The common armor concepts used in modern tanks is as follows:-

(1) Steel armor. This is cheap and easy to make. It can be a casting or made from welded plates. Heat treating can be used to harden the faces of steel armor to improve performance against kinetic energy weapons at the expense of resilience against chemical warheads. Classic tanks like the M48 and T55 uses this.

(2) Aluminum armor. This is very light. Every pound of aluminum armor is also more effective against chemical warheads as an equivalent pound of steel since aluminum is bulkier but less dense and stronger than steel by weight. The M113 uses aluminum armor – too little of it really to be of much value. The protection of the M113 was bad to the point where assault rifle rounds with steel cores will penetrate it at close range.

(3) Perforated steel armor. This involved steel armor that is in effect drilled full of holes perpendicular to the face of the armor. The holes are no bigger than half the expected diameter of the expected penetrator. This allows the armor to be 40-50% the weight of a solid block of steel, but 70% as effective against kinetic threats. It also makes the armor bulkier and full of empty space, which enhances survivability against HEAT and HESH type warheads. Usually the perforated blocks will form the core of the armor, with harden steel strike faces and/or unperforated panels capping off both ends. Advanced versions of perforated armor use hard cylinder liners for the holes to increase kinetic protection and/or ceramic fillers within for protection against HEAT rounds. Despite popular believe, the original Leopard II does not use Chobham type ceramic laminate armor, rather it uses perforated armor. Because the orientation of the holes are very important to effective protection, perforated armor does not lend itself to curved surfaces very well.

(4) Ceramic Laminates (Chobham type). This is usually a laminate of multiple layers of metal and ceramic plates. The ceramic used is usually a guarded secret, but it is speculated that Alumina (Aluminium Oxide or Sapphire), Boron Carbide (the hardest simple ceramic), and similar materials are probably used. Sometimes synthetic fibers are used to enhance the effectiveness of the metal backing plates and metal mesh is integrated into the ceramic plates to localize shattering when struck. Sometimes the term Ceramic Matrix Composite is coined to discribed laminated armor employing these advanced techniques. Because the ceramics are both very hard and crushes into a HEAT jet disrupting retro-fluid action, it is very effective against HEAT warheads. Because it is numerously layered, it is more effective against modern HEAT warheads which frequently has tandem charges to defeat ERA. When it is hit by a tandem charge, the precursor charge will not expend the entire reactive package just the top layer or two. Ceramic laminates also resist kinetic energy penetrators better than steel armor of a comparable weight though not as drastically better as they resist shaped charges from chemical warheads. Pound for pound, this is currently the most

effective single armor concept though it is frequently used in conjunction with other armor concepts. Because ceramics cannot be bent into curved surfaces, tank designs using ceramic laminates also tend to be squarish.

(5) High tensile alloy faced armor. This is an arrangement common amongst state of the art tanks. Basically, it is a thin sheet of tungsten alloy or in the case of late model M1 tanks Depleted Uranium acting as the strike face of whatever the armor type is underneath. The mission of this is to fracture long rod penetrators and render them practically useless. Tungsten-carbide is actually harder than DU, but DU is also very hard and is less prone to shattering making it a superior material for penetrators and strike faces. The problem is DU dust is toxic and is very unhealthy if breathed in.

(6) ERA – Explosive Reactive Armor. This is a cheap and relative light way of protecting against HEAT projectiles. Basically it is high explosive sandwiched between steel plates which explodes when it is hit by a HEAT warhead. It is practically useless against kinetic rounds and there is no repeated strike capability making it very venerable to tandem charge warheads. But it is light, modular and easy to apply over existing vehicles. You will see this on Soviet tanks and Chinese tanks a lot. Generally it is a quick fix for tanks which does not use advanced ceramic laminate type “passive” reactive armor.

(7) Spaced armor. This is one of the oldest tricks in the book and really the only one that does not involve heavy materials and the only thing that is truly effective against HESH rounds. This can be simple slats or skirts mounted some distance off the sides of the hull or turret. It is also a feature inside the advanced construct of some tanks. An empty space is just about as good as steel in countering shaped charges and empty space is weightless. Modern internal spacings also tend to have angled baffles to channel the jet off the centerline to further increase effectiveness against chemical energy attacks.

(8) Advanced Combinations. Most of the best tanks in the world use a combination of two or more of the above.