

Pet Travel Crates - Help!

This is part one of a three part study that makes an extensive investigation of the safety of pet travel crates and 'crash testing'. The entire study will be available as a single white paper after part three is published.



Have you ever been roped into helping out a friend only to find yourself spending far more time on their problem than you ever expected? I can chalk one up thanks to a recent phone call with a college friend. That conversation somehow veered from sports to family vacation plans onto traveling with a dog and his utter exasperation of how best to handle a 65lb bundle of energy for hours at a time inside a SUV.

The problem was not so much that my friend was clueless about the subject of traveling with pets. He was aware of recommendations like

- feeding lightly,
- providing fresh water,
- exercise and relief stops,
- comfortable mat or bed,
- a favorite toy.

The hang up was whether his family really needed to confine or restrain their young dog and if so, the best way to do that. They considered a harness but were not sold on its ability to safely restrain a dog in an accident and not become a tangled nuisance during a 12 hour drive.

Like many owners of larger dogs, they also have a crate. Regrettably, my friend did not think their crate was appropriate for the car as it was more like a piece of furniture and might break too easily. He checked for other crates at the local big box store but was not wowed by anything on display. He also mentioned his wife had looked on Amazon and was overwhelmed by endless choices of crates that all looked more or less the same.

It was at this point I got the question - "Hey, what do you know about this stuff?" Well, nothing like being direct!

I replied honestly - a crate of some kind is the best choice to keep both them and their pet safe in an accident. Their still young dog would also be less of a potential distraction if crated. However, I did not have a specific suggestion off hand as I had no personal experience with any particular style or brand of travel crate.

At this point, I told my friend about my new pet safety website and that his problem would make a really good topic. It would take some time to do the necessary research and analysis but I would help him out.

The Search

Before considering the merits of any crates on the market, I thought some time should be spent getting a feel for what is available. I now understand why my friend's wife was so frustrated.

Checking the Petco, Petsmart and Amazon websites brought up many crates, mostly metal wire or plastic and with few distinguishing features. Prior to filtering, Amazon lists 613 "dog crates and kennels" using keywords "travel crate". Walmart had 165, Petco about 80 and Petsmart fewest at around 30.

The majority of the crates are wire frame; the rest are split between hard plastic and various "soft" materials. There are also a surprisingly large number of wood crates for sale. Looking at crates for sale directly from Amazon narrowed the selection to about 100 with a median price around \$80.

A cursory look shows little to distinguish crates in each category beyond amenities such as an extra door latch. In the median price range, the soft crates have a bit more variety in appearance due to differences in internal framing.

However, look through the more expensive metal crates and one starts to see some differentiation, such as the shape or door location. Rather than the traditional cubic or rectangular parallelepiped forms, some crates have trapezoidal sides while others may be tapered or use trapezoidal fronts and backs.

Initial considerations

What makes for safe car travel with a pet? I can argue there are three objectives that need to be satisfied:

1. Distraction to the driver from the pet is reduced.
2. The pet should remain in the rear area of the car at all times.
3. The safety of the pet should be similar to that afforded human occupants.

The first objective is clearly the easiest to satisfy. If preventing or reducing driver distraction were the only objective, a dog harness is a viable solution to keep Fido from wandering in the vehicle, jumping in the driver's lap or getting into cargo or valuables. A crate of any kind is even more restrictive.

The second objective is a safety issue explained by physics. Sudden braking or turning can launch a dog at high speed into the front of the car (or out of a side window). The dog may hit and injure one or more children or adults while in flight.

Newtonian mechanics tells us a lot about the energy and force in such an event. Per Newton's first law, an unrestrained dog will remain in motion, traveling at the velocity of the car prior to braking. A 65 lb dog traveling close to 35 MPH has a kinetic energy equivalent to a 750 lb weight falling on your foot from a height of 3.5 feet. Ouch!

It is possible to estimate the actual force conveyed by a dog in flight but that figure is highly dependent upon the parameters of the collision. It is influenced by the time over which the interaction takes place and the composition of items hitting each other. More generally, the damage will also be influenced by the area over which the collision is spread. Figure 1 shows how force varies with both velocity and the time over which the crash takes place.

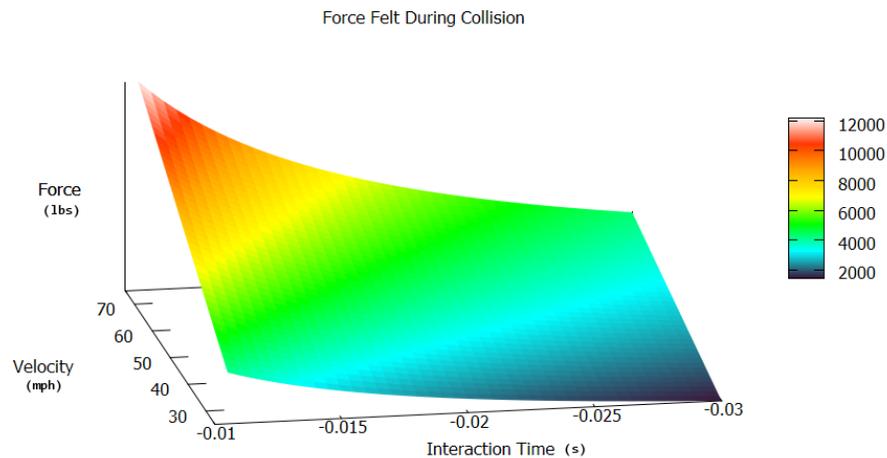


Figure 1. Force felt by a 75 lb dog during collision

Regardless, a dog hitting a human occupant in the head could cause very serious trauma to both. (Small dogs do not get a pass from Newton - the kinetic energy scales linearly with mass and exponentially with velocity. Car speed is far more important, see figure 2)

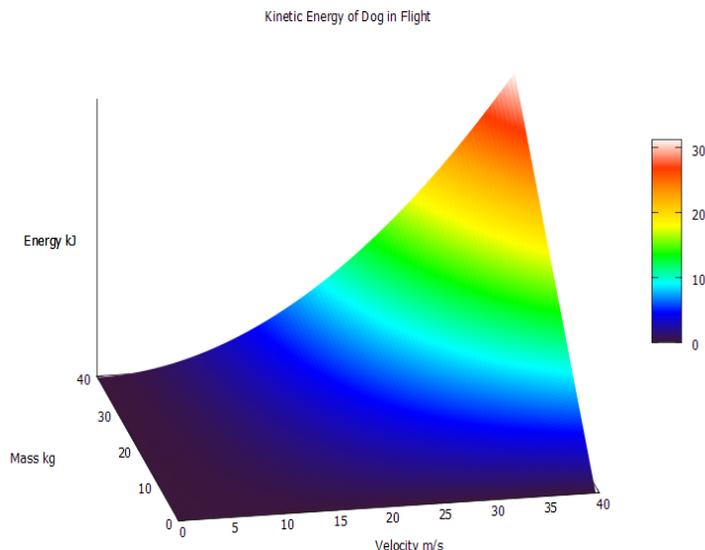


Figure 2. Plot of Kietic Energy (kJ)

The third objective overlaps the second but not entirely. Preventing the dog from flying forward into the front of the vehicle will protect the humans but may or may not protect the dog. When the stopping force on the dog is too high, additional trauma can occur. If the crate is too large, the bio mechanics of a body in free space show other non-impact injuries can occur.

Consideration should also be given to the many types of crash events - frontal, rear, and side impacts all differ as do roll overs. In the case of a crate, it must be able to withstand a roll over or a rear crash as both those events could result in structural damage to the crate from the initial impact. A crate should also avoid causing structural damage to other parts of the car, such as seatbacks.

Narrowing the choices

Given the hundreds of crates and styles available, I really needed to take a representative sample and go from there. Here are my choices:

Name	Model	Description	Cost
Midwest Life Stages	Double-Door Folding Metal Dog Crate	Traditional folding wire, said to be good for home or car	\$90
Good Ideas	KNBK-DES Kennebec Dog Kennel	Traditional hard plastic. What most people envision for car or plane travel. Can be used in home.	\$175
TRIXIE Pet Products	Scratch-Resistant Metallic Crate	The front and back are square but sloped. Mostly solid sides are trapezoidal shaped	\$185
ProLine	Condor Dog Crate, Large	Like the TRIXIE features a trapezoidal shape but on all sides. Crash tested	\$745
MIM	Safe Variocage SL Single Dog Cage	This is a very unusually shaped metal crate. Crash tested	\$837

There is a big step up in price from the Trixie to the ProLine and MIM but I figured why not, there has to be something about the more expensive crates to justify the price.

The TRIXIE, ProLine and MIM Variocage both have "bars" that run in one direction, unlike the lower priced, traditional crates that have cross-crossing metal wires running up/down and front/back.

A big concern I have with all of these crates is deformation in a crash. Deformation is like Goldilocks - too much or too little is not good. When automakers speak of "crumple zones" in a car, they are basically talking about a controlled deformation of the structure of the car. Crumpling absorbs impact energy and **increases** the time over which the impact occurs (the longer the time, the smaller the force from the deceleration). The key word though is *controlled*.

Midwest Life Stages

With the Midwest wire crate, I would be very concerned about significant deformation in any kind of crash, rear in particular. If you have ever put these wire type of crates together, you know even the strongest will bend (and may need to for assembly). Unfortunately, they all will deform unpredictably outwards or inwards, the direction depending upon how much and where forces are applied.

Clearly, bending inward would jeopardize the pet. Another concern is that individual wires may unhook or break their welds and detach from the rest of the frame. This too poses a risk of severe trauma to the pet inside and potentially also to nearby humans.

Similar thoughts apply to the crate door. Will it stay closed in a crash? I would definitely worry the door of a wire crate may open in a crash or potentially worse, be stuck shut afterward. There needs to be a way to get Fido out of the crate at some point, especially if the dog is injured. I am very uneasy that wire crates may lose their structural integrity too easily.

Good Ideas Kennebec

On the other hand, with the Good Ideas crate my concern is the crate will not deform at all. In a rear end crash, it is possible the crate will be impacted by the car body and suffer additional compression forces. These can be relieved in one of two ways - the crate structure breaks or the crate pushes forward into or through a seatback. Without a rear end crash test, it is impossible to predict how the structure of the Good Ideas crate would behave.

However, the Kennebec is a single piece construction so cannot be separated - unlike similar plastic crates joined together from two injection blow mold parts after the fact. Good Ideas touts their process as the same used to make military grade transport containers. All of that may not make the crate any safer for pet transport as the chances of the crate acting as a battering ram against a seatback are probably high.

TRIXIE metallic crate

The TRIXIE crate bears a striking resemblance to the more expensive ProLine model, though rotated by 90 degrees. To get a better handle on this crate, I pulled down a brochure from the manufacturer's [website](#) (TRIXIE is a German company.) Based on this information, I have significant concerns about the use of this crate anywhere other than in the home.

The TRIXIE uses a frame of aluminum with plastic corner connectors. My impression, based on photos and the total weight of the crate, is that the aluminum is probably hollow tubing. Similar vertical bars cover about two-thirds of the face of the front door.

The sides, rear panel and floor are made of MDF covered with an easy to clean metallic plastic finish. MDF is *medium density fiberboard* and is often used in book cases or desks designed for self-assembly at home. MDF is made from fine wood fibers glued and compressed together under pressure. Formaldehyde resins are commonly used to bind together the fibers in MDF and this may be of concern to some pet owners.

My primary concern with the TRIXIE crate is the MDF paneling, less so the plastic corner connectors. MDF is not a particularly strong material and is generally weaker and more flexible than plywood. As noted earlier, though some compressibility can be a good thing, I worry that MDF panels may break, allowing the pet to exit the crate. Breakage from compression on crash impact (i.e., a rear crash) is also a risk.

MDF can fail spectacularly, splitting with many sharp edges. If a panel were to break inward, it is not hard to envision serious trauma to the pet. A pet punching through a panel on impact is at risk of cuts, punctures and abrasions.

Plastic corner connectors are a potential point of failure that makes the entire frame suspect. The TRIXIE is put together much like tents used for camping, tailgating and sometimes car shelters. A not uncommon complaint is of tents collapsing after the connectors shatter under stress and strain. If this happened to a crate, the loss of structural integrity could result

in parts of the crate flying throughout the vehicle, putting pets and humans at risk of injury. Worse yet, the pet inside is no longer contained by the crate.

The potential for failure of the plastic frame connectors, the MDF panels or both, in my opinion, make this crate an unsafe choice for use in a car. Though the industrial look may not be everyone's cup of tea, for use in the home it is probably OK.

ProLine Condor

Moving up the price ladder, next in my list is the ProLine Condor crate. Like the TRIXE, the bars and frame are aluminum. However, the ProLine connectors are fiberglass, rather than plastic, and are bolted to the aluminum framing. The front (door) has vertical bars, the rear is a hard panel with a small gap of vertical bars at the top for ventilation.

ProLine states they use vertical rather than horizontal bars to prevent the dog from causing chewing damage. I've watched my dog chew a hard bone in multiple directions so I don't think this is a big selling point. The composition of the solid side and rear panels is not clear from the marketing literature but like the TRIXIE, they too are silver.

ProLine also mentions their detail in craftsmanship and how their crates require little, if any, maintenance. Without examining the crate by hand, it is impossible to assess the build quality. However, for a \$700 product, it should be well built! As to maintenance, again not a big issue as I don't think most crates require it.

ProLine's website (www.safetycrate.com) has a configurator to help the owner pick the correct crate size for their dog and car from the eight available models. I find it disconcerting ProLine refers to the crate as a "dog box" but perhaps that is just a cultural difference, ProLine is a Swiss product.

My initial take is similar to the TRIXIE - I have concerns about the side and rear panels, and slightly less so for the fiberglass connectors. In addition, the rear panel has a support bar mounted on the interior running horizontally. This strikes me as a poor design. In a crash, the dog may first hit a narrow, sharp edge and transmit the impact force across a small area, rather than the much larger area of the full panel. (ProLine sells an accessory "Crash Bag" for \$90. It is a foam pad that attaches to the rear panel to provide additional impact protection.)

ProLine states this crate has been independently crash tested by the German firm TÜV-SÜD and awarded a "certification".

MIM Safe Variocage

At the highest price point is the MIM Safe Variocage. The Variocage will not win any beauty awards. It is a starkly utilitarian design that looks more like something one would find in a factory than the back of a car. Even so, we all should agree that our primary mission is to find the safest crate, not the best looking.

The standard Variocage, available in four base sizes, is further adjustable to better accommodate any sized dog. The Variocage also is available as a segregated double wide for multidog families. MIM has two additional models to meet unique needs - one designed for compact cars, the other for very small dogs or cats.

The Variocage is sloped front and back. The sides are mostly normal to the base, slightly tapered near the top. Unlike the other barred crates, the Variocage uses vertical bars on the front (door) and horizontal bars on the two long sides. The rear is a mixed metal panel, solid on the lower third and up the sides while gridded in the central two thirds.

A nearly flush horizontal reinforcement midway down the front door appears not to protrude significantly into the interior. The door can be locked with a key and there is a small storage area to tuck a training lead. The marketing material notes that the door is mounted on hydraulic hinges to make for a smoother open and close.

The horizontal bars comprising the sides of the Variocage are unique and a closer look reveals they are two pieces, one fitting inside the end of the other. In their product description, MIM notes that in a rear end collision the Variocage is designed to partially crumple. The telescoping nature of these horizontal side bars are a key element of that safety feature.

The most outstanding design feature of the Variocage is the ability to absorb crash energy by crumpling in a predefined, controlled manner. In a rear crash, MIM has eliminated one of the most significant risks - a crate acting as a battering ram that can break a seatback and injure the occupant. The pet is also better protected from potential trauma as the Variocage won't shatter, nor are metal parts likely to protrude into the interior of the crate.

Without multiple situational crash tests of each crate, it is not possible to quantify the likelihood the door remains closed in an accident nor whether the door can be opened afterward. If the door is mangled in the collision, it may be slow or very difficult to open, potentially putting humans and pets at additional risk of injury.

MIM took this dire circumstance into consideration by providing an additional "escape hatch" through which the pet can be extracted. The rear metal panel of the Variocrate is hinged so it can be folded down after loosening two retention knobs on the top of the crate. Only a handful of crates offer a second door and, other than the Variocage, they are all basic wire structures.

MIM, like ProLine, also states their crate was independently crash tested. Unlike ProLine, MIM provides PDF copies of the test procedures and results on their [website](#).

This is the end of part one. Part two will evaluate efforts of both manufacturers as well as third parties to crash test pet travel crates.