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The following recovery information has been compiled by Kev Williams, Director and Principal Trainer of Bespoke 4WD Education.

The content includes:

- Definition of Vehicle Recovery,
- Recovery Points,
- Definitions and Safety Factors of Recovery Equipment,
- Additional winch recovery equipment required.

Definition of a Vehicle Recovery

Recovery is the process of extracting an immobilised vehicle so that it may become mobile again or can be removed from potential damage, without harm/injuries/fatalities to personnel, damage to vehicles and equipment and minimum impact to the environment.

Never compromise safety when conducting vehicle recovery... The day we do... maybe the day it will harm someone.

Recovery Points

The following information is an abstract from a report, I compiled for Workcover, for a workplace recovery failure investigation.

The purpose of this article is to highlight concern relating to Recovery Points. Most vehicle recovery equipment are rated to the manufacturer specifications and in some cases are tested, except for the vehicles manufacturer's "towing points".

Most times when a recovery fails, it is generally what we connect the recovery equipment to on the vehicle, manufacturer's "towing points"

At present there are no Australian Standards, Regulations or Requirements for Vehicle Rated Recovery Points. The only standards and requirements on rated recovery points are what are in this report and the guidelines or policies that representatives and organisations apply.

My personal theory on the risk of using vehicles manufacturer's "towing points" is that if we choice to use these points "99.9% of the time, this may result in a successful recovery, however there may be a 0.1% of a chance of a failure and possible injury or fatality if the vehicles manufacture's "towing points" fail.

This is obviously of concern to all at Bespoke 4WD Education and most people in the 4WD industry, whether for work related or recreational reasons.

Our trainers and I have no intention to be the expert on this subject, just professional in what we do and always keen to providing safe, correct and up-to-date training and information to our training participants and our clients for whom we deliver training.

Personal Experience

Firstly, I am not an engineer, therefore I acknowledge that I do not have the skills and experience in calculating metal or steel strengths. My personal knowledge and experience are from over 20 years of serves in the Military, mostly as an instructor in many skills, one in particularly was in the field of recovery with vehicles and equipment ranging from 2t -24t and 30t-50t armoured vehicles, in very extreme conditions. In my position as the Director and Principal Trainer of a 4WD and Advanced Driver Education Company, is to continually research and keep my knowledge up-to-date from manufactures testing results and other engineer's explanations on their view on the subject of recovery.

I am experience and familiar with the following recovery factors:

- Resistance to movements (rolling, gradient, damage resistants and soil types);
- Tractive forces/pull (the point where wheels begin to brake traction and spin);
- The mechanics to recovery (pulleys, mechanical advantages, angle of forces, kinetic energy, direct and indirect recovery);
- Definitions and terminology of recovery, including differences between SWL/WLL and towing points/rated recovery points/hooks/ winch systems;
- **Factors of safety (FOS)** and the **Physics of the Pull Power Zone** (How the Laws of Physics govern winch performance);
- Types of recovery equipment, wire cables, straps, ropes, shackles, anchor points etc; and
- Safety Requirements.

Important Note - When selecting recovery equipment, consider recovery equipment that is capable between 2.5 to 3 times the Gross Vehicle Mass.

At a minimum, my personal recommendation is as follows:

- 1 x Equaliser strap (for 2 recovery points).
- 2 x 3.25t and/or 4.75t Bow shackles. Or Soft Shackles.
- 1 x 10m (8 - 10t) Winch Extension Strap (for tow recovery or Extension Strap).
- 9 - 12t snatch strap or 8t - 12t Kinetic Rope (functions the same as a snatch strap).
- Towbar Recovery Hitch Receiver.
- 1 x Dampener (2 would be ideal).
- Recovery Bag.
- Tyre Pressure gauge (keep it simple and easy to use). Compressor (a minimum of 160LPM).

Additional Optional

- Recovery Boards (for example Maxtrax).
- 1 x 8/9t Pulley Block, for mechanical advantage. (if a vehicle mounted winch is fitted).

Definitions, suggestion and Safety Factors of Recovery Equipment.

Equipment	Controls or Control Measures
<p>Recovery Boards</p> 	<ul style="list-style-type: none"> • A safer option to recovery is the Recovery Boards which reduces the risk during recovery. Recovery Boards are safe and ideal recovery equipment, particularly for members who need to perform their task as a single vehicle. • How to use Recovery Boards: <ul style="list-style-type: none"> • Wedge Recovery Boards firmly against your tyre tread, on a slight angle, • Gently accelerate. NO WHEEL SPINNING. Once your tyre tread grips onto the Recovery Boards, you get traction and raises the vehicle up and out of the stuck surface. • Always incorporate Recovery Boards with any straps or winch recovery. 
<p>Correct Recovery Points</p>  <p>Broken towing point of a Toyota Landcruiser tray back, unloaded.</p>	<ul style="list-style-type: none"> • Consult the vehicles manual or Safety Officers to confirm recommended recovery points. • The number of tow points and position varies from vehicle to vehicle. Ensure you have identified the recovery point and not the vehicle tie down point. • Tie down points are used to tie a vehicle down for when it is being transported. Never use Tie Down points to recover a vehicle. • Emergency Towing points are not rated and should not be jerked or shocked load. They are points that only need very little force and can brake easily. • Rated recovery points The purpose of a recognised rated recovery point is to provide a safe and secure point from which to recover a stuck vehicle. The hook should be "RATED", strong enough to enable the recovery of a stuck vehicle, but more importantly must be designed so that if recovery forces exceed the design forces, it fails in a safe manner. • If two rated recovery points are available, use both to equalise the recover forces, reduce forces on one point. 
<p>Use of equalising strap</p> 	<ul style="list-style-type: none"> • If there are two recovery points, it is recommended to use an Equalising Strap. • Equaliser straps distribute the load evenly on your vehicle and shares the load over two points, not just one, during a recovery. • Used in conjunction with a recovery strap, you connect the ends to two rated recovery points either side on the vehicle. • It is made from hi-tenacity polyester webbing to ensure minimum stretch and has fully protected sewn eyes at both ends for ease of connecting, plus a wear sleeve.

Tow Bar Recovery Hitch Receiver



- Tow bar assembly are design for towing and can be rated between 1.5t - 3.5t, depending on the towing capacity of the vehicles specifications.
- **Never use the tow ball** as it is only designed for hitching and downward forces, not recovery forces and shock loading of a snatch strap.
- Remove the tongue and tow ball then insert the strap eyelet inside the housing of the tow bar assembly, using the locking pin.
- If supplied, always use the tow bar accessory hitch receiver that is design to be fitted within the tow bar housing with either a hook bolted to it or a 4.7t Bow Shackle attached, as pictured.



Winch Extension Straps



Ideally for those situations when the winch cable (or recovery strap) is too short for recovery. Winch extension strap is made from 30mm - 60mm polyester webbing and are:

- 10, 20 & 30 metres in lengths.
- Rated at 4,000kg, 4,500kg, 6,000kg, 8,000kg & 12,000kg a n
- 100% High Tenacity Polyester Webbing.

Snatch Strap



- A Snatch recovery differs from a normal tow recovery because the strap connecting the two vehicles is not tensile prior to the recovery, as in a tow recovery.
- A Snatch strap recovery relies on the elastic properties of the strap to work correctly.
- During a normal snatch strap recovery, the snatch strap will elongate (stretch) approximately one to two metres (stretching approximately 20- 27%).
- If the recovery fails with a 20% stretch in the snatch strap, any objects still attached may have the potential to travel between 120kph - 240kph.

Kinetic Snatch Rope



Providing a smoother build up and release of kinetic energy, resulting in a more effective recovery compared to conventional webbing recovery straps. 9m long

- Minimum breaking strength of 20,000kg
- Durable double braided nylon construction with protective sleeves for the eyes
- Approximately 30% stretch (resulting in a smooth recovery)
- Easy to handle and will not kink

Available 3,000kg - 8,000kg - 9,500Kg - 11,000kg and greater.

Joining two straps together



- Never fold a strap in half, choke hitch or slip-knot a strap. The potential can be reducing the rating of a strap, by half.
- Never use a bow shackle to join two straps together, it will only be a lethal weapon, if something fails.
- The best option is to join the straps together by the eyelets, being the strongest part of the strap, as follows:
 - hold the two eyelets of one strap in one hand and one eyelet of the second strap in the other hand.
 - The single eyelet of one strap is passed through one of the eyes of the other strap and
 - then the other eyelet of the second strap is passed through the eye of the first strap and pulled all the way through to form a strong joint.

By placing a stick, rolled-up magazine or a towel between the two straps will prevent the straps tightening together under force. Be careful that the stick does not damage the strap.

<p>Bow Shackles</p> <p>Do not underestimate the strength of Bow Shackles, they may not be the weakest part of the recovery, however if still attached to a strap or winch cable, it is a lethal weapon.</p> 	<ul style="list-style-type: none"> • If it is not needed, do not use any form of shackles during recovery. However, if the operator does need to use shackles, use a 3.25t WLL Bow Shackle (with recovery straps) and 4.75 WLL Shackle for vehicle mounted winches (mechanical advantage when using pulley blocks). • Bow Shackles are designed and rated for lifting. • Understand the differences with SWL and WLL. • The definition of the Safe Working Load is the maximum load the equipment can handle safely, in lifting. • A WLL 4.7-tonne Black Rat bow shackle has been tested to bend approximately 30-tonne and brake at approximately 33.7 tonnes'. Two 4WD vehicles cannot generate that kind of load. • A WLL 3.2-tonne Black Rat bow shackle has been tested to brake at approximately 27.2t. • Use rated bow shackles rather than D shackles. • Shackle Loading: The Working Load Limit on a shackle varies according to the angle of the load. 
<p>Safe Working Load (SWL)</p> <p>Working Load Limits (WLL)</p>	<p>Safe Working Load is the maximum load the equipment can handle safely. The SWL of any piece of equipment must be readily identifiable</p> <ul style="list-style-type: none"> • by a tag attached to the equipment, and • by suitably marking of the equipment <p>Working Load Limit (WLL) indicates the limits within which the equipment can lift a given load safely. Bow Shackles are very strong metal equipment that are designed and rated for lifting.</p> 
<p>Soft Shackles (Replacement for Bow Shackles)</p>  	<p>Soft Shackles are designed to be a safer, light weight, easy to use alternative to conventional steel bow shackles.</p> <p>As an example, 10mm 12 strand synthetic rope, resistant sheaths, and pre-tensioned for immediate use.</p> <p>By using a soft shackle, removes a very heavy and potentially lethal standard steel shackle from your recovery system.</p> <p>Rope Spliced Breaking Strain - 9000kgs - 18,000kgs</p> <p>A few key features of the Soft Shackle...</p> <ul style="list-style-type: none"> • Maximum strength to weight ratio and strength comparable to steel. • Lowest elongation, minimal stretch. • Light weight for gross weight reduction. • Time saver takes less time to set up than a conventional shackle. • Floats in water & muddy environments. <p>Abrasion resistant sleeves for maximum durability.</p>
<p>Recovery Damper</p> 	<ul style="list-style-type: none"> • The recovery damper is a device that has been designed to restrict the whipping action of a strap or winch cable in the event of failure, therefore reducing the possibility of vehicle damage and personal injury. • The recovery damper needs to weigh a minimum of 1kilogram (depending on the total pull required). • This is to ensure if the recovery equipment fails, the recovery damper needs to have the weight to pull the strap (or winch cable) downwards and killing the bit of the strap or winch cable. <p>Some dampers have lead weights sown into the bottom part of the damper and some dampers have pockets to place extra dirt/sand/etc for added weight.</p>

<p>Tree Trunk Protection</p> 	<p>Tree trunk protectors are manufactured from 100% Polyester webbing. Polyester has low stretch and is both lightweight and durable.</p> <p>The Tree Trunk Protector has an 8,000 - 16,000kg breaking load and is designed to be slung around a tree for use as an instant anchor point.</p> <p>The 75mm wide webbing is kind to the tree and prevents the possibility of ring barking, which is common when wire rope or chain is used. This can be said to be an essential piece of equipment and is used in a multitude of ways in all kinds of recovery situations.</p>
<p>Winch Extension Straps (Tow Straps)</p> 	<p>Ideally for Tow Recovery or those situations when the winch cable (or recovery strap) is too short for recovery.</p> <p>Winch extension strap is made from 30mm - 60mm polyester webbing and are:</p> <ul style="list-style-type: none"> • 10, 20 & 30 metres in lengths. • Rated at 4,000kg, 4,500kg, 6,000kg, 8,000kg, 12,000kg, up to 75t. and • 100% High Tenacity Polyester Webbing.
<p>Snatch Ring</p> <p>Strong, lightweight and safe alternative to the traditional metal snatch block.</p>  	<p>The Snatch Ring is used with a soft shackle and Dyneema or Plasma winch rope.</p> <p>RED Winch "Snatch Rings" 150 grams as opposed to be at 3500 grams for a traditional snatch block. Material: 7075 T6 Aluminium Alloy, Hard Anodised, Laser Marked</p> <p>Frictional losses are not as big as one might think, especially when using low friction line such as Dyneema or Plasma winch rope.</p> <p>Snatch Rings available in three sizes, 50kN (5T), 80kN (8T) & 180kN (18T)</p> <p>The Advantages</p> <p>Lighter and smaller than a conventional steel or aluminium pulley block, instead of rolling on a pulley sheave, the active line with a ferrule merely slides on the inside smooth surface of the ring.</p> <p>It is easy to store and doesn't rust.</p> <p>The strength can approach up to five (5) times the line strength. This means when attached to a typical winch line, it is likely the winch line will break long before the "Snatch Ring" does.</p>
<p>Snatch Block (Pulley Block)</p>   <p>changing the direction</p>	<p>The snatch block is a pulley block with a side plate that swings open. By opening the side plate, fit the cable over the pulley, and then close the side plate.</p> <p>A snatch block has two primary functions in recovery. Can be rated between 7 - 30t.</p> <p>One is to change the direction of your winch cable when the anchor point is offset to the stuck vehicle.</p> <p>The second is to increase the pulling power of your winch, by setting up a 2:1 (double line pull).</p> <p>Using a snatch block greatly increases the pulling power of a winch. When a winch drum is fully spooled with cable, it has less power than if it is spooled all the way out, due to less line being on the drum, which changes the effective pull ratio.</p> <ul style="list-style-type: none"> • the snatch block is attached to whatever the vehicle is winching too, • the winch line goes through the pulley block and • back to the vehicle.  <p>2:1</p> <p>In this manner, more of the pulling power is available for the extraction because of more line being out off of the winch drum.</p>