



RESEARCH REPORT

IMPROVING SAFETY AND COMFORT IN PET CARRIER

UNDERSTANDING THE IMPACT OF STRESS
FACTORS ON CATS WELL-BEING DURING
CARRIER TRANSPORT

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Research Report



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ID7 Capstone | 2025



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AUTHENTICITY STATEMENT

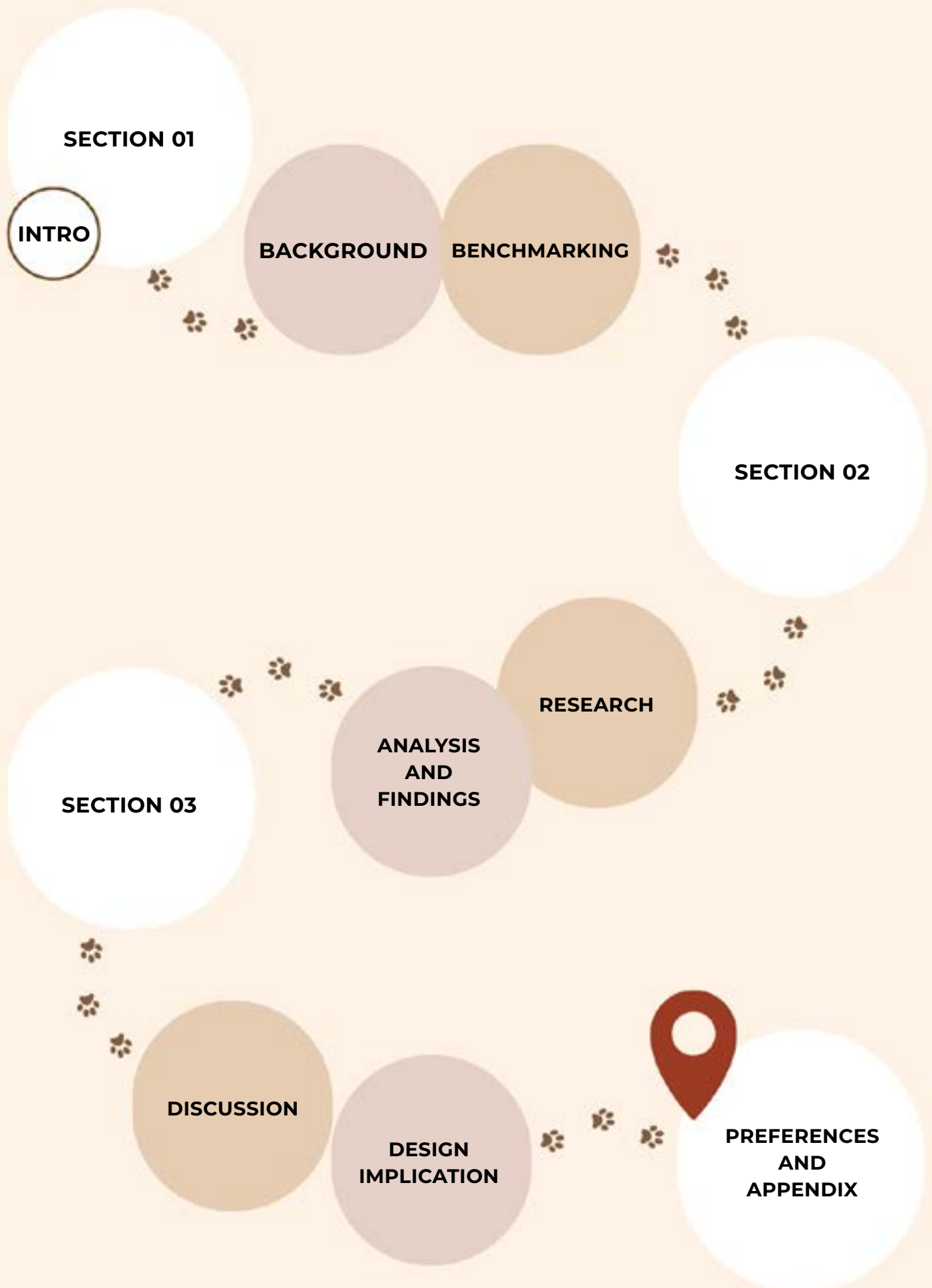
This is to certify that to the best of my knowledge; the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

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AI USE STATEMENT

I have utilized Generative AI in this report (ChatGPT) to assist in various ways. The way I have used Generative AI includes: (1) Summarising, (2) refining and editing text for clarity and cohesion, (3) Transcript the interview, (4) Generate image for visualizing background purpose only

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**Graphic visual of the
overall project structure**



SECTION 01



RESEARCH REPORT

**IMPROVING SAFETY AND COMFORT IN PET
CARRIER**



INTRODUCTION

Pets are considered as important members of the family (Collier et al., 2024). In Australia today, there are more pets than people, with over 69% of households owning at least one cat or dog (Companion Animals New Zealand, 2022). If this rate continues, by 2056 around 3.5 million people aged over 65 will own a dog, and over 2 million of the same age will own a cat (Companion Animals New Zealand, 2022).

At the same time, housing mobility is common, with more than 40% of households reporting they moved within the last five years since 2020 (Australian Bureau of Statistics, 2022). In addition to relocating homes, pets may also travel for reasons such as veterinary visits, holidays, or emergency evacuations.

Together, these factors show the importance of ensuring pets' safety and comfort during travel. Even though pets often face stressors such as loud noises, lack of ventilation, or strange smells, there are not many products that properly address these issues. Most existing carriers focus on basic function or appearance, while overlooking deeper needs such as comfort, safety, and stress reduction. This gap highlights why the study of pet carriage design is an important area to explore.

The aim of this project is to examine existing products, case studies, and user insights to better understand how a safer and more comfortable pet carriage can be designed. It also aims to identify key design opportunities that can improve both pet wellbeing and owner experience.

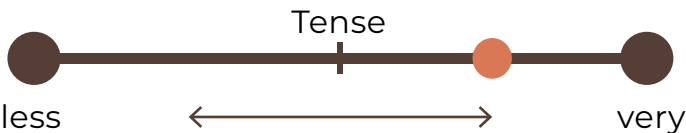
BACKGROUND

This section reviews existing research on pet (mainly small to medium-sized dogs and cats of all ages) behaviours under stress and examines current pet carriage designs on the market. It provides an overview of pet commuting, highlights key features and challenges of existing carriers, and discusses how these designs affect both pets' wellbeing and owners' travel experience

1. Stressors

Pets can experience many stressors during both short and long trips.

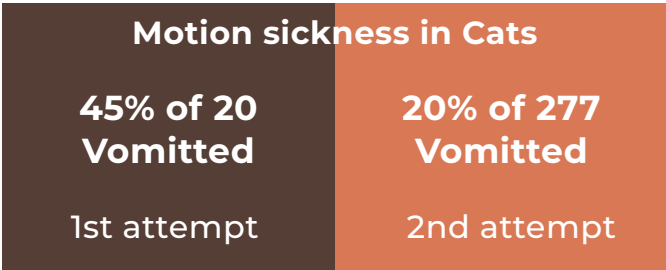
Even a brief 10-minute visit to a veterinary practice can affect a cat's welfare. Common stress factors include confinement to a carrier, transportation, encounters with strangers or other animals, loud noises, unfamiliar smells, handling, and exposure to a new environment (Pratsch et al., 2018). In this study, stress levels were measured through heart rate, body temperature, and observed behaviours during the entire trip. The average Cat Stress Score (CSC) for all cats was recorded as 'very tense'



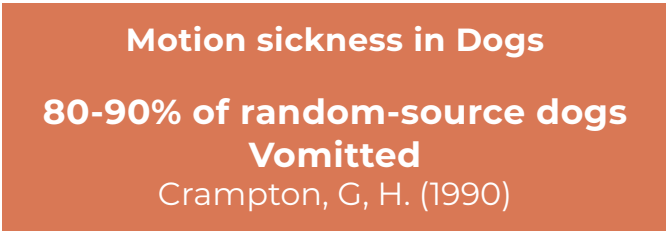
Building on this, another study by Stella examined sickness behaviours (SB) in cats. A total of 28 cats, with and without Feline Interstitial Cystitis (FIC), were exposed to stressors similar to those encountered during travel in an exposed cage. The findings indicated a significant increase in SB from baseline to stress condition in both healthy cats and those with FIC (Stella et al., 2013). Common behaviours included vomiting (hair, food, or bile), reduced appetite, and elimination outside the litter box.

In addition to stress behaviours, motion sickness is also a major concern during pet travel. Motion sickness is common in a wide range of animals, and being transported in a carrier can make the trip even more unpleasant.

In cats, vertical motion has been found to be a strong trigger



Similarly, swinging has been identified as the most effective stimulus for motion sickness in dogs



Besides the stressors that influence carrier design, different travel methods also present distinct challenges that need to be addressed (Sheley, 2007)

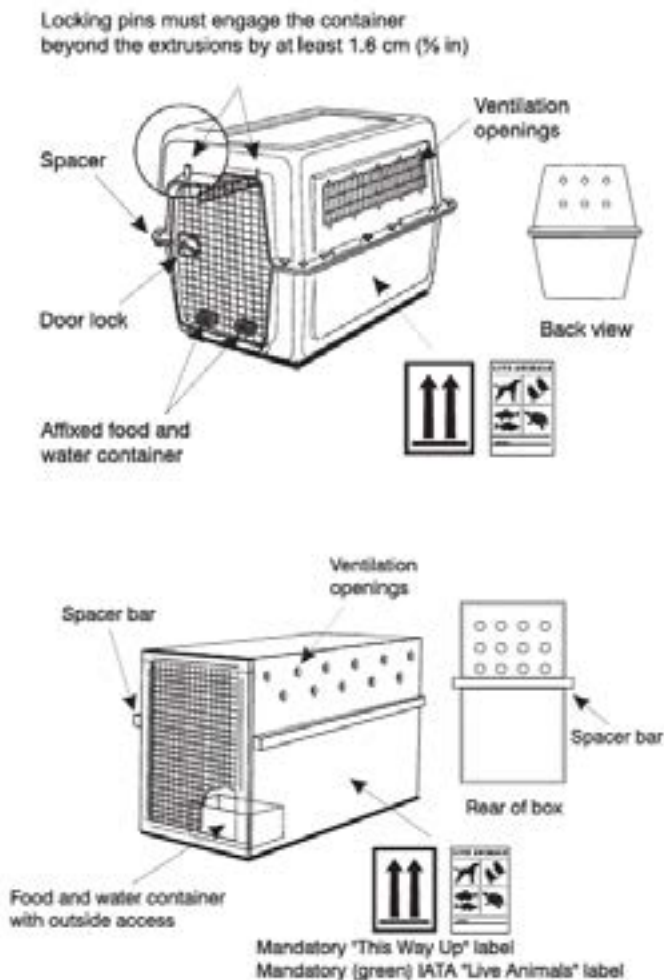


Together, these studies demonstrate that travel inside a carrier, as well as the choice of carrier itself, can strongly influence pet welfare. They highlight the importance of designs that minimise stressors while providing comfort and stability during movement.

2. Guidelines

According to the International Air Transport Association (IATA) container requirements, guidelines developed for air travel can also be adapted for daily use such as car trips or pet transport services. Key requirements include:

1. Welded wire mesh of at least 2.5 mm thickness for dogs and 2.0 mm for cats
2. With all openings designed to be nose- and paw-proof
3. Adequate space for each animal to stand, sit erect, lie in a natural position, and turn around comfortably
4. A solid, leak-proof floor
5. And a minimum ventilated area equal to 16% of the total surface of the four sides



BENCHMARKING

This section will outline the current range of pet carriers available on the market, followed by an analysis of how they are applied in different contexts. Pet carriers are essential for animal safety during transporting, it is important that they meet certain standards in order to address the diverse requirements

Current market

Currently, a wide range of pet carriers is available on the market. However, most designs remain relatively simple, focusing only on basic pet needs and offering little to no integrated technology for improved care. These include wide ranges of carrier:

1. Soft-sided carrier
2. Exposed backpack-style carrier
3. Enclosed backpack-style carrier
4. Hard plastic carrier

This highlights a gap in the market and the potential for incorporating emerging technologies to enhance pet carrier design

The pet carriers analysed in this section include: Soft-sided carrier (1) A4 Pet, (2) MuchL, (3) Orange Dream, Backpack-style carrier (4) PECUT Backpack, (5) Spaceship, and Hard plastic carrier (6) Amazon Basics, and (7) Rosewood.

Together, these examples provide a broad overview of both current and emerging market options by highlighting their challenges, benefits, and opportunities.

To assess the success of these products in the market, they will be evaluated using the following criteria:

1. Comfort level
2. Protection and security
3. Product lifespan
4. Ease of use
5. Aesthetics vs effectiveness



Table 1: Assessment criteria for the evaluation of existing pet carrier design

Category	Rank (points)			
	9-10	7-8	4-6	0-3
Comfort level	High comfort for pet during travel	Moderate comfort for pet during travel	Low comfort for pet	No comfort for pet
Protection and security	High protection for pet inside	Moderate protection for pet inside	Low protection for pet inside	No protection for pet
Ease of use	Very easy to operate, carry and cleaning	Moderate ease of operation	Low ease of operation	Difficult to operate with pet
Product lifespan	Long-lasting with animal use	Moderate lifespan with some wear	Short lifespan with frequent use	Very short lifespan, break and
Aesthetics	Highly attractive and stylish design	Moderate attractive design	Plain and simple design	Unattractive design

Table 2: Assessment of existing pet carrier design against criteria

Product		A4 Pet	Much L	Orange Dream	PEcut	Spaceship	Amazon Basics	Rosewood
Criteria								
1.	Firm padding (stable and keep the form)	3	3	9	5	7	10	10
	Closed space (hiding space – visibility)	5	3	7	5	0	8	8
	Scent control	5	5	7	5	7	5	5
	Noise reduction	0	0	5	0	0	0	0
	Motion reduction	0	0	0	0	0	0	0
2.	Secure – escape prevention	5	5	7	10 (lock + zipper)	7	7	5
	External impacts resistance	3	0	5	5	3	7	7
	Durable material	8	5	8	7	5	7	7
	Permission required (ID card)	0	0	0	0	0	0	0
3.	Internal impacts resistance	7	7	7	7	7	9	9
	Waterproof	7	7	5	5	7	10 (plastic shell)	10 (plastic shell)
4.	Easy access (pet in and out)	7	7	10 (top removable load)	10 (side removable load)	7	10 (stable top and front load)	7
	Ergonomic interaction	7	7	8	8	8	7	7
	Cleaning	3	3	3	3	3	10 (rinse and wash)	10 (rinse and wash)
	Disassembly and storing	7	7	7	3	3	7	5
5.	Function compared to aesthetics	7	7	7	5	5	9	9
Total score: (_/10)		4.62	4.12	5.93	4.6	3.5	6.6	6.1

 Strengths  Weaknesses

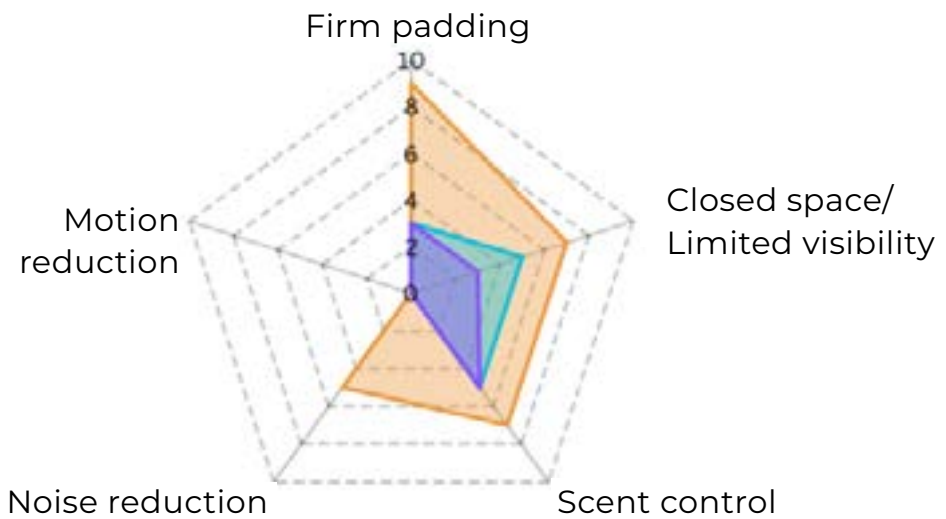
Product Analysis: Soft-sided carrier



(1) A4 PET

Average score: 4.62/10

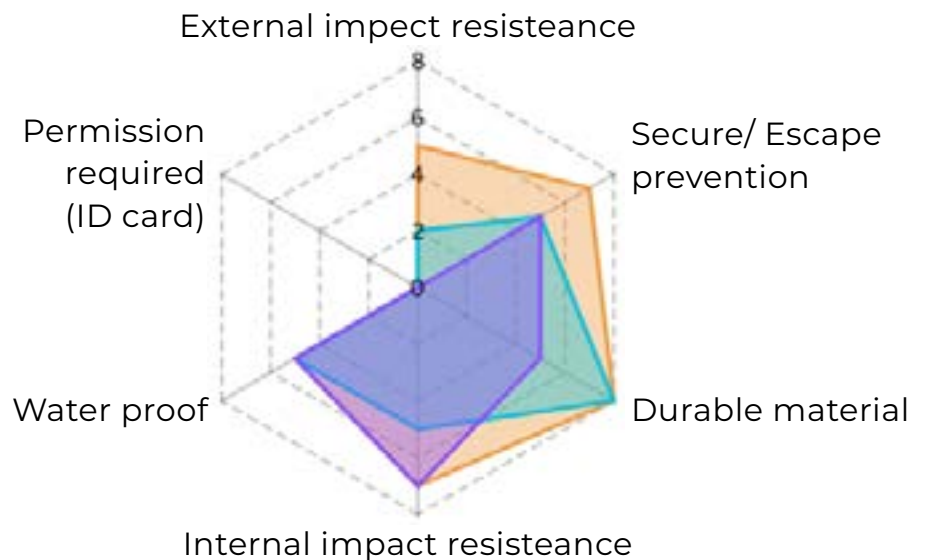
Comfort level - Spider graph (Figure 1)



(2) Much L

Average score: 4.12/10

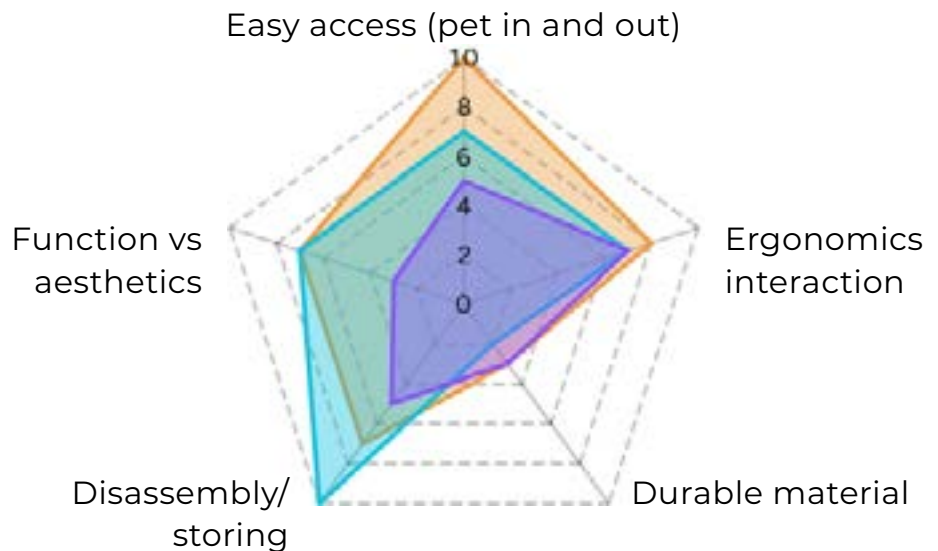
Protection and Product lifespan (Figure 2)



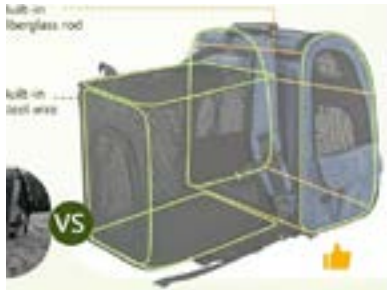
(3) Orange Dream

Average score: 5.93/10

Ease of use and Aesthetics (Figure 3)



Product Analysis: Backpack-style & Hard plastic carrier



(4) PEcut

Average score: 4.6/10



(5) Spaceship

Average score: 3.5/10



(6) Amazon Basics

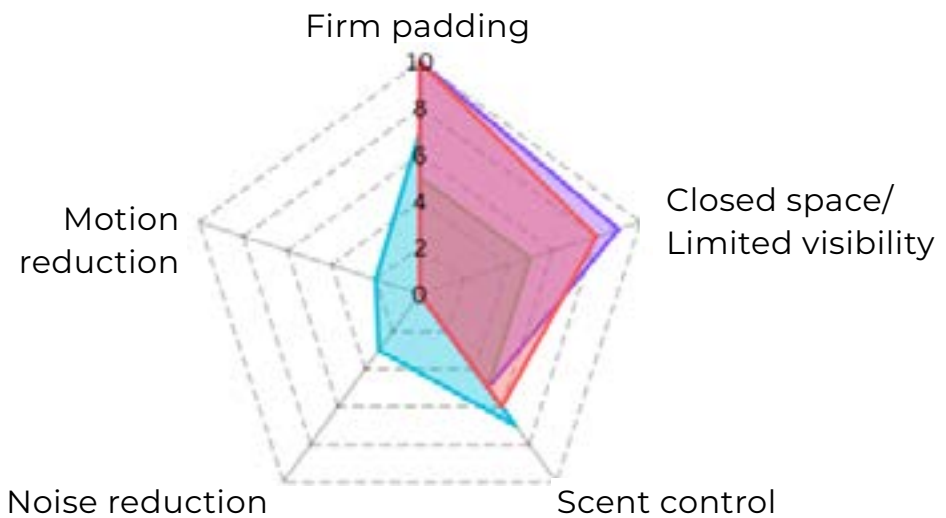
Average score: 6.6/10



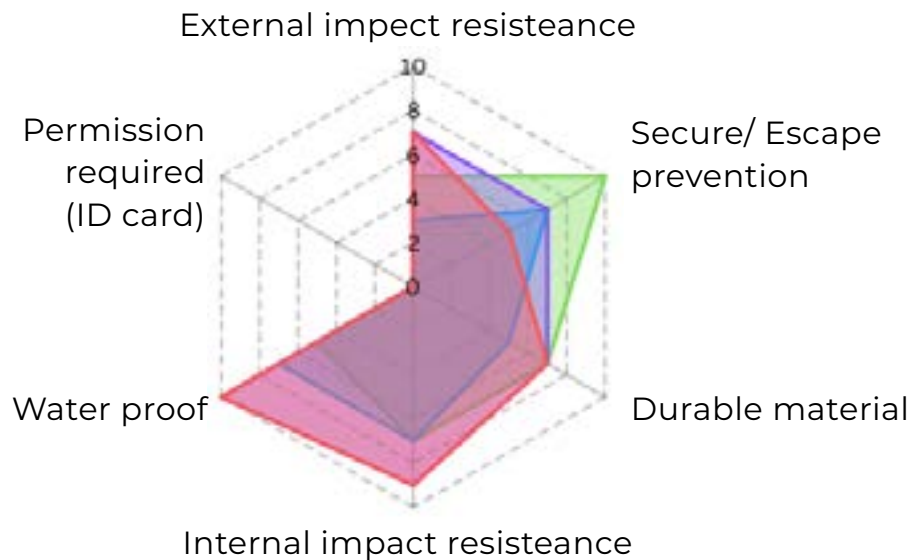
(7) Rosewood

Average score: 6.1/10

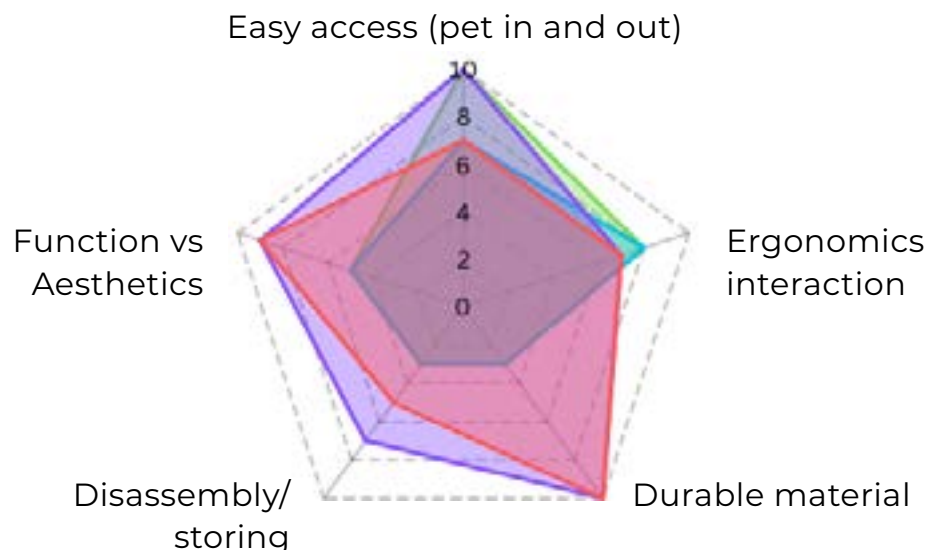
Comfort level - Spider graph (Figure 4)



Protection and Product lifespan (Figure 5)



Ease of use and Aesthetics (Figure 6)



From the benchmarking, the highest-scoring product (6.6 points) of 7 products was the hard plastic carrier from Amazon Basics.

Its strengths include a firm and stable structure with a solid base, durable materials, and ease of loading or removing pet which is an aspect that is often challenging in fabric-based designs, especially when handling aggressive or resistant animals. In addition, the plastic material makes the carrier waterproof and easy to clean, which is particularly useful for managing urine or feces from stressed pets.

Weaknesses

The benchmarking identified several recurring weaknesses across the seven pet carriers.

Most products lacked effective noise reduction and motion control, which are among the most common stressors for pets during travel. With the exception of Orange Dream, all carriers scored zero for noise blocking, leaving animals exposed to external sounds.

Similarly, none of the designs included features to stabilize movement or absorb vibrations, resulting in an unstable, shaking and stressful travel experience. Although some products addressed secure access, many soft-sided carriers relied on zippers that could be easily damaged by clawing, biting and pushing.

Opportunities

These gaps present clear opportunities for innovation in the pet carrier market. A design that combines the convenient of soft-sided carrier with the stability and secure locking mechanisms of hard plastic design could enhance both safety and usability.

Common stressor would also be reduced with sound blocking layers and shock-absorbing mechanism would address the overlooked issues of noise and motion stress.

By focusing on the reduction of stressors for pet along with durability and owner ease of use, , future carrier designs could position themselves as premium solutions for animal well-being during travel



SECTION 02



RESEARCH REPORT

**IMPROVING SAFETY AND COMFORT IN PET
CARRIER**



The survey was distributed through a Facebook post to reach a wider audience of participants. It was shared with both Australian and Vietnamese respondents, allowing for a broader user base and the opportunity to compare potential differences influenced by culture, location, and experience

In addition, a QR code (see figure 8) was printed and placed in pet-friendly cafe, where some pet owners were able to complete the survey while waiting for their coffee.

The responses were largely supportive and enthusiastic, reflecting genuine concern for the well-being of their pets.



Figure 8: Survey QR code

2.2. Survey for Experts in Pet Well-fare

Duration: Approx. 12mins

Total participant: 35

A separate survey was designed for experts, following the same standardized format to gather both qualitative and quantitative insights. This version focused on professional perspectives, with questions addressing industry experience, observed challenges in pet medical conditions, and suggestions for improving carrier design.

The survey was distributed to veterinarians, UQ student group, foster caregiver and animal rescuer, through online platform (facebook) and direct to veterinarian contact email.

The survey consisted of 9 questions,

including 4 open-ended questions, and 5 multiple-choice. To capture richer insights and professional experiences, one additional open-ended question was included. Responses provided valuable expert input, complementing the views collected from pet owners



Figure 9: Example of email requitment

3. Interview

Duration: Approx. 12mins

Total participant: 4

Interviews were performed as an effective method to gain deeper insight into user experiences. This approach allowed participants to share more detailed responses and specific stories through open conversation.

Pet owners and experts in pet welfare, including veterinary doctors, veterinary staff, foster caregivers, and animal rescuers, were selected as the target participants for the interviews. All participants were required to read and sign a consent form before beginning the interview.

Pet owners were chosen for their first-hand experience of travelling with pets, while experts were included for their professional knowledge of interacting with animals, often in medical or high stress situations. The interview consisted of 8 questions for pet owners and 6 questions for experts, focusing on user experiences with pet carriers, including both positive and negative features.

4. Summary

In conclusion, a triangulated research approach was adopted, consisting of preliminary online information researching, structured interviews, and survey. Of these methods, the survey was deployed first and proved to be the most productive, receiving responses from 55 participants. This provided a diverse set of qualitative and quantitative data, forming a robust foundation for analysis

ANALYSIS & FINDING

An exploration of comfort brings together the accuracy of survey findings with the depth of expert knowledge and the personal perspectives gathered from interviews. This combined approach provides a broad and well-rounded understanding of pet travel inside carriers

1. Analysis

To examine the interview data and open-text survey responses, a conceptual analysis technique was applied and carried out manually using Google Docs. After reviewing and marking the data, the information was organised into different categories to support the identification of key insights (see figure 10)



Figure 10: Manual coding and categories

2. Findings

2.1. General background

Most carrier users were owners of small cats (12), followed by medium-to-large cats (11), small dogs (9), and large dogs (3)

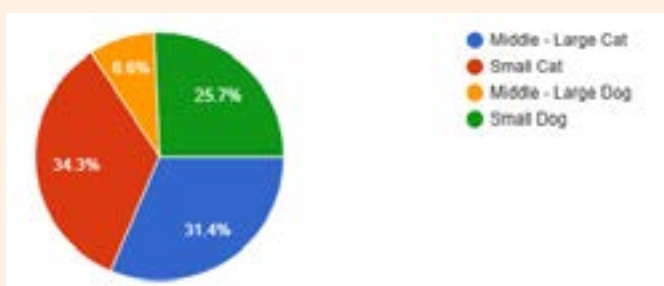


Figure 11: proportion of four targeted types

The survey also examined the number of different types of carriers used by pet owners.

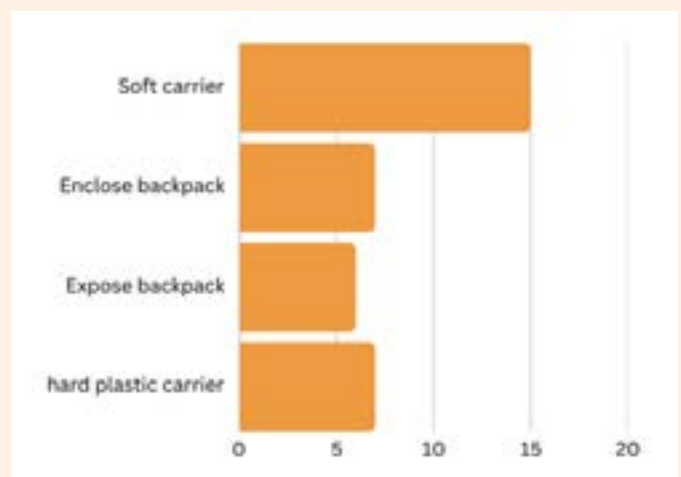


Figure 12: Number of carrier used

The results show that pet owners most commonly use soft-sided carriers, while hard plastic carriers are the least popular. Interestingly, 40% of experts surveyed recommended hard plastic carriers, highlighting a difference between user habits and professional advice.

Private vehicles were the primary mode of transport 82.9% of trips, with vet health checks being the most common reason for travel (65.7%) which underscores the importance of designing carriers suited for daily use.

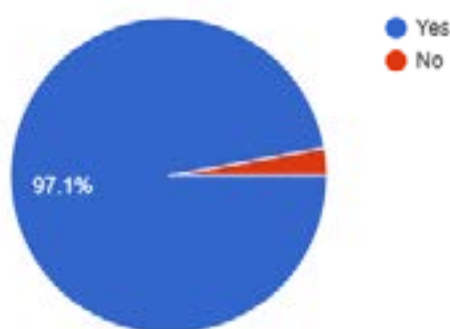


Figure 13: Number of carrier used

The majority of participants (97.1%) supported innovations aimed at enhancing pet comfort during travel, highlighting the care and affection owners have for their pets.

Despite the strong interest in improving pet comfort, the survey revealed that many pets still experience stress during travel (see figure 14)



Figure 14: Pet Stress Levels During Travel

Only 22.9% were reported to have calm and relaxed pets, 71.4% ranged from slightly restless to very restless with multiple aggressive behaviours, and 5.7% exhibited aggressive behaviour. This significant proportion highlight a significant issue: travelling is a major stress for many pets, indicating a need for innovative carrier designs

2.3. Carrier Design Features and Pet Behaviour

Pet owners, being the ones who care for and directly interact with their animals during travel, are well placed to observe signs of stress. They reported noticing numerous indicators of discomfort and anxiety in their pets throughout trips

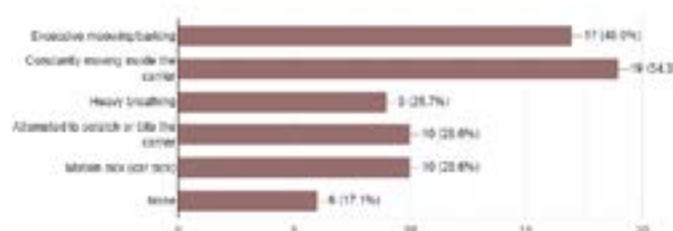


Figure 15: Stress Responses in Pets

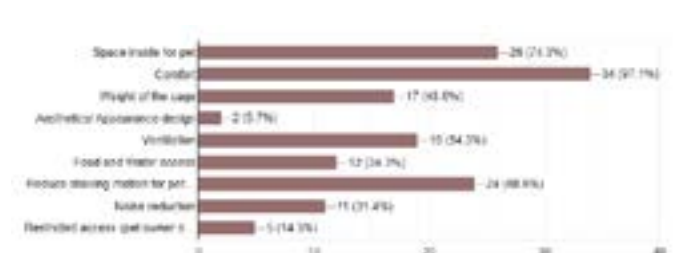


Figure 16: Pet Carrier Features Ranked by Owners

Based on their observations of pets under stress, owners identified the following as the most important features to have in a pet carrier.

Pet owners 1st, 2nd and 4th rank: Ventilation and space

Many owners reported that their pets often refused to enter carriers that were small, cramped, or poorly ventilated. Excessive heat from outside can directly affect pets, sometimes leading to heatstroke.

Reflecting this, owners ranked comfort as the most important feature (97.1%), space second (74.3%), and ventilation fourth (54.3%). This was also supported by 23.1% of experts, who noted that negative associations with the carriage, stemming from unpleasant travel experiences, can make current trips highly stressful.

Pet owners 1st and 2nd rank & Experts 1st and 3rd rank: Carriers and Medical Concerns

Interviews and survey responses in both experts and pet owners revealed that pets recovering from surgery or experiencing medical issues are particularly sensitive to carrier design.

Fabric carriers that lack shape stability and sufficient space can cause discomfort, as movement inside may rub against wounds or trigger pain, leading to stress behaviors such as meowing, barking, or refusal to enter the carrier (see 'figure 15')

Other medical concerns were also raised, such as the risk of heatstroke when transporting pets in exposed 'spaceship' backpack carriers during hot weather, and the discomfort of placing them recovering from abdominal surgery into

cramped backpack carriers. Owners further stressed the importance of calming pets after transport before medical examination

Experts 2nd rank: Ease of Cleaning

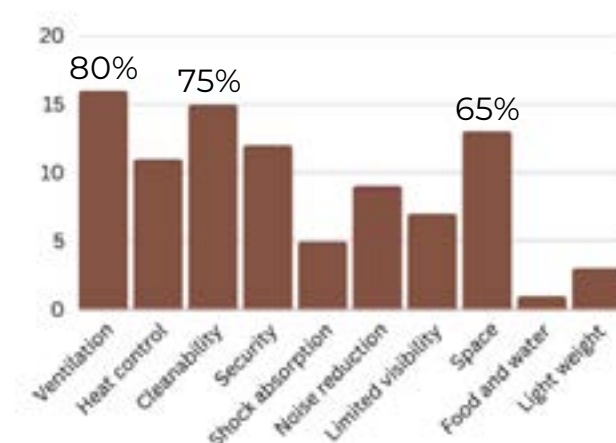


Figure 17: Pet Carrier Features Ranked by Experts

Survey and interview responses revealed that hygiene is a major concern in carrier use, as many cats and puppies urinate, defecate, or vomit during travel due to stress, motion sickness, or illness. This often results in pets becoming soiled and requiring cleaning or bathing upon arrival, adding stress for both animals and veterinary staff working under time pressure.

Participants emphasized that soft or fabric carriers, while comfortable, are difficult to clean and can retain odors, whereas hard plastic carriers are far easier to disinfect.

Pet owners 3rd rank: Motion reduce and Motion sickness

Pet owners survey data also reveal that motion sickness is a major concern during transport.

One owner described how a fabric carrier swayed and causing distress and insecurity for the cat. In the survey, 28.6% reported motion sickness in their pets, with symptoms ranging from nausea and restlessness to collapse and even fainting.

Reflecting these experiences, 68.6% of participants ranked reducing shaking and motion as one of top design priorities

Summary

In summary, this analysis of qualitative and quantitative data highlights the crucial role of pet carriers in creating a more pleasant journey not only for pets, but also for owners and veterinary experts managing stressed animals. Beyond transport, carriers are vital in medical care and stress management, with their design directly influencing pets' physical stability, psychological comfort, and post-surgical safety



SECTION 03



RESEARCH REPORT

**IMPROVING SAFETY AND COMFORT IN PET
CARRIER**



Discussion

The findings from this study highlight the complex role of pet carriers, which extend beyond simple transport to influencing both animal welfare and owner experience. Survey results revealed that soft-sided carriers are the most widely used among owners, yet veterinary experts strongly recommend hard plastic carriers due to their durability, stability, and ease of cleaning. This divergence between user habits and expert guidance suggests a gap in awareness and indicates an opportunity for design innovation that balances familiarity with functionality.

Many owners indicated that pets often exhibit restlessness, aggression, or anxiety during transport, reflecting the shortcomings of existing carrier designs. Issues such as cramped space, unstable structures, and poor ventilation exacerbate discomfort (Pratsch et al., 2018) particularly for pets recovering from surgery or dealing with medical conditions. Additionally, hygiene challenges, such as urination, defecation, and vomiting during travel, further highlight the limitations of fabric and soft-sided carriers compared to hard plastic alternatives, which are easier to clean and manage.

The research also underscores the difference between owner preferences and expert recommendations. While soft-sided carriers are widely used for familiarity and comfort, experts emphasize hard plastic designs for their durability, security, and practicality in medical and stressful situations. This suggests a need for carriers that integrate the advantages of both types, balancing pet comfort with safety, hygiene, and ease of handling.

Interestingly, no entirely new patterns emerged in owner or expert experiences that contradicted existing findings. However, the study highlights the significant role carriers play in ensuring pet well-being, supporting stress reduction, and facilitating safe transport in medical contexts. These insights highlight opportunities for innovation in ergonomics, stability, ventilation, and hygiene, pointing toward the development of premium carriers that better meet the needs of pets, owners, and veterinary professional.

Design Implications

This section presents design recommendations informed by both owner and expert insights, with a focus on improving pet comfort, safety, and usability during travel. The implications also take into account common comforting behaviours that owners use to ease their pets' stress

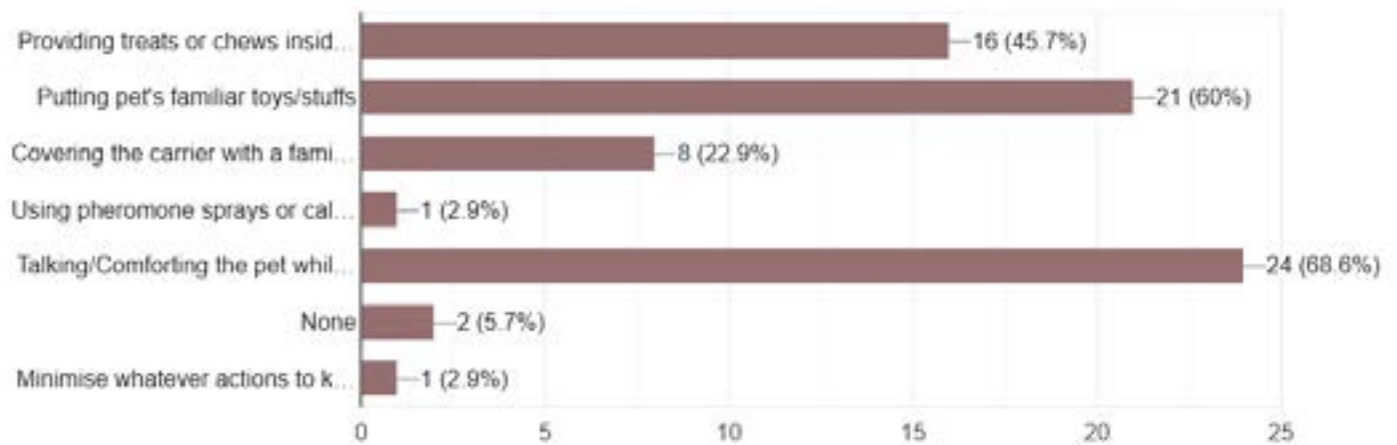


Figure 18: How owners calm pets during travel

Stability & Motion: Constant movement (54.3%) and motion sickness (28.6%) highlight the need for firm, non-sinking bases and stable interiors.

Stressors reduction: With 71.4% showing anxiety or aggression, durable structures, noise reduction, and visual shielding (removable covers, in-built soft lighting) are essential.

Space & Comfort: 65% of pets resisted cramped carriers, carrier should allow enough room and integrate comfort.

Temperature & Airflow Control: Integrating a mini air-conditioning or air-circulation system can help regulate temperature, improve ventilation, and keep pets comfortable during travel, reducing the risk of heat stroke.

Medical & Hygiene: Carriers must support recovery with stability.

Motion Reduction: Design incorporates a motion-absorbing mechanism to stabilize the carrier interior, preventing pets from being shaken, helps reducing stress and motion sickness.

Access & Mobility: Multiple entry points (top/front), clip-locks, and lockable rubber wheels improve handling and transport safety.

Incorporating in-built GPS, camera tracking, and a voice speaker: could allow owners to monitor and comfort their pets remotely, reducing stress and increasing safety during travel.



Conclusion

This report highlights the significant role pet carriers play in shaping animal welfare during transport. From survey data, expert insights, and existing product analysis, key challenges and opportunities were identified. The findings emphasize the importance of durability, stability, and environmental control to reduce stress and improve both pet and owner experiences. Yet, persistent issues remain, including poor hygiene management, inadequate space and support, and limited design features to address motion sickness or behavioral challenges.

Addressing these areas through thoughtful design interventions presents an opportunity to create more user-centred, hard-sided carriers that prioritize comfort, safety, and ease of use. By integrating stable bases, multiple entry points, stress reducing features, and hygienic solutions, future carriers can foster calmer, safer journeys ultimately enhancing pet well-being and reducing the burden on owners and veterinary staff alike.

References

- Australian Bureau of Statistics. (2022). Housing Mobility and Conditions. ABS. <https://www.abs.gov.au/statistics/people/housing/housing-mobility-and-conditions/latest-release>.
- Collier, J. Lewis, J, V. Bennett, P. (2024). 'My pet can't come with me': Pets as a barrier against moving into supported accommodation. <https://onlinelibrary.wiley.com/doi/full/10.1111/ajag.13262>
- Companion Animals New Zealand. (2022). Companion Animals in New Zealand 2020; Companion Animals New Zealand: Auckland, New Zealand, 2020. <https://www.companionanimals.nz/publications>
- Crampton, G, H. (1990). Animal Models in Motion Sickness Research. MOTION and SPACE SICKNESS. <https://books.google.com.au/books?hl=vi&lr=&id=Jr-m3bMy-7IUC&oi=fnd&pg=PA87&dq=do+pet+experience+motion+sickness&ots=tsdPlc-qRFf&sig=BIQCCLNtjD6l3haviUzVrKzC574#v=onepage&q=do%20pet%20experience%20motion%20sickness&f=false>
- Graham, L, H. Brown, J, L. (1996). Cortisol metabolism in the domestic cat and implications for non-invasive monitoring of adrenocortical function in endangered felids. *Zoo Biology*, 15(1), 71-82. [https://onlinelibrary.wiley.com/doi/abs/10.1002/\(SICI\)1098-2361\(1996\)15:1%3C71::AID-ZOO7%3E3.0.CO;2-9](https://onlinelibrary.wiley.com/doi/abs/10.1002/(SICI)1098-2361(1996)15:1%3C71::AID-ZOO7%3E3.0.CO;2-9).
- Pratsch, L. Mohr, N. Palme, R. Rost, J. Troxler, J. Arhant, C. (2018). Carrier training cats reduces stress on transport to a veterinary practice. *Applied Animal Behaviour Science*, 206, 64-74. <https://doi.org/10.1016/j.applanim.2018.05.025>
- Sheley, E. (2007). "Live Animal": Towards Protection For Pets And Livestock in Contracts For Carriage. *Journal of Animal Law*, 3(4), 59-79. <https://heinonline.org/HOL/P?h=hein.journals/janimlaw3&i=1>
- Stella, J, Croney, C. Buffington, T. (2013). Effects of stressors on the behavior and physiology of domestic cats. *Applied Animal Behaviour Science*, 143(2-4), 157-163. <https://doi.org/10.1016/j.applanim.2012.10.014>