

Roadmap to Increase Recycling of Auto Plastics from End-of-Life Vehicles in Canada

Appendix A: Technical Memorandum #1 Baseline Information

Prepared for



Automotive Recyclers of Canada

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A1 Introduction

A1.1 Background

Canada has a zero plastic waste target. Each sector of the economy produces different types of plastic wastes. For this reason, sector specific plastics waste diversion planning and strategies are critical to Canada reaching its plastics diversion goals.

The Deloitte Plastics Report prepared for ECCC in 2019¹ indicated that 2,795,000 tonnes (86%) of plastic waste is landfilled and represents a lost opportunity of \$7.8 billion to the Canadian economy.

The Deloitte report estimated that the auto sector produces about 476,000 tonnes of plastic waste annually, or about 17% of the total.

Recycling rates for plastics contained in end-of-life vehicles (ELVs) are currently low because markets are not available for many of the plastics currently found in vehicles, the plastics tend to be contaminated with other plastics and metal components. Technologies do not currently exist to recycle all of the different plastic components and multi-resin parts found in vehicles.

The objective of the **ARC Auto Plastics Roadmap** is to identify the research steps, projects and activities needed to increase the recycling of pre-shredder auto plastics in Canada.

The research project involved four main tasks, each described in separate Technical Memoranda.

- Task 1: Baseline Data Research (Tech Memo #1);
- Task 2: Time and Motion/ Tear Down Research (Tech Memo #2);
- Task 3: Technical and Policy Research (Tech Memo #3), and
- Task 4: Roadmap to Increasing Recycling of Pre-Shredder Auto Plastics in Canada (Tech Memo #4).

This document presents the findings of the Task 1 research.

A1.2 Approach

The research was carried out through a number of approaches:

- Internet-based research;
- Literature review including technical articles, journals and technical reports;

Economic Study of the Canadian Plastic Industry, Markets and Waste, 2019.(sourced at <http://publications.gc.ca/site/eng/9.871296/publication.html>)

- A survey of all ARC member companies, in addition to other auto recycler contacts throughout Canada, administered through Survey Monkey;
- Telephone interviews with auto recyclers and some auto shredders across Canada;
- Telephone interviews with plastic recyclers across Canada;
- Time and motion study at Standard Auto Wreckers in Port Hope, Ontario to identify the time involved in removing auto plastics from vehicles at the pre-shredder stage;
- Technical and policy research through a literature search and review, with selected follow up emails and interviews;
- Analysis of the baseline research to develop a Roadmap on how to increase the recycling of pre-shredder auto plastics in Canada.

A1.3 Structure of Technical Memorandum #1

The baseline research for the project is described in the following sections:

- Section 2 describes the auto recycling sector in Canada;
- Section 3 describes the different plastic resins used in vehicles and presents the amounts and types of plastics contained in vehicles;
- Section 4 describes the findings of the auto recycler survey and interviews, as well as interviews with selected metal shredders and aggregators;
- Section 5 presents findings of the plastic recycler interviews.

A2 Profile of Canadian the Auto Recycling Industry

A2.1 Canadian Auto Recycling Supply Chain Players

The Canadian auto recycling industry is made up for the following key players:²

- End of life (ELV) recyclers (including ARC members)
- ELV consolidators
- Metal shredders
- Steel producers

ELV recyclers include all auto dismantler and auto wrecker facilities. These facilities receive ELVs and process them in order to remove marketable parts, hazardous materials, and in some cases recyclable components. Typically, the remaining auto body is crushed prior to being sold to either an ELV consolidator or directly to a metal shredder for further processing.

ELV consolidators purchase ELVs at various stages of the recycling process and resell them to ELV shredders or to steel producers. Many consolidators offer transportation services to ELV recyclers and will pick up dismantled and/or crushed ELVs directly, often crushing and/or baling the ELVs at the ELV recycler site. Some consolidators also receive ELVs directly from their original owners and suppliers, such as auctions or dealerships. The ELV consolidator then dismantles, crushes, and bales the ELVs on-site.

Metal shredders typically receive ELVs after they have been drained of fluids, stripped of valuable parts, crushed, and baled. The shredding process involves cutting ELV hulks and other scrap iron and steel household appliances and other primarily ferrous metals collected by scrap yards and scrap metal dealers and brokers into smaller pieces and then using strong magnets to separate out ferrous metals which are then sent to steel producers. Some metal shredders also have sorting equipment that can separate out non-ferrous metals such as copper and aluminum which is sent to secondary smelters. The remaining material, referred to as automobile shredder fluff (ASR), consists mainly of plastics, textiles, rubber, etc. from automobiles. ASR is sent to landfills to be used as daily cover material or to be disposed of as waste.

Steel producers typically receive shredded ferrous metal which is then processed in electric arc furnaces that melt the shred and refine it into finished steel.

This study focussed on the auto recyclers and dismantlers within the supply chain, to identify options to increase the recovery of auto plastic.

² Summerhill Foundation, State of the Ontario Automotive Recycling Industry, April 2012

A2.2 Auto Dismantlers and Recyclers

The Canadian auto recycling sector is a vital player ensuring that auto parts are reused to the extent possible before an ELV is sent to the metal shredder. The industry is represented by Automobile Recyclers of Canada (ARC). Formed in 1997 as an “association of associations”, the Automotive Recyclers of Canada (ARC) is the national voice of the automotive recycling industry, representing, through its provincial affiliates, approximately 350 ELV recyclers and dismantlers throughout Canada. The automobile recycling industry in Canada includes about 1,800 auto recyclers in total. ARC membership includes most of the medium and large companies as well as some small companies. ARC, through its member associations and individual members, has direct interaction and affiliation with all of the ELV shredding operations across Canada.

Member associations include:

- Alberta Automotive Recyclers & Dismantlers Association (AARDA);
- Association des recycleurs de pièces d’autos et de camions inc. (ARPAC);
- Automotive Recyclers Association of Atlantic Canada (ARAAC);
- Automotive Recyclers Association of Manitoba (ARM);
- British Columbia Automotive Recyclers (B-CAR);
- Saskatchewan Automotive Recyclers Association (SARA) and
- Ontario Automotive Recyclers Association (OARA).

In addition to providing a forum for the channelling of information and addressing Canada wide concerns, ARC is actively involved in the leadership, promotion and improvement of the automotive recycling industry across the country.

CAREC (Canadian Automotive Recyclers Environmental Code)

Over the past few years, ARC has developed and implemented the Canadian Automotive Recyclers Environmental Code (CAREC) to help standardize the process for recycling End-of-Life Vehicles (ELV’s). This stringent Code was originally developed by ARC after BC required licencing of auto recyclers in that province, and it was considered beneficial to make the code national. It was used to support the National Vehicle Scrappage Program (Retire Your Ride). It includes minimum compliance requirements to properly and legally process a vehicle, along with best practices and basic housekeeping guidance.

CAREC has three main goals:

- To convey the legal and mandatory requirements before, during, and after the recycling process and promote best management practices within the industry;
- To promote pollution prevention and the 3Rs (Reduce, Reuse, Recycle) in the vehicle recovery industry to reduce the ecological impact of the automotive sector; and
- To ensure that there is a consistent set of practices that are aligned, as much as possible, with federal, provincial, and municipal laws and regulations, as well as with product and industry stewardship programs, where applicable.

ARC has made it a policy that any recycler that is a new or existing member of any of their associations must be audited by an independent third party and certified to meet the standards of the Canadian Auto Recyclers' Environmental Code. Members are audited every two or three years depending on their score in the previous audit.

CAREC has now been adopted by all the Member Associations as a requirement of membership. Each of the members has been evaluated, audited and certified by an independent third party to meet the requirements of the Code.

Typical Steps in Auto Recycling

End of life vehicles (ELVs) arrive at auto recycling facilities through a number of routes including: auctions where auto recyclers purchase vehicles based on the value of the parts they can harvest; collisions; insurance companies and consumers. After arrival at the auto recycler, the vehicles go through the following steps:

1. Typically, ELVs have parts removed based upon market demand which is driven by a number of diverse factors such as: age of vehicle, brand, popularity, repairability, and frequency of damage/wear to parts and component.
2. ELVs have parts removed based on a preset list of items needed for stock or requested by the customers.
3. All vehicles undergo a minimum set of procedures such as depollution which includes removal and draining of the gas tank and evacuation of other fluid reservoirs.
4. Additional parts removed as standard procedure include: engines and drive train; wheels and brake rotors; catalytic converters; fuel tanks and batteries.
5. Vehicles processed at most auto recyclers are tracked with a specific vehicle ID code which attaches to all parts and items removed.
6. Every vehicle receives a work order and series of tags which indicate to the dismantler/technician what parts and assemblies are required to be removed for each vehicle. These are called 'ticketed parts'.
7. Un-ticketed parts, or unneeded parts are not saved, they are returned to the vehicle shell for crushing and eventual shredding.
8. Some ticketed parts are recovered in order to maintain inventory stock, while other parts are pre-sold. This demand for a particular part is what can also trigger the particular vehicle to be moved into the processing lineup, ahead of others.
9. Vehicles are typically divided into 2 initial categories; a partial dismantle and a full dismantle.
10. A partial dismantle is often applied to later model or highly popular vehicles with a high parts demand. Ticketed parts are removed and the remaining shell of the vehicle is stored outside as a whole unit, awaiting further parts recovery at a later date.
11. A full dismantle approach to parts recovery involves a one-time visit with the dismantler where all parts required for inventory or sale are removed prior to the vehicle being directed to the crusher and ultimately the metal shredder. This may be due to the vehicle being in low demand – not worth keeping around after limited tickets are fulfilled, or in

high demand, in which case a high number of tickets are filled and there is limited value remaining in the vehicle for parts recovery.

12. ELVs may arrive at the facility with damage to different components of the vehicle whereas some plastic parts which cannot be harvested and re-sold into the secondary repair system may be recyclable e.g., damaged bumpers

Figure 1 shows the flow of ELVs from dismantling through to shredding.

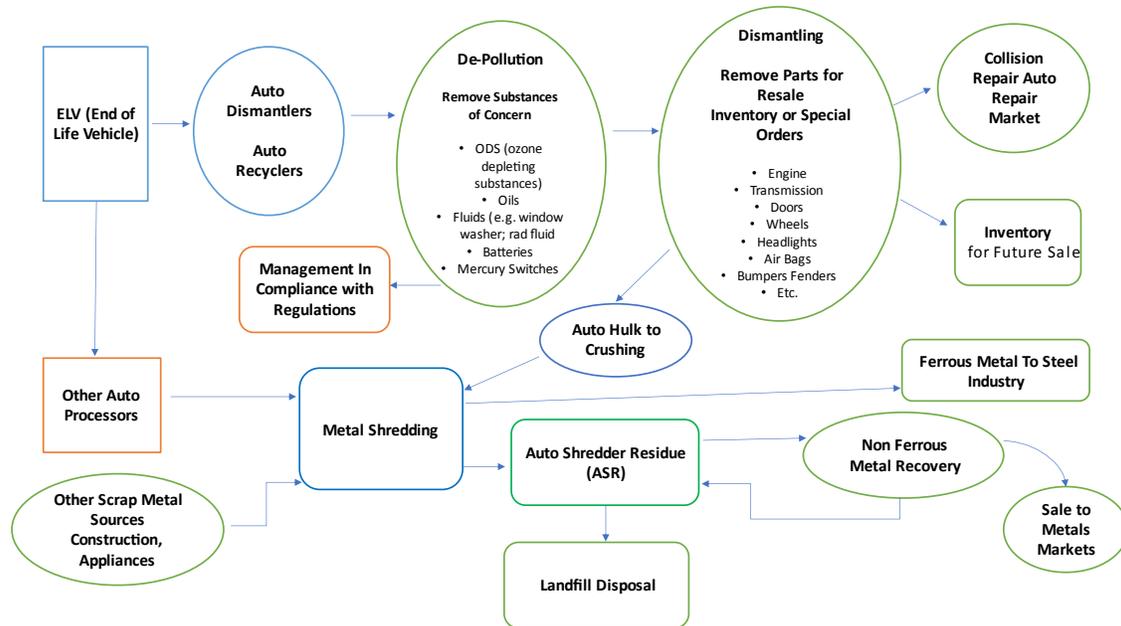


Figure 1: Auto Recycling Schematic

A2.3 Available Statistics on Auto Recycling in Canada

An estimated average of 1.6 million vehicles are scrapped in Canada each year, depending on economic conditions (Cheminfo, 2014). About 95 percent of those vehicles (or 1.52 million) are eventually collected for recycling. Using current techniques, 90 percent of a vehicle can be reused or recycled. The remaining 10 percent is auto shredder residue (ASR) which goes to landfill for use as daily cover or for disposal.

According to the American Chemistry Council, the average weight of a light-duty vehicle manufactured in North America in 2018 was 1,804 kg. The average North American vehicle built in 2010 weighed 1,753 kgs and contained 171.5 kg of plastics (9.8% of total vehicle weight).³

³ American Chemistry Council, Plastics and Polymer Composites in Light Vehicles, August 2019

It is interesting to note that, according to Renault, the average light duty vehicle built in the EU in 2015 weighed 1,250 kg and contained 150 kg of plastics (12% of total vehicle weight).⁴

The ACC estimates that each vehicle manufactured in 2018 was composed of the following materials⁵:

- Steel: 947 kg (52.5%)
- Cast iron: 113 kg (6.3%)
- Aluminum: 193.7 kg (10.7%)
- Other non-ferrous metals: 77.5 kg (4.3%)
- Plastic and polymer composites: 175 kg (9.7%)
- Other materials (incl. rubber, coatings, fluids, textiles, glass): 299 kg (16.6%)

Therefore, 1.52 million ELVs collected for recycling each year would produce an estimated:

- 1.6 million tonnes of scrap iron and steel,
- 294,400 tonnes of aluminum,
- 117,800 tonnes of other non-ferrous metals and
- 266,000 tonnes of plastic and polymer composites.

While ferrous metals make up most of what is recovered from ELVs, other materials, items or products targeted for capture include non-ferrous metals (aluminum, copper, lead); rubber from tires; lead acid batteries (LABs); any precious metals in the catalytic converter, oxygen sensors; operating fluids (gas, oil, windshield washer fluid, antifreeze); parts that are re-used directly, as well as parts that are collected for remanufacturing.

As the auto market moves to an increasing percentage of electric vehicles, the composition of end-of-life vehicles will change. The metal content of electric vehicles (EVs) is different than current internal combustion engine (ICE) vehicles. They contain more copper, lithium, nickel, manganese, cobalt, aluminum (for light-weighting) and potentially more plastics than ICE vehicles. However, given that EVs have a lifespan of 8 years or more and are still a very small percentage of the auto fleet in Canada today, it will be a number of years before this impact will be seen at auto recyclers and shredders.

For this study, an average weight of 175kg plastic per ELV has been assumed.

Employment and Economic Impacts of Auto Recycling Sector

The Automobile Recyclers Association (ARA) website states that the automotive recycling industry employs over 140,000 people in the United States at more than 9,000 locations around the country, generating \$32 billion in sales nationwide. While similar statistics on jobs and sales are not available for Canada, the B.C. Automotive Retailers Association reports that the automotive dismantling industry in B.C. represents over 1,100 full-time jobs and contributes \$82,000,000

⁴ Oakdene Hollins, Driving change: A circular economy for automotive plastic, September 2021

⁵ American Chemistry Council, Plastics and Polymer Composites in Light Vehicles, August, 2019

annually in GDP to the provincial economy.⁶ BC auto recyclers estimated that about 35% of ELVs go to ARC members – the remainder either go directly to shredders or to non- ARC member companies.

A2.4 Reuse of Auto Parts By Auto Recyclers in Canada

The steps used to recover auto parts from ELV are described in detail in Section A2.2.

In summary, the auto recycling sector harvests or surgically removes various parts from the vehicles they manage for resale to auto repair facilities and collision shops as well as the DIY market. When all parts in demand are removed the remaining auto body is sent to a metal shredder.

Table 1 presents the top 50 part searches through Car-Part.com, which represents just over 80% of all searches for auto parts in the auto part reuse business and supply chain. This is an indication of the parts which are most popular in the reuse market and create value for the auto recycler. Discussions with auto recyclers during the study indicate the engines and transmissions are the most frequently requested parts for repairing older vehicles and keeping them on the road longer, consistent with circular economy principles.

Table 1: Top Auto Parts Searched for in Reuse Market in Canada

Rank in Searches	Auto Part	Percentage of Searches (%)
1	Engine Assembly	10.8%
2	Transmission ,Transaxle	7.5%
3	Door Assembly, Front	4.3%
4	Wheel	4.2%
5	Headlamp Assembly	4.0%
6	Air Bag	3.9%
7	Bumper Assembly, Front	3.3%
8	Fender	2.5%
9	Decklid Tailgate	2.4%
10	Door Assembly, Rear	2.4%
11	Side View Mirror	2.3%
12	Hood	2.2%
13	Tail Lamp	1.9%
14	Bumper Cover, Front	1.9%
15	Seat, Front	1.8%

⁶ Automotive Retailers Association, “An analysis of the automotive dismantling industry in British Columbia: current trends impacting the future sustainability of the industry”, June 2015

16	Radio Audio	1.6%
17	Bumper Assembly, Rear	1.4%
18	Engine/Motor Cont Mod	1.3%
19	Grille	1.3%
20	Strut	1.1%
21	Front End Assembly	1.1%
22	Seat Belt, Front	1.1%
23	Transfer Case Assembly	1.0%
24	Chassis Cont Mod	0.9%
25	Steering Gear Rack	0.8%
26	AC Compressor	0.8%
27	Axle Assembly, Rear	0.8%
28	Alternator	0.8%
29	Speedometer Head/Cluster	0.8%
30	Bumper Cover, Rear	0.8%
31	Quarter Panel Assembly	0.8%
32	Spindle Knuckle, Front	0.7%
33	Pickup Box	0.7%
34	Radiators	0.6%
35	Axle Shaft	0.6%
36	Radiator Core Supp	0.6%
37	Differential Assembly	0.5%
38	Drive Shaft, Rear	0.5%
39	Carrier Assembly	0.5%
40	Front Lamp	0.5%
41	Steering Column	0.5%
42	PS Pump/Motor	0.5%
43	Knee, Front	0.5%
44	Starter Motor	0.5%
45	Suspension Cross K-Frame	0.4%
46	Rad Cond Fan Motor	0.4%
47	Fuel Pump	0.4%
48	Anti-lock Brake Parts	0.4%
49	Fuel Tank	0.4%
50	Lower Control Arm, Front	0.4%

A3 Plastics in Vehicles

A3.1 Types of Plastics in Vehicles

An internal combustion engine vehicle (ICEV) contains approximately 30,000 parts, out of which one-third are made of plastic. In total, about 39 different types of plastics resins and polymer composites are used to make an automobile.⁷ The eight most common types of plastics found in light duty vehicles are:

- Polypropylene (PP);
- Thermoplastic polyolefins (TPOs);
- Polyvinyl chloride (PVC);
- Polycarbonate (PC);
- Acrylonitrile butadiene styrene (ABS);
- polyurethane (PU);
- Polyethylene (PE), and
- Nylon, including nylon 6/6 and nylon 6⁸.

Properties and typical uses of these polymers are described briefly below.

Polypropylene (PP)⁹

Polypropylene (PP) is a thermoplastic made from the combination of propylene monomers. It is a "thermoplastic" as opposed to "thermoset" plastic, which has to do with the way the plastic responds to heat.¹⁰ PP is used in a variety of applications including packaging for consumer products, plastic parts for various industries including the automotive industry and textiles.

The major end users of PP are the packaging industry, which consumes about 30% of the total, followed by the electrical and equipment manufacturing, which use about 13% each. Household appliances and automotive industries both consume 10% each and construction materials follows with 5% of the market.

PP has a low density relative to other common plastics which translates to weight savings for manufacturers and distributors of injection molded PP parts. Another advantage of PP is that it can be easily copolymerized (essentially combined into a composite plastic) with other polymers like polyethylene. Copolymerization changes the material properties significantly, allowing for more robust engineering applications than are possible with pure polypropylene.

⁷ resource innovations, Plastics in the Automotive Industry – Which Materials Will Be the Winners and Losers?, February, 2019

⁸ Nylon is the commonly used term for polyamide.

⁹ Taken from <https://www.creativemechanisms.com/blog/all-about-polypropylene-pp-plastic>

¹⁰ The primary difference between the two types is that thermoset plastics strengthen when heated, but cannot be remolded or heated after the initial forming, while thermoplastics can be reheated, remolded, and cooled as necessary without causing any chemical changes. Source: <https://www.thomasnet.com/articles/plastics-rubber/thermoset-vs-thermoplastics/>

PP is a very useful plastic for injection molding and is typically available for this purpose in the form of pellets. It is easy to mold despite its semi-crystalline nature, and it flows very well because of its low melt viscosity. In addition to the conventional plastic applications, PP also lends itself well to fiber applications such as ropes, carpets, upholstery and clothing.

Automotive applications for PP include interior door panels, carpeting and gas tanks (laminated with high-density polyethylene)

Thermoplastic Polyolefins (TPOs)¹¹

Thermoplastic Polyolefins (TPOs) are polypropylene-based materials that have been modified to provide better ductility and impact resistance compared to standard off-the-shelf polypropylene (PP) grades.

TPOs retain the ease of processing, lightweight nature, and chemical resistance of PP. However, they do not require drying prior to moulding, which saves on both cost and time.

Often, TPOs are compounded with fillers – usually minerals – to provide a good balance of stiffness and impact resistance, as well as better dimensional stability and increased Heat Deflection Temperature (HDT). Proper choice of minerals allows these filled compounds to retain ductile behaviour well below 0 °C, something traditional PPs cannot achieve. Stiffness and impact resistance can be custom-tailored to provide the right balance for a wide range of applications.

While the cost of TPOs is often slightly higher than traditional PP compounds, TPOs are still a very cost-effective choice for applications requiring good impact resistance and stiffness when other Polyethylene (PE) or PP materials do not meet the application demands.

TPO compounds can be formulated for increased UV weathering and scratch/mark resistance when needed. The UV grades of TPO compounds can be custom-designed to be compatible with common paint systems to provide an all-in-one solution for situations where some parts are painted and some are not.

Automotive parts made from TPO include bumper covers, wheel well covers and dashboard facings.

Polyvinyl Chloride (PVC)¹²

Polyvinyl Chloride (PVC) is one of the most widely used thermoplastic polymers in the world. Due to its versatile nature, PVC is used extensively across a broad range of industrial, technical and everyday applications including widespread use in building, transport, packaging, electrical/electronic and healthcare applications.

¹¹ Taken from <https://www.rtpcompany.com/products/product-guide/thermoplastic-polyolefin-tpo/>

¹² Taken from <https://www.bpf.co.uk/plastipedia/polymers/PVC.aspx>

The essential raw materials for PVC are derived from salt and oil. The electrolysis of salt water produces chlorine, which is combined with ethylene (obtained from oil) to form vinyl chloride monomer (VCM). Molecules of VCM are polymerised to form PVC resin, to which appropriate additives are incorporated to make a customised PVC compound.

Before PVC can be made into products, it has to be compounded with a range of special additives. These additives can influence or determine a number of the products properties, namely its mechanical properties, weather fastness, its colour and clarity and indeed whether it is to be used in a flexible application.

PVC's compatibility with many different kinds of additives is what makes it such a highly versatile polymer. PVC can be plasticised to make it flexible for use in flooring and medical products. Rigid PVC is used extensively in building applications such as window frames.

Automotive applications for PVC include instrument panels and associated mouldings, interior door panels and pockets, sun visors, seat coverings, seals, mud flaps, underbody coatings, floor coverings, exterior side moulding and anti-stone damage protection.

Polycarbonate (PC)¹³

Polycarbonate (PC) falls into the polyester family of thermoplastics. It is most commonly formed with the reaction of bis-phenol A (produced through the condensation of phenol with acetone under acidic conditions) with carbonyl chloride in an interfacial process.

PC is available in a number of different grades dependent on the application. Grades include film, flame retardant, reinforced and stress crack resistant, branched (for applications requiring high melt strength) and other speciality grades. Blends of PC (e.g., with ABS or polyesters) are widely used in automotive industry.

Typical PC and PC-blend applications used in the auto industry include automotive lighting, headlight lenses, dashboards, interior cladding and exterior parts (bumpers, body panels).

Polyethylene (PE)

Polyethylene (PE) is a thermoplastic polymer with a variable crystalline structure and a vast range of applications depending on the particular type. It is one of the most widely produced plastics in the world, with tens of millions of tons produced worldwide each year. There are several types of PE, and each one is best suited for a different set of applications. Generally speaking, High-Density Polyethylene (HDPE) is much more crystalline, and is often used in entirely different circumstances than Low-Density Polyethylene (LDPE). For example, LDPE is widely used in plastic packaging, such as for grocery bags or plastic wrap. HDPE, by contrast, has common applications in construction (for example, in its use in the fabrication of drain pipes).¹⁴

In the automotive sector, fibreglass-reinforced PE is used for making exterior panels.

¹³ Taken from <https://www.bpf.co.uk/plastipedia/polymers/Polycarbonate.aspx>

¹⁴ <https://www.creativemechanisms.com/blog/polyethylene-pe>

Acrylonitrile Butadiene Styrene (ABS)

Acrylonitrile butadiene styrene (ABS) is a thermoplastic that is hard and resistant to heat and impact. It is a copolymer obtained by the polymerization of styrene and acrylonitrile in the presence of polybutadiene, resulting in the combination of the three monomers and creating a plastic that comes in a variety of grades, depending on the proportions used of each. Basically, styrene contributes to the ease of the manufacturing, acrylonitrile imparts chemical resistance and increases the surface hardness, and butadiene contributes to impact resistance and overall hardness. The portions may vary from 15-35% of acrylonitrile, 5-30% of butadiene and 40-60% of styrene.¹⁵

In the auto industry, steering wheel covers and dashboards are often made of ABS plastic.¹⁶

Polyurethane (PU)

Polyurethane (abbreviated as PUR or PU) is a thermoset plastic and refers to a class of polymers composed of organic units joined by carbamate (urethane) links. In contrast to other common polymers such as polyethylene and polystyrene, polyurethane is produced from a wide range of starting materials (monomers) and is therefore a class of polymers, rather than a distinct compound. This chemical variety allows for polyurethanes with very different physical properties, leading to an equally wide range of different applications. These include rigid and flexible foams, varnishes and coatings, adhesives, electrical potting compounds, and fibres such as spandex. Of these, foams are the largest single application, accounting for 67% of all polyurethane produced in 2016.¹⁷

Polyurethane foams can be found in seats, armrests and headrests of most cars, where their cushioning properties help to reduce the fatigue and stress often associated with driving.¹⁸

Nylons (including nylon 6/6 and nylon 6)

Nylons refer to the group of thermoplastics known as 'polyamides'. Nylons are typified by amide groups and encompass a range of material types (e.g., Nylon 6; Nylon 6/6; Nylon 6/12; Nylon 4/6; Nylon 12 etc.), providing an extremely broad range of available properties. Nylon is used in the production of film and fibre, but is also available as a moulding compound.¹⁹

Nylon 6/6 is a general-use nylon that can be used to make auto parts through both moulding and extrusion processes. It has excellent mechanical qualities and wear resistance. It is often used when a strong, low-cost rigid and stable material is needed and is commonly found in cams and weather-proof coatings.²⁰ Nylon 6 reinforced compounds are being used for many metal replacement applications in the car engine components like intake manifolds, gears, bearings etc.²¹

¹⁵ <https://www.marketer.com/articles/acrylonitrile-butadiene-styrene-abs-description-properties-and-applications-2680387.htm>

¹⁶ <https://www.acplasticsinc.com/informationcenter/r/plastic-used-in-cars>

¹⁷ <https://en.wikipedia.org/wiki/Polyurethane>

¹⁸ <https://www.polyurethanes.org/en/where-is-it/automotive/>

¹⁹ <https://www.bpf.co.uk/plastipedia/polymers/Polyamides.aspx>

²⁰ <https://www.azom.com/article.aspx?ArticleID=17014>

²¹ <https://www.grpweb.com/polymers-industry.html>

Table 2 summarizes typical uses of the main resins in vehicles.

Table 2: Uses of Main Plastic Polymers in Vehicles

Plastic Polymer	Typical uses in vehicles
Polypropylene (PP);	Interior door panels, carpeting, gas tanks (laminated with high-density polyethylene, wheel covers, engine parts, seat panels, safety subsystems and seat assemblies).
Thermoplastic polyolefins (TPOs);	Bumper covers, wheel well covers and dashboard facings.
Polyvinyl chloride (PVC);	Instrument panels and associated mouldings, electrical cables, pipes, instrument panels, interior door panels and pockets, sun visors, seat coverings, seals, mud flaps, underbody coatings, floor coverings, exterior side moulding and anti-stone damage protection.
Polycarbonate (PC);	Automotive lighting, headlight lenses, dashboards, interior cladding and exterior parts (bumpers, body panels).
Acrylonitrile butadiene styrene (ABS);	Steering wheel covers and dashboards are often made of ABS plastic
polyurethane (PU);	Polyurethane foams can be found in seats, armrests headrests, insulation panels, suspension bushings, electrical compounds and bumpers.
Polyethylene (PE)	Fibreglass-reinforced PE is used for making exterior panels
Nylon including Nylon 6	Nylon 6/6 - cams and weather-proof coatings. Nylon 6 reinforced compounds - metal replacement applications like intake manifolds, gears, bearings etc.

A3.2 Estimated Quantity of Plastics in Vehicles

As stated in Section A2, the average light-duty vehicle produced in North America in 2018 weighed approximately 1,800 kgs and contained approximately 175 kgs of plastic resins and plastic composites, representing 9.7% of the total vehicle weight.²²

The breakdown of plastic resins and polymer composites in North American light-duty vehicles built in 2018 is shown in Table 3.

Table 3: Plastic Resins and Polymer Composites in the Average North American Light Duty Vehicle Built in 2018²³

Resin Type	Weight (in kgs)	Percentage of Total Plastics
Polypropylene (PP)	38.1	21.7%
Thermoplastic polyolefins (TPO)	15.9	9.1%
Polyurethane (PU)	28.6	16.3%
Nylon	19.5	11.1%
Polyvinyl chloride (PVC)	10.0	5.7%
Acrylonitrile butadiene styrene (ABS)	9.1	5.2%
Polyethylene (PE)	9.1	5.2%
Polycarbonate (PC)	7.7	4.4%
Other	37.2	21.2%
Total Plastic Resins and Composites	175.2	100%

²² American Chemistry Council, Plastics and Polymer Composites in Light Vehicles, August 2019

²³ The ACC report has similar information for vehicles built in every year from 2009 to 2018. The 2018 vehicle data is presented in the table because there was not a lot of variation from year to year. TPO was included under rubber by ACC but has been separated in the table.

Note that the “other” category in the table includes other engineered resins such as polyacetal, polyphenylene ether (PPE), and thermoplastic polyester (17.7 kg), plus polyvinyl butyral (PBT), acrylics, phenolics, unsaturated polyester, and others (19.5 kg).²⁴

3.3 Estimated Quantity of Plastics Contained in ELVs in Canada

The average ELV discarded in Canada weighs approximately 1,800 kg of which various plastic resins and polymer composites weigh approximately 175 kg, almost 10% of the total vehicle weight (but over 50% of its mass). Auto recyclers remove some undamaged plastic parts (or parts containing plastics), such as bumpers, dashboards, steering wheels, headlight assemblies and airbags, for resale to auto repair shops, collision shops and the general public provided that there is a demand for the specific part. A small number of auto recyclers in close proximity to a TPO plastic processor may also remove damaged bumpers from vehicles and pay to have them recycled.

Table 4 presents the estimated amount of plastic in ELVs in Canada by major resin group, based on data from the American Chemistry Council. The table shows that PP is by far the largest amount of plastic in ELVs, at almost 61,000 tonnes/year across Canada. The “other” category at 59,000 tonnes/year is the second largest category, followed by polyurethane at almost 46,000 tonnes/year. Nylon is the fourth highest category at 31,200 tonnes/year followed by TPO (generally used in bumpers) at 25,440 tonnes/year.

Table 4: Estimated Plastics In ELVs in Canada

Resin Type	Average weight per vehicle (kgs)	Percentage of Total Plastics	Total (tonnes)
Polypropylene (PP)	38.1	21.7%	60,960
Thermoplastic polyolefins (TPO)	15.9	9.1%	25,440
Polyurethane (PU)	28.6	16.3%	45,760
Nylon	19.5	11.1%	31,200
Polyvinyl chloride (PVC)	10	5.7%	16,000
Acrylonitrile butadiene styrene (ABS)	9.1	5.2%	14,560
Polyethylene (PE)	9.1	5.2%	14,560
Polycarbonate (PC)	7.7	4.4%	12,320
Other	37.2	21.2%	59,520
Total Plastic Resins and Composites	175.2	100.0%	280,320

²⁴ American Chemistry Council, Plastics and Polymer Composites in Light Vehicles, August 2019

The remaining plastic components are left on ELVs which are then crushed and sold to metal shredders. After shredding, the plastics end up in residue, referred to as automotive shredder residue (ASR). Eventually, plastic parts sold for reuse will also end up in ASR.

According to a 2019 study by Cheminfo, ASR represents approximately 15-30% of the weight of an ELV and is a mixture of residual ferrous and non-ferrous metals, plastics, rubber, textile and fibre material, wood, and glass.²⁵

An earlier 2014 study by Cheminfo analyzed 18 ASR sampling studies conducted between 1995 and 2013 and found that plastics ranged from 20% to 55% of total ASR weight, with an average from all sampling studies of 39.4%.²⁶

²⁵ Cheminfo, "Auto Shredder Residue Sampling and Testing", January 2019

²⁶ Cheminfo, "Background Study on the Content of Shredder Residue", January, 2014

A4 Auto Recycler Survey and Interviews Canada

Information on current management practices related to plastics in ELVs was collected through a survey of auto recyclers across Canada followed by interviews with selected auto recyclers as well as with some metal shredders. The results of the survey are summarized in this section with interview findings presented in Section 6.

A4.1 Auto Recycling Sector Survey Results

Information on current plastic auto part recycling and reuse/resale by auto recyclers was collected through a comprehensive survey of over 500 auto recyclers across Canada. A total of 92 responses were received, providing a comprehensive view of what is currently happening on the recycling and reuse of plastic auto parts from ELVs in Canada.

The English version of the Survey Monkey auto recycler survey was initially distributed through an email from ARC in December, 2021 with an introduction by Steve Fletcher, Executive Director of ARC. The email with the Survey Monkey link was sent to 350 ARC members and 150 auto recyclers who are not ARC members. The Survey Monkey English form is presented in Appendix AA. The Survey Monkey form was translated into French and distributed to members of ARPAC.

Number and Age of Vehicles Processed Per Year

Most of the auto recycler respondents indicated the number of vehicles processed within the ranges provided. Results for 74 responses are presented in Figure 2.

Most of the respondents (78%) processed between 200 and 3,000 vehicles per year, or anywhere from 4 to 60 vehicles per week, or varying from 1-12 vehicles per day.

- The largest percentage of the respondents (38%) processed between 200-499 vehicles/year;
- The second highest category, at 26% of responses processed 500-999 vehicles/year;
- 14% processed 1,000 to 1,999 vehicles/year and
- An additional 9% processed 2,000 to 2,999 vehicles per year.

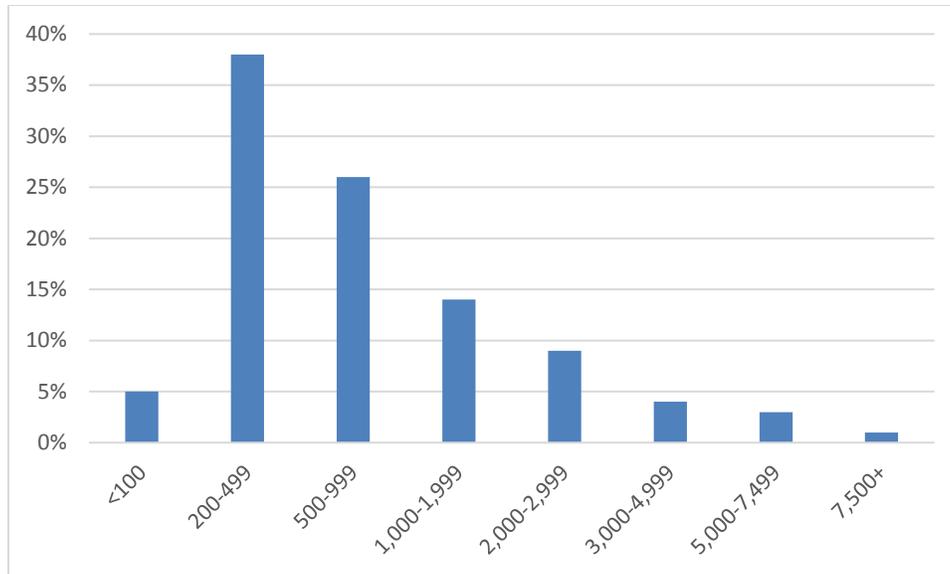


Figure 2: Range of Number of End of Life Vehicles Processed Per Year As Reported By Auto Recyclers in Canada (December, 2021 ARC Survey)

Responses about the average age of vehicles processed varied widely by type and size of business. Some auto recyclers specialize in recycling late model vehicles, often from insurance claims and collisions. Others mostly process older vehicles. Figure 3 shows the percentage of vehicles of different ages processed by survey respondents. Key observations from the data:

- A reported 9% of vehicles processed by survey respondents were late model vehicles (less than 5 years old – likely collision/insurance related) while 11% were older model vehicles (greater than 20 years).
- About one third (33%) of respondents reported the 5–9-year-old age category as the vehicles they process the most;
- A reported 27% of vehicles processed by respondents were 10-14 years old, and 20% were in the 15–19-year-old age category.

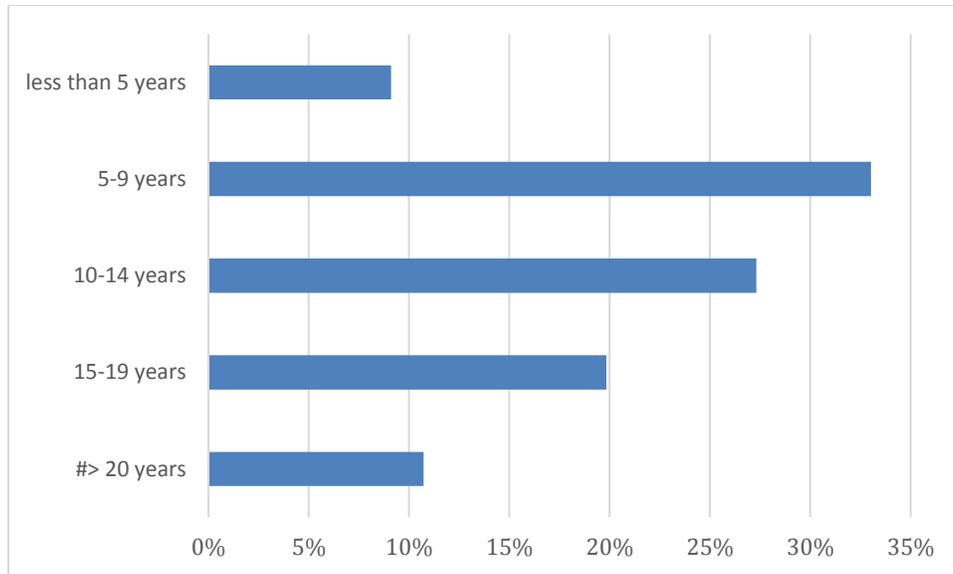


Figure 3: Age Distribution of Vehicles Processed by Auto Recyclers in Canada As Reported in ARC Survey, December, 2019

Amount of Plastic Recycled and Length of Time Processing Plastic

When asked about the amount of plastic parts they recycle or sell for reuse pre-shredder, 66% of survey responses did not indicate an amount. Of those that did indicate an amount, two recyclers indicated they recycled/resold more than 20 tonnes/year of plastic. One indicated that they recycled/resold 11-20 tonnes/year; 3 indicated 6-10 tonnes/year; 10 indicated they recycled/resold 1-5 tonnes and 11 indicated they recycled/resold less than 1 tonne/year. It should be noted that, based on information from follow-up interviews with 26 auto recyclers, the vast majority of plastic parts were sold for reuse as opposed to being recycled.

In any event, the value reported as recycled/resold was relatively modest with 13% indicating less than 1 tonne/year and an additional 13% indicating 1-5 tonnes per year.

The responses are presented in Figure 4.

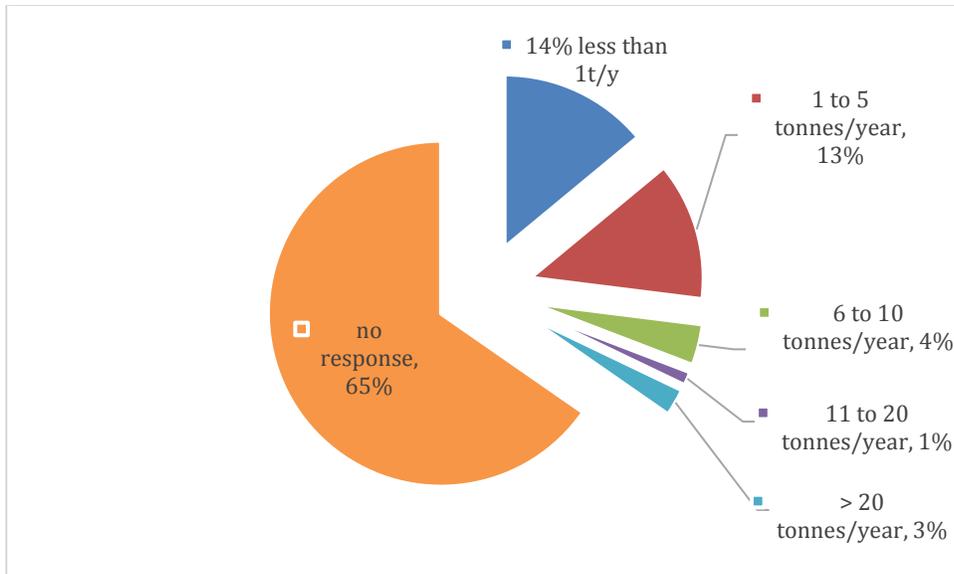


Figure 4: Amount of Plastic Reported to be Recycled or Resold Per Year By Auto Recyclers in Canada (tonnes/year) (December, 2021 ARC Survey)

The auto recycler asked how many years the companies had been recycling or reselling plastics. A total of 48 companies responded. Results are presented in Figure 5.

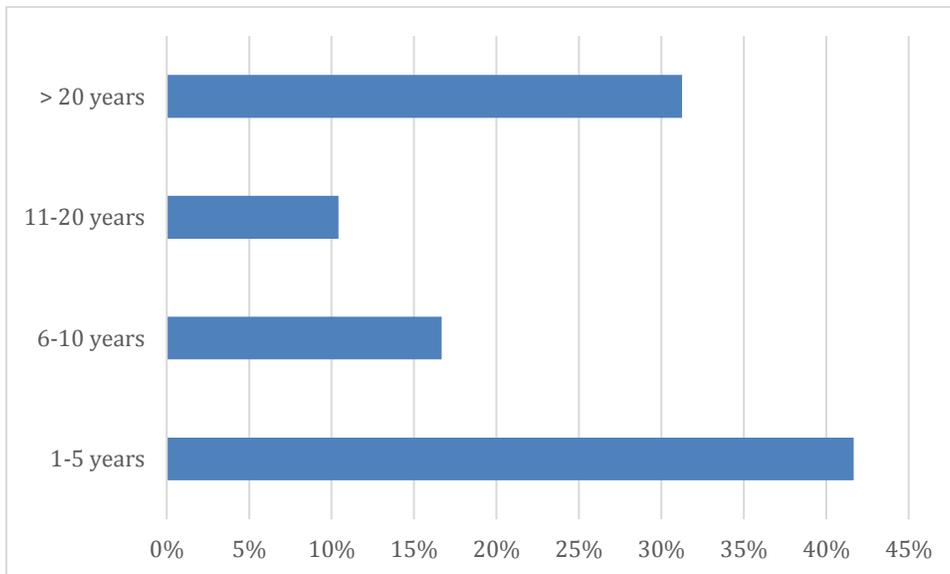


Figure 5: Number of Years Canadian Auto Recyclers Report Having Been Involved In Recycling or Reselling of Auto Plastics (December, 2021 ARC Survey)

As noted above, the detailed responses explored during a follow up interview process discovered that most of the companies were in fact reselling many auto parts which contain plastic for reuse, in particular bumpers, but also other auto parts that contain plastics such as mirrors, dashboards,

headlights and steering wheels. A few also had arrangements with plastic processors to pick up damaged bumpers for recycling. These are described later in this section.

Stability of Auto Plastic Recycling and Reuse Markets: When asked about the stability of auto plastic recycling and reuse markets, about 75% of respondents indicated that markets were poor; 23% indicated that they were fair and 2% indicated that they were stable/good. One respondent commented specifically about recycling that *“every time we have started to collect plastics for an agreement with a buyer, we have found the buyer or even collector has closed up shop”*.

Reasons Given for Not Recycling More Plastic Auto Parts

Table 5 shows reasons (prompted) given for not recycling plastics to a greater extent.

Table 5: Reasons for Not Recycling More Auto Plastics Reported by Auto Recyclers in Canada (December, 2021 ARC Survey)

Reasons for Not Recycling More Auto Plastics	Percentage of Responses	Number of Responses
No one wants to buy	77%	17
No recycler in the area	32%	7
Too much time to pull out materials	36%	8
Not enough storage space	32%	7
Too much cost to ship items to a recycler	14%	3

Plastic Auto Parts Currently Recovered for Resale

When asked during the auto recycler survey if they could recover and sell specific plastic auto parts (e.g., bumper; gas tank; seats; steering wheel; dashboard, etc.), this question had a very high response rate, with 78 of the survey respondents answering this question. Of this total 70% indicated that yes, they could recover specific plastic auto parts to sell and 30% indicated that they could not.

When specifically asked whether they could either reuse/resell the plastic auto part (to generate revenue) the responses varied by part and are summarized in Table 6.

**Table 6: Recovery of Plastic Auto Parts for Resale Reported by Auto Recyclers in Canada
(December, 2021 ARC Survey)**

Recover for Resale				
Auto Plastic Part	Yes	No	Sometimes	Total Responses
Bumper	69%	2%	30%	
	37	1	16	54
Dashboard	40%	12%	48%	
	21	6	25	52
Gas Tank	47%	11%	42%	
	25	6	22	53
Seats	53%	6%	42%	
	28	3	22	53
Steering Wheel	42%	13%	44%	
	22	7	23	52
Other	39%	17%	44%	
	7	3	8	18

Bumpers: The most frequently sold item with 69% of survey respondents indicating they sold bumpers regularly and 30% indicating they sold them sometimes. The weight of bumpers varies significantly by vehicle. As noted elsewhere, they generally weigh 4-5.4 kg each²⁷.

Dashboards: While not resold as frequently as bumpers, dashboards are often sold for reuse (40% of responses reported regularly and 48% of survey responses indicated sometimes).

Gas tanks: Most gas tanks in North America are made of plastic (PP/HDPE laminate), although a smaller portion are made of metal. An estimated 75% of gas tanks in the US and 98% of gas tanks in Europe were plastic in according to a 2016 article.²⁸ An article by American Chemistry Council quotes a weight of 14kg for a plastic gas tank vs 21kg for a steel gas tank²⁹. Some issues with gas tanks are discussed under recycling in the next section.

Seats: Most (95%) auto recyclers report being able to sell seats into the resale market either frequently or occasionally.

Steering Wheels: A large number (88%) of recyclers indicated they were able to sell steering wheels either frequently or occasionally.

Other Plastics: A smaller number of companies (18) responded to this question and indicated that they were able to sell “other plastics” frequently or sometimes. One company provided some clarification on which “other plastics were involved:

²⁷ Email communication Maria Kelleher and Cory Silver of Target Plastics Recycling, Ajax, Ontario, December, 2021

²⁸ <https://raybuck.com/plastic-vs-steel-gas-tanks>

²⁹ <https://www.automotiveplastics.com/wp-content/uploads/FuelTank.pdf>

“Headlamps and tail lamps are common selling plastic parts, but broken or chipped or non-sellers end back in crush cars”

We can sell the odd plastic part like bumpers and fuel tanks....maybe the odd rad support...otherwise it all goes to crush

We currently do not get paid for any plastics. As far as I know, there are companies in Ontario that will pay \$.01-\$.02/ lb for bumper covers but because they take up so much volume, it is not feasible for them to purchase ours. We have quite a large stockpile”.

Plastic Auto Parts Currently Recycled

The auto recycler survey asked which plastic auto parts were currently recycled and where revenue was received from sale of the material. Responses to the question are summarized in Table 7.

**Table 7: Plastic Auto Parts Currently Reported as Recycled By Auto Recyclers Across Canada
(December, 2021 ARC Survey)**

Get Paid for Recycling			
	YES	NO	TOTAL
Bumper	30%	70%	
	11	26	37
Dashboard	23%	77%	
	8	27	35
Gas Tank	37%	63%	
	13	22	35
Seats	36%	64%	
	13	23	36
Steering Wheel	36%	64%	
	13	23	36
Other	36%	64%	
	4	7	11

Given what auto recyclers and plastic processors said in interviews, it appears that the vast majority of auto recyclers was referring to selling plastic parts for reuse as opposed to recycling. Only one auto recycler interviewed (Dom’s Auto Parts) said they were sending bumpers for recycling (to Target Plastics). Only two plastic processors said they processed ELV bumpers (Target and Service Consolidation St. Clair). No auto recyclers or plastic processors that were interviewed mentioned recycling any other plastic parts from ELVs.

Plastic Auto Parts in Electric Vehicles

Given that electric vehicles will make up an increasing percentage of the vehicle fleet in years to come, a series of questions were asked regarding auto plastics in EVs.

The question on electric vehicles had a very high response rate (72 responses). Almost 93% of respondents reported that electric vehicles make up 0-5% of the vehicles they receive, whereas the for the remaining 7% EVs make up 6-10% of what they receive.

When asked if EVs contain more or less plastic than ICE vehicles, most (82%) were not sure; 17% thought they contained more plastic with 1% believing they contained less.

When asked if electric vehicles (EVs) contain more or less plastic than traditional ICE vehicles, 11 responded that they did not know, and one responded that EVs contain more plastic than ICE vehicles.

When asked about which EV parts not found in ICE vehicles contain more plastic, responses identified:

- Battery shields and housings and
- Interior parts and engine components

When asked which plastic parts they recovered from EVs respondents reported the following plastic items:

- Bumper covers
- Lamps
- Radios
- Speedometers
- Air Cleaners
- Plastic Jugs
- Steering Column
- Dashboard
- Miscellaneous fluid lines
- Door Panels

Auto Plastic Pilot Project Suggestions

A total of 34 survey respondents provided suggestions on areas in which the Government of Canada should focus pilot study attention. These suggestions included:

1. Provide bins for plastic collection at each auto recycler site;
2. Provide shredders to shred collected plastic at the auto recycler site to reduce volume before transportation;
3. Provide regional shredders;

4. Provide bounty to cover labour and full costs for removing auto plastic;
5. Create end markets for the plastic;
6. Create regional processing facilities;
7. Label auto plastics for easy identification of plastic resin;
8. Identify types of plastic and pay per piece recovered;
9. Provide funding to transport auto plastics to recycler.

When asked about their level of interest in being involved if the Government of Canada wanted to finance/fund a pilot plastics recycling program, 75% of the responses (53 auto recyclers) indicated that they would be interested in participating.

4.2 Interviews with Auto Recyclers

A selected number of shredders and auto recyclers were interviewed in December, 2021 to obtain more detailed information on their operations. Where the auto recyclers had already filled in the survey (discussed in Section A4.1), they were asked a set of supplementary questions (Appendix AC). Where they had not filled in the Survey Monkey survey, the questions were sent to them in brief format (Appendix AD). Summaries of the auto recycler interviews are presented in Table 8 below. Company names have been removed for confidentiality reasons.

Table 8: Summary of Auto Recycler Interviews

Auto Recycler Name and Location	Plastics Removed for Reuse or Recycling
Recycler #1, Manitoba	<ul style="list-style-type: none"> • Processes 300 cars a year - mostly newer cars. Buy the vehicles for parts as opposed to scrap value. • The average year of the cars received is between 2015 to 2018 <p>Reuse</p> <ul style="list-style-type: none"> • Resell a number of plastic parts: <ul style="list-style-type: none"> ○ Bumpers: out of good bumpers, sells 60-70% of them. ○ Dashboard (very few, maybe 2-3% of total received) ○ Gas Tanks (5% of total received) ○ Front seats (maybe 10% of front seats, mainly from trucks); 2% of all front seats in cars ○ Steering Wheels (2%) ○ Other: door panels: sells the door with the panel on it. If the door is in good condition (a lot of them are damaged), he sells about 50%. They don't take the trim panel (plastic) off when they are sold. • Who they sell to depends on the part: <ul style="list-style-type: none"> ○ Bumpers and seats go to body shops or private individuals. ○ Steering wheels go to body shops and used car sales dealers ○ Dashboard and doors go to body shops or rebuilders • Other parts with some value that are removed and resold: speedometers, radiators, wheel covers, carpeting (very little, 0.5%), air bags <p>Recycling</p> <ul style="list-style-type: none"> • Does not sell any parts to recyclers
Recycler #2	Reuse

Alberta	<ul style="list-style-type: none"> • Undamaged bumpers from late model vehicles are the most sold plastic car part • He processes an average of 1000 cars per year with 2000 bumpers - sells approx. 500 bumpers per year (25%) at any average price of \$400 per bumper (might be a little high) • Nov 2017 – Nov 2021 (4 years): sold 674 front bumpers and 1197 rear bumpers for reuse (front bumpers damaged more often than rear bumpers) • Has only sold 142 gas tanks in 4 years • Sells a few late model seats – mostly driver’s seats from pickup trucks • Sells most of the undamaged headlights he receives on late model vehicles <p>Recycling</p> <ul style="list-style-type: none"> • No parts sold to recyclers - recycling doesn’t make economic sense – a bumper cover weighs 3 – 5 lbs. (Note: actual weight 9 lbs.) and has a value of \$0.10 per lb. • Side mirrors have too many different types of plastic – recycling not feasible • Copper is valuable but even that is too costly to remove – the question you have to ask: “Is the juice worth the squeeze?”
Recycler #3, Ontario	<p>Reuse</p> <ul style="list-style-type: none"> • Sell headlights, plastic grills and bumpers from late model cars • Sell some driver’s seats from late model pickup trucks – wear out faster than other seats • Sell to public and body shops • Have a 3-storey, 80,000 sq ft warehouse for parts <p>Recycling</p> <ul style="list-style-type: none"> • No parts sold for recycling – no markets • A company in Waterford called Covenant Industries (owned by a preacher) used to shred gas tanks and tires for recycling but no longer takes gas tanks • Would be interested in hosting a recycling pilot project if his costs were covered <p>Auto Shredders</p> <ul style="list-style-type: none"> • American Iron and Metal (AIM) in Hamilton ship their ASR to AIM’s sorting facility in Montreal where they extract ferrous and non-ferrous metals from the ASR
Recycler #4, Ontario	<ul style="list-style-type: none"> • Only buy late model EOL vehicles (currently 2019 – 2021 model years) that have been in accidents – not profitable to dismantle older vehicles • Survey filled out incorrectly – entered 80% of vehicles over 20 years old – should have said 80% under 5 years old <p>Reuse</p> <ul style="list-style-type: none"> • Able to sell undamaged plastic bumpers, dashboards, gas tanks, front grills, steering wheels, steering columns, headlights, taillights, roof rails, door rocker panels and pickup truck quarter panels • Sell mostly to auto repair shops but also to the public • Tried exporting carpet from EOL vehicles to the US but customs asked too many questions re: composition, name of producer, etc. so they didn’t go through with it • Cheap (both in price and quality) imported aftermarket parts from Asia undercut demand for Canadian used parts • Some high-end vehicles have fibreglass bumpers that can be repaired <p>Recycling</p> <ul style="list-style-type: none"> • Don't recycle any plastic components • OEMs need to standardize plastic resins used for different components – at least down to 2 or 3 options • Each vehicle should have a couple of stickers in different locations with a QR code that contains a list of all the plastic components in the vehicle and their resin type <p>EVs</p> <ul style="list-style-type: none"> • Get a lot of EVs – easy to manage • Remove and resell EV batteries for reuse
Recycler #5, Ontario	<p>Reuse</p> <ul style="list-style-type: none"> • Sell about 20% of undamaged bumpers – must be in perfect condition to be sold

	<ul style="list-style-type: none"> • Sell the odd door panel <p>Recycling</p> <ul style="list-style-type: none"> • Don't recycle any plastic components – no markets • Gas tanks are difficult to recycle because they must be cut in half and all metal clamps removed • Design for recycling by OEMs required • Recovery of plastics from ASR probably the most feasible approach given the time and effort involved in removing plastic parts before shredding
<p>Recycler #6, Quebec</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Specialize in trucks and pickups • Resell a number of plastic-container parts, if they are in good condition and depending on demand: bumpers; gas tanks; seats; steering wheel, dashboards • Recondition mechanical parts (engine, transmission, alternator) and re-sell them with a warranty. But for plastic parts, this doesn't really apply (aside from cleaning the bumper or making sure the gas tank is empty before re-selling). • The interiors of the doors (plastic trim) can be resold. On certain models, there is a good demand for this (trucks and pick-ups). For example, if you break the inside handle on a Chevrolet 2007-2013 model, you have to change the entire trim of the door. • Interior panels are large plastic parts that are too difficult to remove, because they would likely break in the process. Moreover, transport costs would be prohibitive. • Sales are about 50/50 direct to consumers vs body shops/other vehicle-related companies <p>Recycling</p> <ul style="list-style-type: none"> • Don't sell any parts to recyclers • Plastics recycling from ELVs is practically non-existent. It is a monetary question, and he does not know any company doing this at the moment.
<p>Recycler #7, Saskatchewan</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Sell the "odd" plastic part (bumpers, dashboards, gas tanks, headlights, driver seats) • They have an auto repair shop and rebuild old cars • Can get \$100 for a good bumper • Gas tanks from Chevy Venture vans – Can sell every one they get their hands on – must have been poorly made • Sell driver's seats from pickup trucks – they are in farm country - farmers are frequently climbing in and out of trucks so the sides of the seats get cracked <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts sold for recycling – no markets
<p>Recycler #8, Manitoba</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Headlights and taillights are the #1 items for resale, followed by tires and rear-view mirrors – the parts most frequently damaged • Does not recondition any parts for resale • Sell to both the public and repair shops <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts sold for recycling – no markets • If government wants to recover plastic car parts for recycling, they should put a "bounty" on them like they did for tire

<p>Recycler #9, BC</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Resell about 1 tonne of plastics/year – mainly bumpers but occasionally dashboards, gas tanks and/or steering wheels <p>Recycling</p> <ul style="list-style-type: none"> • Could see plastics grinding on-site if there were a market for the mixed plastics that they could produce with simple technology and a market for the product • Would like to see some incentive for mixed plastics shredding to divert more plastics – “some kind of a subsidy or bounty” • Don’t hold high hopes for DfE type measures – OEMs think they are doing their part already <p>EVs</p> <ul style="list-style-type: none"> • Foresee a huge increase in mixed plastics as weight becomes such a critical consideration in new EVs • Currently have 12 EVs in their yard – have purchased about \$1,000 in supplies to properly dismantle EVs – dedicating a bay part time to EVs as they are the “wave of the future” and “change is good for business as long as you keep up” • Stuart Ady (the owner) recently received his EV certification from the BC Association – he’s also vice-chair of the BC Dismantlers Association
<p>Recycler #10, Alberta</p>	<p>Recycling</p> <ul style="list-style-type: none"> • No longer recycles plastics – the only plastic item they recycled was plastic bumpers – but the company (in Saskatchewan) went out of business – they tried to look at shipping rail car loads of bumpers to recyclers • Staff are paid on a piece basis – if a value is assigned to a large enough piece, it could be recycled but it has to be enough value to warrant shipping to a recycle. The best idea would be to put a bounty on large items - \$5 to \$10 minimum • Big believer in EPR for auto manufacturers – “that’s the only way to make them design automobiles to be more readily recyclable – look at Europe”

<p>Recycler #11, BC</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Process 175 – 200 vehicles per year – nothing older than 15 years • Specialize in reselling auto parts from Chrysler, Dodge and Jeep vehicles • Resell dashboards, seats, engine covers, bumpers, panels, fluid containers, etc. • Steady business for 10 years <p>Recycling</p> <ul style="list-style-type: none"> • Sends some plastic parts to Merlin Plastics to be recycled <p>EVs</p> <ul style="list-style-type: none"> • Have processed very few EVs - 3 or 4 over past three years <p>Recycling vs. Reuse</p> <p>Should be more focus on reuse than recycling</p> <ul style="list-style-type: none"> • Fire retardants are a problem for recyclability of some parts • Safety is an issue regarding critical reuse applications • OEMs should do a better job of marking all plastic parts with the resin type or types in the case of composites • Auto industry has done a poor job at promoting reuse – much better effort on the recycling front • Don't expect the Federal government to focus on auto plastics – EVs are a hotter issue and more challenging
<p>Recycler #12, Ontario</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Vehicles are segregated into two streams 1) vehicles that undergo partial dismantling, whereby some parts are removed and the remainder is stored in the vehicle yard, awaiting further parts recovery and 2) vehicles which undergo full parts recovery and dismantling, with the remainder going to crushing and ultimately shredding. • Each vehicle that is dismantled has a set of tickets that indicates to the dismantler which parts are ready to be sold and which parts need to be re-stocked for future sale • All parts that are pulled for resale go through a QA/QC process to ensure the quality is sufficiently high for resale • Parts (including some plastic parts) that have to be removed to access the parts targeted for resale go into bins that get emptied into the crusher with the car bodies. • Undamaged plastic parts that get removed for resale/re-stocking (if they are on a ticket for a vehicle) may include: bumpers, dashboards (if not passenger side air bag not discharged), airbags if not discharged, headlight and taillight assemblies, steering wheels, steering columns, radios, dashboard displays, front seats, interior door panels • Some items such as seats and dashboards are only removed if the specific item has an offer of sale prior to the teardown because they take a considerable amount of time to be removed (40 minutes plus) • Gas tanks are removed from all vehicles and the gas is drained prior to the tanks being crushed – some plastic gas tanks from late model vehicles are ticketed for resale <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts were removed for recycling – catalytic converters are always removed because of their high dollar value and alternators and starters can be removed for rebuilding

<p>Recycler #13, Alberta</p>	<p>Reuse and Recycling</p> <ul style="list-style-type: none"> • Do not currently resell or recycle any auto plastics – too labour intensive with little sale or reuse value • Some form of payment (to the business and to the dismantler) would be needed to incent the diversion of specific plastics parts - very limited current markets – “It’s just not worth our while” - the cost of labour to separate out plastics is prohibitive • Auto makers could make it easier to remove some materials but you still need a market to re-sell plastic and other parts to • Many parts (e.g., foam stuck to seat fabric or metal door frames) simply can’t be cost effectively recycled without a financial incentive • Gas tanks are easy to remove but most dismantlers just drain them, cut them into chunks and put them back into the hulk for shredding– “maybe some plastics can be removed if the ASR is treated somehow” • Some form of EPR for OEM’s requiring them to create markets/provide incentives to dismantlers is needed to make progress on more diversion (especially for plastics)
<p>Recycler #14, Nova Scotia</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Remove some bumpers and “sometimes” dashboards, gas tanks, seats, steering wheels hubcaps, mirrors, rocker panel moldings, taillights, headlights for resale. Otherwise crushed with vehicle. • Many plastic parts can be harvested but there simply isn’t enough value given the labour required • Large, easy to harvest parts that are almost 100% plastic - interior trim panels, rocker panel moldings, damaged bumper covers. Determine added cost to recover at dismantle process and compare to weight recovered (most likely a net loss) and would need to reimburse recycler for time <p>Recycling</p> <ul style="list-style-type: none"> • Auto recyclers “do their best” in trying to make recycling “doable” but it has long been a metal recycling business – over the long haul, 10 to 15 plastic parts (maybe 25% of plastics by weight) are big enough that they could be recycled if markets/demand were in place • Chemical recycling of ASR makes the most sense to capture hard to remove plastics over the long term – a lot of plastic parts are simply too small and too hard to get at to recover • Mix of different plastic part sizes and resin types also makes cost effective recycling a challenge – no real business case for recycling many small plastic parts • Not sure if recycling materials from vehicles would qualify for carbon credits but this may be an option in the future (from survey monkey response) • 90% of vehicles by weight are now getting recycled which is pretty good achievement

<p>Recycler Ontario</p> <p>#15,</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Can resell complete bumper units if in mint condition • Sometimes able to sell dashboards, gas tanks, front seats, steering wheels <p>Recycling</p> <ul style="list-style-type: none"> • Sends damaged bumper covers to Target Recycling in Ajax • Target picks up barrels of bumper covers at his shop – charges him \$1.90 per bumper plus HST (up from \$1.69 in 2020) • Courtice is close to Ajax so he can afford to send his bumper covers to Target • If he was farther away the cost of labour to remove and handle the bumpers and to transport them to Target would be too expensive • Tried to send fuel tanks to Target but the cost to cut them in half and remove metal made it too expensive <p>EVs</p> <ul style="list-style-type: none"> • Starting to get EVs • Removes batteries and sells them for reuse • One paving contractor bought EV batteries to power traffic lights at road construction sites
<p>Recycler Quebec</p> <p>#16,</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Resell all the main vehicle plastic parts to some extent: bumper; gas tank; seats; steering wheel; dashboard. They must be in good condition and in demand (he follows the shopping-list approach by make and year observed by the team while in Port Hope) <ul style="list-style-type: none"> ○ resell the bumpers on about 50% of vehicles received. ○ Gas tanks: plastic ones are NOT in high demand. The plastic ones are found mostly in newer models. They are removed and perforated. • Resell mostly to companies (e.g., garages) “as-is” (no refurbishment) <p>Recycling</p> <ul style="list-style-type: none"> • Have been studying the issue of plastics from ELVs for about 10 years. The problem is not knowing what plastic type each part is made of. Every OEM has their own way of doing things. This is unlike curbside recycling, where we know that all water bottles are PET plastic. • Recycling plastics from ELVs also poses a significant logistical challenge – these parts are bulky (they take up a lot of storage room, which they don’t have), and the parts are labour-intensive and time-consuming to remove. • Would be interested in participating in a pilot project provided that storage bins/containers were supplied <p>EVs</p> <ul style="list-style-type: none"> • Under 0.5% of total vehicles received

<p>Recycler #17, Ontario</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Top sellers: bumper covers, head lamp assemblies, signal lights and taillight assemblies, mirror assemblies • Also sell driver seats (have the highest wear), speedometers, radios, seat belt assemblies with airbags, rear seat belts • No reconditioning or painting prior to resale • Sell to other wreckers, body shops and directly to the public • When vehicles are in current model year, demand is high and supply volume is usually lower. As vehicles age, the curve inverts and supply outstrips demand. • All other plastic parts put back in the car for the shredder <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts are recycled • Some gas tanks pulled aside previously and picked up, but this stopped years ago • Now tanks and everything else put back in the car for the shredder • Need programs for bumpers, headlights/taillights & seats
<p>Recycler #18, PEI</p>	<p>Reuse</p> <ul style="list-style-type: none"> • The most common plastic-containing parts that they re-sell are headlights and tail-lights. • Resell some seats, radios and dashboards (to replace damaged ones when air bags are deployed) • About 90% of sales are to companies. Who the parts are sold to depends on the part itself: <ul style="list-style-type: none"> ○ Gas tank (steel only): sold to a service center (professionals like a Speedy Auto Centre or Midas) ○ Headlight/bumper cover: sold to body shops (Collision Repair Centres) ○ The remaining 10% is sold to the public. <p>Recycling</p> <ul style="list-style-type: none"> • None of the parts is sold to a recycler <p>Gas Tanks</p> <ul style="list-style-type: none"> • Drill a hole and suck out the fuel with a vacuum system. The plastic ones are left in the car for crushing. There is no demand for plastic gas tanks because unlike the metal ones, they last for the life of the vehicle (unless they are damaged in a crash)
<p>Recycler #19, Ontario</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Bumper covers, head lamp assemblies, signal lights and taillight assemblies, mirrors assemblies - top moving items, high demand • Many parts are low volume, low value. In the current model year parts have higher value but quickly drop off in value and volume after the model changes. • Dashboards are typically reused only if the airbag has blown up the passenger side. • Door Panels – based on demand, often come off doors prior to sale of doors, due to multitude of finishes to match • Radiators and fan assemblies – demand based on frequency of front-end accidents • Radios, speedometers, air handler assemblies, steering column, misc. parts, plastic jugs – low volume, low value, as a general practice become scrap • Insurance shops (auto body repair) won't touch repaired parts – parts must be perfect • Batteries are sold to a battery recycler who recycles the plastic cases • Typically, 10-year-old vehicles is the cut-off for parts demand unless it's a specialty vehicle or a part is in unusually high demand • Bottom line - they sell everything they can make dollar on <p>Recycling</p> <ul style="list-style-type: none"> • Do not recycle any plastic parts • The top 2 plastic items they want to see addressed are bumpers and gas tanks • Leaving plastic in a vehicle disposes of plastic for free, removing plastics cost labour • Recycling, at this point, is a fee-based service – to make it work it must be a revenue

	<p>generator</p> <p>Gas Tanks</p> <ul style="list-style-type: none"> • Must be cut in half and dry to leave in vehicle. The shredder used to allow them to be attached but after some issues they must now be removed. <p>Used to send gas tanks to Niagara Falls, NY chemical recycling company, Plastics2Oil, but they don't take them anymore – not sure why</p>
<p>Recycler #20, Manitoba</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Resell 1-2% of the bumpers, dashboards, gas tanks, seats, steering wheels he gets for reuse – the rest go to a shredder • Sometimes there is increased demand for a specific part e.g., 2017 Silverado pickup trucks have poor quality inner door handles – big demand for inside trim panels for those trucks • Don't do any re-conditioning of parts before resale, except headlights and taillights – will buff them up before resale • Sell parts to the public and to auto repair shops – whoever offers to buy the parts at a price that he can make a profit on • Sale of parts is all driven by dollars – if someone want to pay him more than it costs him to remove a part, he will sell the part (e.g., say it costs him \$25 to remove a bumper – if someone is prepared to pay him \$30, he will remove and sell the bumper) <p>Recycling</p> <ul style="list-style-type: none"> • He does not sell any plastic parts for recycling – no markets • There used to be a local company that reconditioned bumpers but they closed down • A start-up company was taking bumpers for recycling for a short time but couldn't make a go of it • A stewardship program would have to be set up that would guarantee a set price for each part that was higher than the cost of removing the part from a vehicle
<p>Recycler #21, Ontario</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Bumper covers, head lamp assemblies, signal lights and taillight assemblies, mirror assemblies - top sellers • Radiator assemblies also in the top items list due to the frequency of front collision repairs • No reconditioning prior to sale • Sell to other auto wreckers, collision shops and directly to the public • It comes down to value in removing the part. If the plastic generates revenue, they will collect it otherwise disposal is the destination. • Other plastic parts put back in the car for the shredder at Gerdau (thinks the plastic is separated at Gerdau) <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts sent for recycling • Paying for recycling won't work – must be revenue neutral at worst to revenue positive to get buy in. • Recycling takes additional time and effort - not currently required.
<p>Recycler #22, Quebec</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Sell parts sourced from some 1,200 damaged and used vehicles that they recover each year <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts sent for recycling • Car makers need to standardize the plastics they use. They should get together and agree on standard plastics to use in parts (as opposed to using 36 different types of plastics). The type of plastic should be “punched in” directly on each of the plastic parts. • Even in the case of bumpers, which are mostly made of plastics, they are texturized and painted. In addition, they come with metal brackets. Why not make the brackets in plastic, so the bumper can more easily be recycled?

	<ul style="list-style-type: none"> • Provided contacts at Recyclage Tandem and CED-LO <p>Auto Shredders</p> <ul style="list-style-type: none"> • There are three (3) shredders in the province of Quebec: <ul style="list-style-type: none"> ○ American Iron & Metal (AIM) ○ Associate Steel (they send the metal to Italy; their operations are very rudimentary) ○ Mittal Steel (associate of Triple M in Toronto) • Previously, there was a 4th option - Total Métal Récupération (TMR), based in Laval. It was bought by AIM in early 2020. It has “state of the art” technology and equipment (\$70 million investment). Their process involves recovering both ferrous and non-ferrous metals, as well as plastics from the shredder residue. (Note: this could not be confirmed.) • Shredders sell the shredder residue to landfill sites for \$25/tonne. Landfills use it as cover material at their site. Therefore, any plastic recovery solution from the shredder would have to compete with this value.
<p>Recycler #23, Quebec</p>	<p>Reuse</p> <ul style="list-style-type: none"> • The vehicles they receive are quite old • They resell a number of plastic parts, depending on demand and value: <ul style="list-style-type: none"> ○ Bumpers, when they are in good condition ○ Gas tanks: when there is a demand, they are set aside. Otherwise, they are punctured and stay on the car to go on to shredding ○ Mirrors • They sell mainly direct to consumers, a little bit to body shops and garages • They don’t do any refurbishing before selling parts • The insides of wheels, beneath the motor, and inside the car (trim, finishing) all contain a lot of plastic but it is too difficult to get to. <p>Recycling</p> <ul style="list-style-type: none"> • They don’t sell any plastic parts to recyclers. They are not aware of any recyclers in the province that they could sell to. If there was a company that they could send their plastics to, they would. • In order to increase the quantity of plastics recycled, we need companies who are willing to buy it (similar to how we are recycling metal at the moment).
<p>Recycler #24, BC</p>	<ul style="list-style-type: none"> • Jim LeBrun, the owner of Powerhouse, is the Chair of the BC ARA, has been in the industry for over 40 years • They process 200-400 cars per year • Currently facing 2-3000 flood damaged vehicles -possibly up to 7000 • They can’t be repaired, all must be scrapped <p>Recycling</p> <ul style="list-style-type: none"> • There is no action at the BC ARA level on plastics recycling • Infrastructure doesn’t exist to sustainably recycle plastic • Remote sites don’t have access to recycling services • Bulky plastic items don’t allow for size reduction and efficiency – size reduction is expensive • Recyclers are not reimbursed for their time and expenses to recycle plastics • Recycling fees never make it to auto recyclers – tires recyclers and electronics recyclers get paid but auto recyclers don’t.
<p>Recycler #25, Ontario</p>	<p>Reuse</p> <ul style="list-style-type: none"> • Resell bumpers and gas tanks (only metal ones) <ul style="list-style-type: none"> ○ About 10% of bumpers arrive without damage. Only re-sell the undamaged ones. Re-sells about one bumper a month. The driver for what is re-sold versus not re-sold is quality, as opposed to supply and demand

	<ul style="list-style-type: none"> ○ Do not re-sell plastic fuel tanks. They are removed and get picked up separately by the metal recycler, who disposes of them <p>Recycling</p> <ul style="list-style-type: none"> • Do not recycle any plastics • Adco, an auto recycler in Toronto, tried to recycle auto plastics about 40 years ago, it was unsuccessful - can't be done efficiently.
Recycler #26, Ontario	<p>Reuse</p> <ul style="list-style-type: none"> • Plastic parts recovered for resale: bumpers, fuel tanks, dash parts, engine covers <p>Recycling</p> <ul style="list-style-type: none"> • No plastic parts recovered for recycling <p>EVs</p> <ul style="list-style-type: none"> • Does not see any EVs yet – he is in a rural area – “demographics are not there yet”

A4.3 Key Findings from Auto Recycler Interviews

The key findings from the 26 auto recyclers interviewed (plus the site visit at Standard Auto Wreckers) are summarized below:

- 26 of the companies recovered some undamaged plastic parts from ELVs and sold them for reuse whereas only one company interviewed (Dom's Auto Parts in Courtice, ON) recovered bumpers from ELVs for recycling (at a cost);
- Recovery of parts for reuse is driven by market demand and the cost of removal – if the market price for a part is greater than the cost to remove it, auto recyclers will remove the part for resale;
- The most common plastic part recovered for resale was TPO bumpers, followed in no particular order by headlight and taillight assemblies, dashboards, gas tanks, rear-view mirrors, front driver seats, interior door panels, steering wheels, steering columns and front grills;
- Plastic parts that could not be sold for reuse were usually left on the vehicle when it was sent to a shredder, and therefore ended up in ASR;
- The main reasons given for not recycling any plastic parts were lack of markets, low market value, difficulty in identifying and separating different plastic resin types contained in a part and the time involved in removing plastic parts for recycling, and
- Several companies indicated that to make recycling of plastic parts financially viable, stable markets would have to be established, and some kind of fee or bounty would have to be paid to the auto recycler for each part that exceeded the net cost to remove the part and ship it to market.

A4.4 Key Findings from Automobile Shredder and Metal Aggregator Interviews

A total of 10 auto shredders and four metal aggregators were contacted by email and/or phone as part of the study research. Interviews were conducted with four auto shredders and two metal aggregators. The following key findings were developed from interviews that were conducted:

- The two largest metal shredders in Canada are Triple M Metal based in Brampton, ON and American Iron and Steel (AIM) based in Montreal, QC.
- Triple M has three shredder locations in ON – Hamilton, Brampton and Sault St. Marie – and

eight other scrap yards that feed metal to the shredder locations, plus two scrap yards in QC located in Laval and St. Hubert (under the name Metrobec).

- All metal shredding facilities shred a wide range of steel and iron scrap in addition to auto bodies and also recycle non-ferrous metals such as copper, aluminum and brass.
- Triple M's Hamilton location has ASR sorting technology that can sort ferrous and non-ferrous metals from ASR.
- AIM's shredding facility in Montreal has technology to sort ferrous and non-ferrous metals from ASR – their Hamilton shredding facility ships its ASR to the Montreal facility to have the ferrous and non-ferrous metals removed.
- Gerdau's shredding facility in Whitby, ON and Kimco Steel Sales in Kingston ON also have technologies that can sort ferrous and non-ferrous metals from ASR.
- None of the ASR sorting technologies installed at shredding facilities in Canada are designed to extract plastic resins.
- ASR is sent to landfills where it is disposed of or used as landfill cover. One Quebec auto recycler reported that landfills were paying metal shredders \$25 per tonne for ASR to use it for landfill cover.

A5 Auto Plastic Recycling in Canada

A list of 30 companies across Canada that recycle industrial plastics was compiled from Kelleher Environmental contacts and an internet-based search. Each of these companies was contacted by email or phone to explore the extent to which they currently recycle end of life auto plastics or would be interested in recycling end of life auto plastics in the future. Interviewees were also asked whether they would be interested in taking samples from the tear down study carried out at Standard Auto Wreckers in January, 2022.

Each company was asked to answer a series of questions either by email or phone; most elected to answer by interview. The questionnaire/interview guide is included in Appendix AE. Of the 30 industrial plastic processors contacted, 26 were interviewed and 4 did not respond to calls or emails. Results of the interviews are summarized in the following sections.

5.1 Current Auto Plastic Recycling Activity in Canada

The 26 industrial plastic processors that were interviewed can be broken down into the following categories:

- Do not process any auto plastics (6);
- Process manufacturing scrap from auto OEMs only (2);
- Primarily process manufacturing scrap from auto OEMs but are interested in taking end-of-life vehicle (ELV) in the future (8) and
- Currently process ELV plastics or end of life (EoL) plastic auto parts from collision shops (10).

The specific companies that fall into each category are presented in Table 9.

Table 9: Auto Plastics Recycling Activity by Industrial Plastic Recycling Companies Across Canada

Do Not Process Any Auto Plastics	Process Auto OEM Scrap Only – Not Interested in ELV Plastics	Primarily Process Auto OEM Plastic Scrap – Interested in ELV Plastics	Currently Process ELV Plastics or EoL Plastic Auto Parts
<ul style="list-style-type: none"> • Blue Planet Recycling • Enerkem • Ni-Met Polymers • Revital Polymers • Sani-Eco • West Coast Plastic Recycling 	<ul style="list-style-type: none"> • Antek Madison • Canadian Resin Recovery 	<ul style="list-style-type: none"> • Can-Am Recovery • Dacol Plastics • Exxel Polymers • EPL Plastics • Green Solutions Industries Int'l • Kal-Polymers • Nam Polymers • Norwich Plastics 	<ul style="list-style-type: none"> • CED-LO • Lavergne • Merlin Plastics • Polymer Recycle Inc. • Post Plastics • Reclaim Plastics • Recyclage Tandem • Re-source Recycling • Service Consultation St. Clair • Target Recycling

Of the group that do not process any auto plastic now, only Enerkem, who operate a biofuels gasification facility in Edmonton, AB, was interested processing auto plastics (in their case processing ASR) .

Brief summaries of the interviews with the 20 plastic recyclers that currently process auto OEM plastic scrap, EOL plastic parts and/or ELV plastics are presented in Table 10.

Table 10: Information on Auto Plastic Recyclers in Canada

Auto Plastic Recycler Name and Location	Auto Plastics Recycled and Future Interests
Antek Madison, Toronto, ON	<ul style="list-style-type: none"> • Strictly interested in compounding post-industrial plastics, including scrap from auto OEMs. • Will not take any plastic blended with fibreglass, e.g., fibreglass reinforced PE scrap from body panels. • Used to accept bumpers from ELVs, bale them and ship the bales to China, but after China tightened up its import rules, A-M stopped accepting bumpers • ELV plastics are too contaminated with other plastics and metals to be processed in their system • While not interested in seeing plastics from tear down study, they suggested focussing on TPO bumpers, injection molded PP interior door panels (with all clips and fake ABS wood trim removed), nylon hub caps and the PP A-pillars on either side of the windshield
Can-Am Recycling Inc., Tilbury, ON	<ul style="list-style-type: none"> • 95% of the plastics they recycle is auto plastic, with 90% of that being OEM manufacturing scrap from Tier 1 suppliers (e.g., Magna) • Recycle TPO (from bumpers, dashboards, interior parts, exterior parts), PP and ABS (from exterior and interior parts) – both painted and unpainted • Will only accept ELV bumpers from companies that collect, bale and deliver them to Can-Am • Can-Am sorts, shreds and grinds the auto plastics • In some cases, they sell the regrind to compounders to be pelletized (referred to as a re-pro pellet). The compounding process reformulates the grind to increase its strength. Under this scenario, the re-pro pellets can be sent back to the auto industry. For example, TPO pellets from an old bumper could go back into a new bumper (“closed loop recycling”) • In other cases, the regrind is pelletized and used as-is to make new products, such as a lawn chair, parking block, pallet, spool for wire. • Process 1 million lbs. per month (5,450 tonnes/year) plus broker pellets produced by other companies • Volumes of auto plastics processed have gone up over the past five years • Interested in doing any research on the TPO, PP and ABS recovered in the tear down study to explore recycling options, however they don’t have a wash line. • They can either pick up the samples could samples could be shipped to them - would have to look into what makes sense re: freight.
Canadian Resin Recovery, Tilbury, ON	<ul style="list-style-type: none"> • Takes clean post-industrial plastic scrap only, grinds it and sells the flake • Scrap cannot have any contamination • Auto OEM scrap only 2% of their business • Will only take full loads (20k to 50k lbs.) of one resin type (PC, TPO, PPE) from automobile OEMs • Used to bale ELV TPO bumpers and ship them to China but that is no longer possible

	<ul style="list-style-type: none"> • PC headlight lenses have value but too difficult to dismantle lenses from other headlight components • Auto OEMs could make ELV plastic recycling easier if they didn't use multiple resin types in one component (e.g., dashboards) • Not interested in parts from tear down – plant is full of post-industrial scrap to be processed
CED-LO, Farnham, QC	<ul style="list-style-type: none"> • The only auto plastic that they recycle are ELV bumpers • Represents only 2% of their feedstock – they focus primarily on recycling HDPE and PP • Charge \$5 per bumper delivered to their plant • Shred, grind and wash the regrind then sell it to be pelletized – pellets used to make products like black pipes, cell phone cases, etc. • The reason they do not process more auto plastics is the difficulty to deal with a mix of resins, in addition to other materials such as metals. • Processed about 30,000 kg of bumpers in 2021. This volume has stayed the same over the last 5 years. • Interested in doing research on the bumpers recovered in the tear down study
Dacol Plastics, Waterloo, ON	<ul style="list-style-type: none"> • Process post-industrial plastic including: painted and unpainted ABS, PP, TPO as well as flexible and rigid PVC • Only take auto plastics from OEMs • ELV plastic parts too contaminated with other materials • Got away from recycling bumpers 12 years ago – too difficult to deal with due to contamination • 7 years ago, Dacol used to send gas tanks to a company for recycling – cannot remember the name • Stopped sending gas tanks to the company because Dacol was unable to meet their quality specs – too much other material and gas residue • Dacol might be able to take ELV bumpers in the future if they met their specs and they were consolidated into tractor trailer loads and delivered to their plant • Would like to see photos of TPO bumpers from tear down study
EPL Plastics, Brantford, ON	<ul style="list-style-type: none"> • Process post-industrial plastics – rigid PVC, PE, PS, PP, TPE • Processes: grinding, aspiration (air cleaning), densifying, blending, pelletizing and custom compounding of incoming plastic waste • Don't process any ELV plastics because of the sorting and clean-up required before processing • Do process some Tier 3 auto parts production scrap • Supply resins to companies that make auto parts • Ship 2,600 lbs. of pellets per month (65 trucks x 40 lbs. each) • HDPE pellets sent to a company that blow-moulds auto air intake ducts and filter containers • PP pellets sent to company that makes front bumper assemblies for Ford F-150 pickup trucks • PVC, and PE sent to their sister company Tru-North Composites to make deck boards (have also sent TPO bumper regrind to them in the past) • Interested in seeing photos from tear down study
Exxel Polymers, Bromont, QC	<ul style="list-style-type: none"> • Process TPO, PP, PE and ABS auto plastics – 75% is OEM manufacturing scrap • Auto plastics only represents about 5% of their total processing quantities • They have a contract with Green Metals Inc. in Ontario which handles Toyota's factory waste - Green Metals separates the metals and sends plastic waste material to Exxel

	<ul style="list-style-type: none"> • Exxel shreds, grinds, air dries and pelletizes scrap plastic • Can take both painted and unpainted plastics parts • Pellets are sold to companies that use them to make storage bins, shelves used in garage, shovel, parts used in construction industry • Process 30 million kg (30,000 tonnes) of plastic per year (5% comes from auto industry) • Buy TPO regrind from Target Recycling in Ajax, ON • Volumes of TPO have stayed the same for the last 10 years • In the process of adding 3 to 4 million kg of annual processing capacity (not specific to auto plastics) • Interested in doing research on the plastics recovered in the tear down study in order to explore recycling options, but only if the plastics parts are well sorted
Green Solutions Industries Int'l, Brampton, ON	<ul style="list-style-type: none"> • Process scrap nylon, PE, PP, PS, ABS, PC, TPO, TPE, acrylic • Collect scrap from auto OEMs • Will provide 48 ft. or 53 ft. trailer – accept material baled or in gaylords • Processes at Brampton facility: shredding, grinding, float/sink separation, pelletization • Facility can process 3,000 lbs. of regrind per hour • Recycle about one million pounds of plastic scrap per month (5450 tonnes/year) • They currently don't accept plastic parts from ELVs – too contaminated • Only ELV PP bumpers have a good market value – can be recycled and sold at a profit if free of contaminants • Other ELV plastics are low in value – less expensive to landfill them • Used to export gas tanks to Asian countries – can't do that anymore because of import bans • Interested in seeing photos from tear down study
Kal-Polymers Inc., Mississauga, ON	<ul style="list-style-type: none"> • Recycle post-industrial scrap from packaging and manufacturing companies, including auto OEMs • Auto-approved compounder of recovered plastic materials specializing in PP • Unique post-industrial plastic handling capabilities include de-painting, de-metalizing, polymer separation, color separation, reprocessing, shredding, grinding, baling, blending, pelletizing – MK note – this sounds pretty sophisticated to me • 120,000 sq. ft. facility in Mississauga that processes 100 million lbs. per year - expanding the facility in 2022 to add 35 million lbs. of capacity • Have an on-site laboratory that offers advanced polymer testing technologies to provide a full range of quality, product safety, materials and research analysis and testing services. • Currently accept the following plastic scrap from auto OEMs: <ul style="list-style-type: none"> ○ PP/TPO dashboard skins (the soft plastic part of dashboard) - processed into PP copolymer pellets (Repro Black). TPO in dashboards is cross-linked with EPS under dashboard – their technology separates the TPO from the EPS ○ Painted TPO bumpers - processed into de-painted TPO Repro Black pellets. Kal-Polymers has invested in equipment to de-paint bumpers into unpainted recyclable pellets, with properties near to the unpainted bumper grade TPO. ○ Painted/metalized PC - processed into PC Repro Black pellets • Partnered with GM to take their manufacturing scrap from Ontario plants • Would be interested in receiving ELV plastics from auto recyclers – particularly TPO dashboard skins and TPO bumpers • Kal-Polymers can park a trailer at an auto recycler site – plastics can be loaded on trucks in bales or loose in gaylords provided there were high enough quantities to justify a trailer • Interested in picking up samples from the tear down study – send them photos first
Lavergne, Anjou, QC	<ul style="list-style-type: none"> • 95-97% of all the plastic they recycle is post-consumer • Process PET, PS, PP, PE, ABS, PC – but not from autos

	<ul style="list-style-type: none"> • Focus is on designing, developing, and manufacturing high-value sustainable resins (alloys and composites) using 100% post-consumer recycled (PCR) plastics to make base polymers rPET, rABS, rHIPS, and rPC • Also process TPO bumpers – imported from Europe – none from N.A. The reason they import bumpers from Europe is that they have a business relationship with SIMS Metal. Since SIMS does not have any facilities in Canada, and since in the US all the bumpers are sent with the rest of the car for shredding, Lavergne sources the bumpers from SIMS in Europe. • Bumpers are made back into bumpers or other auto parts, including electric vehicle parts (this is a growing segment for them) • Have only recently started processing bumpers and they estimate they are processing about 1 million kgs per year. This is only a small fraction of their total production, but they expect it to increase • Certified auto part Tier 1 supplier (norm IATF-16949) • Worked with Audi in Europe to test the recovery of plastics from their ASR and Lavergne’s conclusion is it is not feasible – Need to add to ASR • There needs to the EPR legislation put in place in the auto sector (similar to the ELV Directive in the EU, and similar to the WEEE EPR framework in place here). Currently, auto shredders like AIM can dispose of the ASR very cheaply (\$10/tonne vs \$100/tonne for standard disposal fee in the province) because disposal sites use the material as a cover – maybe move or at least copy to ASR TM #3 • Very interested in obtaining samples from the tear down study - can pick up or have the materials ship to them
Merlin Plastics	<ul style="list-style-type: none"> • Currently recycle TPO, PP and PE • Shred, wash, grind and pelletize/compound these products and sell some of it back to be used for automotive and/or injection moulding applications • Process somewhere around two to three million pounds (1,300 tonnes) per year of automotive plastics • Do not accept PVC and thermo-set plastics, such as glass-reinforced polymers of any sort
Nam Polymers Inc., Toronto, ON	<ul style="list-style-type: none"> • Recycle PP and ABS manufacturing scrap from auto OEMs • Shred, grind and pelletize the plastic scrap • Don’t process ELV plastic because they don’t have a washing line • The main problem with ELV plastics is that it is different types of plastics mixed together and it is contaminated. This requires high-performance machinery to carry out effective separation, which is very expensive. • Another issue is that plastics in the auto industry are compounded (with nylon, fibreglass, flame retardants). Percentages change from one supplier to the other. • Process approximately 1 million lbs. a month of which about 20% is auto plastic • Interested in doing research on the plastics we recover in the tear down study to explore recycling options. Open to sharing their 35-40 years experience in plastics
Norwich Plastics, Cambridge, ON	<ul style="list-style-type: none"> • Process 50 million lbs. of post-industrial PVC per year • 20% is clean, flexible PVC automotive manufacturing scrap • Shred, grind, compound and pelletize PVC to convert it into high quality reusable compounds • Virgin PVC is selling for \$0.68/lb. whereas recycled PVC is selling for \$0.45/lb. so there is strong demand for recycled PVC • Provide on site collection solutions and <u>sell</u> reprocessed pellets and powders to the North American manufacturing industries • Buy PVC manufacturing scrap from companies that make PVC components for Ford (e.g., floor boards)

	<ul style="list-style-type: none"> • Dashboard insulator panels made of PVC • PVC from ELVs may be too contaminated to be processed at their facility • Interested in viewing PVC parts from tear down study
Polymer Recycle Inc., Sainte Philippe, QC	<ul style="list-style-type: none"> • Have a 20,000 square feet plant in St-Philippe that is equipped with a shredder, grinder and two pelletizing lines • In 2021, they began taking the ELV bumpers collected by Tandem Recyclage. They buy the granulated bumpers from Tandem and compound with PP to reduce hardness and then pelletize • Sell the pellets to companies that make various products (flower pots, storage bins, clothing hooks) • Project that they will process 50 tonnes of plastic bumpers in 2022 - total annual production (all plastics) is 4,000 tonnes • Other auto plastics that could potentially be recycled: Gas tanks if decontaminated, ABS, PVC and PE (excluding fibreglass reinforced PE) • Interested in doing any research on the plastics we recover in the tear down study in order to explore recycling options but it depends on product and quantity – have a lab that can test samples (small quantities)
Post Plastics, Ajax, ON	<ul style="list-style-type: none"> • Provide collection, baling and grinding/shredding/pelletizing services for a wide range of post-industrial plastics, including scrap from auto OEMs • Process a small number of ELV TPO bumpers that are dropped off by collision shops and the public • Don't collect ELV bumpers from auto recyclers because Post would have to charge for collection and recyclers don't want to pay for collection • Kevin Poitras, co-owner of Post Plastics, is also the co-owner of Recyclage Tandem in QC which collects and processes ELV bumpers • Aside from TPO bumpers, ELV plastic parts are too difficult and too expensive to recycle because of contamination with metal and other plastics • For example, dashboards on different vehicle models have a different combination of plastic resins; in some new vehicles the entire dashboard is wrapped in vinyl making it difficult to access the TPO skin) • LKQ Corp. used to refurbish used bumpers but the OEMs lowered the price for brand new bumpers so demand for refurbished bumpers dropped significantly • Although doubtful that our tear down work will produce any clean recyclable plastic, Post is willing to drive to Standard in Ajax to look at the parts that are recovered
Reclaim Plastics, Burnaby, BC	<ul style="list-style-type: none"> • Recycle mainly EoL plastic auto parts from collision shops including: PP, PS, ABS, PVC, PC, TPO, TPE and TEO • Also recycle some auto OEM plastic manufacturing scrap • Shred, granulate, air wash and ship granulated flake to partners to be pelletized • Collect plastic parts from auto collision shops in the lower mainland • Focus mainly on EoL bumpers – process 4,000 bumpers per month • Manually remove all brackets, clips, screws then grind the bumpers into flake for sale to plastic product manufacturers • Blue Planet Recycling and West Coast Plastics Recycling have both handed over their bumper collection programs over to Reclaim • Bumpers can be PP or TPO (older bumpers made of PP) and can sometimes have a “chrome” strip made of ABS • If collision shops want to pay to divert more plastics, Reclaim will collect headlights and taillights and manually disassemble them to remove the PC lenses and PP housings for recycling • Will also collect dashboards (for disassembly), TPO wheel well liners, ABS spoilers, molded PP interior door panels

	<ul style="list-style-type: none"> • Considered installing Steinert Global UniSort BlackEye system to optically sort PP and TPO bumpers (the PP AND TPO used for bumpers is always black) – sent samples to Steinert in Germany but did not get the results they were looking for • Would like to get ELV bumpers from auto recyclers but the price Reclaim pays is not high enough for recyclers to pay for the extra labour costs incurred to remove the bumpers from the ELVs • Auto recyclers often keep as much plastic in an ELV as they can get away with before flattening the body and selling it to a shredder – free disposal and they get paid a little more for the vehicle • Metro Van landfill has a ban on auto parts, including ASR, but the ASR is going to a private landfill • Auto recyclers need a financial incentive to make plastic recycling worth their while • Very interested in our study and would be willing to participate if a tear down study was conducted in BC
Recyclage Tandem, Beloeil, QC	<ul style="list-style-type: none"> • Recyclage Tandem has two plants (one in Beloeil, QC and one in Atlanta, GA) • 90% of what they process is TPO and PP from the auto industry • The TPO, which comes mainly from EoL vehicle bumpers, is collected, shredded, washed, granulated and pelletized • The Beloeil plant can process 1.6 million lbs. of bumpers per year • The PP (e.g., inside door panels) comes mainly from auto OEM manufacturing scrap. Recyclage Tandem contracts out the pelletization process to a third-party, and then buys back the pellets • Were offered gas tanks from Toyota but it was too challenging because of their bulkiness and the fact that they weren't cleaned • The company is co-owned by Mario Maselli and Kevin Poitras who also co-own Post Plastics in Ajax, ON • The Quebec Association of Automobile Insurers (GAA) pays collision shops an allowance to offset the costs charged by processors to collect and recycle EoL bumpers • Charge a uniform fee to pick up bumpers across most of Quebec, regardless of location (minimum of 30 bumpers per pickup). • The only region they are not able to service currently is the Gaspésie area. For the Lac St-Jean and Abitibi Regions, they operate through 3rd party contractors (Pieces Auto Choc and Pieces Auto Trudel, respectively). Those two sub-contractors pick up the bumpers in the two regions, and Recyclage Tandem collects the bumpers from them when there is enough volume • Have an arrangement with a car repair shop ownership group (https://www.carrxpert.com/) whereby all franchisees are to set aside the bumpers for Recyclage Tandem to pick-up. • Volumes have been increasing • Interested in doing any research on the plastics recovered in the tear down study in order to explore recycling options. Need to coordinate logistics and whether to work through Post Plastics
Re-source Recycling, Concord, ON	<ul style="list-style-type: none"> • Their multi-material recycling facility processes metals, plastics, cardboard, paper and textiles from IC&I clients • They process in-plant plastic manufacturing and packaging scrap – including PE, ABS, PVC, PP • Facility is equipped to bale, grind, pelletize and extrude reclaimed plastics • Don't process any ELV plastic but do accept - EoL TPO bumper covers – delivered by collision shops • Stopped taking plastic scrap from auto OEMs – too many metal pieces attached that need to be manually removed • Would be interested in seeing photos of plastic parts removed in tear down study

Service Consultation St. Clair, St. Eugene, QC	<ul style="list-style-type: none"> • Currently processes ELV TPO (bumpers and car interiors) and TPE (gaskets) • Remove metals, shred, grind and optically sort at the St-Eugene plant, near Drummondville • Send regrind to CED-LO for washing (last step). • Process 300 tonnes of TPO per year • Charge a small amount to take bumpers from dismantlers. • Interested in doing any research on the plastics we recover in tear down study to explore recycling options • Also interested in testing ASR recovery using their optical sorters - one of the key challenges is black resins, which are difficult to detect using near infrared
Target Recycling, Ajax, ON	<ul style="list-style-type: none"> • Collect ELV TPO bumpers from auto recyclers • Shred and grind the TPO and ship it to Exxel Polymers to be pelletized³⁰

Table 10 shows that many industrial plastics recyclers across Canada process some auto plastic. The key findings from the interviews are summarized below:

- Many industrial plastics recyclers across Canada focus on processing auto sector OEM manufacturing scrap) including PE, PP, PS, ABS, PC, TPO and PVC) as opposed to ELV plastics because manufacturing scrap is less contaminated with other metal and other plastics
- TPO bumpers (either painted or unpainted) are the most commonly recycled plastic part because recycled TPO has a high market value and bumpers are relatively easy to remove compared to other plastic parts
- Most end-of-life bumpers that are recycled are collected from collision shops as opposed to auto recyclers because collision shops have a financial incentive to avoid landfill disposal fees
- Some plastics recyclers used to be able to send material to Asia, but are not able to do so any longer since China clamped down on quality requirements for imported waste material.
- Some plastics recyclers indicated that they used to recycle gas tanks but are no longer able to find companies to buy them
- Only two plastic processors (Exxel Polymers and Kal-Polymers) indicated that they were adding capacity in 2022 but not specifically for auto plastics. Exxel Polymers stated that they were adding 3 to 4 million kg of annual processing capacity in 2022. Kal-Polymers is expanding their facility in 2022 to add 35 million lbs. of capacity
- The Quebec Association of Automobile Insurers (GAA) pays an allowance to collision shops to offset fees charged by plastic processors to collect and recycle damaged bumpers
- In addition to bumpers, some of the other auto plastics parts mentioned for possible inclusion in an expanded auto plastic recovery project by plastics processors include: injection-molded PP interior door panels (with all ABS imitation wood trim removed); dashboards; nylon hub caps; PP A-pillars on either side of windshields; PC headlight and tail-light lenses; gas tanks; TPO wheel well liners; ABS spoilers; and gaskets

- Recycled auto plastics pellets/flake are sometimes used for: new bumpers; centre console beverage holders; lawn chairs; parking blocks; pallets; spools for wire; black pipes; cell phone cases; air intake ducts; filter containers; storage bins; shelving; shovels; construction industry parts; electric vehicle parts; auto floor boards; flower pots; and clothing hooks
- There was significant interest from the majority of plastic processors interviewed to view the photos of the plastic parts removed in the tear down/time and motion study conducted at Standard Auto Wreckers in Port Hope, ON for the purposes of conducting research.

5.2 Interest in Taking Part in ARC Auto Plastic Research Project

A total 17 plastic processors indicated that they were interested in viewing photos of the plastic parts removed in the tear down study conducted at Standard Auto Wreckers in Port Hope, ON in late January, 2022 (described in TM#2).

These processors were sent an email with a link to a OneDrive file containing photos of all the plastic parts removed in the study.

Five processors (Can-Am Recycling, Kal-Polymers, Lavergne, Post Plastics and Service Consolidation St. Clair), indicated they might be interested in driving to Standard Auto Wreckers and examining the parts in person.

After the tear down study was complete, samples were packaged up for shipment by Lavergne to their facility in Quebec and one of the team dropped off samples at Kal Polymers in Mississauga, Ontario.

Appendix AA: ARC Auto Recycler Survey December, 2021 Regarding Auto Plastics - Survey Monkey Form

Recovering Plastics From Traditional (non-Electric) Vehicles

1. How many vehicles (including sedans, SUVs, pickup trucks, light-duty trucks) do you process per year?
2. How many employees do you have?
3. What is the typical age range of the vehicles you receive? (fill in approximate % from drop menu)
 - More than 20 years
 - 15-19 years
 - 10-14 years
 - 5-9 years
 - < Less than 5 years

Any comments?

4. How many tonnes of different plastics does your company recover each year?
 - 1 tonne
 - 1-5 tonnes
5. How many years have you been recycling those plastic materials
6. How stable are the markets for plastic products that you are able to recycle?
 - Excellent
 - Good
 - Fair
 - Poor
7. Have you heard of any new or emerging technologies for recycling plastic from vehicles?
 - If Yes, include the name of the company or link to an article or news item you have seen?
8. Are you able to recover and sell any vehicle plastic parts?
(e.g. bumper; gas tank; seats; steering wheel; dashboard; other)

YES, able to recover and sell vehicle plastic parts, please choose all that apply (by part)

- Recover for Resale
- Get Paid for Recycling
- Pay to Depose
- Return to the Vehicle for Crushing

Parts

- Bumper
- Dashboard
- Gas Tank

- Seats
 - Steering Wheel
 - Other
 - Comments or any information you can share
9. List the companies that the plastic parts are shipped to for recycling
10. If not able to recover any plastic parts, please indicate the reason (check all that apply)
- No one wants to buy
 - No recycler in the area
 - Too much time to pull out materials
 - Not enough storage space
 - Too much cost to ship items to a recycler
11. Name any companies you know of that recycle vehicle plastics?
12. Do you operate a vehicle shredder?
13. If YES, how many vehicles do you typically shred annually?
14. How many tonnes of shredder residue do you produce in a typical year?
15. How do you manage this shredder residue? (check all that apply)
- On-site landfill
 - Off-site landfill
 - Build berms and other structures on-site
16. Do you recover any PLASTICS post-shredder now?
17. If YES, do you do this ON-SITE or send OFF-SITE for additional processing?
- On-site
 - Off-site
 - Comments
18. How many years have you been recycling those plastic materials?
19. Do you recover any NON-FERROUS METALS post-shredder now?

Recovering Plastics From HYBRIDs, PLUG-In Hybrids and Full Electric Vehicles

Approximately what % of the vehicles that you receive are hybrid, plug-in hybrid, or fully electric vehicles?

Do these electric vehicles (EVs) contain more or less plastic than traditional vehicles

- more
- less
- not sure

What components in EVs not found in internal combustion engine vehicles are made from plastic?

Are you able to recover any of these plastic parts from EVs?

If yes, please list parts recovered

Involvement in Future Auto Plastics Pilot Studies

If the Government of Canada wanted to fund a vehicle plastics recycling pilot project, do you have suggestions on how that project should be designed in order to increase the recycling of vehicle plastics?

If the Government of Canada wanted to fund a vehicle plastics recycling pilot project, would you be interested in participating?

Appendix AB: Auto Recycler Auto Plastic Interview Questionnaire, January, 2022

1. How many vehicles (including sedans, SUVs, pickup trucks, light-duty trucks) do you process per year?
2. How many employees do you have?
3. What is the typical age range of the vehicles you receive? (approximate % > 20 years; 15-20 years; 10-15 years; 5-10 years and newer than 5 years))
4. Are you able to recover and sell any vehicle **plastic** parts? (e.g., bumper; gas tank; seats; steering wheel; dashboard; other)
5. How many tonnes of different **plastics** does your company recover each year?
6. How many years have you been recycling those plastic materials?
7. How stable are the markets for plastic products that you are able to recycle?
8. What companies are the plastic parts shipped to for recycling (if able to share)

Shredder Questions

1. Do you shred end of life vehicles?
2. If YES, how many vehicles do you typically shred annually?
3. Do you recover any parts or plastics ahead of the shredder?
4. How many tonnes of shredder residue do you produce in a typical year?
5. How do you manage this shredder residue?
6. Do you recover any PLASTICS post-shredder now?
7. If YES, do you do this ON-SITE or send OFF-SITE for additional processing?
8. How many years have you been recycling those plastic materials?
9. Do you recover any NON-FERROUS METALS post-shredder now?

Recovering Plastics from Hybrids, Plug--in Hybrids and Full Electric Vehicles

1. Approximately what % of the vehicles that you receive are hybrid, plug-in hybrid, or fully electric vehicles?
2. Do these electric vehicles (EVs) contain more or less plastic than traditional vehicles?
3. What components in EVs not found in internal combustion engine vehicles are made from plastic?
4. Are you able to recover any of these plastic parts from EVs?

Future Plastic Pilot Projects

1. If the Government of Canada wanted to fund a vehicle plastics recycling pilot project, do you have suggestions on how that project should be designed in order to increase the recycling of vehicle plastics?

Appendix AC– Auto Recycler and Metal Shredder Interview Questions Regarding Auto Plastics, December, 2021 and January, 2022

For Auto Recyclers Interviewed 16th December, 2021 and Later

Q1 –Reuse and Recycling of Bumpers, Dashboard, Gas Tanks, Seats, Steering Wheels

Do you reuse/re-condition/recycle one of the following auto plastics:

- Bumpers
- Dashboard
- Gas Tanks
- Seats
- Steering Wheels
- Other

For each of these we would like to understand a bit better how the business works:

- What kind of company do you sell them to? (someone who fixes them up a bit more before selling them on- then where do they go)?
- Do you do any repair-re-conditioning/painting or other effort before you sell them
- Do you sell to another company or directly to the public?

Do you sell any of these to a recycler (who breaks down the plastic into pellets – does not re-sell the part as a part)?

If so, can you share any names with us? We are trying to build up a list of companies who recycle auto plastics for the next step in our research. Names we have been provided so far for auto plastics recyclers:

- Target Recycling, Ajax
- Post Recycling Ajax
- Reclaim Plastics, BC (<https://reclaimplastics.com/>)

Q2: “Other Plastics” Reuse and Recycling Information

From 62 survey responses we got the following list of “other” plastics recovered or recycled:

- Bumper covers
- Lamps
- Headlights,
- Signal lights,
- Tail lights,
- Radios
- Speedometers (what is this?)
- Air cleanser
- Plastic jugs
- Steering column (we had asked about steering wheel – I wonder do the others include column – we should ask this)
- Misc lines (this is an actual response – ask the person what this is – I am guessing plastic tubing?)
- Door Panels (this is a big one for me – we need to find out if a lot of them do door panels specifically)

- Mirrors,
- Radiators,
- Radiator fan assemblies
- Other plastics piece that are part of another assembly,
- Reservoirs on power steering pumps,
- Other mechanical parts

Do you re-sell any of these as parts?

Do you send any to an auto plastics recycler (so that they are washed, ground up and turned back into plastic)?

If so, can you give us any names?

Question 3 – Plastics Parts Identified in Other Studies

Some studies from the UK and Europe have a long list of plastic parts reused/recycled. Have you tried to reuse/recycle any of these?

- wheel covers
- safety subsystem
- insulation panels
- suspension bushings
- dash boards
- wheel arch liners
- floor insulation
- carpeting
- air bags
- engine bottom protection plates
- mud flaps

Question 4: Plastic Parts That Are Hard to Remove

Are there parts you see in vehicles that are large piece of plastic but are too hard to remove from the vehicle to send to a recycler?

If yes, which parts?

Question 5: "What do you think could be done to increase the amount of plastics recycled or reused from the vehicles you currently dismantle"?

Appendix AD: Metal Shredder Interview Questions Regarding Auto Plastics, December, 2021 and January, 2022

1. What percentage of the metals you process come from vehicles?
2. What is the volume (number or tonnes) of automobiles you typically shred annually?
3. How many tonnes of auto shredder residue (ASR)/fluff do you produce in a typical year?
4. How do you manage this auto shredder residue?
 - a. On-site landfill
 - b. Off-site landfill
 - c. Off site landfill as landfill cover
 - d. Build berms and other structures on-site
 - e. Other (please specify)
5. Do you salvage/recover and sell any **plastic** auto_parts (e.g. bumper; gas tank; seats; steering wheel; dashboard; other)?

Does it cost less to salvage the plastic part rather than dispose of it as garbage? Please fill in any information you can share in the table below.

6. Do you recover any plastic from vehicles to sell to a **plastic recycler**?
7. If yes, can you give us a sense of how many tonnes of different plastics your company sends to plastic recyclers each year?
8. From our survey to date people have identified some companies who **recycle auto plastics**:
 - a. Target and Post Plastics in Ajax, Ontario and Reclaim Plastics in BC.

If you know of any other auto plastic recycling companies, could you provide some names (we will approach them to be involved in research related to this project)

Electric Vehicles (Hybrids, Plug-In Hybrids, Full Electric Vehicles)

9. How many electric vehicles (including hybrids, plug-in hybrids and full electric vehicles) do you see or process per year?
 - a. Or approximately what % of the vehicles that you receive are hybrid, plug-in hybrid or fully electric vehicles?
10. Are you able to **salvage** any plastic parts from EVs for **re-purposing/resale**? If yes, please list which parts are salvaged and the companies they are sold to (if not confidential)

11. Are the batteries generally still in the EV when you receive it?
12. Is there any plastic in EV batteries?

Involvement in Future Auto Plastics Pilot Studies

13. If the Government of Canada wanted to fund an auto plastics recycling pilot project, do you have suggestions on how that project should be designed in order to increase recycling of auto plastics?
14. If the Government of Canada wanted to fund an auto plastics recycling pilot project, would you be interested in participating?

Appendix AE: Plastic Recycler Interview Questionnaire Regarding End of Life Auto Plastic, January, 2022

A: Managing Auto Plastics at Current Operations

We are carrying out research on recycling auto plastics from end of life vehicles.

- 1 Does your company currently accept any plastics from the automobile sector for recycling (either manufacturing waste or end of life vehicle plastic)
- 2 If yes, which resins or parts do you accept for recycling (specify if manufacturing waste or EOL)?

Plastic Resin	Recycle (Yes/No)	Manufacturing or End of Life Vehicles
PVC		
PUR		
TPO		
PP		
PE		
ABS		
Other		

- 3 How do you process the auto plastics?
 - a. washing,
 - b. grinding
 - c. shredding,
 - d. other (please specify)
- 4 What is the processed auto plastic used for (who or what type of end market is it sold to?)
- 5 How much do you process per year (lbs or tonnes)
- 6 Has this gone up or down over the last 5 years?
 - a. Up
 - b. Down
 - c. Stayed the same

B: Potential for Recycling End of Life Auto Plastics (If no to Part 1, question 1)

- 1 Would it be technically possible for you to recycle some or all of the following plastic vehicle parts?

Auto Part	Typical Plastic Resin	Potential To Recycle (Yes/No)
Bumpers	TPO	
Gas Tanks	PP	
Dashboards	ABS and PVC	
Seat Cushioning	PU	
Body Panels	Glass reinforced PE	

C: Taking End of Life Auto Plastic Samples from Port Hope Tear Down/Time in Motion Study

We are doing a tear down/time in motion study on getting plastics out of end-of-life vehicles at Standard Auto Wreckers in Port Hope Ontario. We will be storing the plastics parts we get out of end-of-life vehicles for a while at the Port Hope site.

- 1 Would you be interested in doing any research on the plastics we recovered to explore recycling options?

- 2 If yes, can you pick up or ship the samples from Port Hope to your facility?

D: Future Plans to Recycle End of Life Auto Plastics

- 1 Do you plan to install any additional technologies at your facility to handle auto plastics in the future?

- 2 If yes, would you be willing to share information on the planned expansion:
 - a. The capacity of the future addition
 - b. Schedule and timing of any capacity expansion to accommodate end of life auto plastics
 - c. Capital investment involved

E: Do you have or know of technology to recover plastic from ASR (auto shredder Residue)

F: Do you know of any university, institution or company doing research on recycling of plastic from automobiles?