative to the base model, so a new design for the bracket supporting the seat rail lowered the position by 7 mm. An adjustment of cushion urethane thickness and a new design of the cushion spring lowered the position by another 8 mm.

To enhance the auto’s proportions as a sedan, the wheelbase was analyzed by imaging simulation and extended by 50 mm over the base model and 100 mm over the previous CITY.

Table 1 compares the three dimensions and wheelbase, while Fig. 3 shows the CITY’s packaging design.



Fig. 2 Exterior design theme: Arrowshot Form

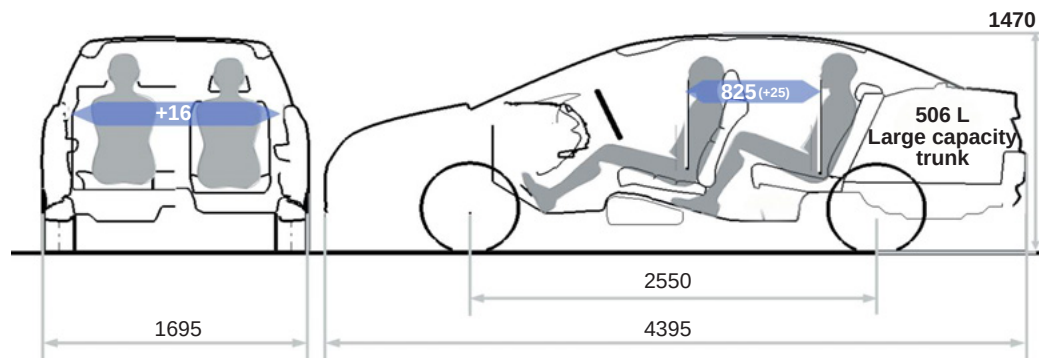


Fig. 3 Package design

3.2.2. Side styling

Market studies indicated that important elements included strength plus a silhouette that flows smoothly from the tip of the hood and over the roof to the rear of the vehicle, and these values were incorporated into the side styling (Fig. 4).

The body side seeks to harmonize visual appeal and comfort. Compared to the previous CITY, the external width is 5 mm greater, while cabin width is 16 mm greater, and the body side panel was finished to give it a

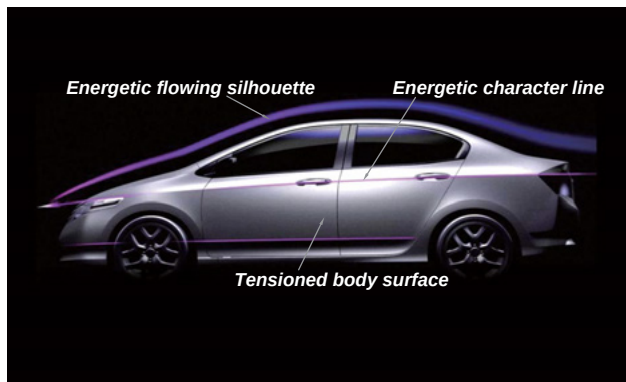


Fig. 4 Side styling : Solid and imposing design



Fig. 5 Front styling : Powerful, forward-thrusting, front-end design



Fig. 6 Rear styling : Sharp rear-end design

tensioned surface.

The body's side character line, sharp from front to back, recalls the impression of the arrow in the ARROW SHOT FORM theme as an integral part of the active styling.

3.2.3. Front styling

The goal of the styling of the front mask was to pack it with power (Fig. 5).

The trigger of this concept was the words by the president of a Honda dealership in Thailand: "If you look a person in the eyes, you know his ambition. It's the same with automobiles." Many small sedans are equipped with single-bulb headlights bearing an elliptical motif. The CITY, in contrast, uses horizontally-wide and longitudinally-slim single-bulb headlights with styling like eyes to render a powerful impression. The model takes advantage of cross-direction lighting to achieve the same level of performance as the previous CITY.

The grill design, which is continuous with the headlights, completes the characteristic front mask, while the front styling incorporates the functional elements of collision performance, pedestrian protection and forward visibility.

3.2.4. Rear styling

The goal for the rear styling is to establish an appearance that would leave a strong impression (Fig. 6).

The forceful line leading from the tip of the hood, the solid look leading from the side, and a form that creates trunk volume, combine into dynamic high-deck styling.

The body's side character line connects to the rear end's characteristic taillights, creating an image of arrow feathers.

The taillights are of a one-piece construction mounted on the side panel. Taillight size was balanced against the size of the trunk opening line, making the trunk easy to use despite the limited body width. The one-piece construction is designed to house the rear fog lights that are required in Europe.

4. Creating Attractive Performance

4.1. Powerful yet Relaxing

Test-drive sessions were held in Thailand and India as representative of the CITY's sales markets. These test drives included competing models, and based on the results, the key requirements in these regions were narrowed down to the following.

1. Power plant standing start and acceleration response suitable for heavy traffic and high-speed cruising (Fig. 7)
2. Comfortable riding on rough roads, whether in the city or on its outskirts

Therefore, the performance theme chosen was "powerful yet relaxing," and the team tuned the common platform to achieve this theme.

4.2. Power Plant and Engine Room

The power plant used the same specifications as the base model, i.e., a 1.34 L or 1.5 L i-VTEC engine, each available with manual or automatic transmission. The CITY is additionally available with a power plant that combines an automatic transmission with a 1.8 L i-VTEC engine.

The engine room was designed to accommodate the large-size 1.8 L space layout. A summary comparison of the size of the 1.5 L and 1.8 L engines is shown in Fig. 8.

The same major parts as the base model were successfully utilized on the dashboard side. It was

necessary to expand the space on the front side, however, in part to accommodate a larger battery, so the overhang was extended 105 mm compared to the base model. A view of the 1.8 L engine room from above is shown in Fig. 9. The view from above shows that the battery goes in at an angle to limit how much the total length and width of the small sedan had to be increased.

4.3. Chassis

The chassis is a major determining factor for performance. As with the power plant, the CITY uses the

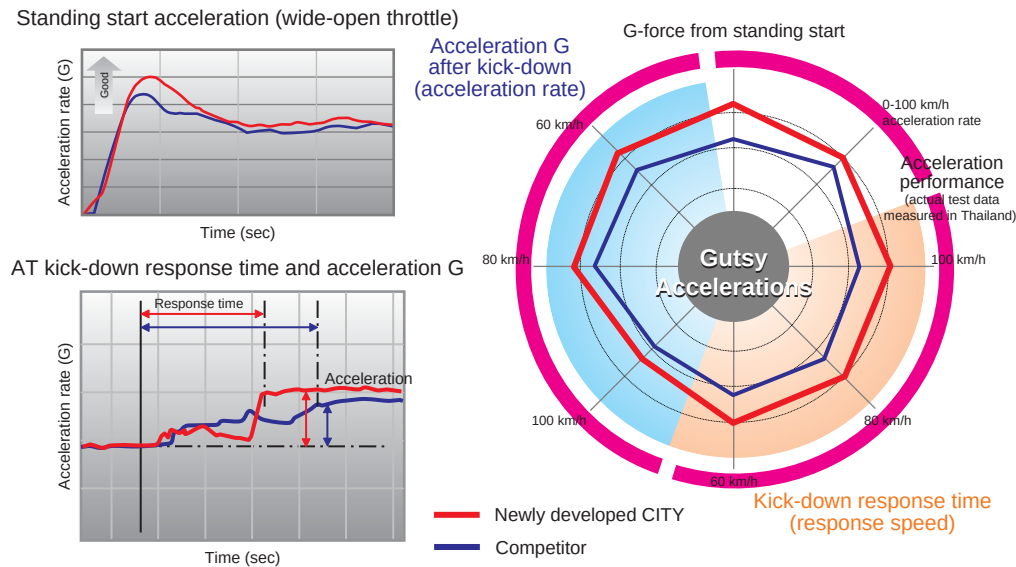


Fig. 7 Acceleration rate : Powerful Accelerations

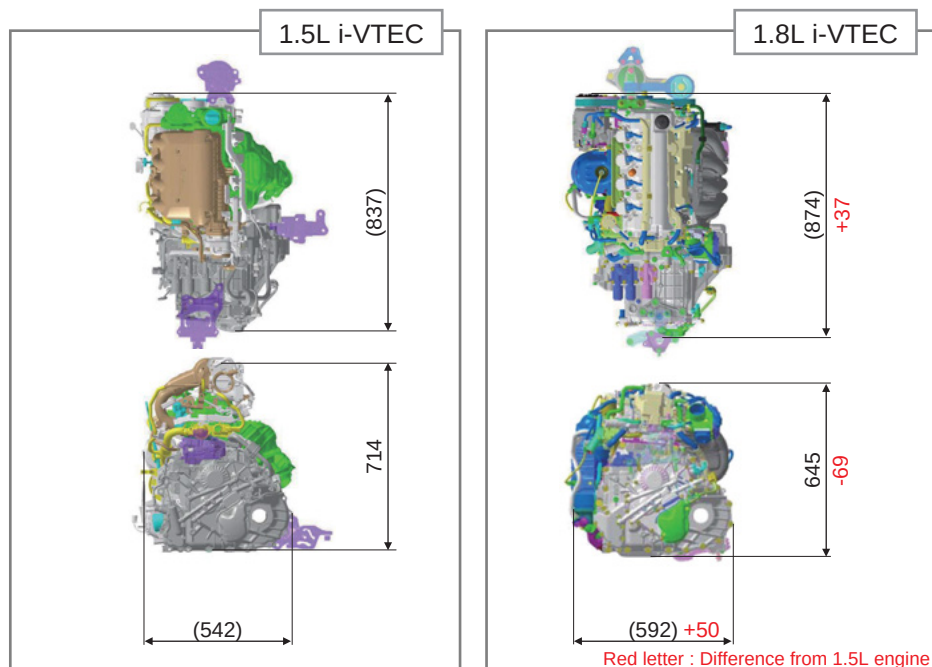


Fig. 8 Engine size comparison

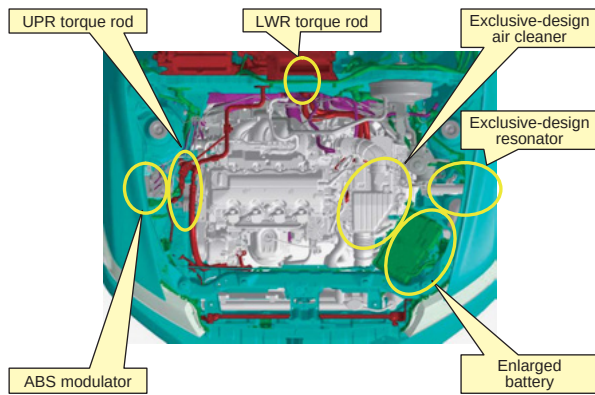


Fig. 9 1.8L engine room

same chassis as the base model, with three major exceptions stemming from the fact that the bodies are shaped differently.

1. The wheelbase is 50 mm longer
2. The 1.8 L engine and front overhang
3. The trunk room and rear overhang

In addition to the above, there is a different weight balance between front and rear, and exclusive designs and tunings were applied to the chassis in order to achieve the aim of a “powerful yet relaxing” design. The structure of the chassis and differences with the base model are shown below (Fig. 10).

4.4. Suspension and Power Steering

The CITY uses the same suspension as in the base model, including the body structure to which the suspension is attached. However, unique tuning was applied for the spring rate and damping constant. Additionally, the stabilizer diameter was decreased from 21 mm to 19 mm. Unique electric power steering data settings were applied to account for the suspension’s characteristics. This tuning functions as the base for powerful acceleration, while enhancing relaxing performance with a flexibly comfortable ride, high stability, and crisp steering feel.

4.5. Exhaust System

The exhaust system is affected by all three of the previously noted major differences in the chassis. Differences in the exhaust system specifications are shown in Fig. 11.

4.6. Body Rigidity

Simulations were employed to study body rigidity, which supports cruising performance. By increasing the bonding rigidity in each part, a light but highly rigid construction was achieved.

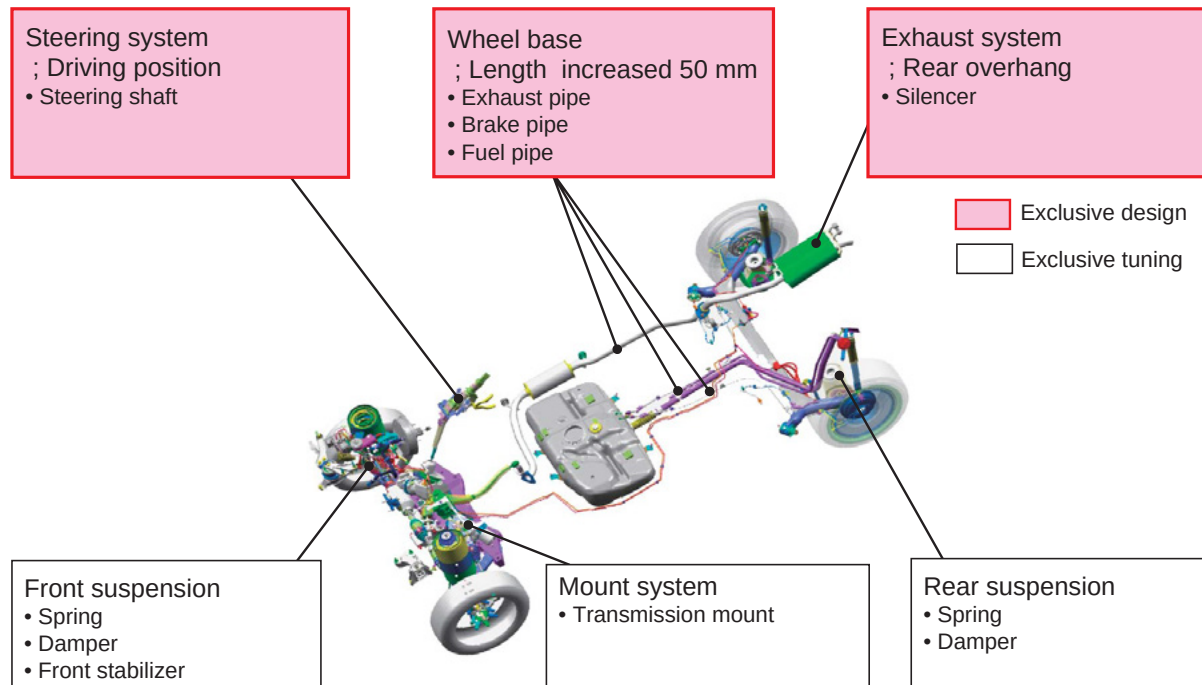


Fig. 10 Chassis platform for 1.5L

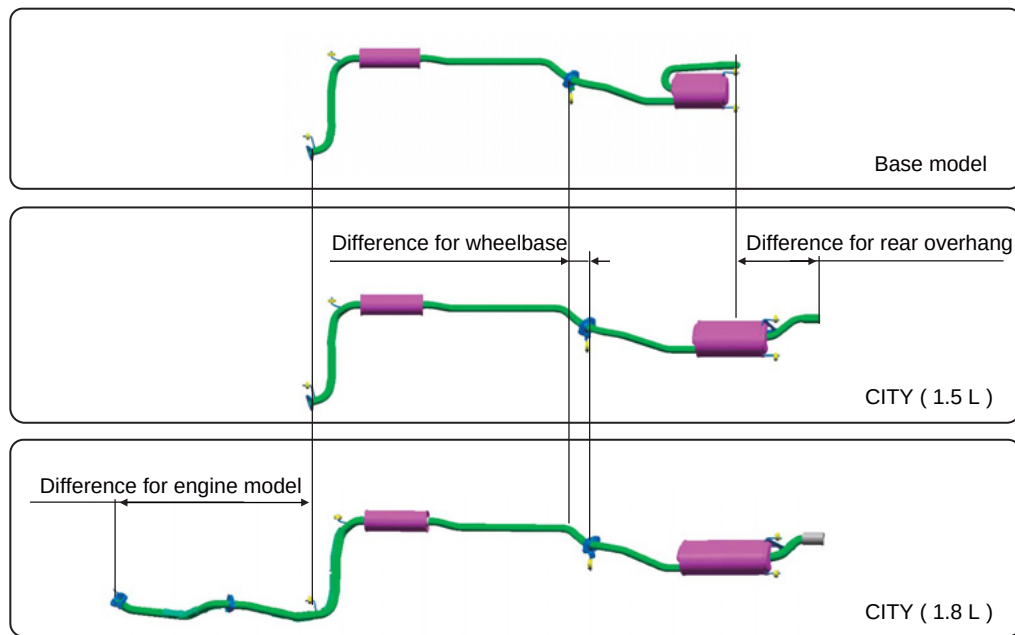


Fig. 11 Exhaust system comparison

The barrier between the cabin and trunk room (i.e., the rear bulkhead), a part of the automobile that differs greatly in construction from the hatchback, is integral to body rigidity in a sedan (Fig. 12). Here, the CITY uses the same rear wheelhouse, where the suspension is attached, as the base model. In addition, the trunk room was given a wide opening and a highly rigid framework was achieved.

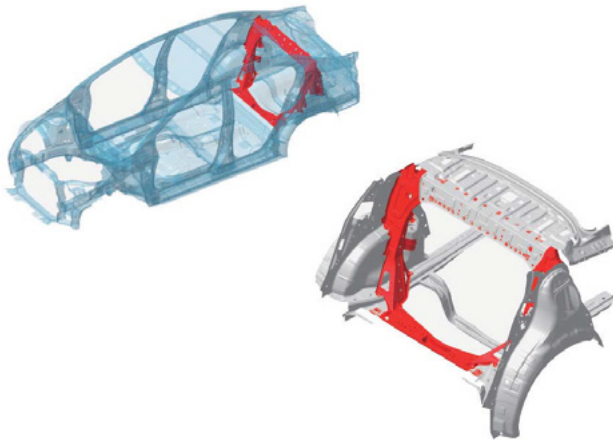


Fig. 12 Body rear bulkhead

5. Exclusively Designed Comfortable Space

5.1. Generosity and Strength

It is the team's desire to provide a comfortable interior space isolated from the road environment (for example, heavy traffic) and the weather (such as sudden squalls). The CITY was styled to envelop passengers in generosity and strength so they can take pride in being inside this interior space.

5.2. Front Seat Interior

The front seat impresses the observer with the strength that is expressed by the interior (Fig. 13). One can see this strength in the forceful character line and color flow from the silver-colored panel in the center of the instrument panel to the front pillar, door interior, and console.



Fig. 13 Interior styling 1

The lively steering wheel, which is also used in the base model, hardly seems out of place in the sedan's interior, and was highly praised in market studies.

The meter design features edge lights and metallic-finished 3-D faces, as well as a fuel consumption indicator designed to make the meters appear advanced (Fig. 14). The meters have the same panel as in the base model, with the difference expressed in their appearance.

5.3. Rear Seat Interior

Sitting in the rear seat, however, the strong form that is apparent in the front is sensed as a generous flow. The roof surface, extending from above the passenger's head to the front, appears to pass through the glass (including the side glass) and spread out as it blends into the outside scenery (Fig. 15).

Thanks to a front-to-back-seat tandem distance that is 25 mm greater than in the previous CITY, the rear seat space is greater than the standard for small sedans (Fig. 16). As a result, the ease of sitting in the rear seat makes not only owners themselves, but also family, friends or guests keenly feel how comfortable the space is. Consequently, "Pride of comfort" for owners was achieved.

Compared to the base model, which comes with a ULTR Seat, the CITY's rear seat focuses on the comfort expected of a sedan. It has a fixed seat face with plenty of cushion, with the space below functioning as a storage space. When this was arranged, incorporating study results, the team assumed that umbrellas and shoes were the type of items that would be placed in the storage space, and considered how it would feel on the



Fig. 15 Interior styling 2

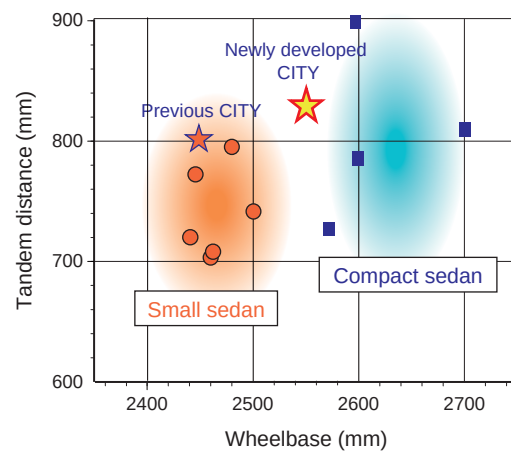


Fig. 16 Tandem distance

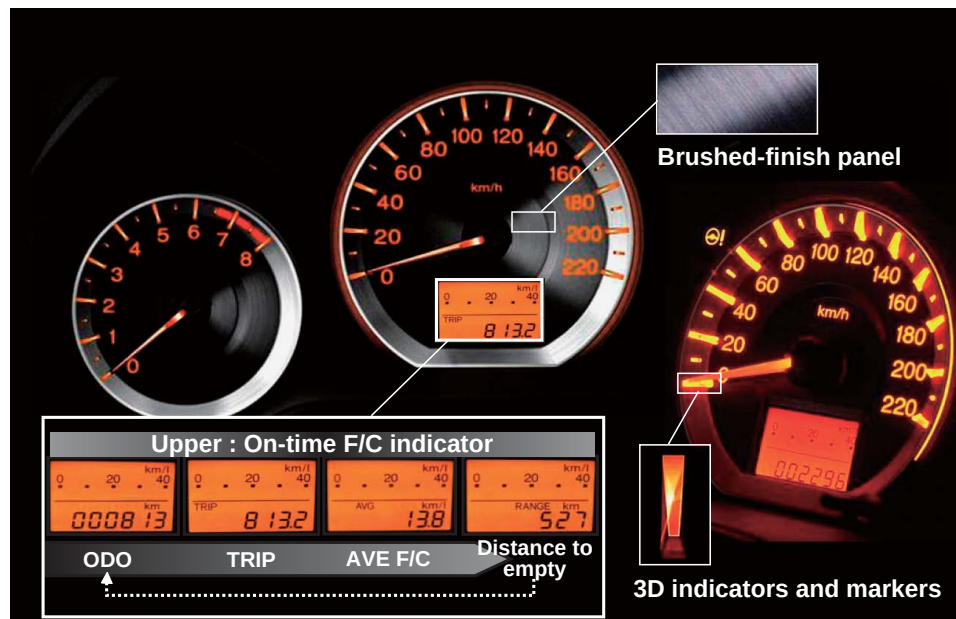


Fig. 14 Meters : Advanced meter design

passengers' heels while seated, in addition to appearance and theft prevention (stored items are not easily visible when the door is open).

The rear seat back is of the fixed type, but in addition there is a high-end variation that has the same lock and striker as the base model and uses a reclining mechanism (Fig. 17).

5.4. Trunk

While the hatchback model prioritizes cargo room utility, trunk spaciousness is what is required in a sedan (Fig. 18). The team studied the ease of trunk use in competing models and the types of objects put in the trunk in various regions, then designed a high-capacity trunk of 506 L, an opening that does not impede the user from placing items in the trunk or removing them, and a trunk opening threshold that is low enough for ease of loading and unloading.

5.5. NV Performance

The CITY's response to noise and vibration, as part of offering customers a comfortable space, is to emulate the configuration of the base model but use an exclusive design in the parts of the package that differ from the base model.

To equip the automobile with a 1.8 L engine, all mount systems have an exclusive design.

Sound blocking and sound absorption were accomplished through unique designs in the trunk and rear bulkhead area, which differ in configuration from the hatchback model. In the rear pillars in particular, to enhance the comfort of rear-seat passengers, the design blocks noise by placing a seal over the large aperture where the seat belt retractor is attached.

Furthermore, in pursuit of the comfortable space expected in a sedan, a dynamic damper for the side frame tip was adopted to reduce interior booming noise.



Fig. 17 Rear seat and under-seat tray

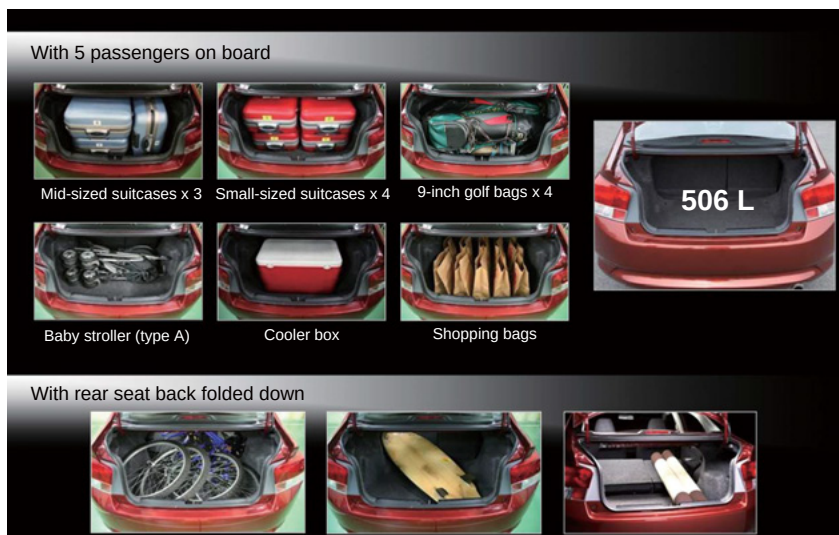


Fig. 18 Trunk room

6. Presentation of Advanced Features

The advanced equipment of the CITY is one step ahead of, yet easier to understand, than the equipment of competing automobiles.

Although taken for granted in the Japanese market, in the CITY's markets the fuel consumption indicator is regarded as advanced equipment that makes one think of a "driving computer." Following introduction of the automobile, the indicator received favorable evaluations, coming at a time when users have a reason to limit fuel consumption.

The upper-end variation has side turn signals located in the door mirrors, which enhances the image of the series as a whole.

The Steermatic function, also on the high-end variation, elevates the sporty impression.

Finally, the CITY is equipped with an audio system specifically developed for use with digital media players (below, DMP) as another feature in which people purchasing the CITY can take pride. This audio system was developed exclusively for the CITY to meet the needs of users in the model's sales regions.

7. Advanced Audio

Initial studies revealed that audio is a subject of in-car entertainment interest in the CITY's sales region, and so the team decided to develop an audio system for this model alone. This exclusive development included identifying the following three points as changes in the needs of the CITY target customer and incorporating them into the audio concept.

1. Conventional small sedans typically come with a 1DIN-size audio system. However, there is an increasing trend for even small sedans to come equipped with audio systems integrated into the panel and featuring the refined styling already widespread in the upper segment of the market.
2. Highly portable DMPs are rapidly growing in the market.

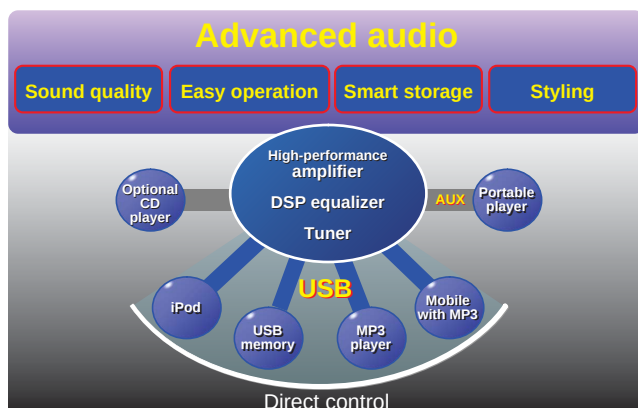


Fig. 19 Audio concept

3. CITY target customers keep a large number of music pieces on their personal computers in the form of compressed audio and listen to them in that form.

As these three points imply, an audio system suitable for the CITY in these markets is one that is integrated into the panel and is designed primarily to connect to a DMP. The following were the specific development points.

1. The system should be able to connect to many types of DMPs
2. It should be easy to operate as well as select songs
3. It should be able to play back compressed audio at high sound quality
4. It should have added functionality and a forward-looking façade design to increase the joy of ownership

A CD player, moreover, is an option and was designed to be installed at the request of any customer desiring it. Figure 19 demonstrates this concept.

This audio system, developed under the name of "advanced audio," has earned high praise in the market, with many users commenting, "I'd been hoping for something like this."

7.1. Playback of Compressed Audio

In line with the concept that the main function would be to play back compressed audio from a DMP, the different hardware components were tuned, including exclusively tuned condensers (Fig. 20), with the goal of high-quality playback performance as a basic function.

The system includes a DSP graphic equalizer, which lets users easily alter sound quality as the mood strikes them; choices include "Natural," "Relax" and "Energy." The equalizer also has an "MP3 mode" to emphasize the audio's musical contours and reverberation, which are often lost in compression. This addition enhances the functionality of the unit as a primarily DMP audio system.

System designers enhanced the performance of the head unit and tuned the six-speaker acoustic qualities by first considering both the preferences of customers and the characteristics of music in the sales region.

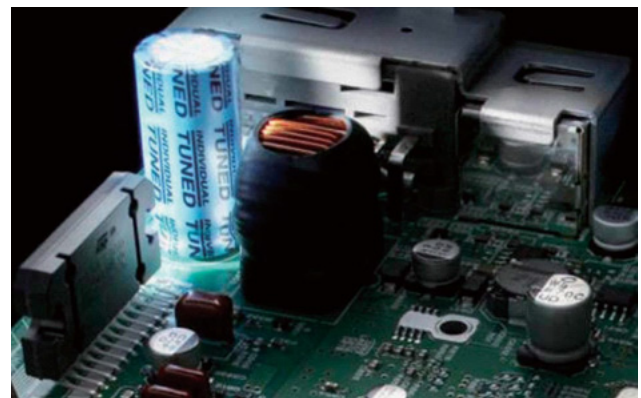


Fig. 20 Exclusively tuned condenser

7.2. Reflecting the Way DMPs are Used

The greatest advantages of DMPs are that they hold so many songs and allow stress-free operation and song selection. A car audio system based on DMP playback must have an operating system that makes it easy to select songs. Therefore, a large rotary selector with high-speed search function was added to the system. In addition, considering the fact that DMP users frequently skip to the next song during random playback, the system has larger left and right skip buttons corresponding to this function.

The steering wheel features an audio switch that, together with the unique way of using DMPs, enhances operability while driving.

7.3. Media Storage Function

To design this audio system based on a DMP connection, the project took advantage of developing the system as an integral part of the vehicle. The hardware of the audio unit, which is normally built to DIN specifications, was made smaller and given an exclusive design, and a pocket was built into the vehicle to accommodate the DMP.

The pocket lid with LCD is designed to deter theft (items within are not directly visible from outside the vehicle) while enhancing appearance (connectors and cables are hidden). The lid uses metallic cam hinges such

as are used on folding mobile phones, giving the lid a high-grade feel when opening and closing while enhancing durability and expanding pocket size (Fig. 21).

7.4. Advanced Styling

By accurately grasping market needs and developing an integrated new-design audio system that is not limited by existing specifications, styling freedom has been effectively expanded. The shiny black audio system positioned in the center of the instrument panel has achieved advanced styling equal to its functionality (Fig. 22).

8. Conclusion

For small sedans based on hatchback models, using common components and efficiency are critical issues. During development of the CITY, the power plant, the platform including the chassis, the construction of the body supporting the platform, and the interior and exterior all feature a large number of shared functional components (e.g., the steering wheel and small items), as well as components in areas that are hidden from view on the surface (e.g., the front seat frame and meter panel).

Even more important, however, is to assume the point-of-view of customers who are looking for a real sedan. The CITY was developed by engineers who based their concept on specific market needs. The strong sales of this automobile attest to the fact that they created a product that both responds to those needs and delights its users.



Fig. 21 Smart storage



Fig. 22 Advanced styling

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