DOWNLOAD PDF DESIGN OF STEEL BUNKERS

Chapter 1 : 6 Hidden Underground Shelters that Will Survive Doomsday

Structural design of bunkers with procedure and design considerations are discussed. The bunkers and silos made of reinforced concrete have almost replaced the steel storage structures. Concrete bins possess less maintenance and other architectural qualities greater than steel storage tanks.

The one place to find the best blast doors and hatches for your underground shelter American Safe Room is your complete design, engineer, and build solution for high pressure single leaf blast resistant doors Plate steel or fabricated steel blast resistant doors with engineer certified UFC dynamic blast load calculations We have supplied plate and fabricated steel single leaf blast doors for a variety of critical applications ranging from nuclear power plants to aerospace industry test cells, foundries, and military munitions bunkers. We work with our customers to ensure that our custom engineered product will meet their needs. Our doors feature a wide range of proven hardware that can be scaled up or down to meet your requirements. Our high duty-cycle hinges and latches feature oil impregnated bronze sleeve bearings and stainless grease fittings. We can quickly and easily design doors for your unique triangular or bilinear dynamic blast load specifications. A triangular blast load is characterized by either the peak pressure psi and duration ms , or by impulse psi-ms and either peak pressure or duration. A bilinear blast load is a combination of two triangular loads resulting from shock pressure and gas pressure. We complete the initial design and engineering calculations in house and send them out to be reviewed and certified by a professional engineer. All initial design and engineering is done in house, then the design is reviewed by external professional engineers so that we can get stamps in all 50 states and Canada and more. Send your specifications to our sales department sales AmericanSafeRoom. Concrete filled steel envelope doors with engineer certified static blast load calculations Our concrete filled doors are the best solution for bomb shelters and safe rooms. They are legitimate blast doors, not ornamental "vault style" doors made from sheet metal with fancy paint jobs. These doors are also very popular for industrial applications - even in low pressure environments. They have outstanding ballistic properties - UL , level 8 compliant multiple 7. Add to that our engineer certified 50 PSI blast load rating and you have the perfect bomb shelter door. The door leaf envelope is filled after the door is mounted on the wall. Mount a pound door and then fill it with concrete to put 1, pounds of mass between you and whatever is outside your shelter! Our engineers select the hardware set based on the blast load requirements, the rebound response, and the door leaf weight. Standard duty hinges These massive hinges are machined from one and a half inch shafts that capture oil impregnated bronze sleeve bearings that are press fit into steel blocks. They feature grease fittings for ongoing lubrication. The end blocks have a full strength continuous weld to the frame and the pins are stitch welded to the door leaf to spread the forces over a large area. We use these hinges on door leaves up to 2, pounds. They are rated for 60, pounds per hinge - and our hinges go up in strength from there: Heavy duty hinges These hinges allow the door leaf to be removed from the frame for assembly or repair in the filed. They are machined from 2. Both the frame and door leaf have continuous full strength welds. They feature oil impregnated bronze sleeve bearings that have a flange that bears the thrust load. We recess the stainless steel grease fitting into the bottom pin. The top pin has the capture bracket. The capture bracket in this picture is bolted on to the frame so the door leaf can be removed if needed. For high security applications, we weld the capture bracket in place. See the video below for showing removal and reinstallation of a 6, pound 78" x " plate steel door leaf with four heavy duty hinges. They feature high load oil impregnated bronze alloy sleeve bearings and separate oil impregnated high load bronze alloy thrust bearings. The pins are machined from two inch cold rolled steel and are welded in place after the door leaves are installed on the embedded frame. These hinges are suitable for extremely large and heavy door leaves. See the video below showing a Cam latches The cam latches are rotating handles on the inside of the door leaf that engage a cam welded on the frame. They operate in opposite directions in case the door is subject to violent movements by a detonation - one may loosen, but the other one will tighten, holding the door in place. As you turn them, they draw the door leaf into the frame, compressing the door seal. This picture shows the latch in the closed latched position. Note the bracket on the door leaf above the latch that allows you to lock your latches in the open position with a paddle lock. The hole

in the bracket correspond with the hole in the cam latch handle. This picture shows the latches in the open unlatched position. They are positions over the brackets. Most machinery and large tools have a "lock out" function for maintenance. This duplicates that function in case you have to give someone access to your shelter who may try to lock you out. We incorporated this feature on all of our blast doors after a customer with a teenager inquired about a way to ensure he was not locked out of his shelter. Outside operators On doors that require access from both sides, we install outside cam latch operators. On the seated side of the door leaf, they operate just like our standard cam latches. One the unseated side, they have a handle that is on a shaft that goes through the door leaf and rotates the cam latch inside. We machine a steel barrel for the shaft to ride in. Each end of that barrel has an oil impregnated bronze bushing and there is a stainless steel grease fitting on the seated side. These outside operators are not suitable for bomb shelters or safe rooms, but they are quite popular with our industrial customers. This is a 40 x 85 inch plate steel missile resistant door with outside operators and an inset deadbolt assembly that locks one of the operators in either the latched or unlatched position: Inward swinging blast doors Blast doors normally open outward to carry the load in the seated condition. The blast load transfers directly from the door leaf to the frame and wall, not through the hinges and latches. Certain installations require an inward swinging door and we offer it as an option. This is one of our cam latches secured shut on an inward swinging door. We mount the cams on risers and widen the face flange of the frame. This picture shows an inward swinging door cam latch secured under the cam which is mounted on a riser to clear the door leaf thickness. Professional engineer certified blast load calculations Plate steel doors Plate steel doors are fabricated from a single piece of steel. The hinges and latches are welded directly to the door leaf plate. On doors that require less than one inch of plate, we fabricate a frame to hold the plate flat out of structural steel tubing. Fabricated steel doors Very large doors or doors that have extreme blast loads can require a plate thickness that becomes weight and cost prohibitive. We engineer door leaves that are fabricated from wide flange beams with a steel skin on each side. Calculations for plate and fabricated steel doors Because the plate thickness and fabrication of these doors are driven by the blast load specifications, we engineer these doors to your specifications. We will quote the engineering and calculations separately from the doors. Contact our sales department to start the process. See our custom blast door page for a gallery of doors that we have engineered and built. Concrete filled door leaves We have standard sizes and thicknesses for our concrete filled doors. These doors are certified by a professional engineer to withstand a 50 PSI 3 bar blast load in the seated condition and Sealing it all up - the door seal and threshold style Compression seal These doors features a synthetic rubber seal between the door and the frame allowing for the use of a positive pressure NBC filtration system inside the shelter. The inside cam latches draw the door into the seal as they are rotated. This puts the seal under compression between the door leaf and the frame. This seal is expertly applied without stretching it and the corners are cleanly chamfered to seal out airborne toxins. Steel on steel We stitch weld a piece of flat bar onto the edge of the door leaf to ensure the door seal does not get over-compressed. Fire rated door seal As an option, you can get a second, fire rated seal applied outside of the primary seal. UL classified for use on hollow metal and steel-covered composite-style fire doors rated up to and including three hours. There are four different frame options to handle any type of threshold you have: Flat threshold Three inch concrete step over Five inch concrete step over Frame step over This inward swinging door has a flat threshold with an adjustable sweep, a deadbolt lock, and an inset pull handle so that an outward swinging wooden door can be mounted over it to hide the shelter entrance. Opening force We asked one of our industrial customers that had a door installed in a FLEX building at a nuclear power generation plate in Missouri to test the force required to open a door. This particular door was a 36 by 80 inch door, but the thickness was sized to resist a certain spectra of missile threats. The weight of the door leaf after filling was about 2, pounds compared to about 1, pounds on a normal door. Here is their test results: We did the test on the American Safe [Room] personnel doors that you requested. All testing was performed on the Plant South Door. We did the test 3 times and got consistent results on all 3 tests. There was no break away force needed to get the door swing started and the force was consistent throughout the travel to 45 degree OPEN. See below for equipment used and force observed:

Chapter 2 : Northeast Bunkers - home

Design of Bins - Bunkers and Silos:: Introduction Rectangular (Pyramidal Hopper) Shallow Deep Bunkers By BK Pandey, Structural Section, MECON Ranchi. Design of Bins - Bunkers and Silos:: Introduction Rectangular (Pyramidal Hopper) Shallow Deep Bunkers By BK Pandey, Structural Section, MECON Ranchi.

They also had homes above ground. If a raid were about to occur, they would retreat to their underground city. The entrances were carefully hidden. Luxury Renovated Bomb Shelter in Georgia This impressive renovated nuclear bunker located at an undisclosed location in Georgia. It is set on 20 acres and has features like 3-feet thick hardened concrete walls which can withstand a 20 kiloton nuclear blast, a secure air intake system, HVAC underground systems, and much more. Yes, this bunker will take you through doomsday in style! Atlas Galvanized Steel Underground Shelters Atlas is one of the most popular names in pre-fabricated underground survival shelters. They offer a lot of features, like models with a main entrance hatch plus escape hatch, tested air filtration systems, underfloor storage, and a year lifespan. They also offer generator pods which can attach to the shelter underground for a concealed power source. Inside of an Atlas survival shelter Atlas survival shelter floor plan Installing the Atlas survival shelter Vivos Survival Shelters Vivos is known for its massive underground survival shelters which can house communities in the hundreds. They use a spoke-like design, and multiple spokes can be put together to increase the size of the shelters. For individuals who want an underground bunker on their own land, the Quantum model is the best choice. One of the more notable features of the Vivos Quantum shelters is that they can be hooked up to an underground well. Then, using a hand-pump, you will be able to provide your own water for the tank. There is also a built-in NBC nuclear, biological, and chemical air filtration system and a diesel generator. You can apply to join in on one of their survival shelter communities. When doomsday hits, you can retreat to the shelter and wait out the disaster with a group of like-minded individuals and families. These are luxury shelters and you are expected to have a budget to match them! They have fantastic air purification systems which use 3 different purifiers. Radius builds its bunkers with nuclear warfare in mind, so the air purifier has a UV-radiation sterilization system too. These underground shelters are mostly meant for military and government use, but they do have family models too. Lately, there has been a lot of talk about using a shipping container as a bunker. Watch this video if you want to see how its done. Some of the main issues are: Corrosion Walls are not load bear â€” you must reinforce them! Need air shafts to prevent suffocation; these shafts could give away your location or get covered up and prevent air flow Not much storage space for food, water, and living Logistics â€” like how you will remove human waste No emergency exit hatch On the other hand, a shipping container is a very easy survival shelter to install by yourself, and it is better than nothing. And, if you are already prepared to dig up your property and put a shipping container in it, then you might as well spend a little bit more time and money to design your own hidden underground survival shelter. Are you thinking of installing your own underground survival shelter? What route would you go with â€” prefabricated or DIY? Let us know in the comments or join the discussion on FB. I believe in empowering people with the knowledge to prepare and survive in the modern world. More about Jacob here.

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Chapter 3 : Bunker - Wikipedia

We offer the best underground bunkers, storm shelters and safe-rooms on the market. % steel, fabricated by hand and customized to each client's unique specs; our bomb shelters are the BEST on the market.

Austrian bunker from World War I in West Ukraine Blast protection[edit] Bunkers deflect the blast wave from nearby explosions to prevent ear and internal injuries to people sheltering in the bunker. While frame buildings collapse from as little as 3 psi 0. This substantially decreases the likelihood that a bomb other than a bunker buster can harm the structure. The basic plan is to provide a structure that is very strong in physical compression. The most common purpose-built structure is a buried, steel reinforced concrete vault or arch. Most expedient makeshift blast shelters are civil engineering structures that contain large buried tubes or pipes such as sewage or rapid transit tunnels. Improvised purpose-built blast shelters normally use earthen arches or vaults. To form these, a narrow meter flexible tent of thin wood is placed in a deep trench usually the apex is below grade , and then covered with cloth or plastic, and then covered with 1â€”2 meter of tamped earth. A large ground shock can move the walls of a bunker several centimeters in a few milliseconds. Bunkers designed for large ground shocks must have sprung internal buildings to protect inhabitants from the walls and floors. Fallout shelter Nuclear bunkers must also cope with the underpressure that lasts for several seconds after the shock wave passes, and block radiation. Usually these features are easy to provide. General features[edit] A bunker on the island of Texel , in the Netherlands. The doors must be at least as strong as the walls. The usual design is now starting to incorporate vault doors. To reduce the weight, the door is normally constructed of steel, with a fitted steel lintel and frame. Very thick wood also serves, and is more resistant to heat because it chars rather than melts. A bunker should have two doors. Door shafts may double as ventilation shafts to reduce digging. In bunkers inhabited for prolonged periods, large amounts of ventilation or air conditioning must be provided in order to prevent ill effects of heat. In bunkers designed for war-time use, manually operated ventilators must be provided because supplies of electricity or gas are unreliable. One of the most efficient manual ventilator designs is the Kearny Air Pump. Ventilation openings in a bunker must be protected by blast valves. A blast valve is closed by a shock wave, but otherwise remains open. One form of expedient blast valve is worn flat rubber tire treads nailed or bolted to frames strong enough to resist the maximum overpressure. Bunkers must also protect the inhabitants from normal weather, including rain, summer heat and winter cold. Thick 5-mil or 0. Countermeasures[edit] Bunkers can be destroyed with powerful explosives and bunkerbusting warheads. The crew of a pillbox can be killed with flamethrowers. If the exits to the surface can be closed off, those manning the facility can be trapped. The fortification can then be bypassed. In Switzerland , there is an unusually large number of bunkers because of a law requiring protective shelters to be constructed for all new buildings since , as well as a number of bunkers built as part of its National Redoubt military defense plan.

Chapter 4 : Steel Shelters | Elemental Shelter Solutions

The Structural Design of Steel Bins and Silos August, 1 INTRODUCTION General The storage of granular solids in bulk represents an important stage in the production of many substances derived in raw material form and requiring subsequent processing for final use.

Tweet on Twitter Best bunker design. This article was generously contributed by Clarence Mason and in it he compares and contrasts two different survival bunker designs. Each have their advantages, but if you are considering building your own survival retreat option in the future, it makes sense to consider what is the best bunker design before you get too far down the planning road. Many are written by Pat Henry, who I recently had the pleasure of having a conversation with. The ability to shelter in place , in a shelter that provides protection from radiation, bombs, attacks, tornadoes and numerous other threats to safety. That said, with the exception of a line of Tornadoes passing through, you need to be psychologically and physically prepared to go underground for at least weeks. The amount of time will of course depend on the extent and type of event that has or is occurring. What is the best bunker design? You are going to be stressed enough if you are in there, and the last thing you need is the additional stress of a cramped, unfriendly environment. I present this question for your consideration: Would you rather be in a claustrophobic steel pipe or in the open area provided by a square-shaped reinforced concrete bunker that is already finished with non-toxic material? There has to be something to be said about that, and there is: All the information you need to implement a high security and self-sufficient residence or retreat. They are typically installed with feet of earth covering the top and this presents a considerable number of challenges with regard to the costs for excavating, the need to hire a crane and other issues. For example, a 10 foot Pipe that is 20 feet long will require an feet deep hole and provides a gross interior area of 1, cubic feet. Keep in mind that the interior surface is curved similar to being in a submarine , and therefore requires a floor to be installed, which reduces headroom. Comparatively, a 10 foot tall, 10 foot wide and 20 foot long Concrete shelter will only require a foot deep hole, provides a gross interior area of 2, cubic feet, does not require a floor to be installed, has no loss of headroom anywhere inside the structure and only needs to have feet of earth cover overhead. If the height of the Concrete shelter is decreased to 8 feet the same height of the ceilings in your home , the required depth of the hole is reduced to feet and the gross interior area is 1, cubic feet. This is still more than a 10 foot pipe of the same length while also providing complete use of the space, as the side walls are not coming in toward the center as they do in a pipe. Space Comparison of a 10 ft Pipe to a 10ft Square In my opinion, the 2 feet of headroom throughout is more than adequate. Of biggest concern with these systems is the fact that the Polystyrene contains toxic chemicals. Not only because they are made of petroleum-based foamed plastics, but also because they contain fire-retardant chemicals that are also toxic. HBCD has been classified as a category 2 for reproductive toxicity. Additionally, EPS is labeled a flammable material and MUST be covered with a non-flammable material such as fire rated sheetrock or masonry to limit surface exposure to possible ignition sources. This covering also reduces exposure to the off-gassing of other chemicals considered to be toxic that occurs without exposure to fire. When it burns, EPS produces heavy, acrid and toxic smoke. This obviously presents another serious problem when you are in a confined space, from which there is no escape. Exposure to the heavy smoke generated, even if only for a few minutes, has been shown to be lethal. In short, you are looking for your shelter to provide you a safe, healthy and fireproof refuge from a multitude of disaster scenarios. The dangerous and potentially lethal points made above should not be overlooked when making a decision in choosing a bunker or shelter. Clarence Mason has 35 concurrent years of interdisciplinary experience and training in the public and private sectors of the fire service, law enforcement and investigations. Clarence has extensive knowledge and experience in the building of commercial and residential concrete structures, and as a result of blending these unique experiences, is also the inventor of a patented system designed to provide the levels of protections needed in the building industry. You can learn more about the building products in this article at www.

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Chapter 5 : Bomb Shelter, Underground and Survival Shelters - Hardened Structures

structural-design-of-steel-bins-and-silos 1. The Structural Design of Steel Bins and Silos August, 01 - - 1 INTRODUCTION General The storage of granular solids in bulk represents an important stage in the production of many substances derived in raw material form and requiring subsequent processing for final use.

Contact Us Why an underground Bunker or Shelter? The central theme to all catastrophic and epic life-threatening events is to find shelter underground. Throughout history mankind has understood that the earth itself can provide the best shelter for most catastrophes. Regardless of the threat These underground shelters are commonly referred to as "Bunkers". Out team of engineers have spent countless hours designing shelters that will meet the challenges of protecting your Family under the most extreme conditions. Because of our simple and efficient designs and quality, robust materials, we feel our bunkers are the best value of any underground shelter available. For those that want more Whether you have a custom build in mind or your content with one of our economical standard sizes We are not aware of any other bunker company that meets this standard. All our bunkers are primed and sealed both outside for all weather conditions and inside for wear and safety for generations to come. All our bunkers include a main entrance hatch with a robust locking door, the required air exchange system to safely supply your specified number of occupants with fresh air and an emergency escape hatch. Answering the following Questions will help in determining the best Bunker for your Family. Total number of people that have or may be invited into your bunker? This will help you in choosing your bunker size, options for comfort and convenience along with the necessary food water and supplies to sustain life. Additionally, "Bunker of Steel" will help you in choosing the necessary "air exchange system". We never know for certain what dangers we may face Understanding the potential dangers your Family may face will help in determining what options you may need, the burial depth of your bunker and the correct air supply or filtration system needed along with food, water and medical supplies. Understanding how long you may potentially need to remain in your bunker will assist you in making wise choices pertaining to supplies and amenities for your physical and mental health. Elderly, Infants or Handicap needs? An important part of your preparation is to consider the needs of infants or those with disabilities or dependencies on medications. Location of your bunker? Every location is unique. Additionally, you do not want unwelcome guests to know anything about what you are doing. Confidentiality and secrecy is paramount. Based on your bunker size and options, there is a week build time, plus freight time. To minimize your exposure to unwelcome guests or curious neighbors Having the hole dug and ready to go before your bunker arrives will allow for a quick and covert installation. Based on your bunker size and number of occupants, "Bunker of Steel" will help you assess an "air exchange system" that will meet the needs of your shelter. Your needed "air exchange system" will be determined by the size of your bunker and the number of occupants, along with any requested options for filtration from biological, chemical or nuclear contaminants. Standard Bunker sizes and prices:

Chapter 6 : [Pdf] Free Download Design of steel structures by SK Duggal

As a Civil Engineer, I have used them in numerous applications as a cost effetive alternative to poured in place concrete. I would expect a bunker design would be an easy adaptation of the typical box culvert instalation. The ends can be precast solid or with openings for addition of steel or aluminum doors.

Chapter 7 : Bunker of Steel - Protection Against Disasters and Enemy Threats

Rising S Bunkers offers the best underground steel shelters, bomb shelters, safe rooms & blast doors on the market. We lead the industry in quality and we have the highest standards for craftsmanship in underground bunkers and other emergency shelters.

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Chapter 8 : Single leaf blast resistant doors

Ultimate Bunker Custom Manufactures Steel Underground Vaults that Offer The Most Extreme Protection and is by far the most Secure way to store anything of value. Our TL 10 and TL 30 X 6 rated safes will keep all your belongings safe and secure.

Chapter 9 : Design and construction of silos and bunkers - Sargis S. Safarian, Ernest C. Harris - Google Bo

With 1/4â€² thick steel skin on the outside and a heavy coat of Epoxy Coal Tar Coating on the exterior, we guarantee that ALL our Ultimate Underground Bunkers will last a lifetime! Ultimate Bunker manufactures high quality % steel Underground Bunkers for small or large families, groups and businesses.