Attachment 1: Comparing the ergonomics and OHS factors of each of the modes of delivery

The following is a comparison of the four delivery modes from general OHS and ergonomics perspectives.
The comments made here are based on our general knowledge of these modes rather than detailed knowledge as other than the motorcycle, we have not been able to examine these modes in detail nor obtain feedback from the users of them.

	MOTORCYCLE	BICYCLE	E-TRIKE	PUSH BUGGIES
				 
MANUAL HANDLING RISK				
ASSESSMENT BY THE NATIONAL CODE OF PRACTICE (MANUAL TASKS)	More than 50% of the listed potential hazards in the National Code of Practice are identifiable with the motorcycle for having risk for acute strains or injuries and/or chronic long onset inquiries.	Similar risk severity to that of the motorcycle except (arguably) for reach distances to letterboxes (the bicycle is smaller and more manoeuvrable), reaching back to the panniers (easier to get off the bicycle), and whole body vibration.	Similar to the bicycle (and motorcycle) except the E-trike is wide and may be less manoeuvrable than either. Otherwise, a preponderance of risk factors is evident.	The buggies are generally better for the postural aspects (bending, twisting, reaching, etc) as the PDO is not constrained by being seated. But the other manual handling issues with SBD occur, including the long durations and lack of breaks.
EASE OF USE				
• Adjustability	Adjustable only for the reach distance to the handlebars but the adjustment is limited by the mounting of the FLC.	Adjustments for seat height (quick action clamp) and handlebar height and reach (spanner).	Adjustments for seat height (quick action clamp) and handlebar height and reach (spanner).	Adjustments not known. Handle height would be the minimum adjustment required.
• Mounting and dismounting	Awkward to mount and dismount because of the bulk of the machine and the seat. The FLC	Not bad for PDOs with longer legs as they can swing their leg over the panniers. The cross bar	Appears to be similar to the bicycle.	No issue.

	limits the space to move the leg through.	is angled down but shorter-legged PDOs will have to lift their leg over this.		
• Effort to operate	Relatively little effort because of engine power and clutchless operation. Some effort needed to hold the bike stationary on steep gradients by the footbrake alone.	Effort varies with terrain and will be considerable at times on hills. Pedal-assisted powered bicycles would require less effort although pedalling would be needed on hills.	Similar to bicycles and although a powered conveyance, the extra weight of the E-trike will (probably) increase the need for pedal assistance.	Some effort always required and effort increases when going up steep hills, driveways, etc. Pushing a cart has a similar efficiency to cycling, but the energy usages may be quite different and dependent on the wheel/tyre design and the terrain. The wheels are different between the two models so further evaluation is needed.
• Effort to balance	Needs to be carefully handled as the weight of the motorcycle may overwhelm less strong PDOs if it tips over too far. Shorter-legged PDOs are at a disadvantage if their feet only just touch the ground when the motorcycle is stationary; they are at greater risk of leg strains or injuries from having to sustain the weight at a biomechanical disadvantage.	Must be balanced at all times. Effort to balance when stationary depends on the weight in the panniers at the rear and the RMC on the front of the bicycle. Shorter PDOs will find balancing more difficult unless they dismount at every stop – a time consuming and fatiguing practice, and potentially hazardous if a foot slips off a pedal. Front carrier is large and high, so could affect balance of the bicycle overall if too heavy.	The three-wheel configuration makes the trike very stable on even and level ground and eliminates the need to balance heavy weights (as with two-wheeled conveyances). The E-trike could be unstable on uneven surfaces, or if going obliquely over gutters (etc), or if traversing a lateral slope on a footpath. The ability for all PDOs to be able to maintain control in all circumstances will need to be demonstrated.	It might be the case that no balancing is required for the buggies if they are loaded evenly (although this is difficult to assess from the pictures and may be quite different in practice).
• Manoeuvrability	Skilled riders can get the motorcycle reasonably close to points of access, but the bulk of	More manoeuvrable than the motorcycle as it is generally a smaller package except perhaps	The triangular wheel configuration will limit how close the E-trike can be got to tight	No obvious issues of manoeuvrability except the lack of swivel castors on the front of

	the machine limits its manoeuvrability to some extent. Turning in tight spaces is limited by the angle of rotation of the steering head. Reversing can only be done by leg action so this can be limited by the length of a PDO's legs – the shorter the legs the less easily pushed backwards.	for the bulky carrier on the front. But mostly will be able to use the large rotation of the steering head to exit any tight spaces. Can be walked backwards when straddling the cross bar although this is not easy for PDOs with shorter legs.	access points, and reach distances may be greater because of it. The steering head will have the same rotation as a bicycle to enable clearance of tight spaces ahead of the trike. Can be pushed backwards quite easily by longer-legged PDOs but those with shorter legs may have more difficulty unless they dismount.	the buggy - the front wheels will have to be lifted to swing the buggy in tight spaces and over small lips and curbs or other terrain-related challenges. This may put an increased load on the wrists and back of the PDO.
• Load carrying capacity and manner of storage	Carrying capacity limited by overall SWL and little available storage volume other than the panniers. Problems with these particular panniers noted in a previous report (2004). Small load volume requires more frequent replenishing at depot boxes (but this is actually desirable as it provides rest break opportunities).	Large storage capacity but it all has to be moved by physical effort in the form of pedalling. While the rear panniers will have the same manual handling problems as the motorcycles, it is quite easy for the PDO to dismount to access them. The front carrier is quite voluminous and being high on the frame may cause some instability for the bicycle and rider.	Carrying capacity could be quite substantial so there could be a concern about the amount of effort required by the PDO in the transport process (even allowing for the E-trike being partly powered). The front carrier is the same as that used on the bicycles and forward reach looks to be poor. The rear bin is large and there would be significant manual handling issues if accessed from the seat. Otherwise, the PDO will dismount, and access will be good.	The carrying capacity appears to be substantial and mainly in the large central container seen in both models. The means of accessing the storage is not clear from the photographs but is assumed to be through a lid or cover on top of the storage compartment. The actual manual handling conditions are unclear with both of these conveyances, but the containers are low and the PDO will have to bend down to reach into them.
SAFETY				
• On the road in mixed traffic	Known to be involved in many serious traffic accidents with serious injuries and fatalities.	High level of risk if ridden on open roads for any distance (risk correlates with exposure).	As for bicycle.	Will only be used on footpaths, so a generally low level of risk. Main hazards will be crossing

				driveways with obscured vision (high walls) and crossing streets.
• On uneven surfaces	Copes quite well although requires skill by rider.	Harder to control because of smaller tyre contact, high centre of gravity, and low power.	Potential tip hazard on very uneven surfaces. Could be difficult to control in some circumstances.	Awkward to maintain control but unlikely to have PDO related safety issues in the event of loss of control.
• In hilly terrain	Power is usually adequate but safe control requires skill and strength by rider. Adequate brakes for steep downhill gradients but high leg forces on foot brake reported to be necessary at times.	Increased level of exertion to climb hills. Lack of gears will increase the effort required and the PDO may be reduced to walking the bicycle up a steep gradient. Brakes probably just adequate for steep downhills but the bicycle can be walked downhill if necessary.	Climbing (most?) gradients will require pedal assistance from PDO. Lack of gears will increase the effort required. The option to walk the E-trike uphills may not be available. Not known how PDOs would deal with very steep downhill gradients re braking capacity and effort required.	Effort to climb steep gradients may be arduous for some PDOs depending on their strength and fitness. There is no indication of a braking method in the pictures so it is hard to know whether or not there may be safety issues when climbing or descending stepper gradients.
• Propensity to fall while on conveyance.	Falls are likely on slippery and loose surfaces, and may occur if the surface is broken such as to overwhelm the PDO's ability to control the steering. No protection against injury in the event of a fall. Injuries can be severe because of the weight and speed of the motorcycle.	Potential for instability as for the motorcycle and perhaps moreso because of the small tyre contact patch and the high centre of gravity. Steering head rotation can cause the front wheel to turn to a point where the bicycle simply falls over (potentially a serious hazard). No protection against injury in the event of a fall but injuries typically not so severe because of lower speed and weight.	A fall is only likely if the E-trike is on a very steep lateral incline. Otherwise it is likely to be quite stable and not subject to slippery surfaces as are two-wheeled conveyances.	No propensity for a fall as the buggies are pushed and not ridden.
TRAVEL OVER DISTANCE (to start of round)				
	Good, although exposure to other road traffic is a known	Poor over distance as PDO could be fatigued even before	As for bicycle.	Can only proceed at walking pace so any walking long

	high-level hazard.	they start their round. Road hazard level is very high.		distances to the start of the round would be inefficient both of energy and time.
NEED FOR REST BREAKS				
	Rest breaks are <u>especially</u> important for motorcycle PDOs because of: • Sustained and constrained sitting on an unadjustable machine. • Exposure to whole body vibration. • Awkward work postures and actions. • Poor manual handling arrangements.	Rest breaks are <u>very</u> important for bicycle PDOs because of: • Physical exertion to propel bicycle. • Limited seated comfort (variable with individuals). • Repetitive stopping and restarting efforts. • Awkward work postures and actions. • Poor manual handling arrangements.	Rest breaks are <u>quite</u> important for E-trike PDOs because of: • Limited seated comfort (variable with individuals). • Awkward work postures and actions. • Poor manual handling arrangements.	Rest breaks are <u>very</u> important for PDOs using buggies because of: • Sustained walking while pushing the buggy.
OVERALL ASSESSMENT OF ERGONOMICS AND OHS FACTORS.				
Practicality for the purpose	The motorcycle is useful for long rounds because of its power and speed. Also good for hilly terrain.	The bicycle is mainly suitable for rounds that are not too long. Not well suited to hilly terrain.	Presumably similar to the bicycle but being powered should make it suitable for moderate length rounds. Required effort in hilly terrain is unknown.	The buggies are well suited to shorter rounds that can be completed with minimal 'dead walking'. Not ideal in persistently steep terrain.
Skill and effort required	It requires skill and strength to operate a motorcycle safely in all circumstances. Riding errors are likely to typically result in injury (weight and speed of motorcycle), and could be fatal if on the road.	It requires physical fitness, reasonable strength and endurance to use a bicycle for this purpose. Errors when riding could be fatal if on the road, but otherwise serious injuries are less likely from operating errors.	Although it is powered there will still be some physical exertion on hills to assist the electric drive. Errors when riding will often produce no outcome,, i.e. there will not be a fall, but errors when on the road could be fatal.	No specific skills needed to operate the buggies, but there may be a strength component when pushing them up steep gradients or over difficult terrain. Operating errors unlikely to cause injury except perhaps at obscured driveways (etc).

Safety	The motorcycle has a poor safety record on the road. It can be unstable on poor surfaces. Injuries may be worse because of its weight and speed, and fatal when on the road.	There is a high level of risk when used on the road amongst other traffic. It can be unstable on poor surfaces. Accident outcomes can include fatalities but otherwise not likely to be too severe.	Would be a high level of risk on the road and it may even be less suited to road use than a bicycle because of its bulk and low speed. Should be quite stable on all but steep lateral slopes. Falls from the E-trike are not likely but could entail injury if PDO trapped while falling.	No safety issues apart from those encountered on footpaths and when crossing streets.
Adjustability	It is not adjustable to individual PDOs and many are not well accommodated by the machine.	It is adjustable to a reasonable degree and all PDOs except perhaps those with very short legs should be able to be accommodated reasonably well.	Probably as for the bicycle.	Adjustability will be required for at least handle height and perhaps other aspects as well. It is not known if the models cited have any adjustability.
Manual handling	The setup for carrying and handling mail is poor and creates many manual handling problems for the PDOs.	The setup for carrying and handling mail is poor and creates many manual handling problems for the PDOs.	The set-up for merging and posting mail looks to be poor. Accessing the rear bin may be better than accessing panniers on the motorcycle and bicycle if the bin is inaccessible while seated and the PDO is forced to dismount and walk around.	The manual handling should be able to be made quite acceptable but whether it is so with the examples cited is not known.
SUMMARY				
	• The motorcycle is suitable for traversing long rounds. • It is not safe on the road and requires skill and concentration at all times to operate it safely. • It requires strength at times	• The bicycle is suitable for shorter rounds. • It is not safe on the road. • It requires a lot of exertion at times and PDOs must be fit and have good stamina. • It is difficult to control on	• The E-trike is suitable for short-to-medium rounds (?) • It is not safe on the road. • It is powered but will still require some physical exertion at times by the PDO.	• Buggies will only be suitable for short rounds. • They will be reasonably safe. • Physical exertion is mainly light but steep hills will require exertion.

	to maintain control when on unstable surfaces. • It is bulky and awkward to manoeuvre; hard to get close to letterboxes. • The arrangements for the manual handling of the mail by SBD are unacceptable. • It has no adjustability to suit all users.	poor surfaces and may be hard to control on steep slopes. • It is compact and quite manoeuvrable; able to get reasonably close to letterboxes. • It has poor arrangements for the manual handling of the mail. • It is reasonably adjustable to suit a range of users.	• It may not be easy to manage on many poor surfaces. • Very bulky and will be hard to get close to many letterboxes. • Some of the manual handling arrangements will be unacceptable. • It is reasonably adjustability to suit a range of users.	• They will be less suitable for uneven ground and poor surfaces. • They will be relatively easy to get close to letterboxes. • The manual handling arrangements are not known; they ought to be acceptable (but it is not clear whether they are). • Adjustability of handles (etc) not clear.