

# 2012 Litter Survey Report



Your Environmental Trust Fund at Work

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## EXECUTIVE SUMMARY

Recycle NB, in partnership with Encorp Atlantic and through the Environmental Trust Fund, initiated this survey throughout the province of New Brunswick to establish province-wide baseline data for visible roadside litter across New Brunswick. In total, 424 sites were surveyed across more than 8,400 kilometers finding thousands of items.

The survey examined various types of materials as well as what brands are being discarded most. This baseline survey provides the foundation for the development of future recycling programs and to benchmark existing program performance.

The region in this study was extensive and included a vast area ranging from urban to extremely rural locations.

The total amount of waste observed was 7,270 items, with an average amount of 17.2 items found per site. Overwhelmingly, the most prolific item of categorized litter was take-out/drive through containers (quick service) at 23.92% of litter collected. Of containers collected, branded cups were the most common item, at 14.17%. A correlation between roadside litter and drive-through/take out service is an obvious conclusion.

In an effort to reduce the prevalence of roadside litter, the concept of Extended Producer Responsibility (EPR) has emerged around the world over the past decade. This philosophy advocates that a producer is responsible for its product through its entire life-cycle, beyond just the consumer stage. EPR product stewardship includes system efficiencies that would extend benefits to New Brunswickers.

Stemming from this baseline litter survey, Recycle NB is encouraging the government of New Brunswick to involve industry stakeholders in the process and suggests that EPR stewardship programs be developed and implemented in New Brunswick.

Next steps from this report include a phased system of EPR program adoption for identified priority products and materials. Recycle NB will continue to work toward encouraging and supporting clean manufacturing, pollution prevention and zero waste.

## INTRODUCTION

This study was initiated by Recycle NB in partnership with Encorp Atlantic for the Province of New Brunswick, Department of the Environment to serve as a public document.

Its purpose is to establish province-wide baseline data for visible roadside litter across New Brunswick. Additional surveys may be performed in the future to develop new recycling programs or to benchmark existing program performance.

Across New Brunswick a total of 424 sites were surveyed by University of New Brunswick students. Over 7,200 items were found in the study, which covered more than 8,400 kilometers across the Province.

Recycle NB gratefully acknowledges funding for this study from the New Brunswick Environmental Trust Fund and Encorp Atlantic.

## BACKGROUND

### Litter Survey - Initiation

A province-wide litter survey was commissioned by Recycle NB in partnership with Encorp Atlantic during the summer months of 2012.

The visible litter survey was designed to look at the issue of roadside litter throughout the province of New Brunswick to develop a baseline quantity of waste being discarded near roadways across the province.

The survey examined various types of materials as well as what brands are being discarded most. Now that the initial survey is complete, additional surveys may be performed in the future to develop new recycling programs or to benchmark existing program performance.

## SURVEY METHODOLOGY

### Overview

This study looked at the methodology used for conducting litter audits in various Canadian and US jurisdictions and found that there are several notable surveys from which techniques are adopted for this survey. Many surveys in the US have been performed by Syrek, which lends to a common thread and facilitates direct comparison among all of them. Typically those surveys are using a methodology called “fresh litter counts”, where a site is cleaned, and then researchers return after a set time to count the number of pieces of litter that have been deposited and report the results. This is in contrast to the method outlined in this study which aims to count “accumulated litter” and report those percentages of each brand/ type of waste. Accumulated litter allows for an examination of the occurrence of litter as it has developed over time. Fresh litter count surveys are much more labour intensive than accumulated litter counts and there is little evidence that the percentage of litter types would change based on either method.

In some instances, local environmental groups have done litter counting. These methodologies may not always be scientific in their development and tend not to be reproducible (often the site selection is left entirely to the workers in the field thus you will get a selection of sites which are skewed toward the workers’ ability to remain objective). Measurement techniques need to be unbiased, scientifically rigorous, and reproducible to be defensible. Comparison to other jurisdictions is not usually possible with local methods (for instance engaging a local group to organize the study). In contrast, this survey is designed to be reproducible by using a randomized technique for site selection and careful analysis techniques for mapping at a given site.

This methodology was developed based on several landmark litter surveys including one of the first, the 1993 Florida Centre for Solid and Hazardous Management survey. The Centre had developed a method for surveying litter that will be understandable, simple and statistically valid. MGM Consulting in Canada also performed many surveys over the last 18 years including surveys for Newfoundland, Alberta, five surveys for the city of Toronto as well as other municipalities in the province of Ontario. This survey is largely based on the general approach taken in those surveys so as to ensure a certain consistency in the results found.



## SITE SELECTION PROCESS

### Random Site Selection

In selecting sites to survey it is important to have an unbiased method of selection. The survey teams' goal is to minimize the use of judgment in the field in selecting sites, and rely on the use of GPS data from a predetermined list of locations on roadways throughout New Brunswick. In this way, neither the "dirtiest" nor the "cleanest" locations are picked. The survey teams count litter at sites that are selected well in advance of traveling to the location but some variance may be necessary due to safety concerns.

To select sites for the survey, the total mileage of all numbered routes were first collected in a database. Once that was complete, it was estimated that roughly 400 surveys could be completed during the summer while still leaving some time at the end to compile data and review results. From this it was calculated that there would be approximately one survey completed for every 20 Km of roadway in the province.

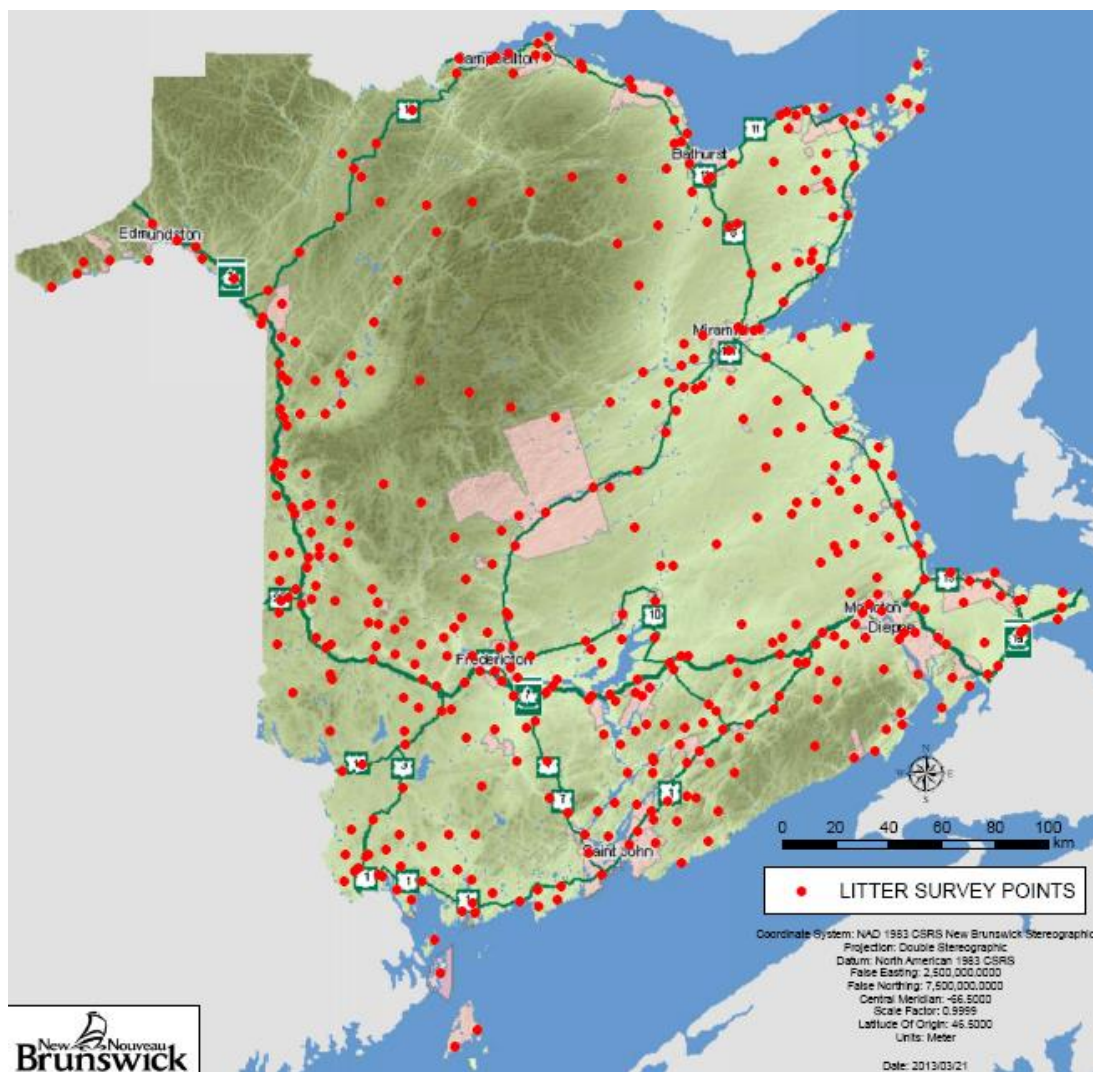
Using this technique the km/survey ratio was applied to all roads in the database in order to generate a list of potential site samples assembled for consideration. It was interesting to note that the number of site locations chosen within the more populated or urban areas within the region versus those sites which represented the rest of the region's rural or country settings was approximately 50/50 or around the same breakout as the population distribution.

While the goal is to have a purely random selection process, safety is paramount. Since the surveys take place on many different types of roads and in many different locations, in many cases it is not safe to randomly locate the survey due to site safety issues (lack of road shoulder, wetlands, difficult terrain, etc.). So although the sites were chosen by GPS initially, the teams are allowed to relocate the survey site near culverts or other features to allow for safety during the survey process.

## Clean Highway Program

The survey took place during the summer months and the team was required to work both quickly and efficiently often in adverse weather conditions in order to complete all the sites. While the sheer number of sites prevented recording all the materials in advance of any annual roadside cleanup efforts (specifically the Adopt-A-Highway program), it is very unlikely to skew the data. Typically most cleanup efforts take place very close to localized centers of population while most of the data points on the survey fall outside a 10km radius from these centers. Some random cleaning of locations may also occur due to Department of Transportation personnel, authorities or even simply concerned citizens.

**Figure 1: Random Site Map**



## Litter Classification

Litter counted for the survey is grouped into 14 major categories:

- Alcoholic beverages (all alcoholic beverage containers including wine, beer, liquor, etc.)
- Automotive (car parts, tires, ATV/snowmobile/dirt-bike parts)
- Bags (paper or plastic)
- Beverage containers (all non-alcoholic beverage containers including milk, energy drinks, diet products, etc.)
- Construction and demolition, C & D (pallets, strapping, insulation, drywall, carpet)
- Confectionery products (candy, chip, cookie bags/wrappers)
- Cups (unbranded take-out, plastic lids, paper cups, Styrofoam cup, etc.)
- Other containers (pickle jar, misc. plastic caps, propane containers, etc.)
- Other Miscellaneous materials (all other items such as mattresses, appliances, medical waste, electronics, household items, textiles such as clothing, footwear, towels, etc.)
- Other packaging (cardboard, boxing, plastic wrap, broken glass, produce clamshell, 6-pk can rings, etc.)
- Paper and fiber material (unbranded paper products, napkins, muffin wrap)
- Printed materials (books, flyers, newspapers, brochures, receipts, etc.)
- Quick service (trays, utensils, straws, Styrofoam bowl, branded cups/napkins/bags, etc.)
- Tobacco products (packaging, foils, dip cans.....cigarette butts were excluded)

## RESULTS

Survey results are based on all items collected and analysed during the survey period of June through August of 2012. Results are based on the quantity of items collected versus volume by weight or by litter size. Minimum size for recording of items was an area of approximately 1 square inch.

The total provincial roadside litter was classified into 14 major categories, namely, in order of prevalence: quick service, miscellaneous, paper and fiber, confectionary/snack, tobacco, alcoholic beverage, other packaging, bags, general beverage, automotive, other containers, cups, printed materials, and construction and demolition (C&D).

The litter identified fell into five major categories of materials: metal, paper, plastic, fiber, glass as well as three major sub-categories: bottles, cups, and cans.

### Total Provincial Litter

The total amount of waste observed was 7,270 items, with an average amount of 17.2 items found per site. When extrapolated using a confidence level of 95%, this gives us a range of total litter on numbered highways throughout New Brunswick of around 4,400,000 to 5,100,000 items.

It is very important to note this survey only included numbered routes, many of which were rural with very low concentrations of surrounding population. Additionally the site selection process began approximately 10 kilometers from any major population center. Therefore if we take these into account it is possible to hypothesize that the true number of litter items in the environment is actually significantly higher than the range given above. Further study of population concentrations versus site locations would be needed in order to draw any further conclusions from the data collected under this study.

### Litter Statistics Across Province

Overwhelmingly, the most prolific item of categorized litter was take-out/drive through containers (quick service) at 23.92% of litter collected, as noted in Figure 2A, 2B and 2C.

Of containers collected, branded cups were the most common item, at 14.17%. Tim Horton's cups were, by far, the largest single brand at 26.67% of branded cups collected as itemized in Figure 4A and 4B.

A correlation between roadside litter and drive-through/take out service is an obvious conclusion.

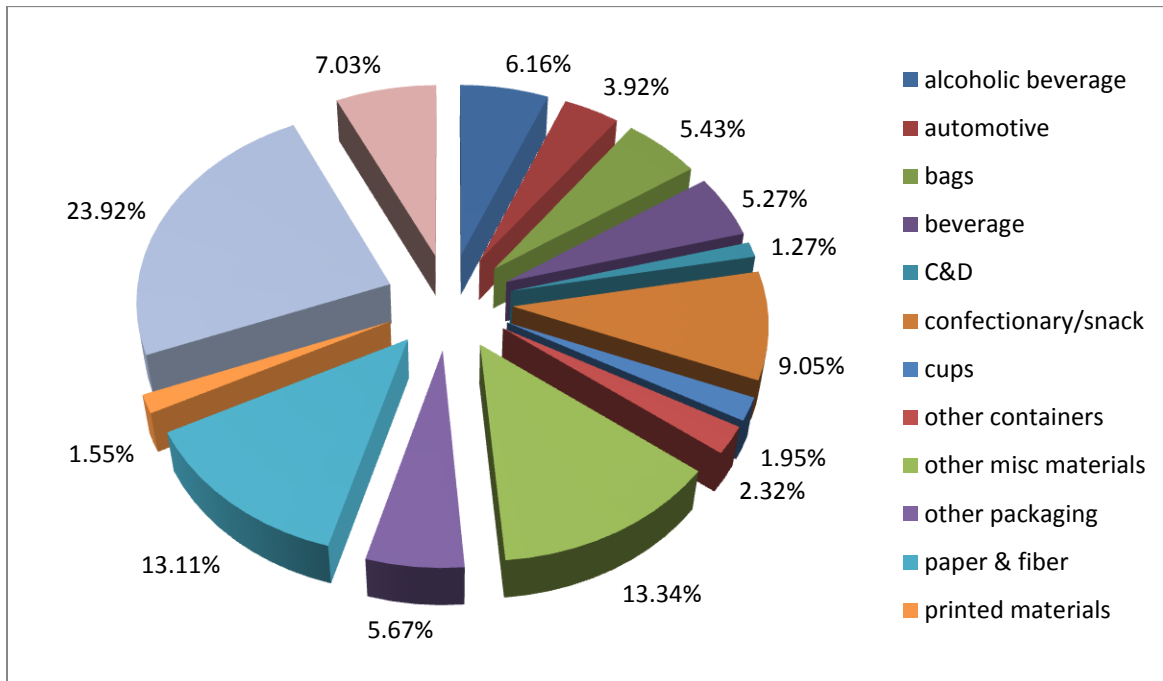
After cups, the next top four single categories were: paper and fiber (13.11%), confectionary/snack (9.05%), tobacco (7.03%), and alcoholic beverages (6.16%).

In sub-categories, the top item was cups at 14.17%, misc. paper at 9.74%, misc. plastic at 8.01%, plastic bags at 7.63% and wrappers at 6.78%.

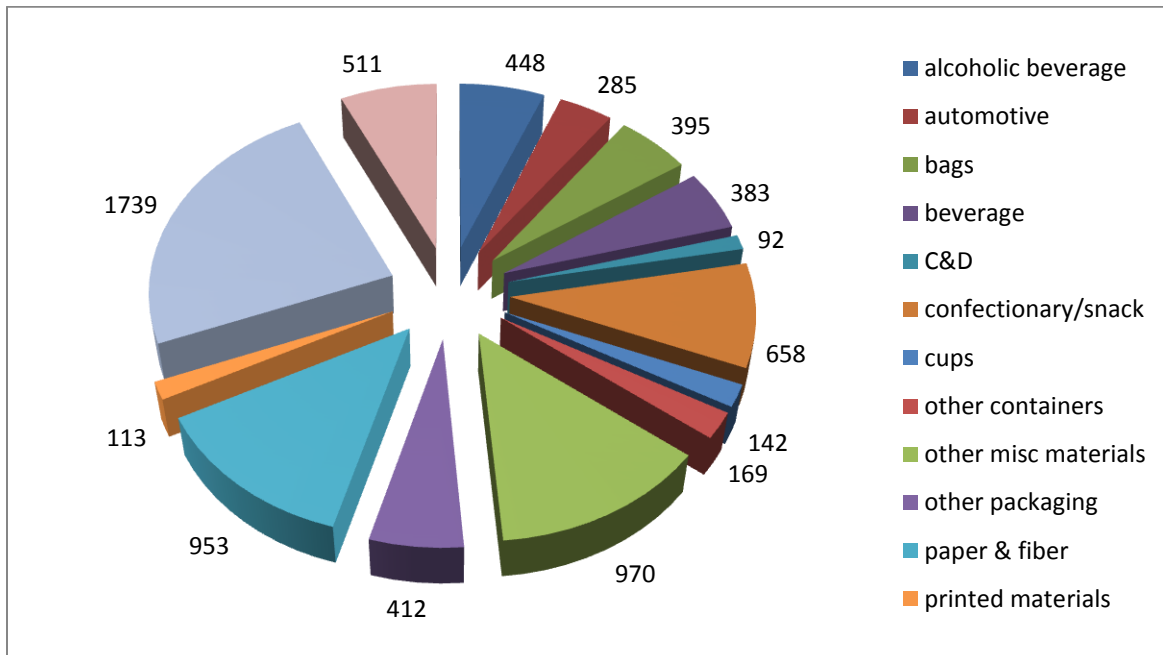
**Figure 2 A: Totals for all major categories across New Brunswick**

Major Category	Percent	# of Items
alcoholic beverage	6.16%	448
automotive	3.92%	285
bags	5.43%	395
beverage	5.27%	383
C&D	1.27%	92
confectionary/snack	9.05%	658
cups	1.95%	142
other containers	2.32%	169
other misc materials	13.34%	970
other packaging	5.67%	412
paper & fiber	13.11%	953
printed materials	1.55%	113
quick service	23.92%	1739
tobacco	7.03%	511
Total	100.00%	7270

**Figure 2 B: Major categories across New Brunswick by percentage**



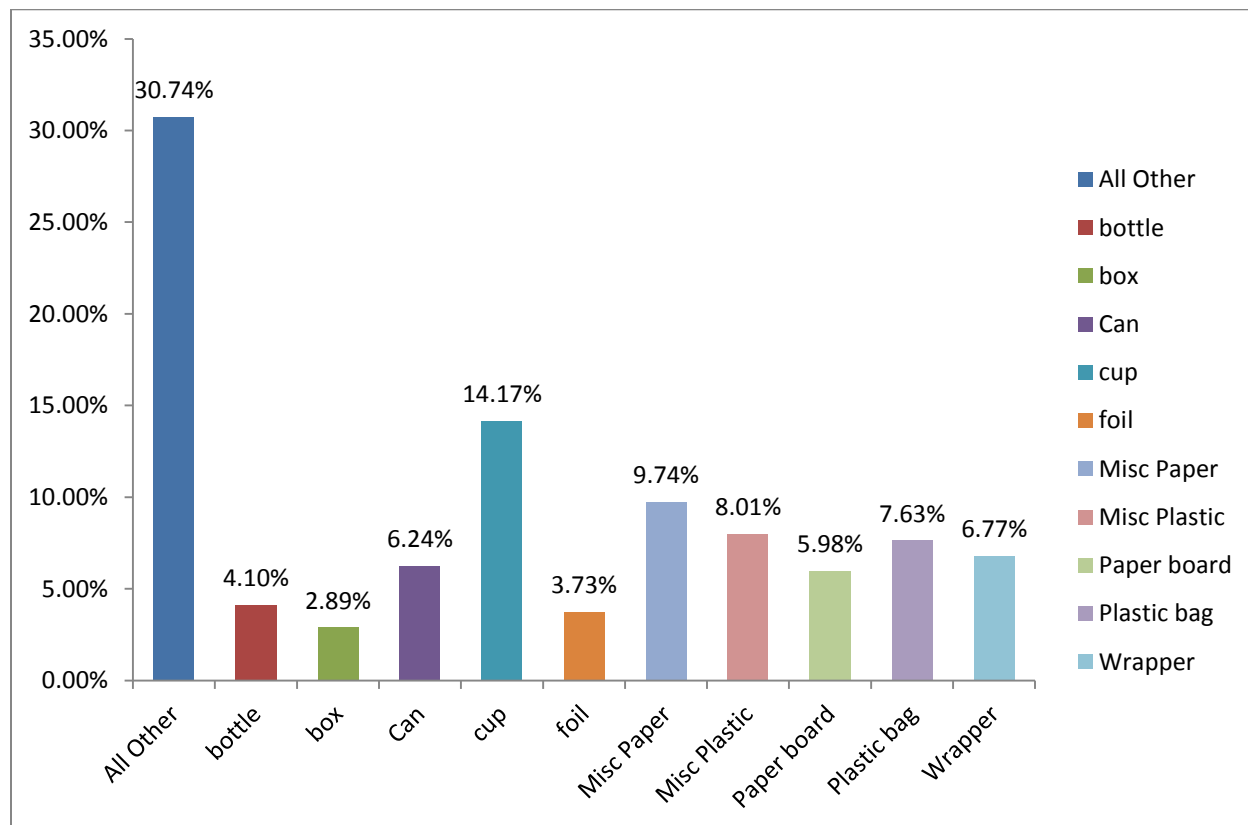
**Figure 2 C: Major categories across New Brunswick by quantity**



**Figure 3 A: Top 10 sub-categories across New Brunswick**

Sub category	Percentage
All Other	30.74%
bottle	4.10%
box	2.89%
Can	6.24%
cup	14.17%
foil	3.73%
Misc Paper	9.74%
Misc Plastic	8.01%
Paper board	5.98%
Plastic bag	7.63%
Wrapper	6.77%
Total	100.00%

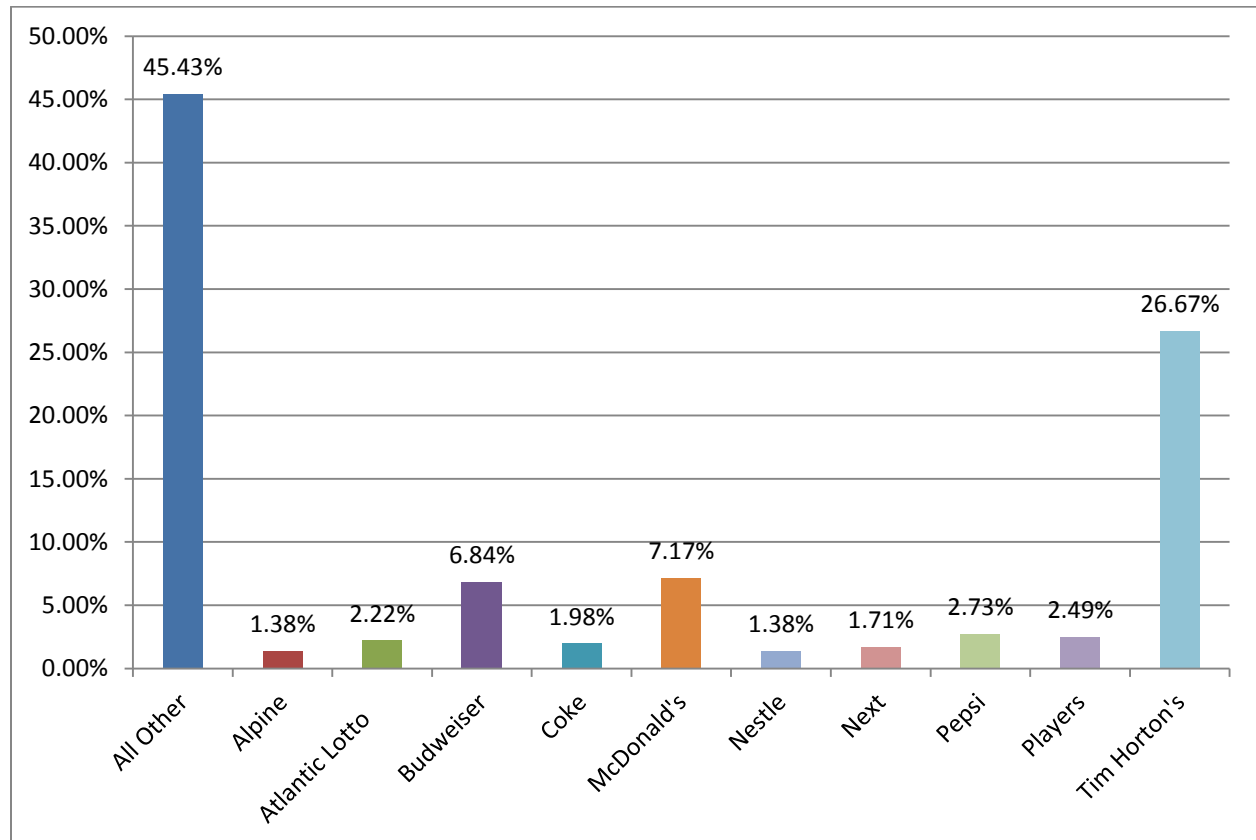
**Figure 3 B: Top 10 sub-categories across New Brunswick**



**Figure 4 A: Top 10 brands across New Brunswick**

Brand	Percentage
All Other	45.43%
Alpine	1.38%
Atlantic Lotto	2.22%
Budweiser	6.84%
Coke	1.98%
McDonald's	7.17%
Nestle	1.38%
Next	1.71%
Pepsi	2.73%
Players	2.49%
Tim Horton's	26.67%
Total	100.00%

**Figure 4 B: Top 10 brands across New Brunswick**





## Cleanliness of Individual Sites

The study took place across a vast region of area to be sampled ranging from urban to extremely rural locations. As such, it was assumed that the most rural locations would be the cleanest simply due to the lack of any significant population inhabiting that area. Despite this fact, there were only 53 sites (12.5% of all sites) with five or less litter items found and only two of those sites were completely clean (zero items found).

Inversely, when talking about the dirtiest sites in the province, there were a few which stood out particularly near larger population centers as would be expected. Again, it would be important when analyzing the data to factor for population densities in order to get a relative idea of how dirty the sites are compared to one another. We also noted several dirty sites were not necessarily within a large population center, but were likely along heavy commuter routes, likely contributing to the potential for litter accumulation in those areas.

**Figure 5: Top 10 sites by number of items found**

Route #	Postal Code	Region	County	Nearest Municipality	# items found
102	E3E	11	York	Fredericton	122
15	E1C	7	Westmoreland	Moncton	83
102	E5M	11	Queens	Upper Gagetown (Oromocto)	76
106	E1G	7	Westmoreland	Allison (Moncton)	74
620	E6B	11	York	Tay Creek (Stanley)	74
108	E9E	5	Northumberland	Renous (Miramichi)	66
102	E2V	11	Sunbury	Burton (Oromocto)	55
176	E5H	10	Charlotte	Pennfield (Black's Harbour)	55
102	E3B	11	York	Lincoln (Fredericton)	54
105	E3Y	1	Victoria	Drummond (Grand Falls)	53

## CONCLUSIONS

In an effort to reduce the prevalence of roadside litter, the concept of Extended Producer Responsibility (EPR) has emerged around the world over the past decade. This philosophy advocates that a producer is responsible for its product through its entire life-cycle, beyond just the consumer stage. Thus, a producer assumes responsibility for the waste management of its product after purchase and consumption.

As the most prolific categories of litter were take-out/drive-through containers (quick service) at 23.92% of litter collected, and branded cups at 14.17%, the application of EPR would extend responsibility for reducing this litter to the producer.

EPR product stewardship includes system efficiencies that would extend benefits to New Brunswickers. Based on this baseline litter survey, Recycle NB would encourage the government of New Brunswick to involve industry stakeholders in the process and develop active EPR regulations. Local government authorities, and by default taxpayers, should be relieved from the legal, physical, socio-economic and financial impact of waste management for the most prevalent categories of roadside litter.

The overall benefits to New Brunswickers of implementing the EPR concept are:

- EPR shifts end-of-life costs to the producer, rather than the taxpayer
- Producers have an incentive to redesign products and manage their end-of-life disposal
- EPR creates incentives for producers to “green” package design
- EPR promotes innovation in recycling and re-using consumer product packaging
- EPR creates a framework for continual program development
- EPR reduces carbon footprints of packaged material through re-use and recycling
- EPR programs further New Brunswick’s path towards zero waste

The Canadian Council of Ministers of the Environment (CCME) has approved a Canada-wide Action Plan for EPR. Recycle NB suggests that EPR stewardship programs be developed and implemented in New Brunswick.

Beginning with this baseline litter survey, a phased EPR program can be adopted for identified priority products and material. This will help to reduce litter on our highways in the future as more programs, especially a program for packaging and printed paper, due to be studied in 2013, are enacted.

Recycle NB will continue to work toward encouraging and supporting clean manufacturing, pollution prevention and zero waste.

## Total Regional Litter

In addition to looking at the Provincial level, this study also broke down the data according to the new Regional Service Commissions (RSCs) being created.

According to the New Brunswick Department of Environment and Local Government's "Action Plan for a new Local Governance System" the 24 single-purpose commissions looking after solid waste management and planning services for the province will be reduced to 12 multi-purpose commissions. The new RSC structure will increase opportunities for New Brunswick communities to work together on regional issues, with increased decision-making power and greater accountability to taxpayers.

These new commissions will include:

- Regional Planning
- Local Planning in Local Service Districts
- Solid Waste Management
- Regional Policing Collaboration
- Regional Emergency Measures Planning
- Regional Sport, Recreational, and Cultural Infrastructure Planning and Cost-Sharing

The solution for the litter problem will likely come from a combination of efforts, especially considering the benefit of understanding what categories are more problematic for specific regions. As discussed above, further study based on population densities could also help target certain areas for improvement.

## Litter Statistics across Regions

Overall, rural locations were the cleanest due to the lower population inhabiting those areas. The dirtiest sites in the province were two large urban centres (Fredericton and Moncton). The

survey identified several dirty sites that were not large population centers, but included heavy commuter routes which likely contributed to the larger litter accumulated in those areas.

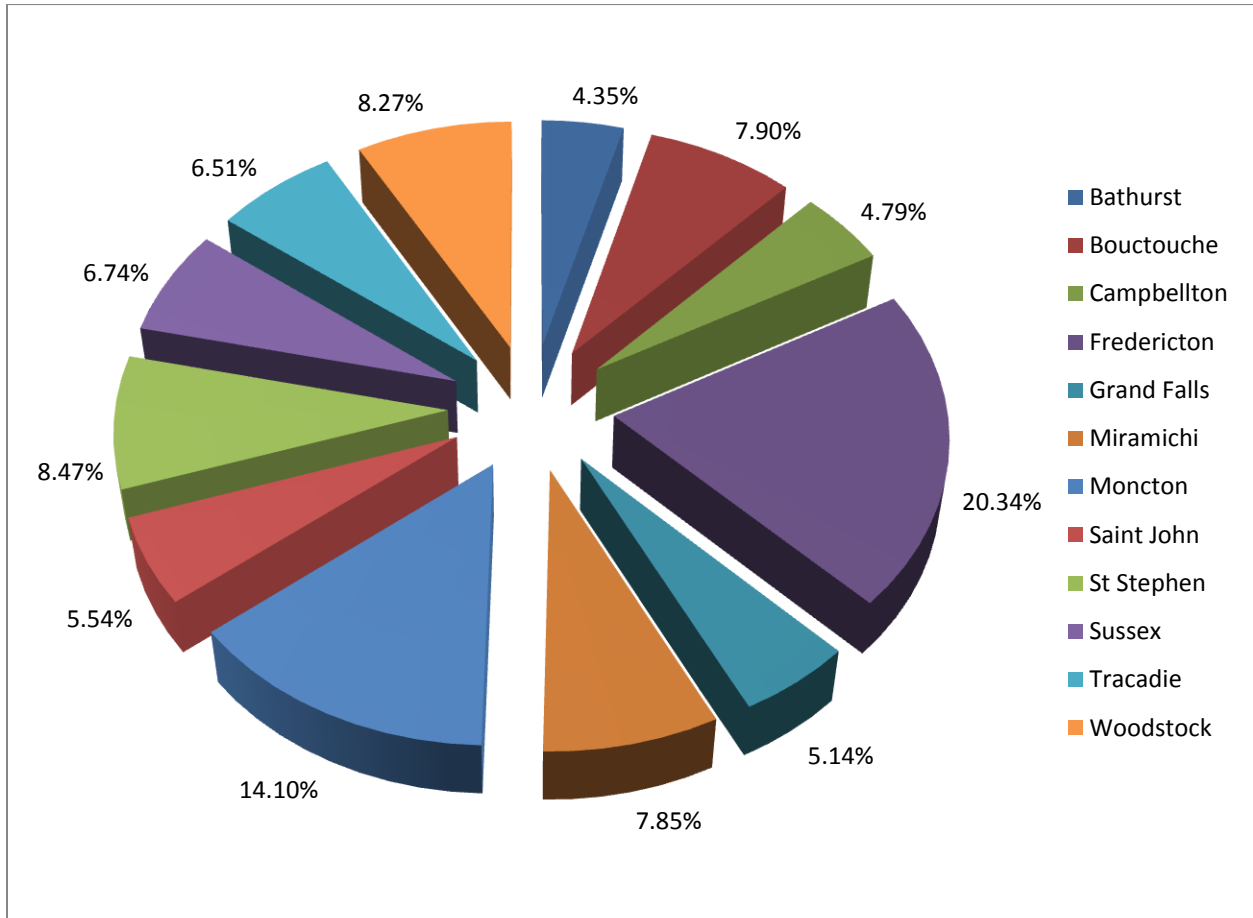
The region with the most roadside litter was the urban area of Fredericton at 20.34%. It had, by far, the most roadside litter. Moncton, another urban area, had the second most litter at 14.10%. Interestingly, the second largest urban area in the province, Saint John, had significantly lower roadside litter at 5.54%. This anomaly should be a focus of a follow-up survey to determine if the urban, industrial area of Saint John continues to produce roadside litter in quantities consistent with rural areas such as Tracadie (6.51%) and Grand Falls (5.14%).

Figure 5 denotes the distribution of litter across each region of New Brunswick. For the breakdown by each region, refer to Appendix 3.

**Figure 6 A: Distribution across all regions for total litter**

Region	Percent	Number of Items
Bathurst	4.35%	316
Bouctouche	7.90%	574
Campbellton	4.79%	348
Fredericton	20.34%	1479
Grand Falls	5.14%	374
Miramichi	7.85%	571
Moncton	14.10%	1025
Saint John	5.54%	403
St Stephen	8.47%	616
Sussex	6.74%	490
Tracadie	6.51%	473
Woodstock	8.27%	601
Total	100.00%	7270

Figure 6 B: Distribution across all regions for total litter



## Total County Litter

In addition to looking at the provincial level, this study also broke down the data according to the Parish/County system which had served to divided the province.

This system allows us to further study the litter by household since counties continue to be used as an organizational unit, along with parishes, for registry of real-estate, and to some extent, taxation. It is also common to find county outlines on provincial maps.

## Litter Statistics across Counties

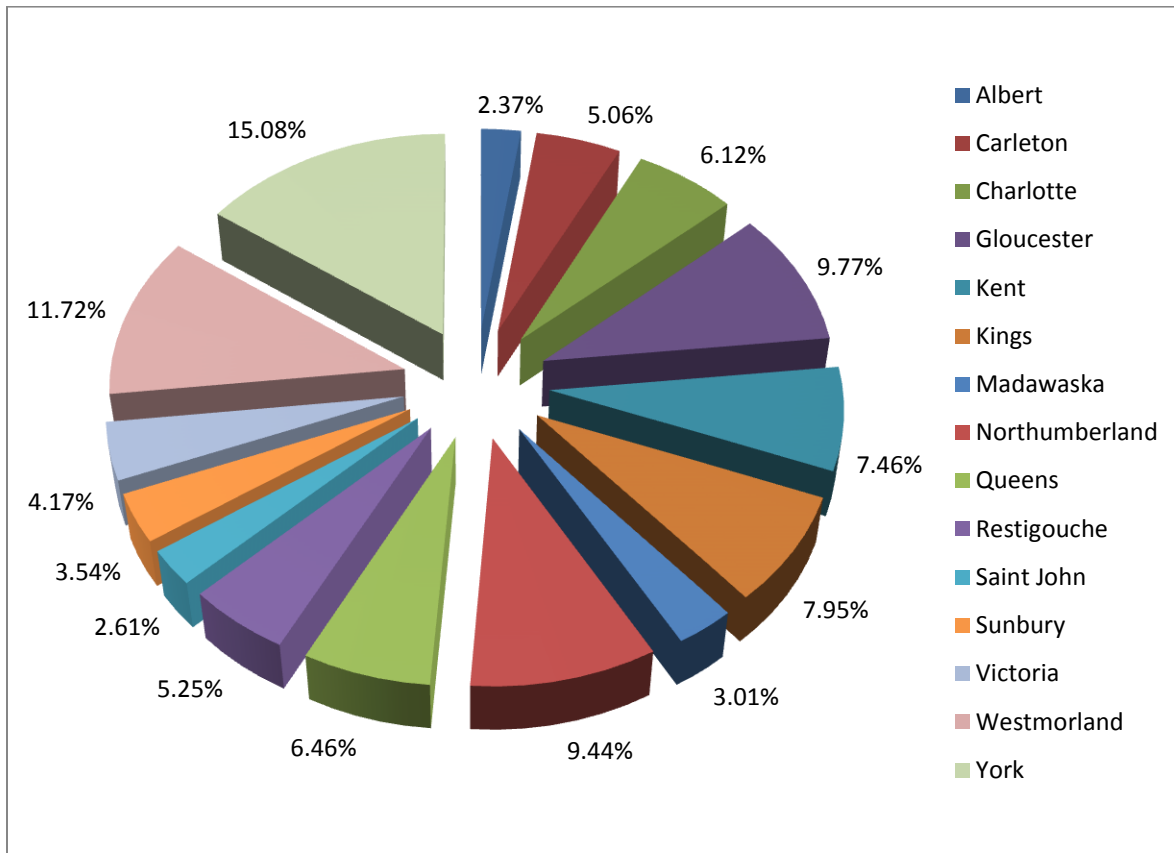
York and Westmorland counties led the province in roadside litter at 15.08% and 11.72% respectively. These counties include the two largest urban roadside litter communities of Fredericton and Moncton.

The two counties with the lowest roadside litter are Albert and Saint John counties at 2.37% and 2.61% respectively.

**Figure 7 A: Distribution across all Counties for total litter**

Region	Percent	Number of Items
Albert	2.37%	172
Carleton	5.06%	368
Charlotte	6.12%	445
Gloucester	9.77%	710
Kent	7.46%	542
Kings	7.95%	578
Madawaska	3.01%	219
Northumberland	9.44%	686
Queens	6.46%	470
Restigouche	5.25%	382
Saint John	2.61%	190
Sunbury	3.54%	257
Victoria	4.17%	303
Westmorland	11.72%	852
York	15.08%	1096
Total	100.00%	7270

**Figure 7 B: Distribution across all Counties for total litter**



**Total Litter by Major Category**

This study is designed to provide an initial baseline for understanding the amount of litter in the environment, as well as to help show which types of litter are contributing most to the issue so that solutions may be found. In order to study this area, a cross-section of each of the largest contributing Major Categories was performed.



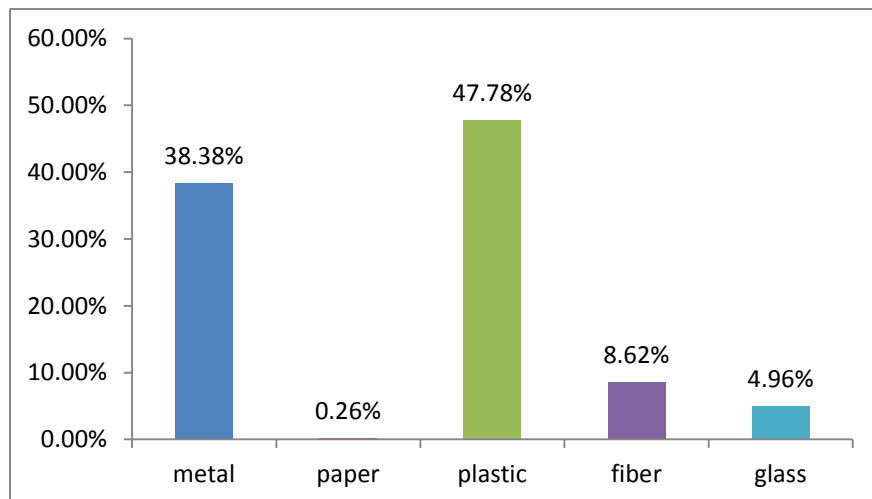
## Beverage Containers

Beverage containers amounted to more than 5% of all litter collected throughout the province. The litter found was primarily made of either metal (cans) or plastic (bottles) across many different types of brands and beverage types including primarily soft drink, energy drinks and dairy beverages. It was interesting to note that just two brands (Coke and Pepsi) together made up more than 38% of the beverage container litter.

**Figure 8 A: Beverage container materials by percentage**

Material	Percent	Number of Items
metal	38.38%	147
paper	0.26%	1
plastic	47.78%	183
fiber	8.62%	33
glass	4.96%	19
Total	100.00%	383

**Figure 8 B: Beverage container materials by percentage**



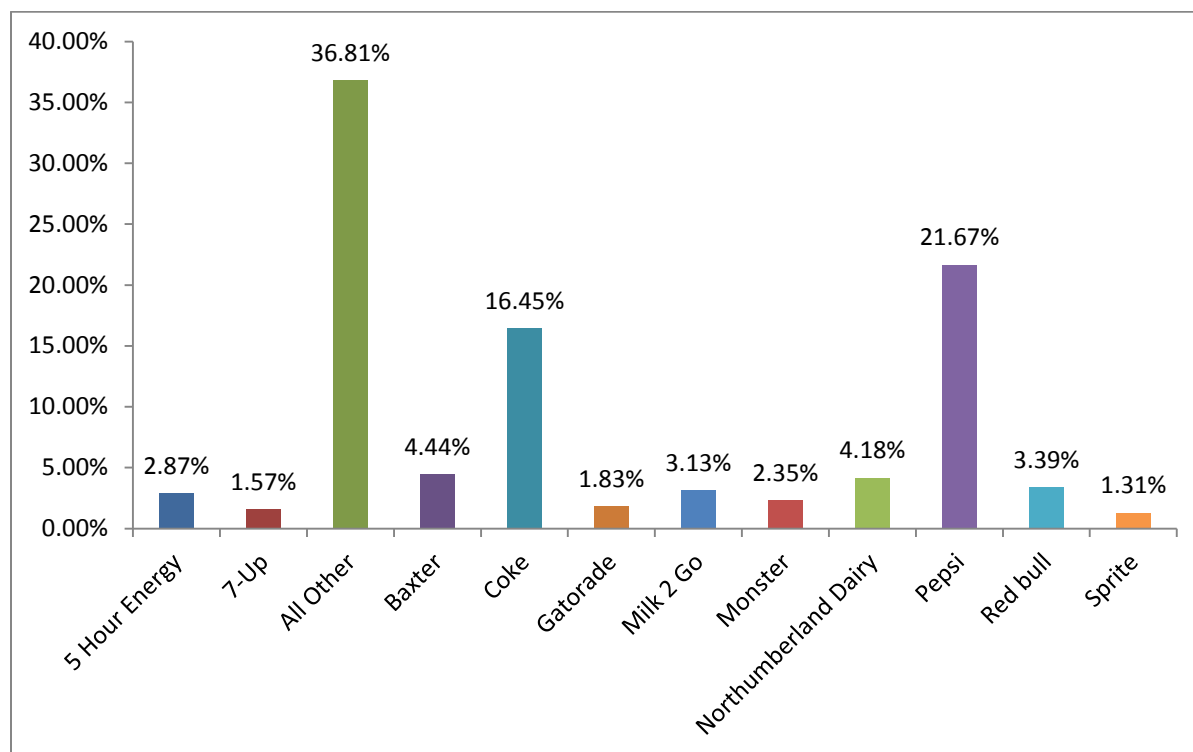


**Figure 9 A: Major categories, beverage containers by brand**

(Brand for which at least five items were found)

Brand	Percent	Number of Items
5 Hour Energy	2.87%	11
7-Up	1.57%	6
All Other	36.81%	141
Baxter	4.44%	17
Coke	16.45%	63
Gatorade	1.83%	7
Milk 2 Go	3.13%	12
Monster	2.35%	9
Northumberland Dairy	4.18%	16
Pepsi	21.67%	83
Red Bull	3.39%	13
Sprite	1.31%	5
Total	100.00%	383

**Figure 9 B: Major categories, beverage containers by brand**



## Alcoholic Beverage Containers

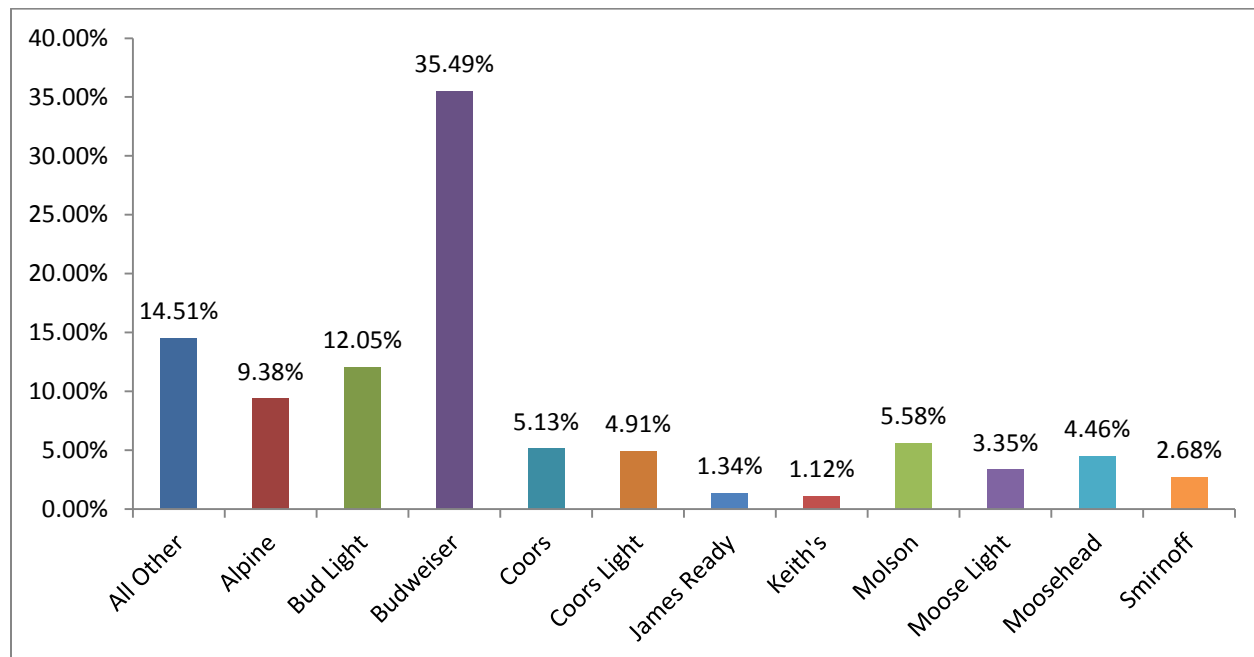
From the previous Figure 2, we know that alcoholic beverage containers represent more than 6% of all litter collected throughout the province. The litter found was primarily made of either metal (cans) or glass (bottles), but there was a smaller percentage of plastic (containers, rings, caps) as well as paper used for packaging purposes. As noted in Figure 10, it was clear that Budweiser (Budweiser and Bud Light) made up more than 47% of all the litter found in this category. Looking at the data under the sub-category of Cans in Figure 11, it was interesting to note that a further 73.3% of all cans found (with at least five items from the same brand) were from the Alcoholic Beverage Category.

### Figure 10 A: Alcoholic Beverage by Brand

(Brand for which at least 5 items found)

Brand	Percent	Number of Items
All Other	14.51%	65
Alpine	9.38%	42
Bud Light	12.05%	54
Budweiser	35.49%	159
Coors	5.13%	23
Coors Light	4.91%	22
James Ready	1.34%	6
Keith's	1.12%	5
Molson	5.58%	25
Moose Light	3.35%	15
Moosehead	4.46%	20
Smirnoff	2.68%	12
Total	100.00%	448

**Figure 10 B: Alcoholic Beverages by Brand**

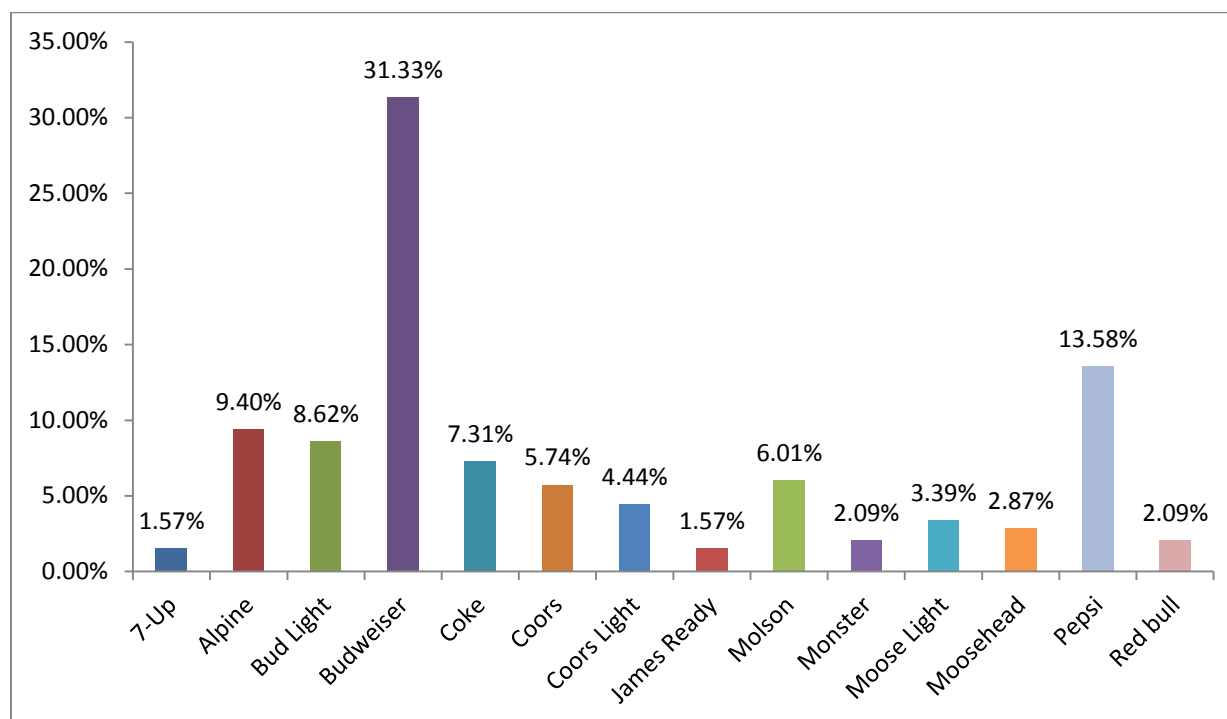


**Figure 11 A: Sub-Category - Cans by Brand**

(Brand for which at least 5 items found)

Brand	Percent	Number of Items
7-Up	1.57%	6
Alpine	9.40%	36
Bud Light	8.62%	33
Budweiser	31.33%	120
Coke	7.31%	28
Coors	5.74%	22
Coors Light	4.44%	17
James Ready	1.57%	6
Molson	6.01%	23
Monster	2.09%	8
Moose Light	3.39%	13
Moosehead	2.87%	11
Pepsi	13.58%	52
Red Bull	2.09%	8
Total	100.00%	383



**Figure 11 B: Sub-Category - Cans by Brand**

## Quick Service

Quick service tends to be a lightning rod for similar studies on litter. The primary reason is that it typically represents the highest percentage of total identifiable waste found. The 2012 Litter Survey's field work showed that Quick Service represented nearly a quarter (23.92%) of all litter collected throughout the province.

The litter found was primarily made of either paper or plastic, and was comprised of a wide variety of items including cups, napkins, bags, plates, trays, utensils, wrappers and condiments among others.

In terms of brands, Tim Horton's (51.01%) and McDonald's (13.51%) together represented nearly 65% of all litter found under this category. When broken out further under the sub-

category of Cups, the division becomes even more extreme with Tim Horton's (71.70%) and McDonald's (13.29%) together representing nearly 85% of all litter found.

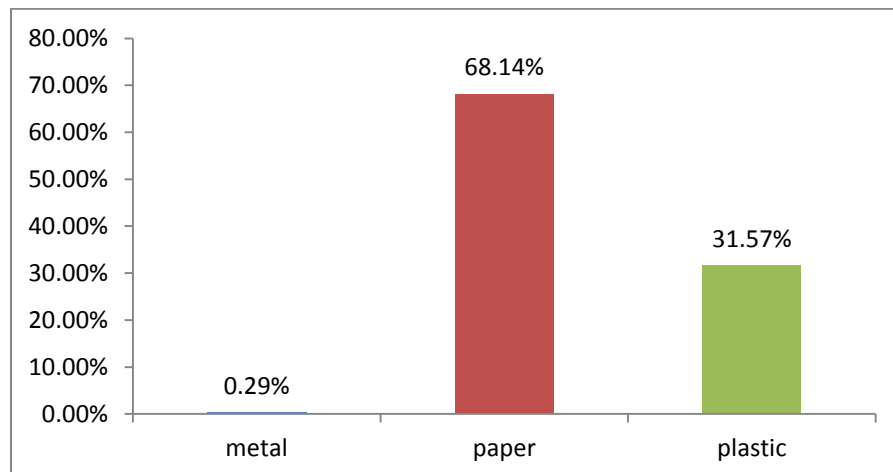
In terms of sub categories, it was hypothesized that Quick Service beverage articles (cups, lids, straws) were more likely than other items to be found littering highways. This was perhaps due to the fact people may be finishing their meals on-site, and take the drinks (often a refill) with them in the vehicle.

We should also note that due to safety concerns, the site surveyors were instructed not to open any of the bags or containers found in the field. This means that, for example, should someone have thrown a bag full of Quick Service items out the car window, it would have been classified only as a single Quick Service bag. Given the circumstances, it is reasonable to make the assumption that the total number of items collected, as well as those classified as quick service, would both increase if the bags had been opened.

**Figure 12 A: Major Category - Quick Service by Material**

Material	Percent	Number of Items
metal	0.29%	5
paper	68.14%	1185
plastic	31.57%	549
Total	100.00%	1739

**Figure 12 B: Major Category - Quick Service by Material**

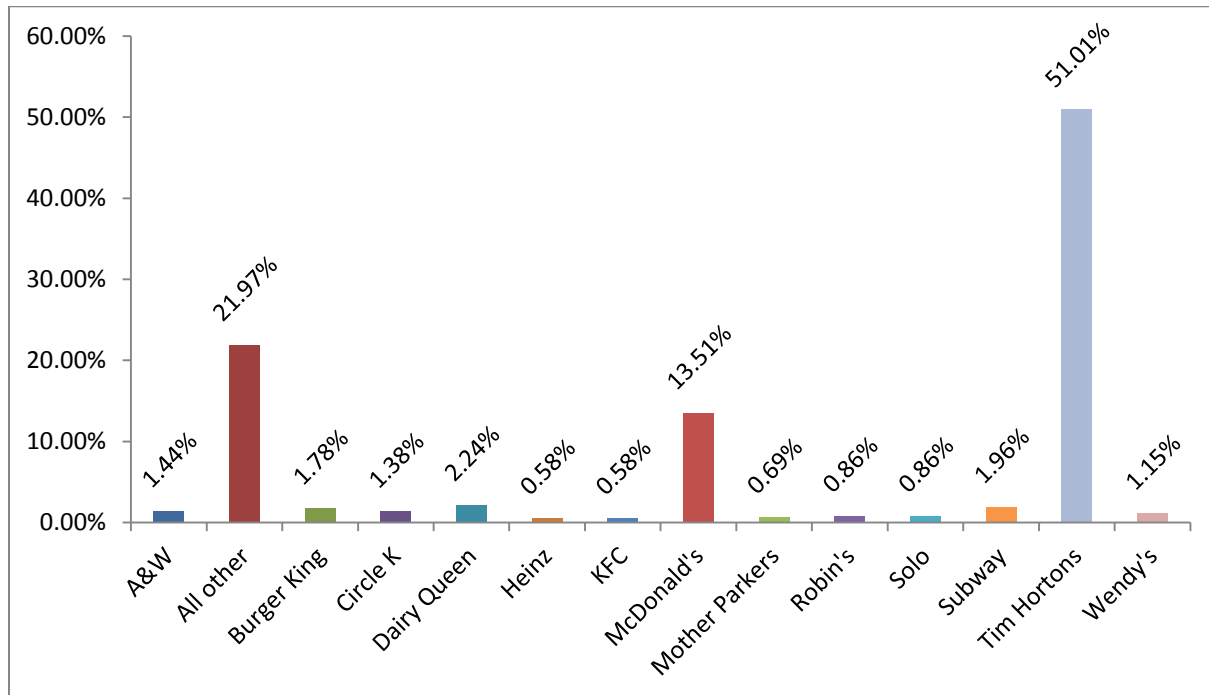


**Figure 13 A: Major Category - Quick Service by Brand**

(Brand for which at least 10 items found)

Brand	Percent	Number of Items
A&W	1.44%	25
All other	21.97%	382
Burger King	1.78%	31
Circle K	1.38%	24
Dairy Queen	2.24%	39
Heinz	0.58%	10
KFC	0.58%	10
McDonald's	13.51%	235
Mother Parkers	0.69%	12
Robin's	0.86%	15
Solo	0.86%	15
Subway	1.96%	34
Tim Horton's	51.01%	887
Wendy's	1.15%	20
Total	100.00%	1739

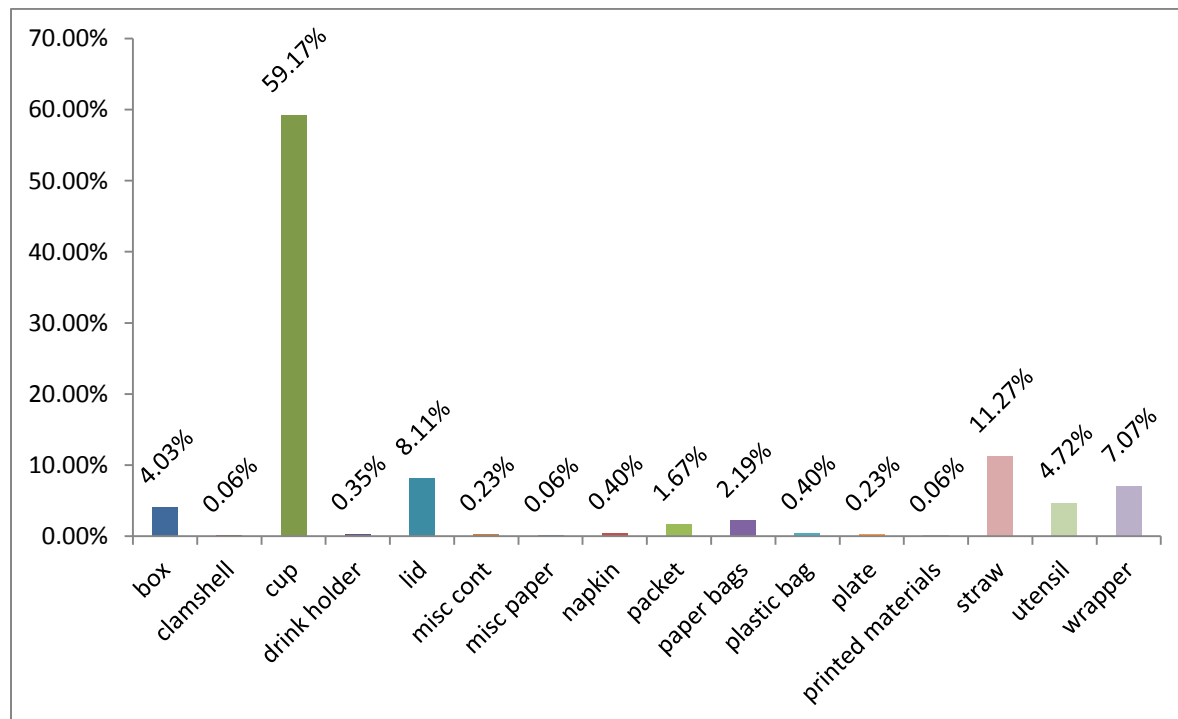
**Figure 13 B: Major Category - Quick Service by Brand**



**Figure 14 A: Major Category - Quick Service by Sub-category**

Sub Category	Percent	Number of Items
box	4.03%	70
clamshell	0.06%	1
cup	59.17%	1029
drink holder	0.35%	6
lid	8.11%	141
misc cont	0.23%	4
misc paper	0.06%	1
napkin	0.40%	7
packet	1.67%	29
paper bags	2.19%	38
plastic bag	0.40%	7
plate	0.23%	4
printed materials	0.06%	1
straw	11.27%	196
utensil	4.72%	82
wrapper	7.07%	123
Total	100.00%	1739

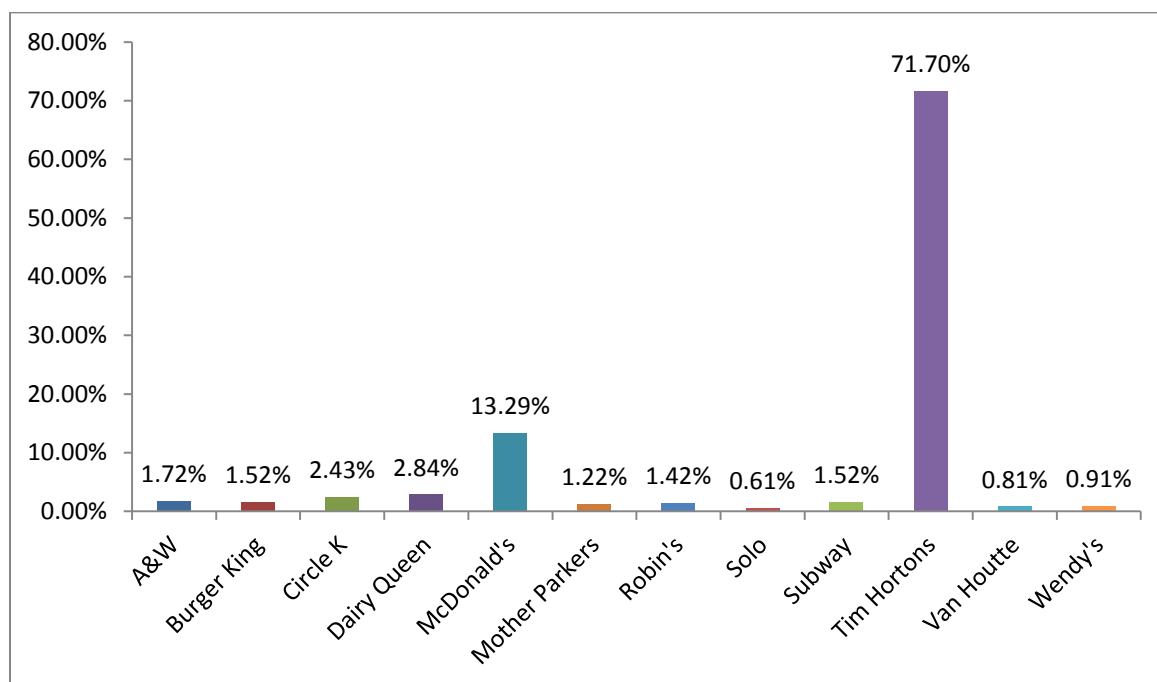
**Figure 14 B: Major Category - Quick Service by Sub-category**



**Figure 15 A: Sub-Category - Cups by Brand**  
**(Brand for which at least five items found)**

Brand	Percent	Number of Items
A&W	1.72%	17
Burger King	1.52%	15
Circle K	2.43%	24
Dairy Queen	2.84%	28
McDonald's	13.29%	131
Mother Parkers	1.22%	12
Robin's	1.42%	14
Solo	0.61%	6
Subway	1.52%	15
Tim Horton's	71.70%	707
Van Houtte	0.81%	8
Wendy's	0.91%	9
Total	100.00%	986

**Figure 15 B: Sub-Category - Cups by Brand**





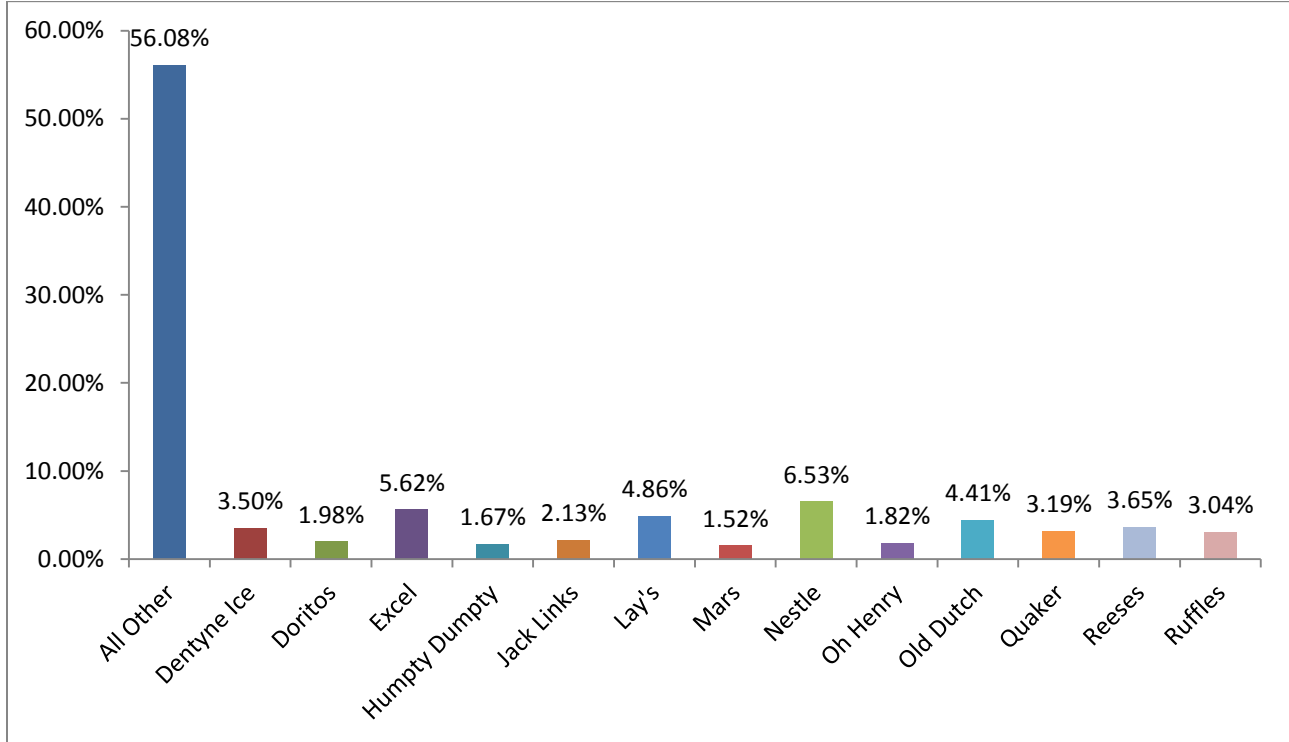
## Confectionary

Confectionary litter represents more than 9% of all litter collected throughout the province. The litter found was primarily made of paper, plastic or a composite material, which is often made from plastic/aluminum. This category represented the largest variety of brands classified under any major category. While Nestle (6.53%) was the most common brand found as litter in this category, the grouping was well distributed. This meant that most contributed relatively equally to the total amount of confectionary litter.

**Figure 16 A: Major Category - Confectionary/snack by Brand**  
(Brand for which at least 10 items found)

Brand	Percent	Number of Items
All Other	56.08%	369
Dentyne Ice	3.50%	23
Doritos	1.98%	13
Excel	5.62%	37
Humpty Dumpty	1.67%	11
Jack Links	2.13%	14
Lay's	4.86%	32
Mars	1.52%	10
Nestle	6.53%	43
Oh Henry	1.82%	12
Old Dutch	4.41%	29
Quaker	3.19%	21
Reeses	3.65%	24
Ruffles	3.04%	20
Total	100.00%	658

**Figure 16 B: Major Category - Confectionary/snack by Brand**



**Tobacco**

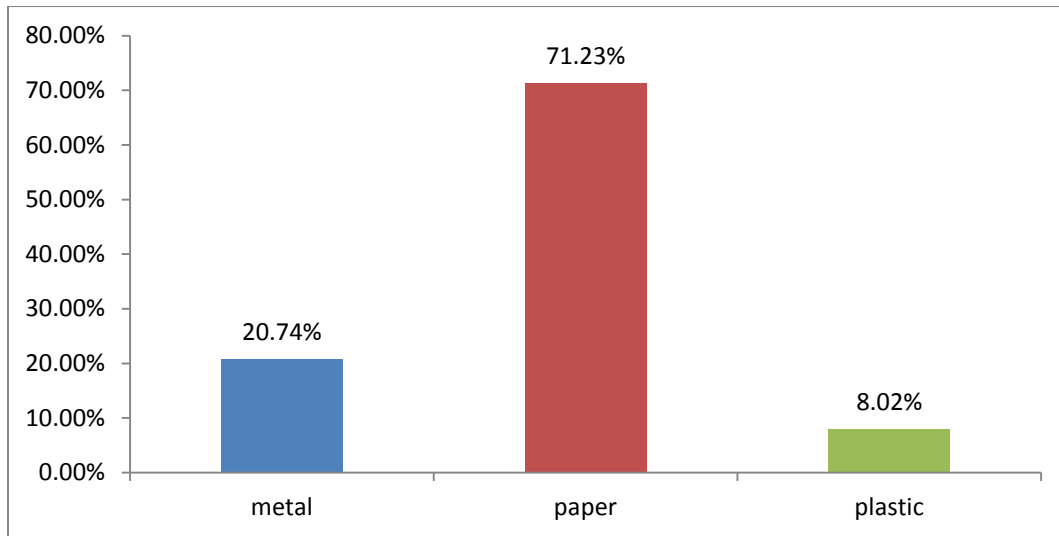
Litter from tobacco products represents more than 7% of all litter collected throughout the province. The litter found was primarily made of paper (cartons, packages), plastic (wrapping), or metal (typically aluminum foils). Together the two most prevalent brands, Players (23.87%) and Next (11.15%) made up more than 35% of all the litter found under this category. As mentioned earlier in the study, no cigarette butts were counted primarily because doing so would be extremely time consuming and would have likely limited the total number of sites the survey could complete during the summer.



**Figure 17 A: Major Category - Tobacco by Materials**

Material	Percent	Number of Items
metal	20.74%	106
paper	71.23%	364
plastic	8.02%	41
Total	100.00%	511

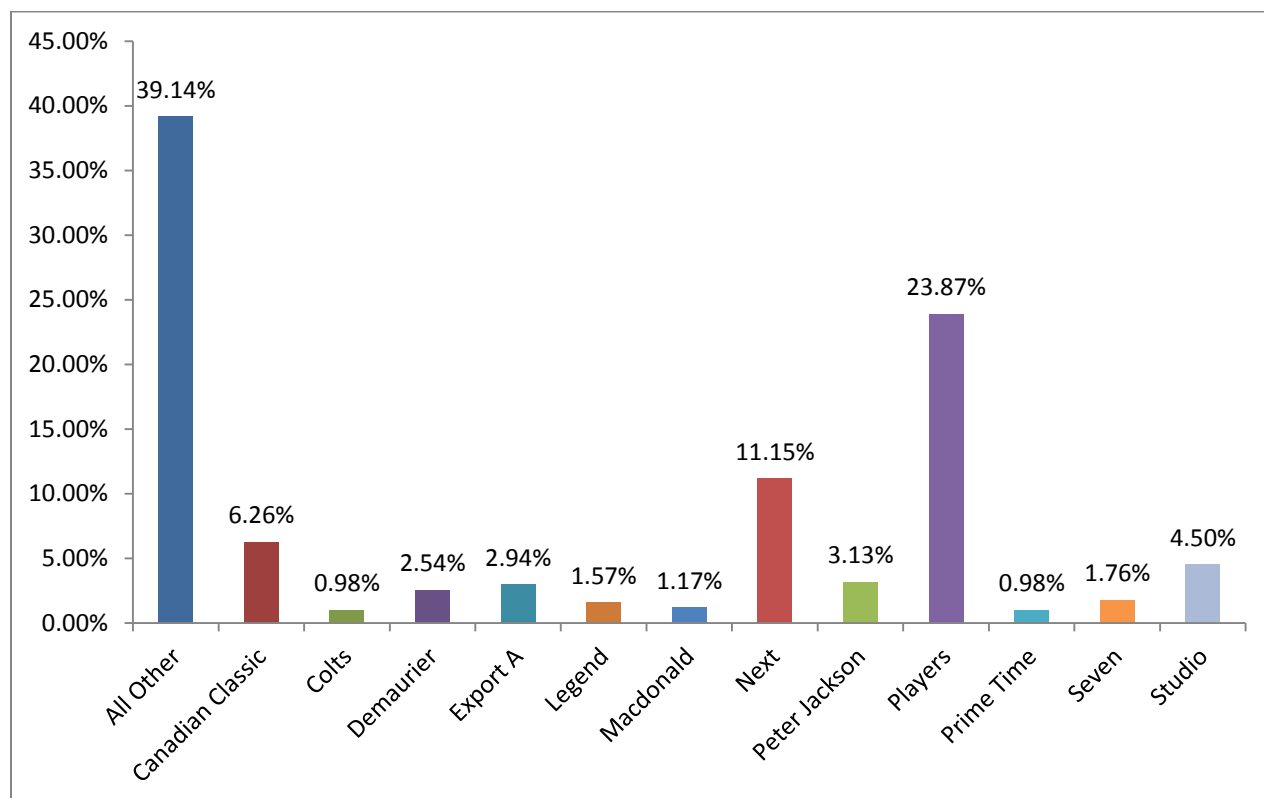
**Figure 17 B: Major Category - Tobacco by Materials**



**Figure 18 A: Major Category - Tobacco by Brand**

Brand	Percent	Number of Items
All Other	39.14%	200
Canadian Classic	6.26%	32
Colts	0.98%	5
DuMaurier	2.54%	13
Export A	2.94%	15
Legend	1.57%	8
Macdonald	1.17%	6
Next	11.15%	57
Peter Jackson	3.13%	16
Players	23.87%	122
Prime Time	0.98%	5
Seven	1.76%	9
Studio	4.50%	23
Total	100.00%	511

**Figure 18 B: Major Category - Tobacco by Brand**



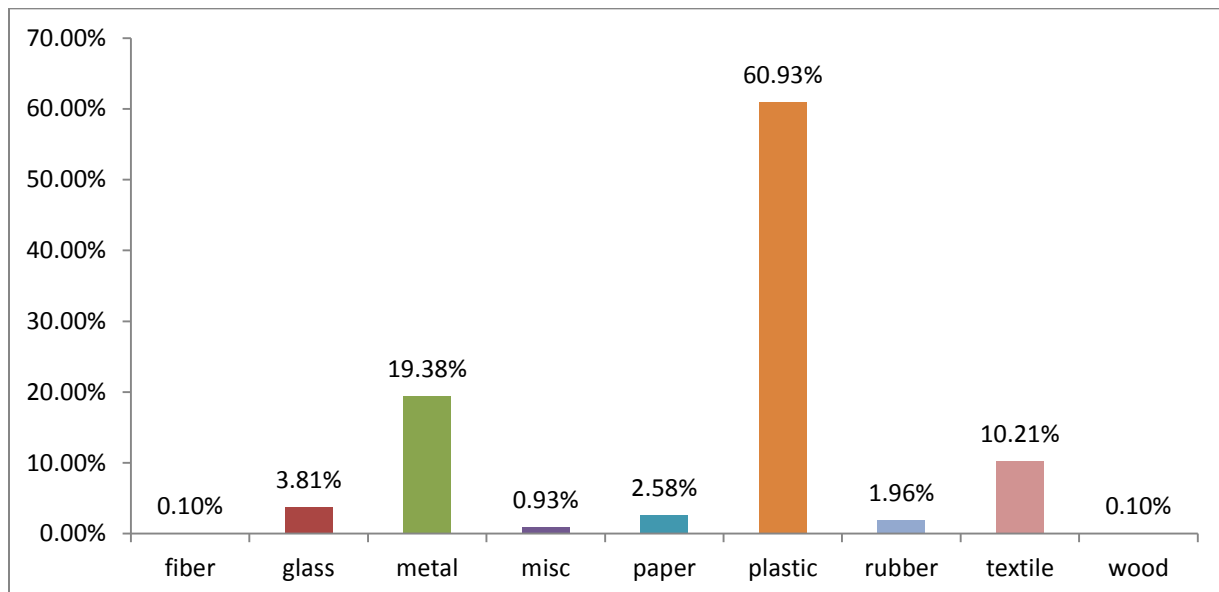
### Miscellaneous Materials

While rather non-descript, other miscellaneous materials actually represents a relatively significant number of items, particularly those made of plastic. The items in this category are primarily made up of those which would otherwise be part of another segment, but may have been exposed to the elements in such a way that any traces of branding are no longer visible. Overall these brand-less items mostly comprised of plastic, metal and textile materials represent approximately 13.3% of the total litter found in the survey.

**Figure 19 A: Major Category - Other miscellaneous materials**

Material	Percent	Number of Items
fiber	0.10%	1
glass	3.81%	37
metal	19.38%	188
misc	0.93%	9
paper	2.58%	25
plastic	60.93%	591
rubber	1.96%	19
textile	10.21%	99
wood	0.10%	1
Total	100.00%	970

**Figure 19 B: Major Category - Other miscellaneous materials**



## Appendix 1

### Survey Methodology

#### Conducting a Site Survey

Teams are paired in groups of two. Each team works independently, reporting their activities to the Manager of the project. Upon being assigned site files each surveying team travels to the sites.

Teams review their personal equipment checklist before departure for any sites:

- Medications taken on a regular basis
- Allergy treatments as needed
- Insect repellent, sunscreen and hat
- Bottled water /water filter devices
- Rain gear (coat, pants, etc)
- Personal protective equipment (PPE) such as gloves, work boots, etc.
- Flashlight
- Cell phone must be fully charged and carried on your person at all times

Teams also review/inspect the survey equipment prior to departure:

- First aid kit and first aid manual
- Vehicle emergency kit (flares, jumper cables, etc.)
- Measuring wheel
- Flag markers
- Trash poker
- Voice recorders
- GPS
- Cell phone
- Cameras
- Laptops
- DC to AC inverter (for charging electronics)

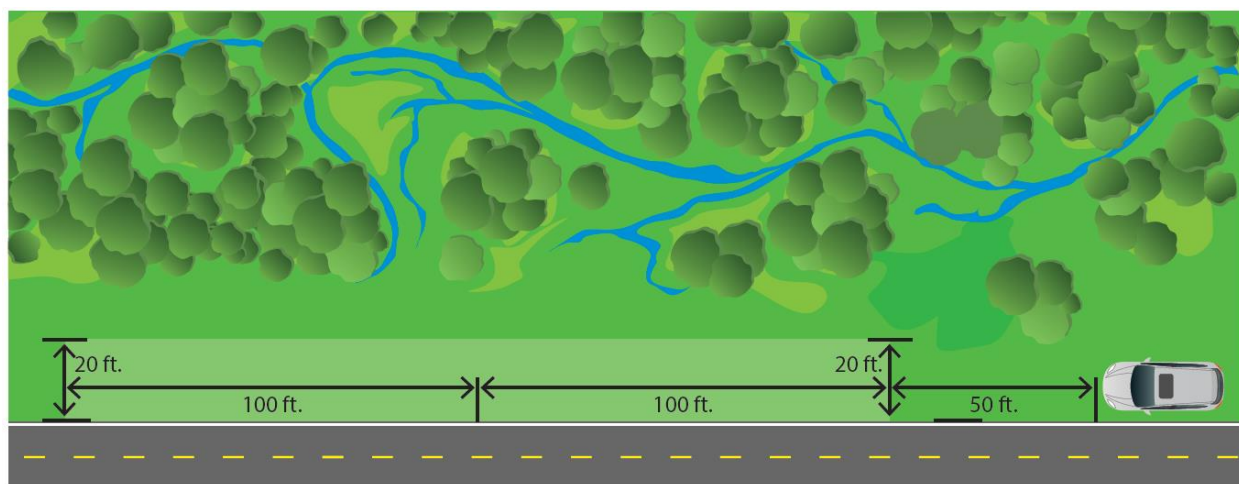
Upon arriving at a site, the teams safely park their vehicles. Traffic cones are placed behind the vehicle, and team members dress in fluorescent orange/ yellow traffic vests to increase visibility

then don appropriate PPE (personal protective equipment) for field work. The teams then report their arrival to the Project Manager by instant messaging on their cellular telephone.

Beginning at the front of the parked car, the team uses a "wheeled-measuring-device" to measure 50 feet ahead of the vehicle. Using a flag marker, one flag is dropped on the 50ft mark towards the edge of the pavement. This mark will denote the starting point of the survey site. From this point the team measures an additional 100 feet, then places another flag marker on the roadway to show the mid-point of the survey site. A final measurement of an additional 100 feet is indicated by a final flag marker next to the pavement and denotes the end of the survey site. Each site is therefore a total of 200 feet in length.

The width of the site is measured from the curb to the outer edge of the site, up to a maximum width of 20 feet. This rule was set to include two feet into the street since the curb or road shoulder is a normal catchment structure, and local jurisdictions are often responsible for cleaning up litter caught by this structure. The maximum site width is 20 feet and a site that is 200 feet long by 20 feet wide is designated as a "fixed" site. In many instances a site is less than 20 feet wide. This may occur in commercial areas or places where terrain makes surveying difficult. Sites less than 20 feet in width are designated as "variable" sites. Preference is always given to ensure a full site can be surveyed whenever possible.

## Site Survey Diagram



## Large Litter Counts

1. Team arrives at the site, measures 50 ft. ahead of car, sets up site.
2. Marks starting point, mid-point and end of site.
3. Takes photos of site.
4. Then walks site – describing the large litter and dictating into a tape recorder.

## Survey Counts

At each site, and upon setting up the site, both surveyors commence the large litter survey count, and record the names of branded items examined on the site.

To start the large litter survey, each technician first completes the description sections of the Site Selection form using a voice recorder. This information describes the site number, date, digital photographs taken, camera used, start time, type of site (residential, industrial, commercial, downtown, highway), type of roadway, whether the road was divided, grass height, evidence of a clean-up, stop sign/traffic light, near-by fast food outlet, convenience store, litter catch points (i.e., grass mow line, hedge, fence, other), and visual litter rating on a subjective basis. All photographs are part of the archival record for this survey and are part of the electronic database.

Once this information is recorded, the two surveyors start back to back in the center of the site. They then proceed to walk the site slowly, taping their observations as they observe the site. Proceeding in opposing serpentine paths, the surveyors walk the entire site, until the end-point is reached. During their examination of the site, the surveyor makes verbal observations of the litter observed, trying to describe it as one of the 14 main categories being reviewed as well as giving an indication of the size of the waste and noting any visible brand markings.

## Documentation and File Management

At each site, the teams are required to make a tape recording of their observations. At the end of doing the verbal entries into the recorder, the team member then saves both voice files to their field laptop labeling the files with the site number and filing them under the site voice file sub-directory.



These voice files are later transcribed into an Excel database for analysis. All site observation files are transcribed at the site before leaving the location. If a recording problem occurs, the site is surveyed again.

Each night the transcribed Excel files are uploaded to an online file folder via an Internet connection for archival purposes and later analysis of the data.

### **Photographic Record of the Site**

At each site location, the survey team should take digital photographs. One photograph should be taken at the start of the site, looking towards the end of the site, away from the vehicle. The second photograph should be taken in the mid-point of the site, looking across the width of the site. The final photograph should be taken at the end of the site, looking back towards the start of the site (towards the vehicle). The purpose of the photographs is to set the scene of the site, not to detail litter on the ground. In each case, the number of photographs taken at each site is recorded on the Site Selection form. The site-specific digital photographs are downloaded to an online file site each day as an archival record of the site during the survey period.

### **Branded Litter Observations**

Using the GPS coordinate mapping as a guide, data is gathered for observing branded litter. Branded litter is litter that has a recognizable brand name affixed. Where doubt occurred in the brand of the item, no entry is made.

Team surveyors verbally identify litter by brand name, which is transcribed later into the Excel Site Survey file for later compilation and analysis.

### **Training of Staff**

The field survey team is assembled for training during the initial week. At this time, an orientation and safety training session is conducted. During the initial week, field teams receive field and safety equipment. A field trial at two sites occurs before the team sets out to survey province-wide.

It was determined that a two-person survey team could evaluate between five to eight sites per day.

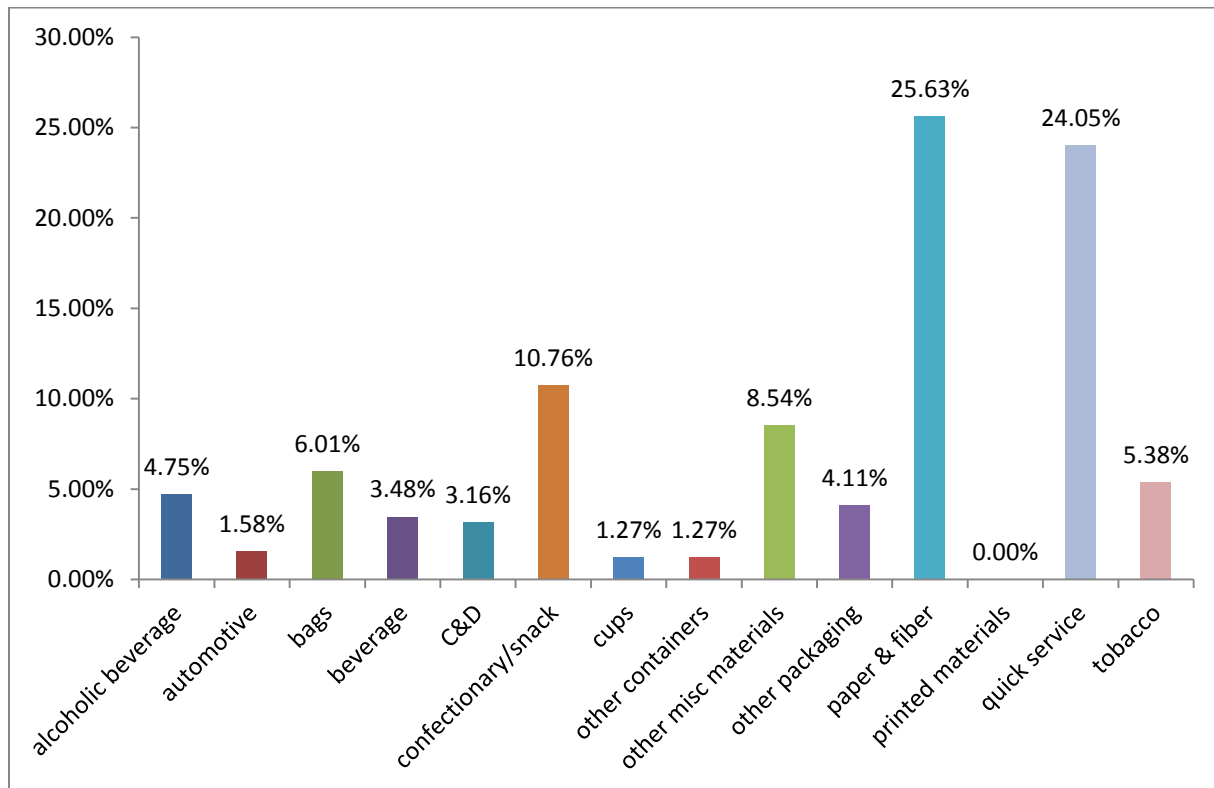
The fieldwork in the region should be completed by mid-August. All data is then transcribed and the process of entering data for analysis begins.

**Appendix 2**

**Distribution percentage across each Region by major category**

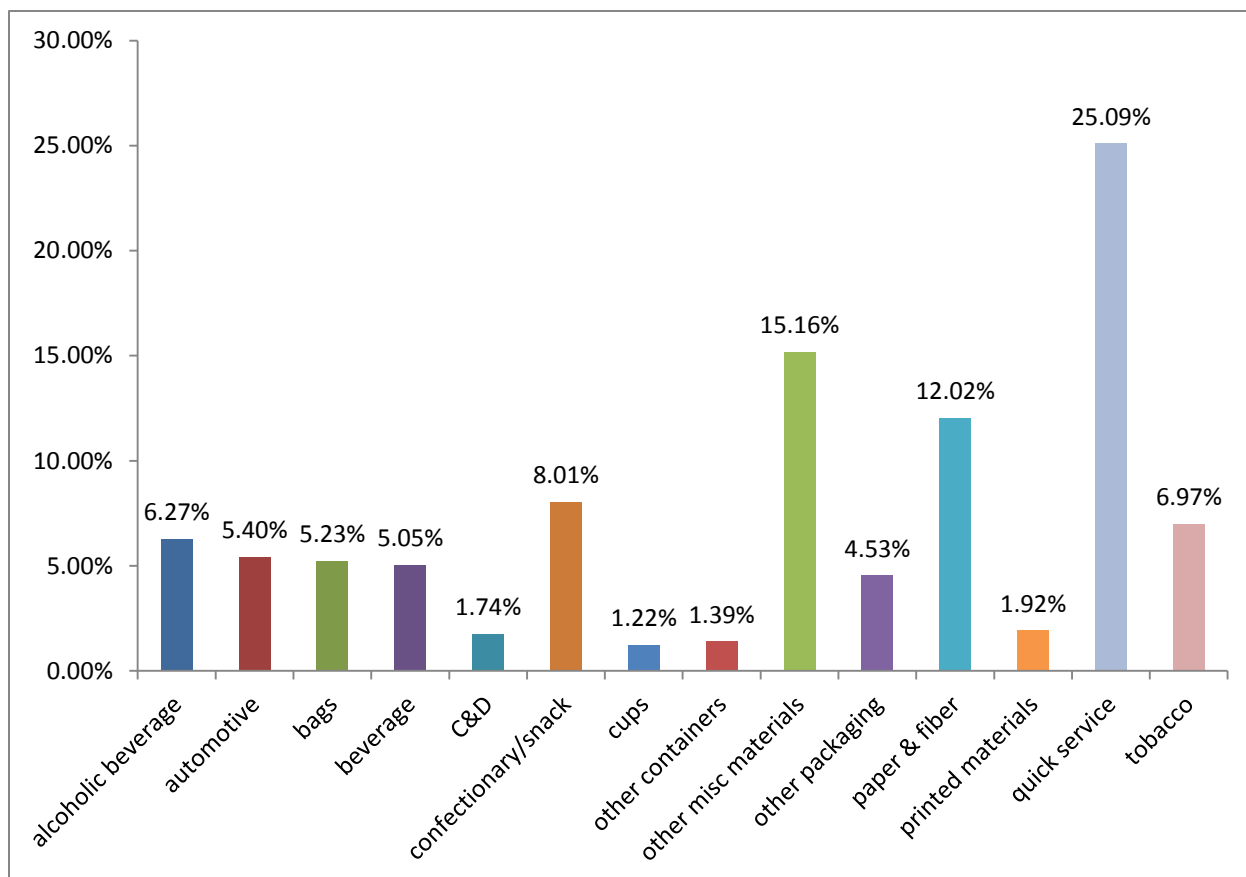
**Region : Bathurst**

Major Category	Percent	Number of Items
alcoholic beverage	4.75%	15
automotive	1.58%	5
bags	6.01%	19
beverage	3.48%	11
C&D	3.16%	10
confectionary/snack	10.76%	34
cups	1.27%	4
other containers	1.27%	4
other misc materials	8.54%	27
other packaging	4.11%	13
paper & fiber	25.63%	81
printed materials	0.00%	0
quick service	24.05%	76
tobacco	5.38%	17
Total	100.00%	316



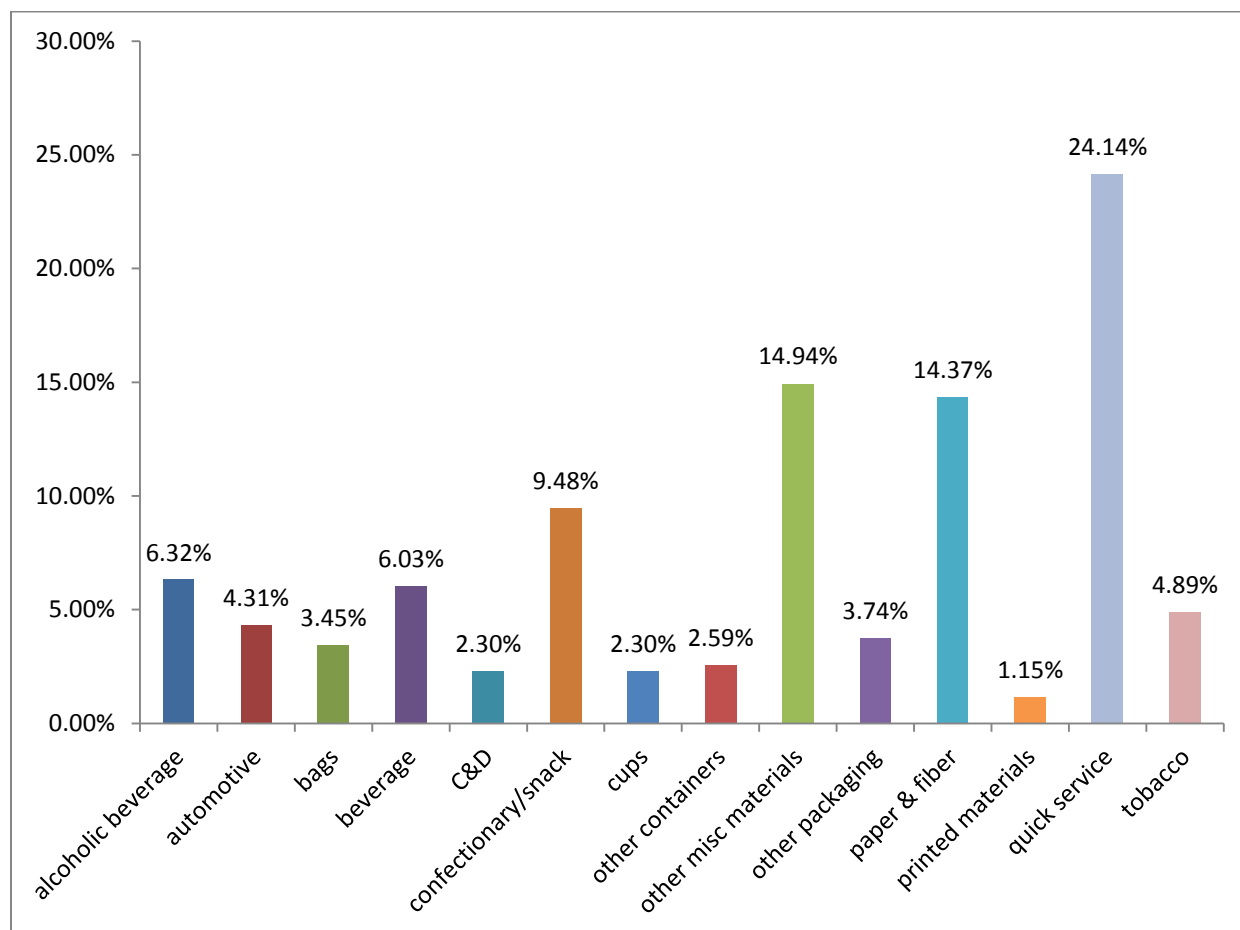
**Region : Bouctouche**

Major Category	Percent	Number of Items
alcoholic beverage	6.27%	36
automotive	5.40%	31
bags	5.23%	30
beverage	5.05%	29
C&D	1.74%	10
confectionary/snack	8.01%	46
cups	1.22%	7
other containers	1.39%	8
other misc materials	15.16%	87
other packaging	4.53%	26
paper & fiber	12.02%	69
printed materials	1.92%	11
quick service	25.09%	144
tobacco	6.97%	40
Total	100.00%	574



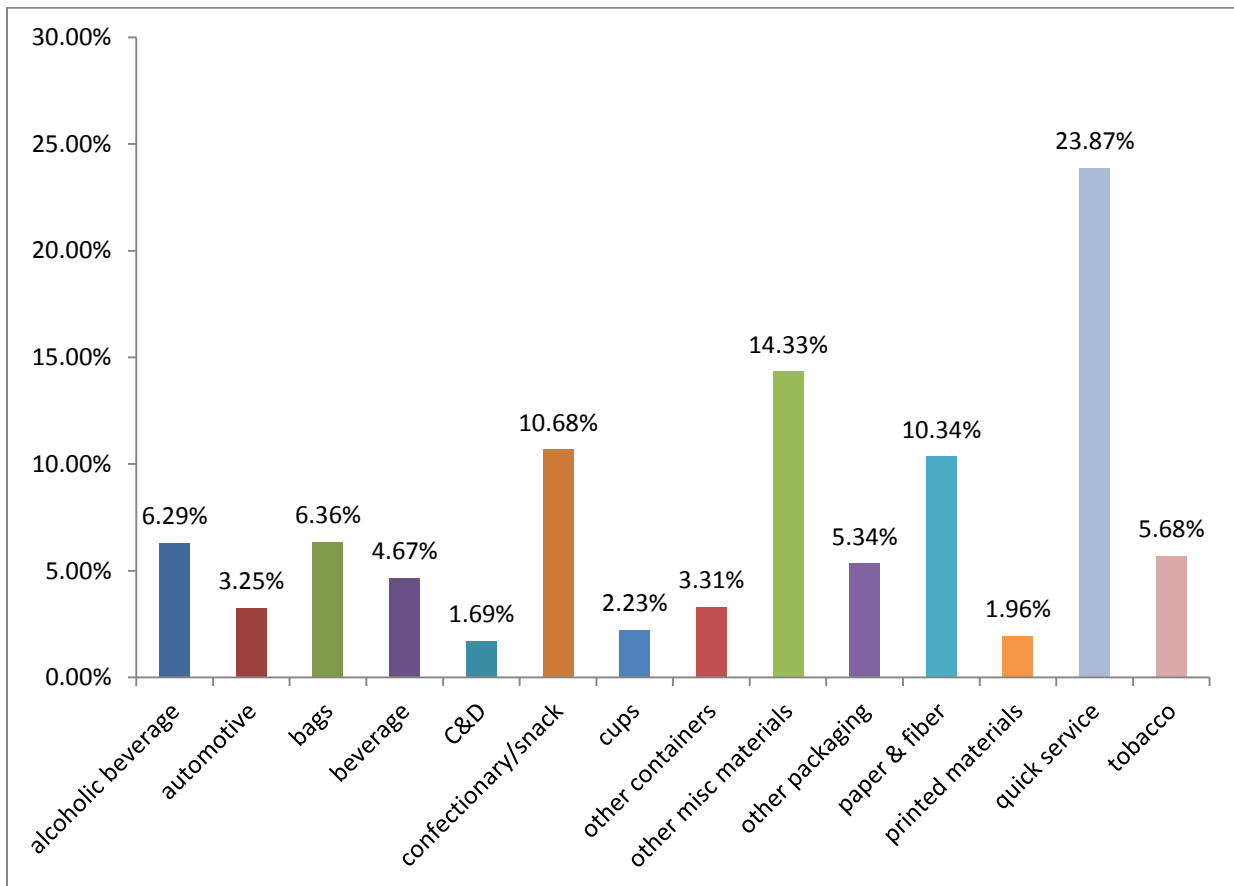
**Region : Campbellton**

Major Category	Percent	Number of Items
alcoholic beverage	6.32%	22
automotive	4.31%	15
bags	3.45%	12
beverage	6.03%	21
C&D	2.30%	8
confectionary/snack	9.48%	33
cups	2.30%	8
other containers	2.59%	9
other misc materials	14.94%	52
other packaging	3.74%	13
paper & fiber	14.37%	50
printed materials	1.15%	4
quick service	24.14%	84
tobacco	4.89%	17
<b>Total</b>	<b>100.00%</b>	<b>348</b>



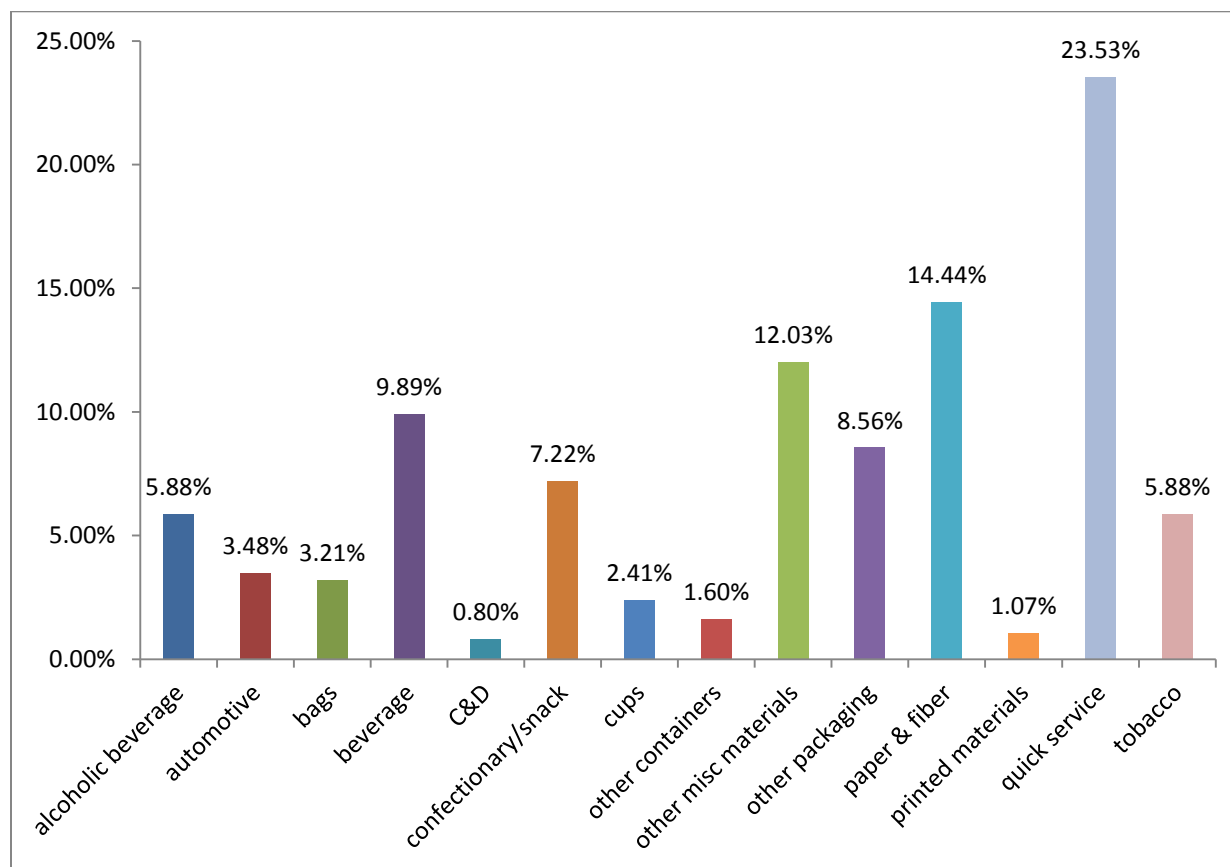
**Region : Fredericton**

Major Category	Percent	Number of Items
alcoholic beverage	6.29%	93
automotive	3.25%	48
bags	6.36%	94
beverage	4.67%	69
C&D	1.69%	25
confectionary/snack	10.68%	158
cups	2.23%	33
other containers	3.31%	49
other misc materials	14.33%	212
other packaging	5.34%	79
paper & fiber	10.34%	153
printed materials	1.96%	29
quick service	23.87%	353
tobacco	5.68%	84
Total	100.00%	1479



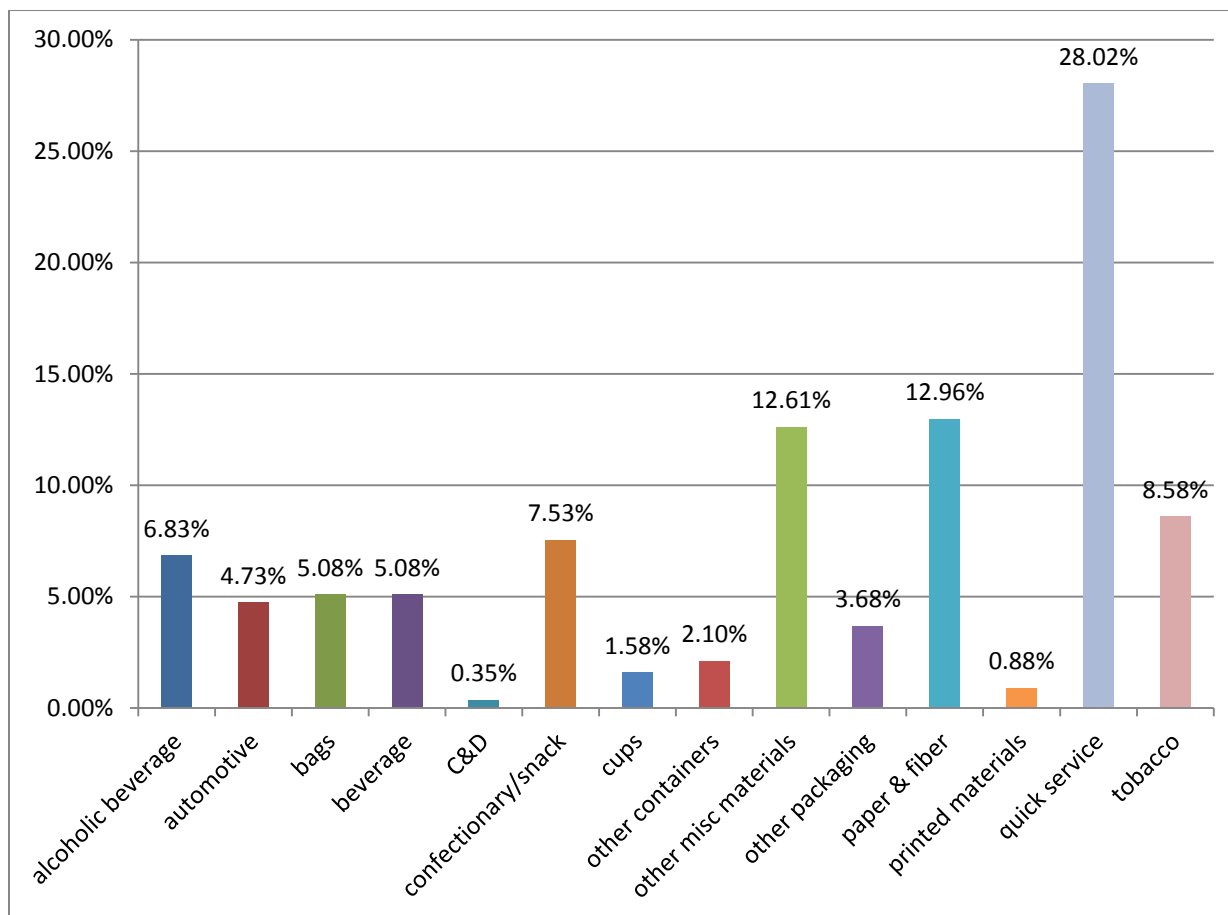
**Region : Grand Falls**

Major Category	Percent	Number of Items
alcoholic beverage	5.88%	22
automotive	3.48%	13
bags	3.21%	12
beverage	9.89%	37
C&D	0.80%	3
confectionary/snack	7.22%	27
cups	2.41%	9
other containers	1.60%	6
other misc materials	12.03%	45
other packaging	8.56%	32
paper & fiber	14.44%	54
printed materials	1.07%	4
quick service	23.53%	88
tobacco	5.88%	22
Total	100.00%	374



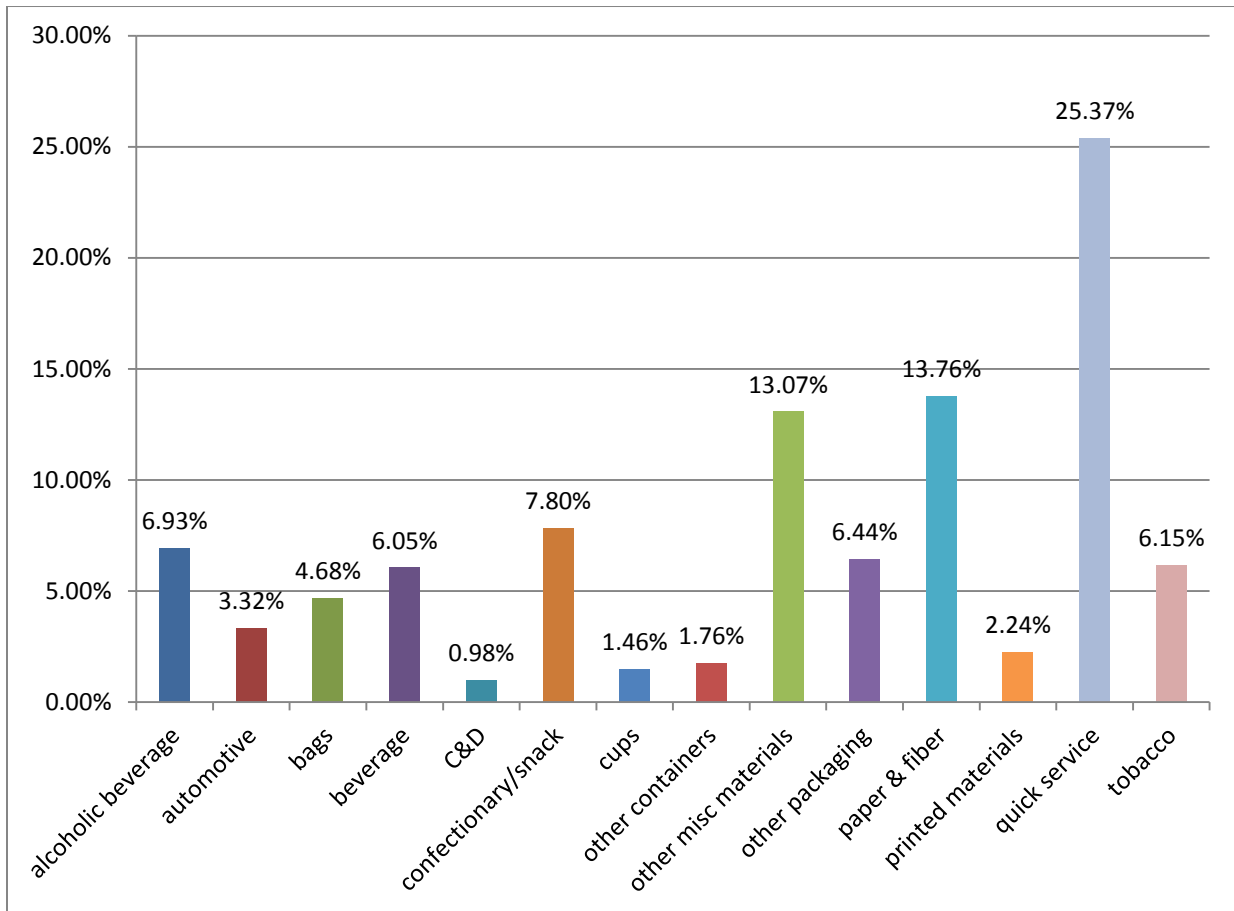
**Region : Miramichi**

Major Category	Percent	Number of Items
alcoholic beverage	6.83%	39
automotive	4.73%	27
bags	5.08%	29
beverage	5.08%	29
C&D	0.35%	2
confectionary/snack	7.53%	43
cups	1.58%	9
other containers	2.10%	12
other misc materials	12.61%	72
other packaging	3.68%	21
paper & fiber	12.96%	74
printed materials	0.88%	5
quick service	28.02%	160
tobacco	8.58%	49
Total	100.00%	571



**Region : Moncton**

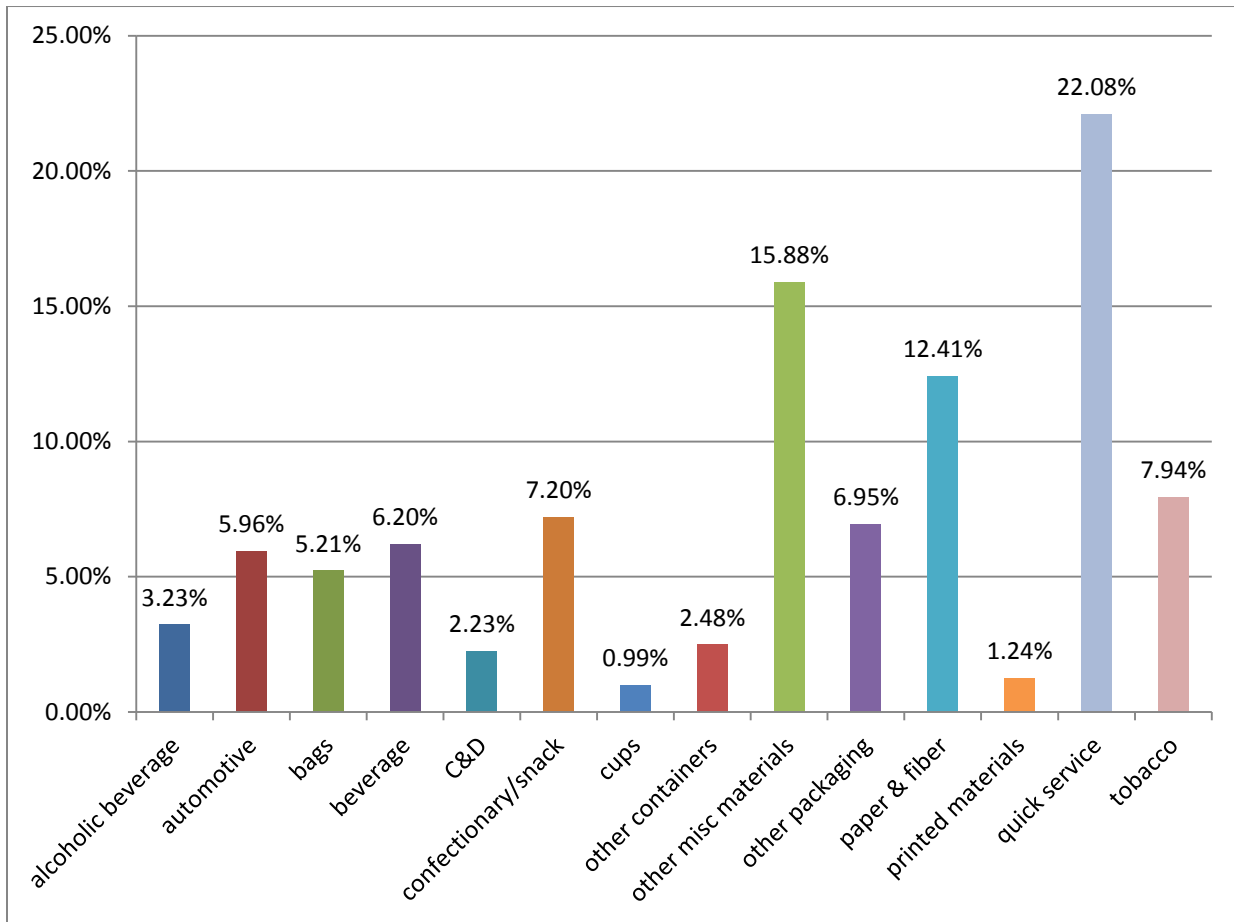
Major Category	Percent	Number of Items
alcoholic beverage	6.93%	71
automotive	3.32%	34
bags	4.68%	48
beverage	6.05%	62
C&D	0.98%	10
confectionary/snack	7.80%	80
cups	1.46%	15
other containers	1.76%	18
other misc materials	13.07%	134
other packaging	6.44%	66
paper & fiber	13.76%	141
printed materials	2.24%	23
quick service	25.37%	260
tobacco	6.15%	63
Total	100.00%	1025





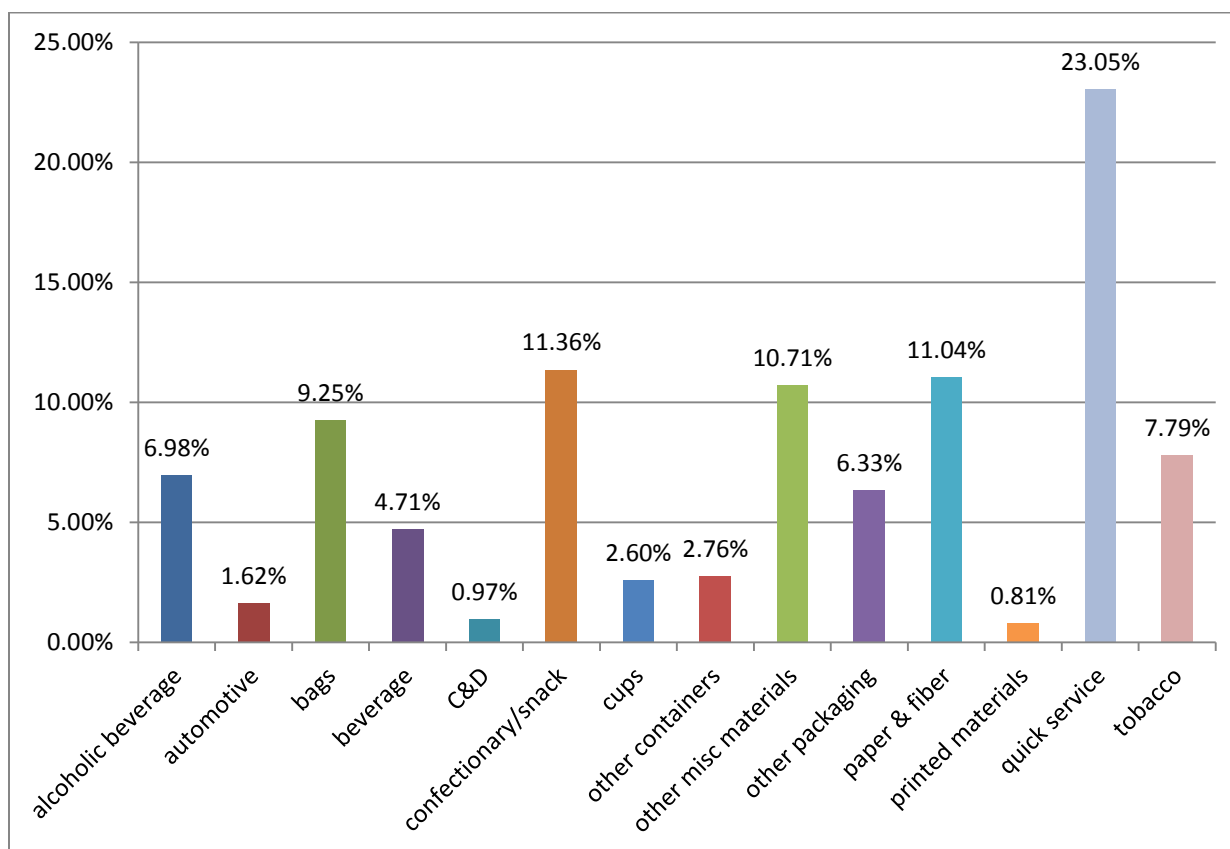
**Region : Saint John**

Major Category	Percent	Number of Items
alcoholic beverage	3.23%	13
automotive	5.96%	24
bags	5.21%	21
beverage	6.20%	25
C&D	2.23%	9
confectionary/snack	7.20%	29
cups	0.99%	4
other containers	2.48%	10
other misc materials	15.88%	64
other packaging	6.95%	28
paper & fiber	12.41%	50
printed materials	1.24%	5
quick service	22.08%	89
tobacco	7.94%	32
<b>Total</b>	<b>100.00%</b>	<b>403</b>



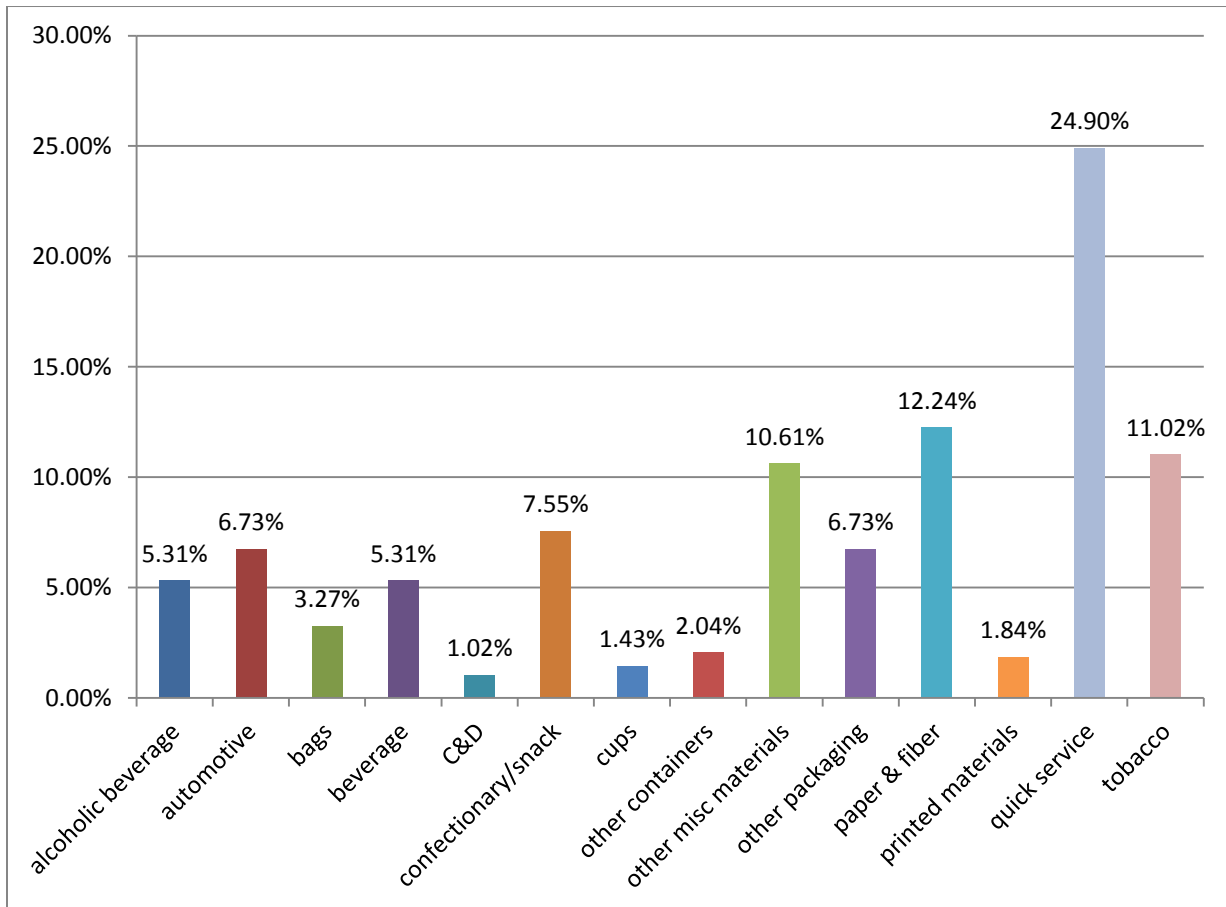
**Region : St Stephen**

Major Category	Percent	Number of Items
alcoholic beverage	6.98%	43
automotive	1.62%	10
bags	9.25%	57
beverage	4.71%	29
C&D	0.97%	6
confectionary/snack	11.36%	70
cups	2.60%	16
other containers	2.76%	17
other misc materials	10.71%	66
other packaging	6.33%	39
paper & fiber	11.04%	68
printed materials	0.81%	5
quick service	23.05%	142
tobacco	7.79%	48
<b>Total</b>	<b>100.00%</b>	<b>616</b>



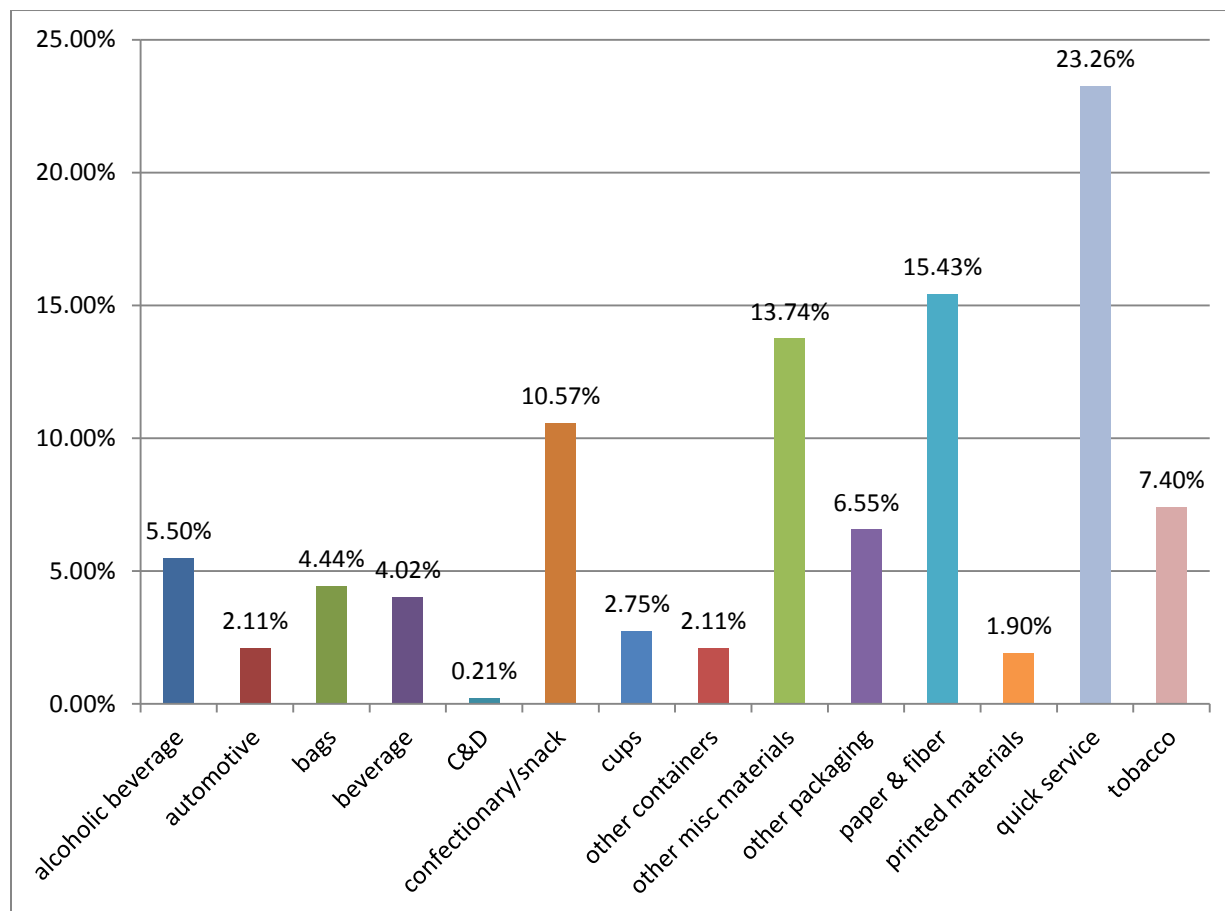
**Region : Sussex**

Major Category	Percent	Number of Items
alcoholic beverage	5.31%	26
automotive	6.73%	33
bags	3.27%	16
beverage	5.31%	26
C&D	1.02%	5
confectionary/snack	7.55%	37
cups	1.43%	7
other containers	2.04%	10
other misc materials	10.61%	52
other packaging	6.73%	33
paper & fiber	12.24%	60
printed materials	1.84%	9
quick service	24.90%	122
tobacco	11.02%	54
Total	100.00%	490



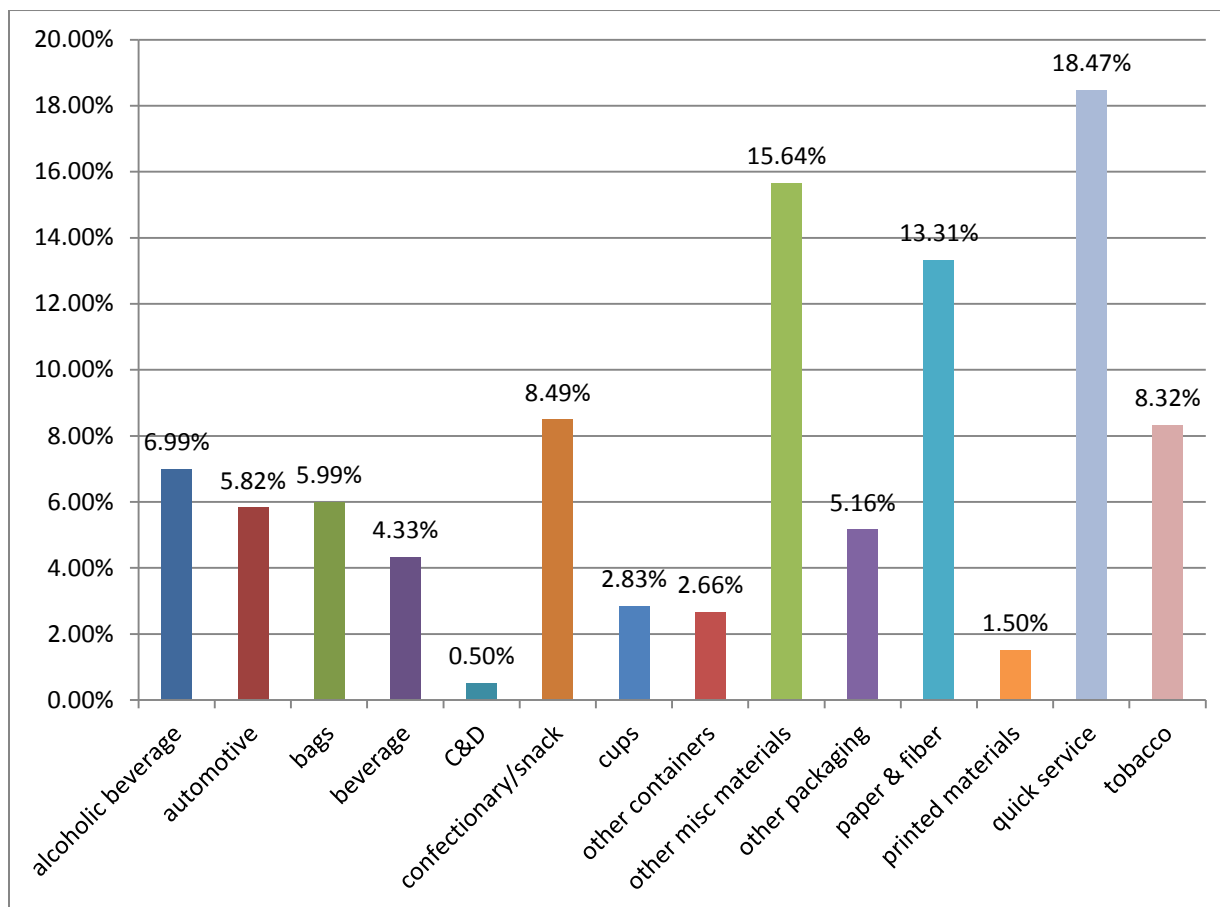
**Region : Tracadie**

Major Category	Percent	Number of Items
alcoholic beverage	5.50%	26
automotive	2.11%	10
bags	4.44%	21
beverage	4.02%	19
C&D	0.21%	1
confectionary/snack	10.57%	50
cups	2.75%	13
other containers	2.11%	10
other misc materials	13.74%	65
other packaging	6.55%	31
paper & fiber	15.43%	73
printed materials	1.90%	9
quick service	23.26%	110
tobacco	7.40%	35
<b>Total</b>	<b>100.00%</b>	<b>473</b>



**Region : Woodstock**

Major Category	Percent	Number of Items
alcoholic beverage	6.99%	42
automotive	5.82%	35
bags	5.99%	36
beverage	4.33%	26
C&D	0.50%	3
confectionary/snack	8.49%	51
cups	2.83%	17
other containers	2.66%	16
other misc materials	15.64%	94
other packaging	5.16%	31
paper & fiber	13.31%	80
printed materials	1.50%	9
quick service	18.47%	111
tobacco	8.32%	50
Total	100.00%	601

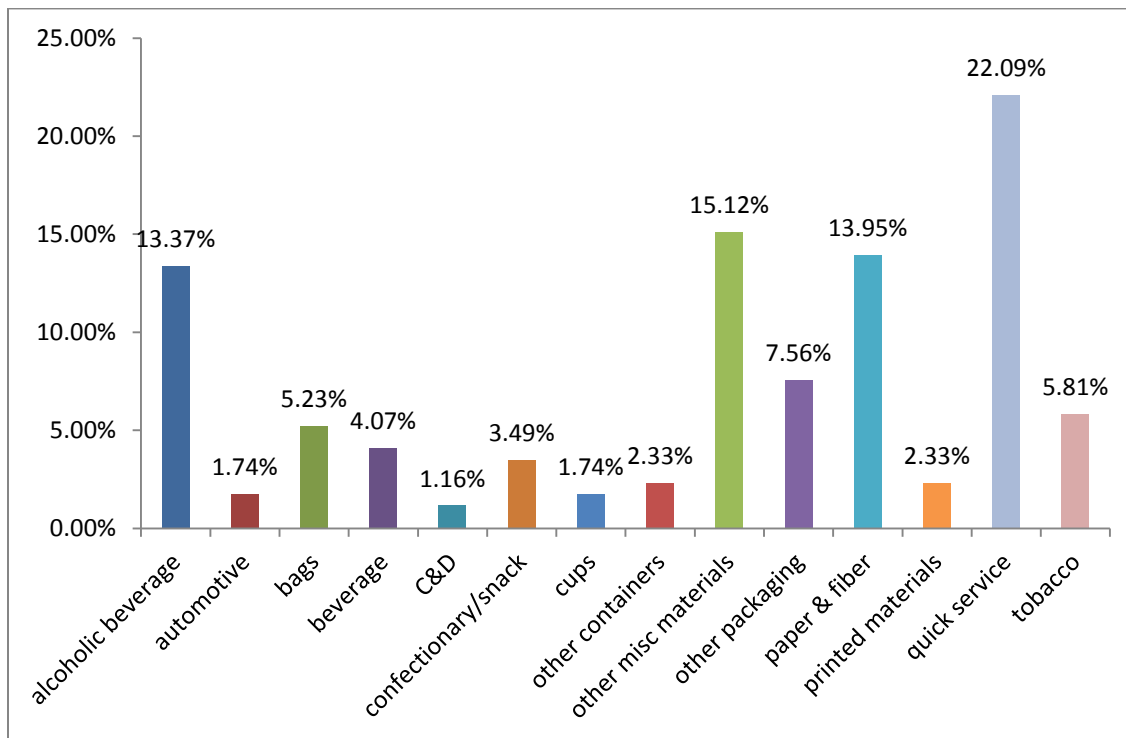


### Appendix 3

#### Distribution percentage across each County by major category

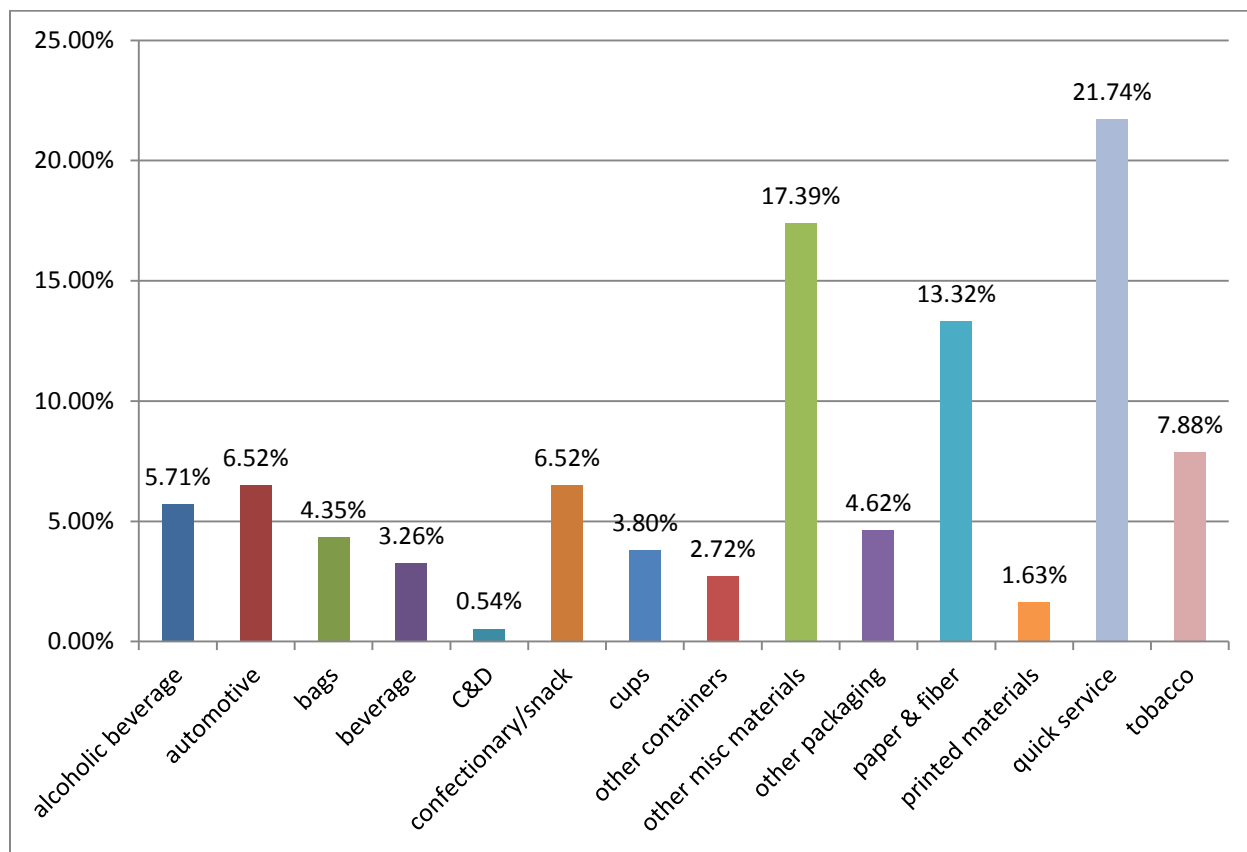
**County : Albert**

Major Category	Percent	Number of Items
alcoholic beverage	13.37%	23
automotive	1.74%	3
bags	5.23%	9
beverage	4.07%	7
C&D	1.16%	2
confectionary/snack	3.49%	6
cups	1.74%	3
other containers	2.33%	4
other misc materials	15.12%	26
other packaging	7.56%	13
paper & fiber	13.95%	24
printed materials	2.33%	4
quick service	22.09%	38
tobacco	5.81%	10
<b>Total</b>	<b>100.00%</b>	<b>172</b>



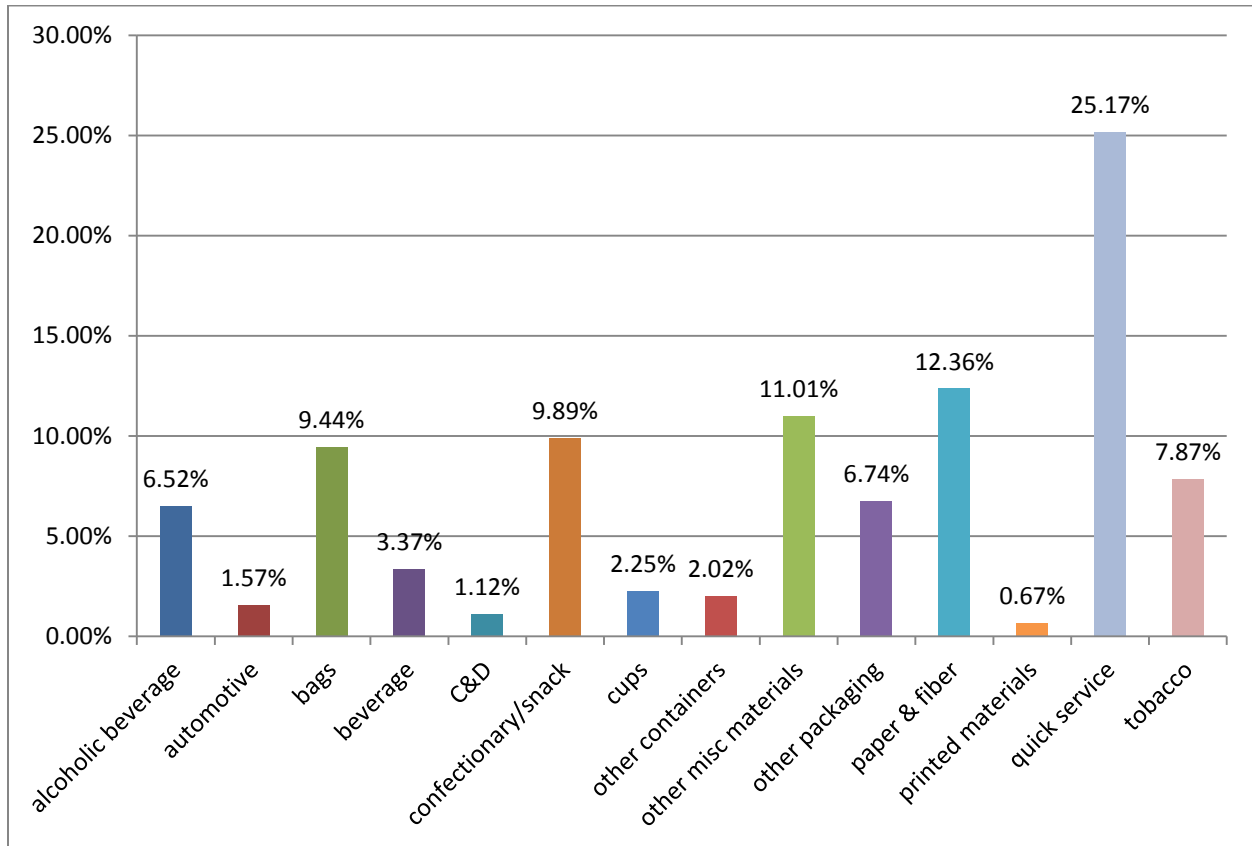
**County : Carleton**

Major Category	Percent	Number of Items
alcoholic beverage	5.71%	21
automotive	6.52%	24
bags	4.35%	16
beverage	3.26%	12
C&D	0.54%	2
confectionary/snack	6.52%	24
cups	3.80%	14
other containers	2.72%	10
other misc materials	17.39%	64
other packaging	4.62%	17
paper & fiber	13.32%	49
printed materials	1.63%	6
quick service	21.74%	80
tobacco	7.88%	29
<b>Total</b>	<b>100.00%</b>	<b>368</b>



**County : Charlotte**

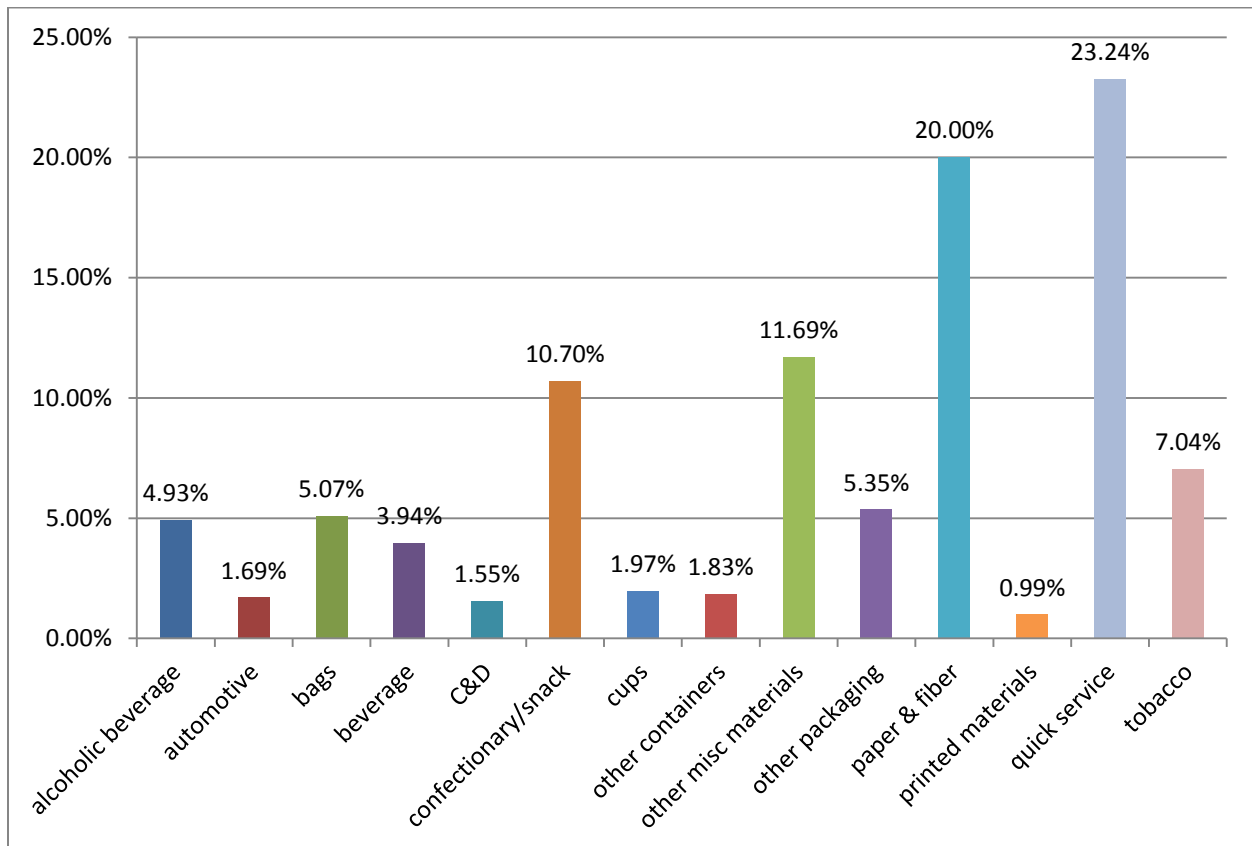
Major Category	Percent	Number of Items
alcoholic beverage	6.52%	29
automotive	1.57%	7
bags	9.44%	42
beverage	3.37%	15
C&D	1.12%	5
confectionary/snack	9.89%	44
cups	2.25%	10
other containers	2.02%	9
other misc materials	11.01%	49
other packaging	6.74%	30
paper & fiber	12.36%	55
printed materials	0.67%	3
quick service	25.17%	112
tobacco	7.87%	35
<b>Total</b>	<b>100.00%</b>	<b>445</b>





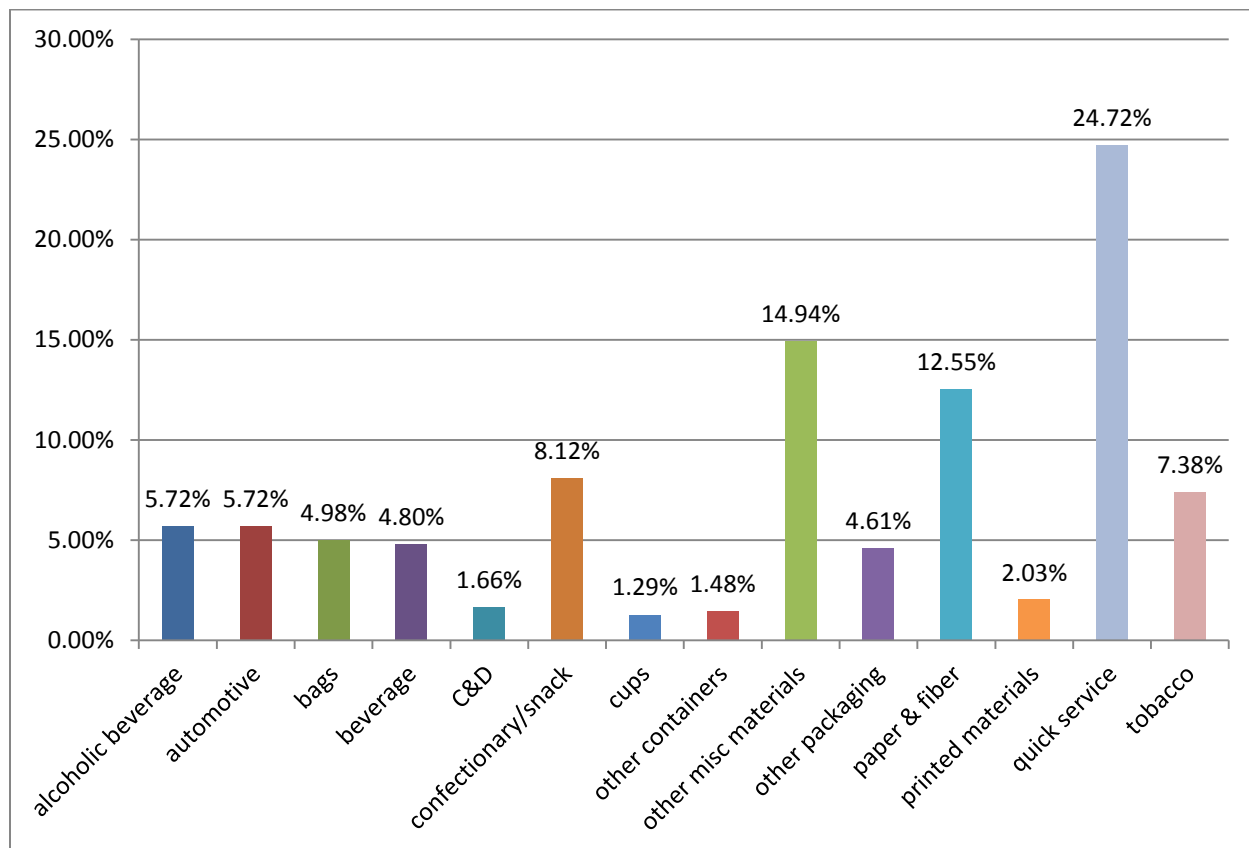
**County : Gloucester**

Major Category	Percent	Number of Items
alcoholic beverage	4.93%	35
automotive	1.69%	12
bags	5.07%	36
beverage	3.94%	28
C&D	1.55%	11
confectionary/snack	10.70%	76
cups	1.97%	14
other containers	1.83%	13
other misc materials	11.69%	83
other packaging	5.35%	38
paper & fiber	20.00%	142
printed materials	0.99%	7
quick service	23.24%	165
tobacco	7.04%	50
<b>Total</b>	<b>100.00%</b>	<b>710</b>



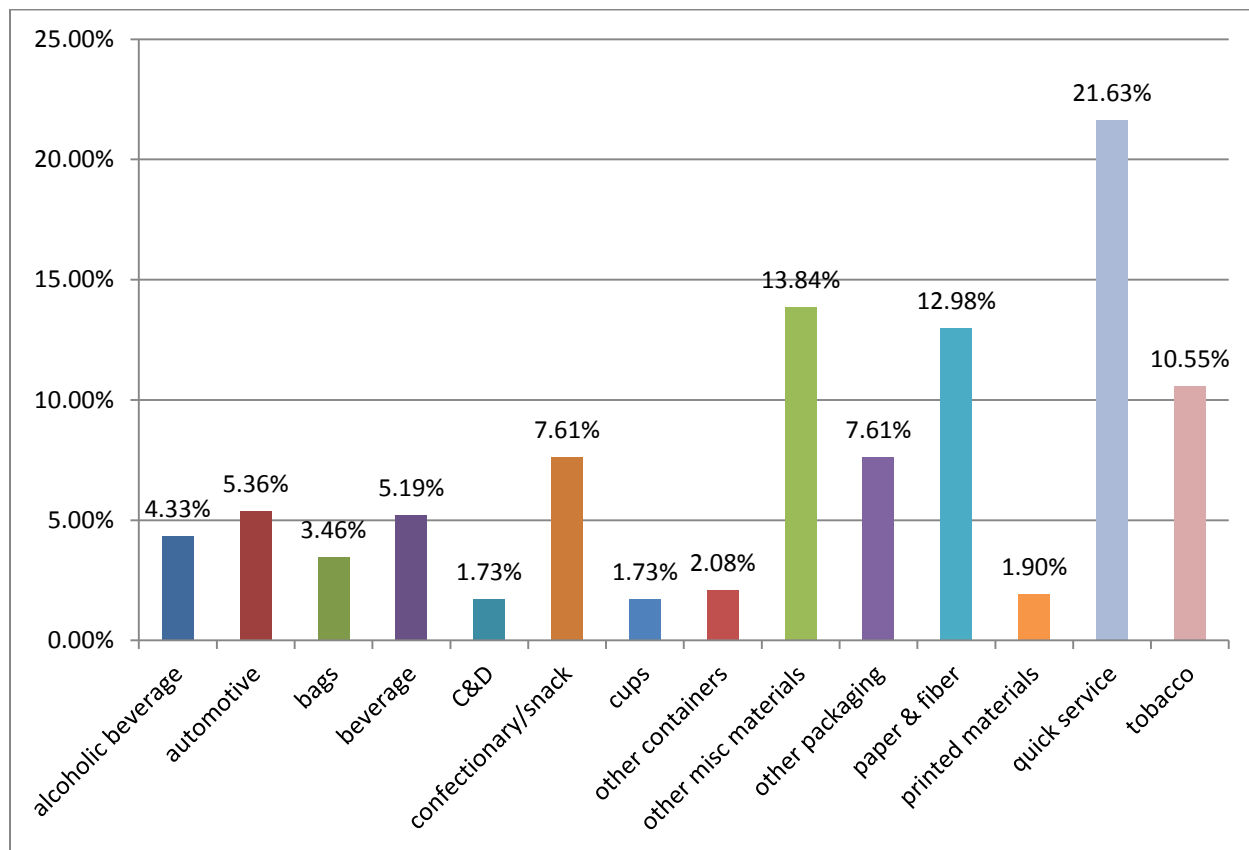
**County : Kent**

Major Category	Percent	Number of Items
alcoholic beverage	5.72%	31
automotive	5.72%	31
bags	4.98%	27
beverage	4.80%	26
C&D	1.66%	9
confectionary/snack	8.12%	44
cups	1.29%	7
other containers	1.48%	8
other misc materials	14.94%	81
other packaging	4.61%	25
paper & fiber	12.55%	68
printed materials	2.03%	11
quick service	24.72%	134
tobacco	7.38%	40
<b>Total</b>	<b>100.00%</b>	<b>542</b>



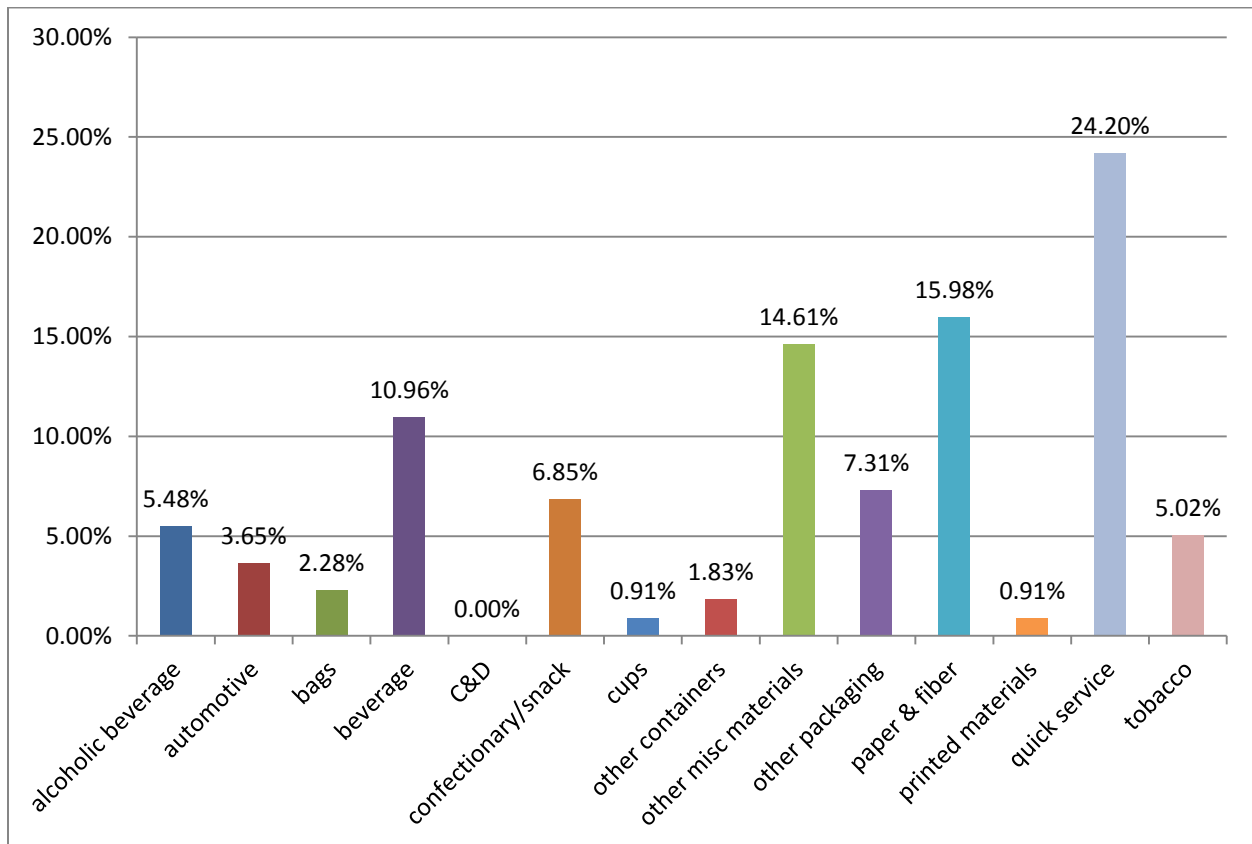
**County : Kings**

Major Category	Percent	Number of Items
alcoholic beverage	4.33%	25
automotive	5.36%	31
bags	3.46%	20
beverage	5.19%	30
C&D	1.73%	10
confectionary/snack	7.61%	44
cups	1.73%	10
other containers	2.08%	12
other misc materials	13.84%	80
other packaging	7.61%	44
paper & fiber	12.98%	75
printed materials	1.90%	11
quick service	21.63%	125
tobacco	10.55%	61
<b>Total</b>	<b>100.00%</b>	<b>578</b>



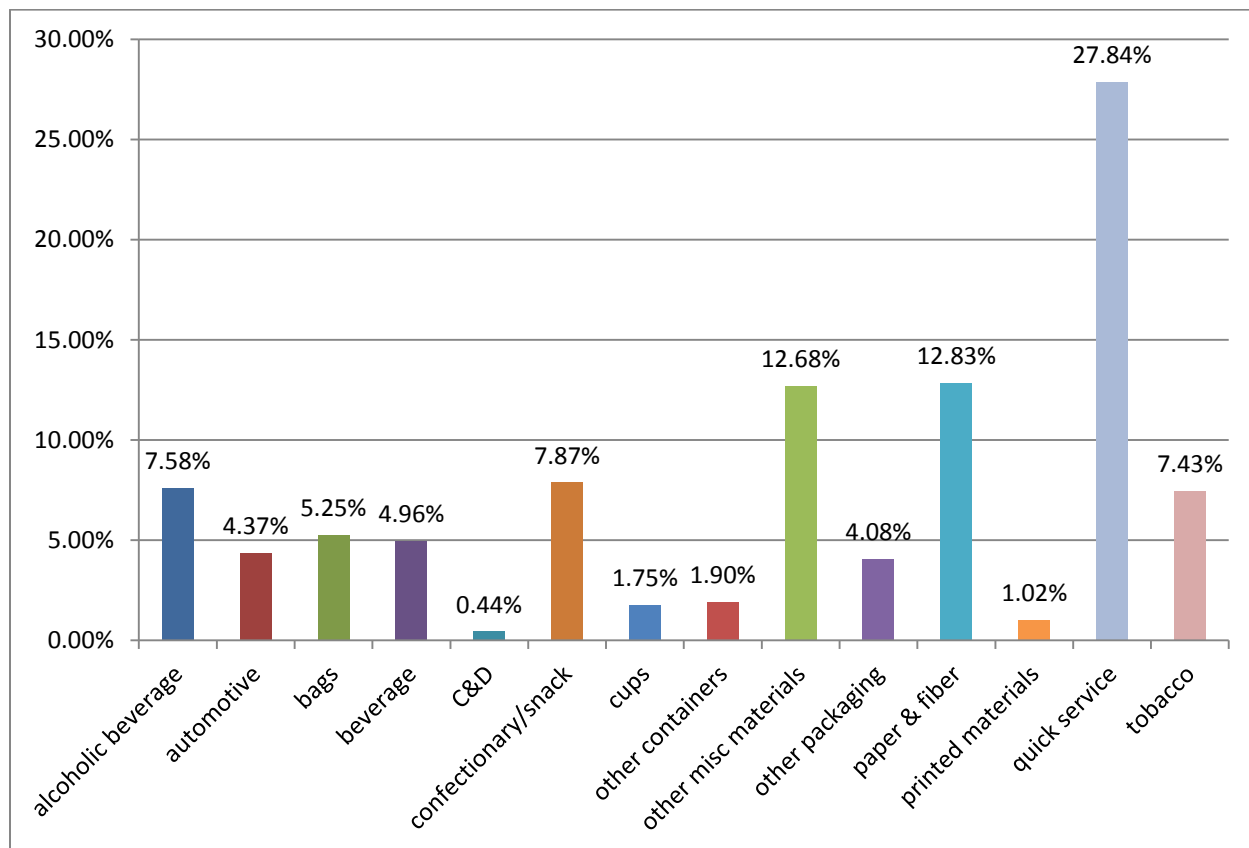
**County : Madawaska**

Major Category	Percent	Number of Items
alcoholic beverage	5.48%	12
automotive	3.65%	8
bags	2.28%	5
beverage	10.96%	24
C&D	0.00%	0
confectionary/snack	6.85%	15
cups	0.91%	2
other containers	1.83%	4
other misc materials	14.61%	32
other packaging	7.31%	16
paper & fiber	15.98%	35
printed materials	0.91%	2
quick service	24.20%	53
tobacco	5.02%	11
<b>Total</b>	<b>100.00%</b>	<b>219</b>



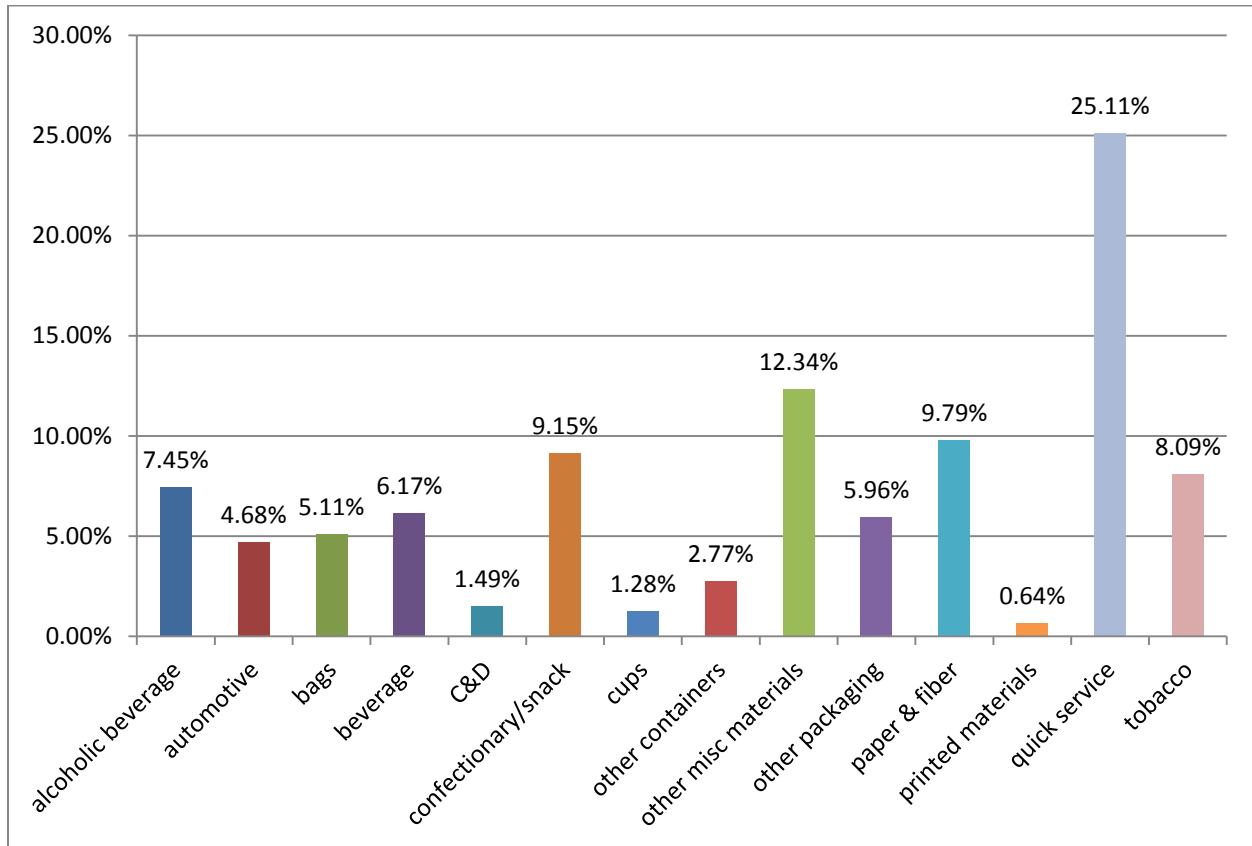
**County : Northumberland**

Major Category	Percent	Number of Items
alcoholic beverage	7.58%	52
automotive	4.37%	30
bags	5.25%	36
beverage	4.96%	34
C&D	0.44%	3
confectionary/snack	7.87%	54
cups	1.75%	12
other containers	1.90%	13
other misc materials	12.68%	87
other packaging	4.08%	28
paper & fiber	12.83%	88
printed materials	1.02%	7
quick service	27.84%	191
tobacco	7.43%	51
<b>Total</b>	<b>100.00%</b>	<b>686</b>



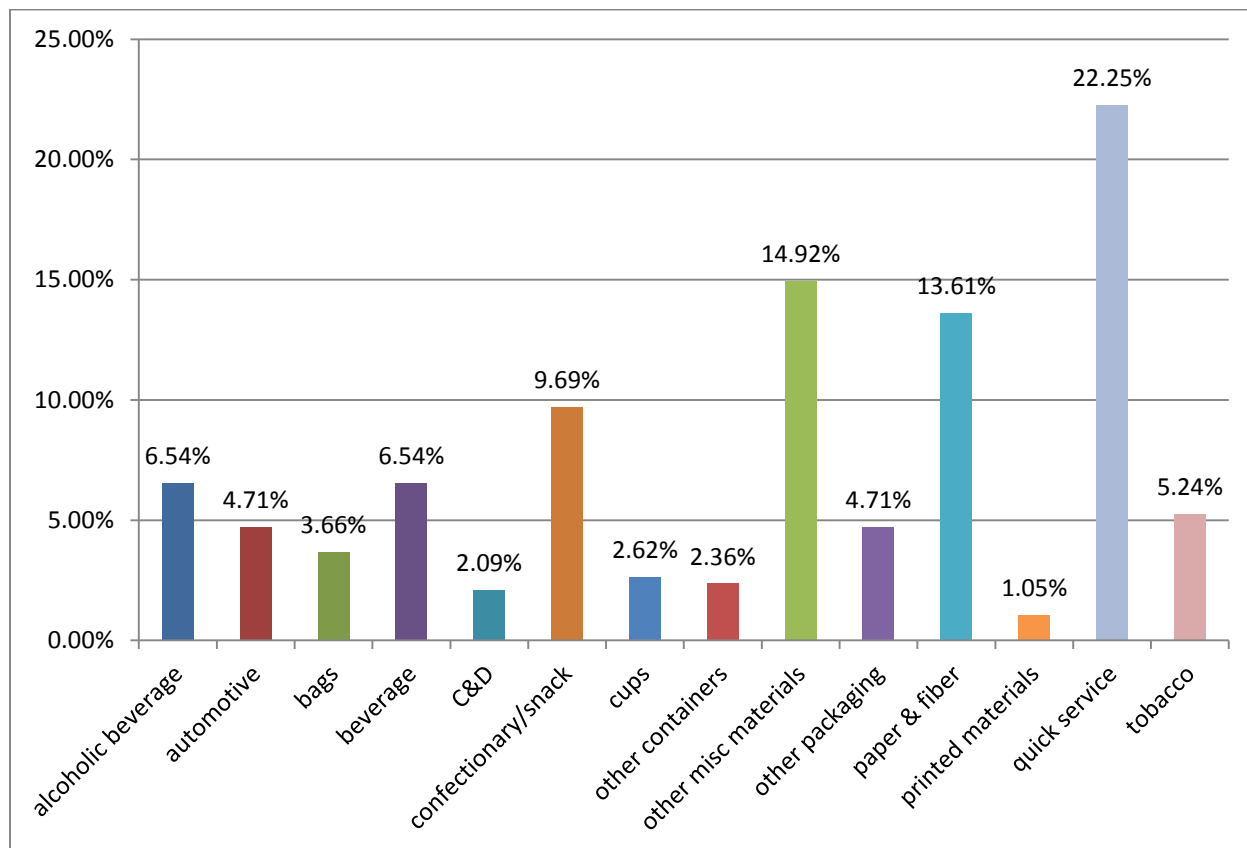
**County : Queens**

Major Category	Percent	Number of Items
alcoholic beverage	7.45%	35
automotive	4.68%	22
bags	5.11%	24
beverage	6.17%	29
C&D	1.49%	7
confectionary/snack	9.15%	43
cups	1.28%	6
other containers	2.77%	13
other misc materials	12.34%	58
other packaging	5.96%	28
paper & fiber	9.79%	46
printed materials	0.64%	3
quick service	25.11%	118
tobacco	8.09%	38
<b>Total</b>	<b>100.00%</b>	<b>470</b>



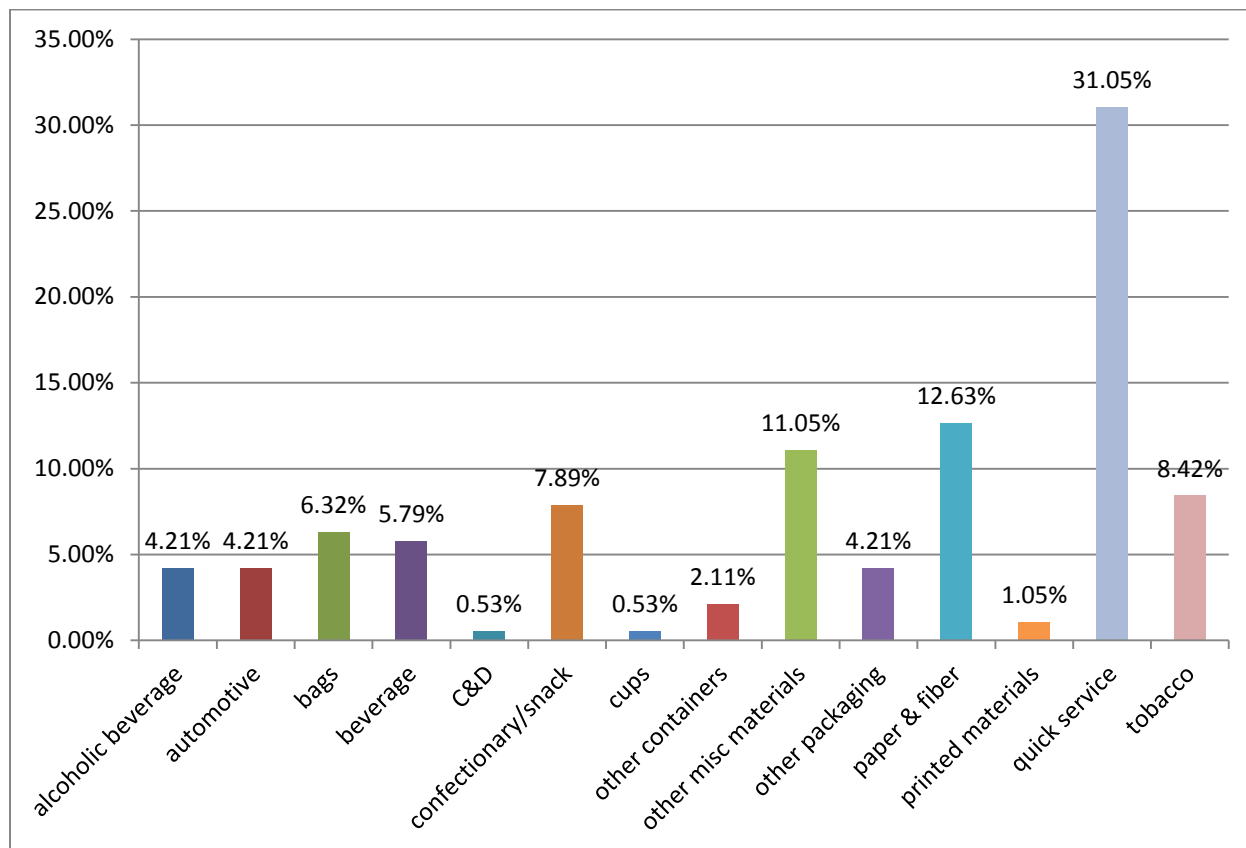
**County : Restigouche**

Major Category	Percent	Number of Items
alcoholic beverage	6.54%	25
automotive	4.71%	18
bags	3.66%	14
beverage	6.54%	25
C&D	2.09%	8
confectionary/snack	9.69%	37
cups	2.62%	10
other containers	2.36%	9
other misc materials	14.92%	57
other packaging	4.71%	18
paper & fiber	13.61%	52
printed materials	1.05%	4
quick service	22.25%	85
tobacco	5.24%	20
<b>Total</b>	<b>100.00%</b>	<b>382</b>



**County : Saint John**

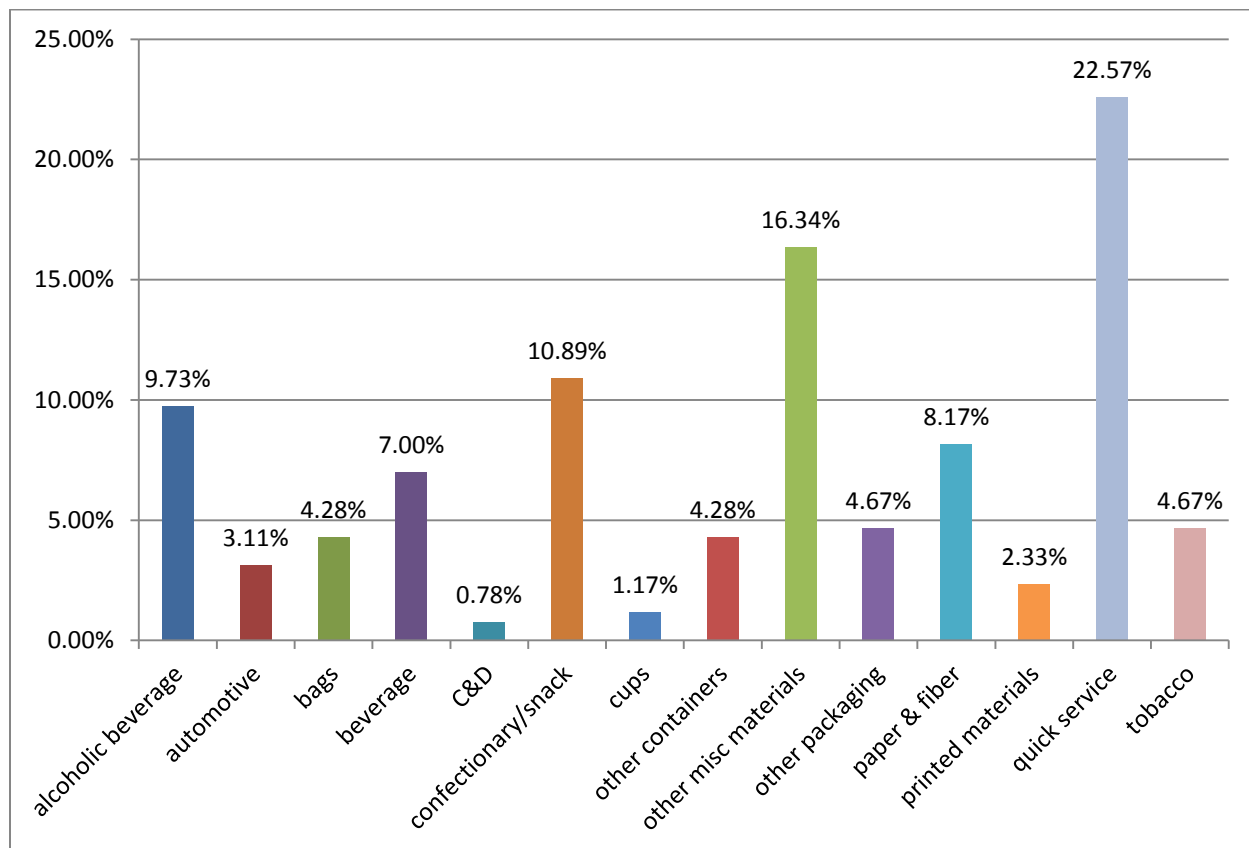
Major Category	Percent	Number of Items
alcoholic beverage	4.21%	8
automotive	4.21%	8
bags	6.32%	12
beverage	5.79%	11
C&D	0.53%	1
confectionary/snack	7.89%	15
cups	0.53%	1
other containers	2.11%	4
other misc materials	11.05%	21
other packaging	4.21%	8
paper & fiber	12.63%	24
printed materials	1.05%	2
quick service	31.05%	59
tobacco	8.42%	16
<b>Total</b>	<b>100.00%</b>	<b>190</b>





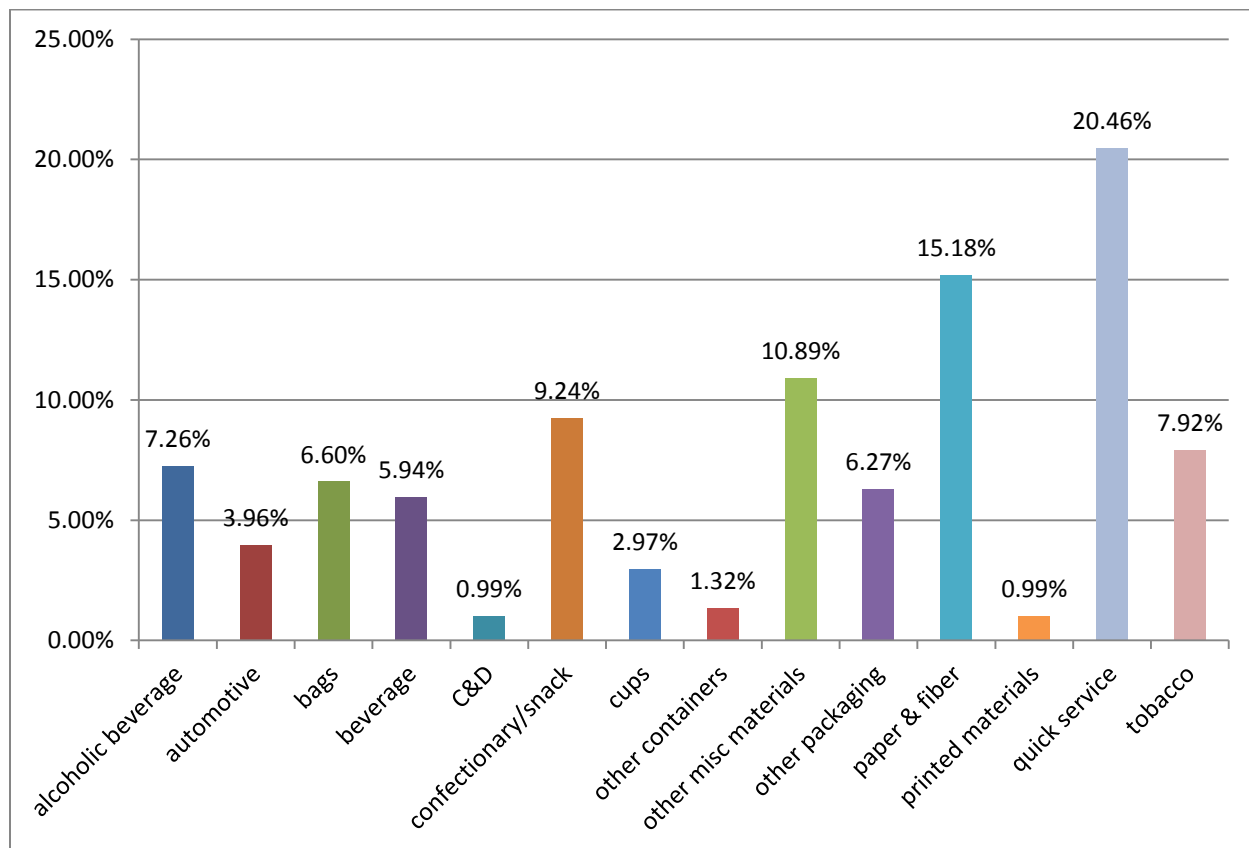
**County : Sunbury**

Major Category	Percent	Number of Items
alcoholic beverage	9.73%	25
automotive	3.11%	8
bags	4.28%	11
beverage	7.00%	18
C&D	0.78%	2
confectionary/snack	10.89%	28
cups	1.17%	3
other containers	4.28%	11
other misc materials	16.34%	42
other packaging	4.67%	12
paper & fiber	8.17%	21
printed materials	2.33%	6
quick service	22.57%	58
tobacco	4.67%	12
<b>Total</b>	<b>100.00%</b>	<b>257</b>



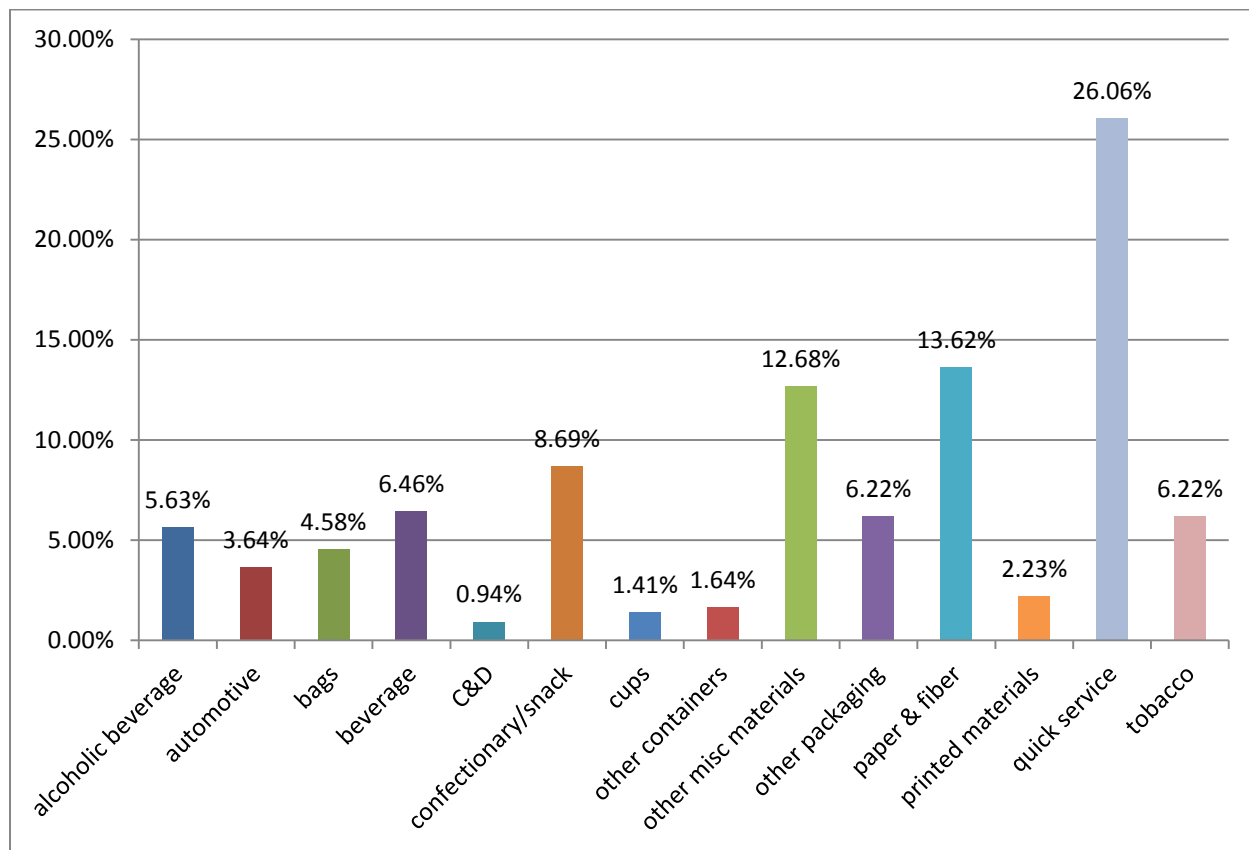
**County : Victoria**

Major Category	Percent	Number of Items
alcoholic beverage	7.26%	22
automotive	3.96%	12
bags	6.60%	20
beverage	5.94%	18
C&D	0.99%	3
confectionary/snack	9.24%	28
cups	2.97%	9
other containers	1.32%	4
other misc materials	10.89%	33
other packaging	6.27%	19
paper & fiber	15.18%	46
printed materials	0.99%	3
quick service	20.46%	62
tobacco	7.92%	24
<b>Total</b>	<b>100.00%</b>	<b>303</b>



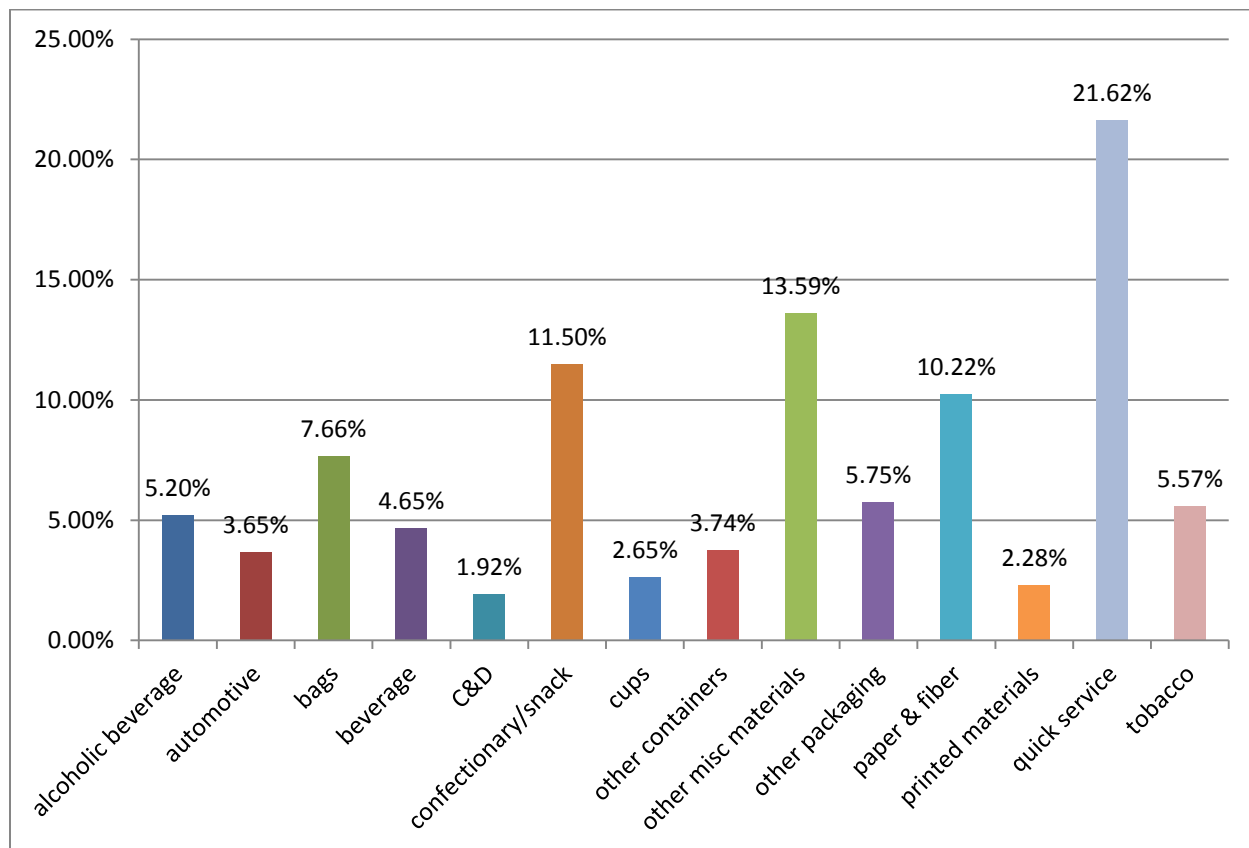
**County : Westmorland**

Major Category	Percent	Number of Items
alcoholic beverage	5.63%	48
automotive	3.64%	31
bags	4.58%	39
beverage	6.46%	55
C&D	0.94%	8
confectionary/snack	8.69%	74
cups	1.41%	12
other containers	1.64%	14
other misc materials	12.68%	108
other packaging	6.22%	53
paper & fiber	13.62%	116
printed materials	2.23%	19
quick service	26.06%	222
tobacco	6.22%	53
<b>Total</b>	<b>100.00%</b>	<b>852</b>



**County : York**

Major Category	Percent	Number of Items
alcoholic beverage	5.20%	57
automotive	3.65%	40
bags	7.66%	84
beverage	4.65%	51
C&D	1.92%	21
confectionary/snack	11.50%	126
cups	2.65%	29
other containers	3.74%	41
other misc materials	13.59%	149
other packaging	5.75%	63
paper & fiber	10.22%	112
printed materials	2.28%	25
quick service	21.62%	237
tobacco	5.57%	61
<b>Total</b>	<b>100.00%</b>	<b>1096</b>



## Appendix 4

### Chi-Square Goodness-of-Fit Test

$H_0$ : The proportions of all items in major categories are equal.

$H_a$ : At least two of the proportions are not equal.

Category	Test Observed	Contribution Proportion	Expected	to Chi-Sq
alcoholic beverage	448	0.0714286	519.286	9.79
automotive	285	0.0714286	519.286	105.70
bags	395	0.0714286	519.286	29.75
beverage	383	0.0714286	519.286	35.77
C&D	92	0.0714286	519.286	351.59
confectionary/snack	658	0.0714286	519.286	37.05
cups	142	0.0714286	519.286	274.12
other containers	169	0.0714286	519.286	236.29
other misc materials	970	0.0714286	519.286	391.20
other packaging	412	0.0714286	519.286	22.17
paper & fiber	953	0.0714286	519.286	362.24
printed materials	113	0.0714286	519.286	317.88
quick service	1739	0.0714286	519.286	2864.90
tobacco	511	0.0714286	519.286	0.13

N	DF	Chi-Sq	P-Value
7270	13	5038.56	0.000

#### Comment:

Reject  $H_0$ . Data provides enough evidence to conclude that that the proportions of items in major categories are significantly different to each other.

**All statistics presented in this report have been independently verified by Dr. Tariqul Hasan, Professor of Statistics at the University of New Brunswick, Fredericton.**

## Appendix 5

### Confidence interval for the population total

1 km (1 side of the street) = 3,280.84 feet = 3,280.84/200 = 16.4042 sites

1 km (2 sides of the street) = 32.8084 sites

Total sites possible = 32.8084 sites/km \* 8,410 kms = 275,918.6 sites = 275,919 sites

Total number of sites in population

$$N = 275,919$$

Total number of sites in sample

$$n = 422$$

### Descriptive Statistics: Tally2

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
Tally2	422	0	17.227	0.646	13.273	1.000	9.000	14.000	22.000

Variable Maximum

Tally2 122.000

Estimate of the number of Litters in the total

$$Y_{\text{Total}} = N * \text{mean} = 275,919 * 17.227 = 4,753,257$$

95% Confidence interval for the population total is

$$N\bar{X} \pm N \left( t_{\alpha/2, n-1} \right) \frac{S}{\sqrt{n}} \sqrt{\frac{(N-n)}{(N-1)}}$$

$$= (4404101, 5102413)$$

**Therefore the total amount of litter items along numbered routes in New Brunswick was predicted to be between 4,404,101 and 5,102,413 items.**