

INTEGRATION OF THE BABY SEAT IN THE BACKSEAT OF THE CAR

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Rezumat. În contextul asigurării celor mai bune condiții de transport pentru toți pasagerii unui autovehicul, lucrarea tratează dezvoltarea și implementarea unui scaun de copil în bancheta din spate a automobilului. Dezbătută din mai multe puncte de vedere această temă se dovedește de o importanță majoră pentru tânăra generație care dorește copii și este acaparată de viața profesională, fiind nevoită să călătorească din ce în ce mai mult, nu doar în țară, dar și în străinătate. Pentru acest lucru, o mașină dotată cu un scaun de copil integrat care să poată fi închiriată în țara destinatară le-ar face tinerilor părinți viața mai ușoară. Printre punctele studiate vom enumera: concepția scaunului de copil, sistemul de culisare, software-ul folosit pentru conceperea scaunului. Tema va fi însoțită și de un studiu de caz privind integrarea scaunului în bancheta unui model de serie și necesarul de materiale pentru realizarea acestuia.

Abstract. In the context of providing the best transport conditions for all passengers in a vehicle, the paper deals with developing and implementing a child seat in the backseat of the car. Discussed from many points of view, the issue is thus of major importance for the new generation who wants children and is overtaken by the professional life, having to travel more and more, not only in the country but also abroad. For this reason, a car equipped with an integrated child seat that can be rented in the destination country would make life easier for the parents. Among other subjects we will include: the design of the child seat, the sliding system, the software used to design the seat. The theme will be accompanied by a case study on integrating the baby seat in a series model backseat and the materials necessary for its execution.

Keywords: baby, seat, car, slide.

1. Introduction

In the context of living in the century of speed and a fast growing world, people face the necessity of travelling from one place to another as fast as possible in order to optimize their time. Such being the case, transport by car is a must and

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needs to offer the best comfort for all passengers, especially when one of them is a baby who needs all the attention from his mother.

One of the most important jobs you have as a parent is keeping your child safe when travelling in a vehicle. All parents take all the necessary measures before having a baby and certain took into account the purchase of a baby seat which can be attached in the car - however this can be very uncomfortable. The proper use of car seats helps keep children safe, but with so many different seats on the market, many parents find this overwhelming especially when it is known that the type of kids' seat depends on the child's age and size.

In the next chapters we shall describe the standard requirements for baby seats with their specifications and the current integrated solutions used by other companies. After the analysis of the above, we shall present the concept of integrating a baby rear-facing seat in the backseat of a car with the possibility of sliding it in and out in the place of the armrest.

2. Current Status and Useful Information

2.1. Car seat specifications

There are many baby seat choices on the market and they depend on the child's age and size, but at the same time on the type of car that is driven. All seats have the manufacturer's instructions for helping in choosing the best option, however, in order to keep the child safe, he/she should be fitted in special seats just until the age of 12. The figure below (Fig. 1) explains in very few words what kind of seats should be used depending on the child's age, following detailed explanations⁵.

When having a small baby just less than 12 months, it is mandatory to use a rear-facing car seat, which can be of 2 types:

- Infant-only seats can only be used rear-facing.
- Convertible and All-in-one car seats typically have higher height and weight limits for the rear-facing position, allowing you to keep your child rear-facing for a longer period of time.

⁵ "Car Seat Recommendations for Children" available at <http://www.safercar.gov/parents/carseats/right-seat-age-and-size-recommendations.htm>

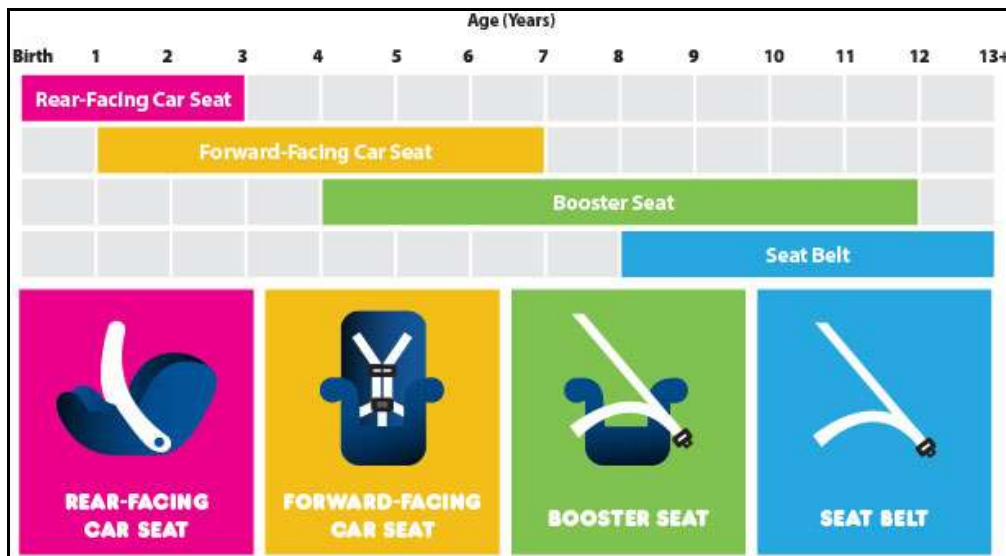


Fig. 1. Child's seat selection instructions.

Between the age of one year and just before the baby is 3 years old, he /she should be kept rear-facing as long as possible as it is the best way to offer him /her the best safety conditions. Once the child outgrows the rear-facing car seat, he / she can travel in a forward-facing car seat with a harness and tether.

For kids over 4 years old who have reached the top height or weight limit allowed by the car seat's manufacturer, the booster seat will be the best way to travel, but still in the back seat.

Finally, if the child is big enough to fit in a seat belt properly, he can use the booster seat, but only if the lap belt lies snugly across the upper thighs, not the stomach and the shoulder belt lies snugly across the shoulder and chest and not cross the neck or face.

2.2. First uses of the idea

Currently many of the big car manufacturers use and have integrated a baby seat in the backseat of their cars. Out of these we will present three big companies which have different points of view regarding the conception and development of the studied case. They are the Swedish company Volvo, the German Volkswagen and the American Dodge.

All these companies have taken over this special segment and have integrated the baby seat in the car out of the wish to offer clients a greater comfort and a larger space when the cars are used, but also when there is no need to use this facility. The seats are already integrated and when necessary they can be pulled out very

easily and in a short time. When the seats are not in use, they don't take any space like the classic seats which are manually fit in and the place can be used by a grown-up.

The above-mentioned car companies the concept from 2 different points of view. The Swedish company uses the seat on only one of the places in the back. This can be height adjusted offering the child a good seat adjustment and the ability of using the safety belt by lifting the seat without hurting the child or making him uncomfortable (see Fig. 2). The same approach was also used by the German company which has moreover used the headrest of the seat offering the child an increased safety at the shoulder level when the car takes a turn or in the event of an accident, without allowing lateral movement in the seat (Fig. 3).

Both companies offer this facility to families that have kids with a height of over 135 cm. Under this height the seats cannot be used, thus meaning that the owners of the cars should use classic kids' seats.



Fig. 2. Volvo seat



Fig. 3. Volkswagen seat



Fig. 4. Dodge seat

The US Company Dodge has chosen another approach for the current topic discussed. The backrest of the backseat of the car is adjustable, descending over the seat and in the remaining space being integrated the special safety belts for kids with 5 clamping points (see Fig. 4).

3. Conception of the Integrated Baby Seat in the Backseat of the Car

3.1. Installation rules for Rear-Facing seats

It is recommended that all infants ride rear facing starting with their first ride home from the hospital. All infants and toddlers should ride in a rear-facing seat until they are at least 1-2 years of age or, preferably, until they reach the highest weight or height allowed by their seat car manufacturer.

When using the rear-facing seats, the following requirements are to be taken into account:

- The harnesses in the rear-facing seat should be placed in slots that are at or below the baby's shoulders.
- Ensure that the harness is snug (you cannot pinch any slack between your fingers when testing the harness straps over the baby's shoulders) and that the retainer clip is placed at the centre of the chest.
- Make sure the car seat is installed tightly in the vehicle with either LATCH (lower anchors and tethers for children) or a locked seatbelt. If you can move the seat at the belt path more than an inch side to side or front to back, it is not tight enough.
- Never place a rear-facing seat in the front seat of a vehicle that has an active front passenger air bag. If the air bag inflates, it will hit the back of the car seat, right where your baby's head is, and could cause injuries.
- Make sure the seat is at the correct angle so the infant's head does not flop forward. All rear-facing seats have built-in angle indicators or adjusters.
- Check the car seat instructions and vehicle owner's manual about whether the car seat may contact the back of the vehicle seat in front of it.

3.2. Technical solution for developing a baby seat integrated in the back seat of the car

After analyzing the market needs as regards the transportation of children of different ages and the lack of cars with preinstalled rear-facing baby seats in the cars, we have developed a solution that meets the needs of young parents with infants. The solution presented below respects the baby seat requirements detailed above and is innovative by installing the seat in the backseat of the car, having thus the possibility of pulling it out or leaving it inside, making room for a grown-up to sit in the same place (see Fig. 5 and Fig 6 below).



Fig. 5. Baby seat in closed position.



Fig. 6. Baby seat in open position.

This development offers more space to the owners of the car and after the child has past the age constraining him / her to stay in the baby seat, the parents can use the backseat of the car. It can be said that this idea provides a two in one backseat for our car. The concept also includes a protection for the feet, which allows the child to stay in the baby seat and not to slide into the trunk of the car.

The position chosen on the backseat of the car is the middle of the seat where the armrest should be situated. This will permit the other two places next to the baby seat to be available for one or for both parents who can have total control on the infant. The rear-facing seat can provide direct eye contact with the people sitting next to the baby (see Fig. 7).

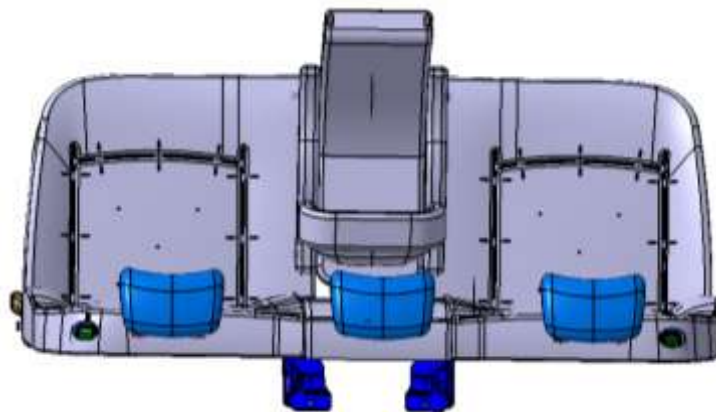


Fig. 7. Baby seat open position (view from above).

The installation itself involves placing a metal guidance for sliding and folding the seat behind the seatback of the car. To unlock the seat it is necessary only to action the handle situated on the back of the baby seat. The backseat will thus extend to vertical position and will slide outwards. In the final position, the baby seat and the two lateral arms will be locked in fixed position with the help of blocking systems (see Fig. 8 and Fig. 9). The baby seat will also be installed with three clamping point seat belts.



Fig. 8. Baby seat location and lateral arms.

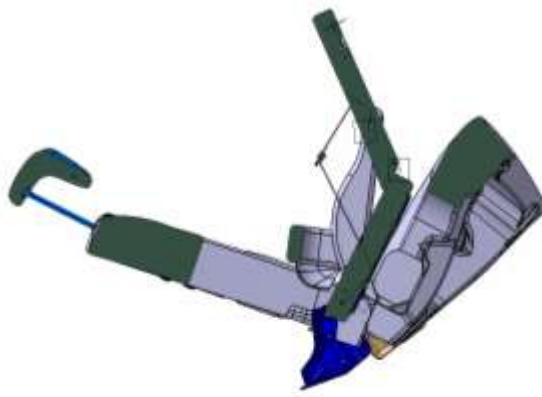


Fig. 9. Baby seat mechanism.

Taking into account that the baby needs to be protected by any means, the materials used for the seat will be purchased from the same supplier as the rest of the seats, but softer sponge and cover will be chose in order not to harm the child.

The conception of the baby seat as it was presented in the pictures above was made in the simulation tool Catia. In the figure below we can also find the measurements for the final product in 2D sketch.

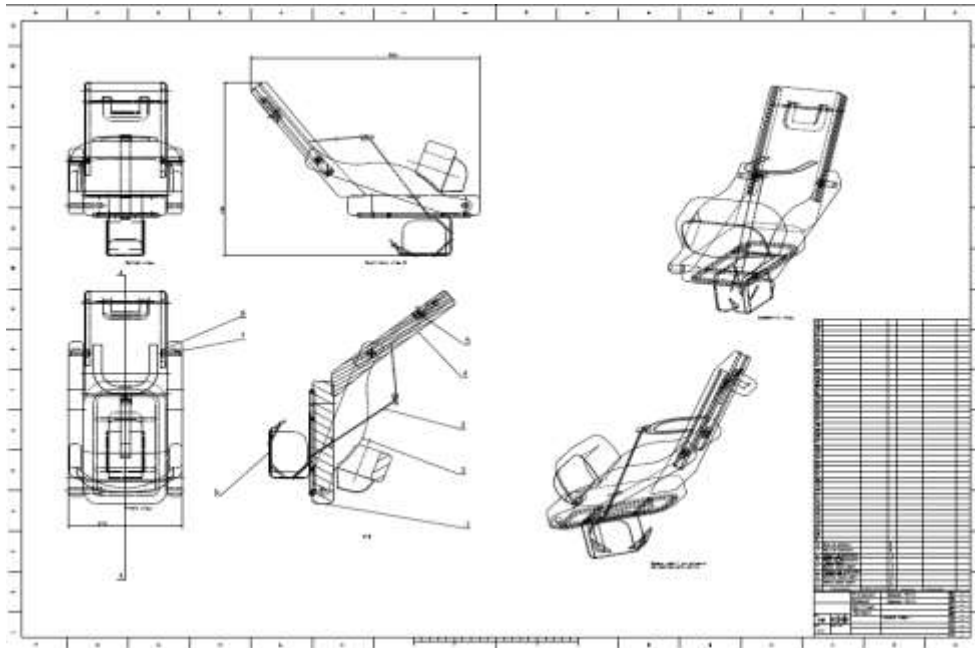


Fig. 10. Assembly drawing of the baby seat.

The dimensions that have been taken into account were chosen based on the geometry of the backseat of a Romanian car and the height of a 2 year old baby. The conception of the design is new on the market and was proposed after analyzing the constraints of the studied car and the specifications of a baby seat that observes the standards in use.

It is well known that the seat can have different upgrades in the near future, however the main objective was to develop a cheap product that can offer clients the best option to be taken into account when buying a car already equipped with the possibility to fit their new-born child when travelling from one place to another.

3.3. Costs involved for the materials

In order to develop the idea, we made a list of the materials to be used:

N°	Materials	Costs (EUR)
1	Injection mould	15,000
2	Metallic frame for the seat and backrest	500
3	Telescopic system of the seat	1,000

4	The undercarriage of armrests movement	500
5	The blocking system of the armrests	200
6	Handle for the baby seat	100
7	Safety belts with 3 clamping points	100

We estimate a total prototype production cost of 20.000 EUR. This amount also includes the backseat of the car.

Conclusions

The provided solution aims 90% of the clients who buy a car, between 25 and 35 years old, as this group of people is the most likely to have a baby in a near future and would consider the transportation much safer and easier by choosing a car with a build-in baby seat. The idea has not been used until now by any car company thus giving it innovative nature. If the Swedish and German car companies have found a solution for integrating booster seats in their cars and the American company went further in building integrated forward-facing seats, we tried going over the mile with the rear-facing baby seat which can be also hidden when not in use, without restricting the use of space by a grown-up. The possibility of pulling the seat by sliding, just like a drawer hidden in the backrest, offers the idea the ease of use.

For building the product and making it available for serial cars, a license contract will be signed with the car manufacturer that will agree to add this option to its vehicles. Also, an association contract will be signed with the manufacturer in order to split the profit made with the help of the respective product.

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