Characterizing Impacts of Operating Parameter Variability on the Performance and Reliability of a Double-Stage Trommel

by

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ABSTRACT

A principal equipment used in waste pre-processing systems is a rotary screen (trommel). Despite the application of trommel screens in waste processing, the full-scale performance of this method has been shown inconsistencies with theoretical models and has not been thoroughly detailed. There were two high-level sets of research goals defined in this work, which studied screening performance and operation performance of a full-scale trommel. The first set of research objectives was to quantify and assess the impact of feed rate variation and seasonal variation in waste characteristics, in terms of particle size distribution and composition, on trommel's screening performance during full-scale operation throughout the year. Also investigated was the impact of clogging of screen apertures on screening of material. The second set of objectives were defined to characterize the operation performance of the waste processing system, with a primary focus on the trommel, using system analysis methods including system availability, maintainability and throughput.

A two-stage trommel, respectively, with 5 cm and 23 cm screens was evaluated in this study. The trommel design capacity was 55 tonnes per hour (t/h) and it was operated at a municipal solid waste processing facility located in a cold region (Edmonton, Canada), where weather and temperature variation is extreme. The facility is currently at maximum capacity and is fed with co-mingled refuse with the inorganic recyclable material removed.

The variation in size separation efficiency and recovery was monitored with respect to the total feed rate, the overs loading feed rate, the season, operation time, and waste characteristics. The characteristics of the feedstock and separated waste streams were determined by sieve and compositional analyses. Separation efficiency and recovery results verified that the performance

of the first stage varied seasonally, primarily due to changes in the particle size distribution of the feedstock; secondly, because of a greater feed rate. The seasonal variation in the compostable fraction of the waste streams was found to be the primary reason for changes in the trommel's performance. On the contrary, the particle size distribution of the inorganic fraction of feedstock suitable for refuse-derived fuel production remained similar throughout the year and had steeper sigmoid curves. This indicated that the refuse-derived fuel material was more uniformly distributed, making it more sensitive to sieve size, which should be taken advantage of by selecting a smaller cut-off size for separating compost and refuse-derived fuel material from each other.

A strong linear correlation was found between the recovery results and the corresponding overs loading rate. This correlation not only varied between seasons, but also varied within the operation cycle during the winter tests due to the clogging of the screens. A non-linear equation was fitted to quantify clogging formation according to the net operation time and feed rate. It showed that the 5 cm screens in the trommel's first stage were completely clogged after 10 hours at feed rate of 40 t/h and after 1.8 hours at feed rate of 60 t/h.

The system analysis results indicated that the majority of downtimes (by total number and duration) originated from the first-hand-sort room followed by the second-hand-sort room, which were located before and after the trommel. Other types of downtimes (e.g., jammed disc screen and conveyors), mostly occurred when the waste pre-processing system was overloaded, especially during the peak (summer) season. Overall, availability of the system decreased non-linearly in relation to the increased feed rate. The most probable downtime (probability >50%) measured 47.6 ± 1.1 sec when feeding was <50 t/h, which on average was 25 seconds longer than the most probable downtime (probability >35%) when the feeding was >65 t/h, as indicated by the

Lognormal probability density function, fitted to the mean time to repair results. Accordingly, the Weibull cumulative distribution functions fitted to the mean time between failures results showed that the probability of operating for longer periods was higher when the feeding was managed at lower rates.

This research quantified full trommel operations in different seasons and during the operation cycle. The aforementioned valuable findings of this research can be utilized in the development of a simulation model using discrete event simulation that can be used as a tool to assess the behavior of the pre-processing system under different operating conditions.

PREFACE

The research completed in this dissertation was planned, designed, analyzed, interpreted, and compiled by myself, and was reviewed and supervised by Dr. Daryl McCartney in the Department of Civil and Environmental Engineering at the University of Alberta. All experiments completed in this dissertation were conducted at full-scale in the Integrated Pre-processing and Transfer Facility and the Edmonton Waste Management Centre of Excellence with support, insight and collaboration from the managers, supervisors, lab technicians and operation staff, as well as the support from students and other people hired during this study.

A version of Chapter 3 of this thesis was published as "Rajabpour Ashkiki, A., Felske, C., McCartney, D., (2019) Impacts of Seasonal Variation and Operating Parameters on Double-Stage Trommel Performance. *Journal of Waste Management* 86 (36–48)". I was responsible for the experimental design, data analysis and interpretation, and the manuscript composition. Dr. Felske and Dr. McCartney were my co-supervisory authors and were involved with concept formation, manuscript composition and edits.

A version of Chapter 4 of this thesis is under preparation for submission as "Rajabpour Ashkiki and McCartney, D., A Simple System Reliability Analysis of a Waste Pre-processing Facility". I was responsible for the experimental design, data analysis and interpretation, and the manuscript composition. Dr. McCartney was my supervisory author and was involved with concept formation, manuscript composition and edits.

In Chapter 5 (Summary and Conclusions), one of the core future works recommended was adapted from a collaborative NSERC Engage Research Proposal, "Discrete event simulation of the integrated pre-processing and transfer facility", submitted to the Edmonton Waste Management Centre and NSERC by Dr. Hooman Askari-Nasab (my Ph.D. Committee Member), his former Postdoc, Dr. Mohammad Tabesh and myself in January 2016. The initial idea of that research originated from this research. The scope of the future work, however, was broader than my area of expertise, and I had the pleasure of collaborating with professionals from the Mining Optimization Lab managed by Dr. Askari-Nasab at the University of Alberta in preparation and submission of the proposal. Approval of the submitted proposal has been postponed to a later time.

DEDICATION

This dissertation is dedicated to my beloved family.

A special gratitude to my dearest parents, Effat and Manoochehr, for their invaluable and endless support, dedication, and prayer throughout my life, and for passionately inspiring and encouraging me to always pursue my goals with enthusiasm,

and,

To my loving brother, Behnam, for his support and care.

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I also appreciate my Co-advisor, Dr. Christian Felske, formerly from the Waste Management Centre at the City of Edmonton, for his great support and encouragement since I started my internship with the City until the end of this research work.

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I also would like to thank Dr. Hooman Askari-Nasab and my friend and colleague Dr. Mohammad Tabesh for their collaboration in the preparation of a research proposal entitled "Discrete event simulation of the integrated pre-processing and transfer facility (IPTF)", submitted to the Waste Management Centre of the City of Edmonton.

I would like to acknowledge the financial support provided by the Waste Management Utility of the City of Edmonton and the Edmonton Waste Management Centre of Excellence as the major funders for this research project; MITACS Accelerate Graduate Research Program for the Internship Award; University of Alberta, Faculty of Graduate Studies and Research for the Provost Entrance Awards and Academic Travel Awards, and the Air & Waste Management Association for the Richard Stessel Memorial Scholarship.

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NOMENCLATURE

Symbol	Definition
CDF	Cumulative distribution function
$COMP_U$	Fraction of compostable material smaller than any given sieve size
D_A	Diameter of screen aperture (if circular), or dimension of screen aperture (if non-circular)
d_b	Bulk density of waste (kg/m^3)
D_{max}	Largest particle sizes
D_{min}	Smallest and largest particle sizes
D_P	Diameter of waste particle
E	Factor (>1) considering additional exposure to the screen as a result of slippage during particle rise.
$E(x_o,x_m)$	Efficiency of trommel (%) in removing particles within (x_o,x_m) range
F	Fill factor
$F(x_o,x_m)$	Total particles ranging between size x_0 and x_m in the feed
f_a	Ratio between the area of apertures (holes) and the total area of the screen surface
g	Gravitational acceleration
K_v	Velocity correction factor
l	Total horizontal displacement per impingement (m)
L_t	Length of trommel (m)

NOMENCLATURE

Symbol	Definition
MC_i	Moisture content in each post-sieved size range
MC_O	Moisture content in oversized waste particles larger than any given sieve size
MC_U	Moisture content in undersized waste particles smaller than any given sieve size
n	Uniformity constant
$OLR_{<x}$	Overs loading rate, portion of feed rate associated with particles larger than D_P (cm), dry tonnes per hour
p	Probability of a particle passing through a screen
$P(x_1)$	Cumulative probability of passage after n impingements for particles of size x_1
$P(x_o,x_m)$	Total probability (%) of the passage of particles ranging between size x_0 and x_m
$P_N(D_p)$	Number-based particle size distribution
p_r	Reflected probability of passage
PSD_C	Particle-size distribution associated with the compostable portion of any sample sieved, expressed as cumulative % passing through any given sieve size
PSD_R	Particle-size distribution associated with the portion of a sample suitable for RDF production, expressed as cumulative % retained on any given sieve size
PSD_T	Particle size distribution of total sample, expressed as cumulative % retained on any given sieve size
$P_V(D_p)$	Volume-based particle size distribution
Q	Feed rate, tonnes per hour
Q_I	Feed index ($t/(hm^2)$)

NOMENCLATURE

Symbol	Definition
Q_m	Trommel throughput (t/h)
RDF_O	Total refused-derived fraction of material larger than any given sieve size, % by weight of sample
R_t	Total recovery of targeted undersize (%)
R_T	Radius of trommel (m)
R_u	Recovery index (%/m)
R_x	Recovery efficiency, percent of material separated in a screening stage for a given particles size (x, cm) calculated as dry weight separated divided by the dry weight in feed (expressed as %)
S_O	Separation of overs, amount of overs leaving trommel outlet calculated as wet weight of overs divided by the total amount of material in feed (expressed as % by wet weight)
S_{U1}	Separation of first unders, amount of first unders removed in the first screening stage calculated as wet weight of first unders divided by the total amount of material in feed (expressed as % by wet weight)
S_{U2}	Separation of second unders, amount of second unders removed in the second screening stage calculated as wet weight of second unders divided by the total amount of material in feed (expressed as % by wet weight)
t	Time (min)
T	Temperature, ^{o}C

NOMENCLATURE

Symbol	Definition
T_R	Trommel residence time (min)
$V(D_p)$	Volume of the particle of diameter D_p
V_B	is the volume of the multi-layer bed
Vc	Volume of an individual frustum left after a fraction of the bed passed through the screen.
V_h	Volume of particles calculated that passes through the screen
V_p	Total volume of particles passing through an aperture
VP_B	Total particle volume in the multi-layer bed
V_T	Total volume of particles passing through the multi-layer bed
W_O	Total weight of trommel's overs unders, wet tonne
W_{U1}	Total weight of trommel's first unders, wet tonne
W_{U2}	Total weight of trommel's second unders, wet tonne
x_o	Characteristic particle size, cm
Y_x	Cumulative passing dry weight fraction of particles smaller than or equal to given sieve size x, w:w
α	Particle departure angle (rad)
β	Trommel inclination angle (rad)
δ	Particle landing angle (rad)
θ	Trommel inclination angle (rad)
λ_o	Angle yelding reflected passage of a particle

NOMENCLATURE

Symbol	Definition
μ	Mean
σ	Standard deviation
ω	Trommel rotational velocity (rad/s)
ω_c	Trommel critical velocity
Φ	Derived factor

ABBREVIATIONS AND ACRONYMS

CI	Confidence interval
COL	Collection
COM	Composting facility
db	Dry basis
DT	Operation downtimes
ECF	Edmonton Composting Facility
h	Hour
IPTF	Integrated processing and transfer facility
ISWM	Integrated solid waste management
L	Litre
lb	Pound
MBT	Mechanical-biological treatment
MC	Moisture content

ABBREVIATIONS AND ACRONYMS

min	Minute
MRF	Material recovery facility
MSW	Municipal solid waste
MTBF	mean time between failures
MTTR	mean time to repair
PDF	Probability density function
PP	Pre-processing facility
PSD	Particle size distribution
RDF	Refuse-derived fuel
REC	Recycling facility
RR-PSD	Rosin-Rammler PSD
RSD	Relative standard deviation
s	Second
SD	Standard deviation
SE	Standard error
t	Metric tonnes
TS	Transfer station
UT	Operation uptimes
wb	Wet basis
WTE	Waste-to-energy facility

CHAPTER 1. INTRODUCTION

1.1 Significance of Waste Separation

The waste hierarchy includes the five major waste management priorities of (1) waste prevention; (2) reuse; (3) recycling of materials; (4) recovery, e.g., material utilization and energy recovery; and (5) disposal, e.g., landfilling and incineration (Christensen, 2011; Turner et al., 2016). However, implementing waste prevention/minimization and the separate collection of recyclables from the sources of generation is not sufficient and mixed waste that is mainly composed of organic matter should be processed further prior to landfilling (Di Lonardo et al., 2012). Additionally, recycling at a material recovery facility (MRF), and waste treatment methods, such as composting, anaerobic digestion, waste-to-energy, etc. rely on effective waste pre-processing, which mainly comprises of mechanical treatment. In Europe, mechanical-biological treatment (MBT) plants are widely used (Dias et al., 2014) to remove the organic fraction of municipal solid waste (OFMSW) for bio-stabilization before landfilling (Fei et al., 2018a; Scaglia et al., 2013). Further processing can be done to remove high-calorific value material for utilization in refuse-derived fuel (RDF) production.

The purpose of mechanical treatment is therefore to split the infeed waste into different desired waste streams to be recycled or further treated. One of the major categories of mechanical treatment is size separation. Size separation is typically used in the first stage of waste processing. Additionally, size separation can be effective when there is a relationship between the size of waste material and their type (Christensen, 2011). Trommel screens, disc screens and oscillating screens are the most common separation equipment in waste processing.

1.2 Rotary Screen (Trommel)

A rotary screen (or trommel screen or drum screen) is an inclined rotating drum with apertures in its surface that creates a continuous cataracting motion to ensure that particles impinge on the rotating screen (Montejo et al., 2013). Particles that are smaller than the apertures can be separated, although the separation is never ideal. Typically, spikes and lifters are used inside municipal solid waste trommels to improve bag breakage and screening efficiency. In comparison to other size separation equipment, trommels have low maintenance and operating costs (Stessel, 1991) and can handle larger throughputs.

As demonstrated in other articles (Pressley et al., 2015; Romero-Güiza et al., 2014; Velis et al., 2013a), trommel screens are typically installed immediately after the feeder or as one of the first mechanical separating equipment used in facilities processing mixed waste and MBT plants to perform the initial waste separation. A trommel is not a stand-alone size separation device. Usually, more sophisticated waste separation equipment follow the trommel in order to increase the quality of separation of the target material. Some applications of trommels in solid waste processing are: (a) grit removal from high heating value materials; (b) screening out OFMSW for composting (Rajabpour Ashkiki et al., 2019) or biological treatment prior to landfilling (Montejo et al., 2013, 2010); (c) separation of recyclables such as aluminum cans and plastic bottles in material recovery facilities; (d) final screening for quality enhancement of finished compost (Christensen, 2011; Montejo et al., 2010); (e) processing construction and demolition waste (Christensen, 2011; W.-L. Huang et al., 2002; Sullivan et al., 1992); and f) landfill reclamation (Chiemchaisri et al., 2010; Prechthai et al., 2008).

1.3 Trommel Operation

The principles of trommel design were originally adapted from mineral processing in the early 1980s. Trommel models were developed for application in waste management using numerical methods (Alter et al., 1981; Glaub, 1982; Glaub et al., 1982; Stessel, 1991; Stessel and Kranc, 1992) and an empirical method (Sullivan et al., 1992; Wheeler et al., 1989). However, there is no strong consensus among developed models on the performance of the trommel in terms of the amount of undersized fractions removed versus feed rate and aperture size, as there is variation in full-scale operation that results in unsteady conditions that affect trommel performance. Variability in trommel performance can be due to: (a) seasonal variation in composition and characteristics of waste (b) feed rate variation, (c) bag breakage, and (d) clogging of the apertures, which, to the best of our knowledge, have not been significantly studied although the need to do so has been identified (Alter et al., 1981; Sullivan et al., 1992). As a result, the performance of mechanical treatment equipment, such as trommels, is poorly characterized in full-scale operation, and consequently the design and operation of waste facilities processing, such as MBT plants that mostly use trommel screens, remains semi-empirical (Velis et al., 2013a), as opposed to other size separation screens.

Recent studies that evaluated an MBT plant via material flow analysis and a life-cycle assessment, or that assessed the biological treatment of the OFMSW (de Araújo Morais et al., 2008; Edo-Alcón et al., 2016; Montejo et al., 2013, 2010; Pantini et al., 2015; Pressley et al., 2015; Romero-Güiza et al., 2014; Velis et al., 2013a, 2009) have superficially reviewed each related trommel. The reviewed information included the resulting waste separation mass balance and separation efficiency of the target material, e.g. organics, paper, plastic, etc. in each waste stream.

No detailed investigation has individually focused on the trommel performance and operation. In addition, most of the trommel case studies completed in North America were selected from California (Glaub, 1982; Glaub et al., 1982), New Orleans (Alter et al., 1981), Iowa (Robinson, 1986) and Maryland (Hennon et al., 1983), and did not necessarily reflect the operation conditions in a location with extreme cold weather.

1.4 Case Study

The case study investigated herein is a waste pre-processing facility located in the Integrated Processing and Transfer Facility[1] (IPTF) of the City of Edmonton, Canada. The IPTF is currently operating at a maximum capacity of 90 tonnes per hour during the peak loading season. This facility separates the OFMSW streams for composting, while oversized waste streams containing high heating value material are further processed for refuse-derived fuel (RDF) production. IPTF is the only facility that processed mixed residential waste (with recyclables removed) in the province of Alberta. In 2016, this facility processed more than 250,000 tonnes of single- and multi-family comingled residential waste (Edmonton, 2016). Among provinces of Canada, Alberta has the highest waste generation per capita rate, calculated using waste disposal (by source)[2] (Statistics Canada., 2019a) and population data (Statistics Canada., 2019b). As shown in Figure 1-1, the total waste and the non-residential waste generated in Alberta was the highest across Canada since 2008. In addition, Alberta is among provinces with the highest residential

[1]https://www.edmonton.ca/programs_services/garbage_waste/integrated-processing-and-transfer-facility.aspx

[2] Table: 38-10-0032-01 (formerly CANSIM 153-0041)

waste generation rate, while its waste diversion rate is among the lowest, as indicated in Figure 1-1, which urges on more waste recycling that would enable Alberta to divert more waste from landfills.

The pre-processing system in IPTF consists of two parallel lines fed by a grapple. The feeding system, comprising of a hopper and conveyors, transfers the raw MSW from the tipping floor to the first hand-sorting room, where hazardous household waste and bulky discards are manually removed. Afterward, the post-sorted waste is mechanically size separated into different waste streams using a two-stage trommel followed by a disc screen. The trommel is 14 m long, comprises of two 7 m long connected screening stages. The diameter of the apertures in the first and second stages are 5 cm (2”) and 23 cm (9”). Following the second stage of the trommel is a disc screen with a cut-off size of 12.7 cm (5”). The >23 cm (>9”) waste material leaves the trommel outlet as the oversized flow (overs) and goes through a secondary hand-sorting. The schematic of the explained waste pre-processing and system is presented in Figure 1-2. Following initial investigations and interview with operation staff, it was realized that the trommel is a potential bottleneck to the overall facility throughput since this equipment is loaded with the majority of the waste material received by the IPTF, except a small portion of the feedstock that is removed ahead by the first-hand-sorting unit operation. Furthermore, the performance of the trommel affects the quantity and quality of resultant waste streams separated from it, and subsequently affects the overall effectiveness of the receiving equipment/facilities. Therefore, from an operation perspective, the trommel’s performance was of concern more than of other unit operations and equipment’s in IPTF.

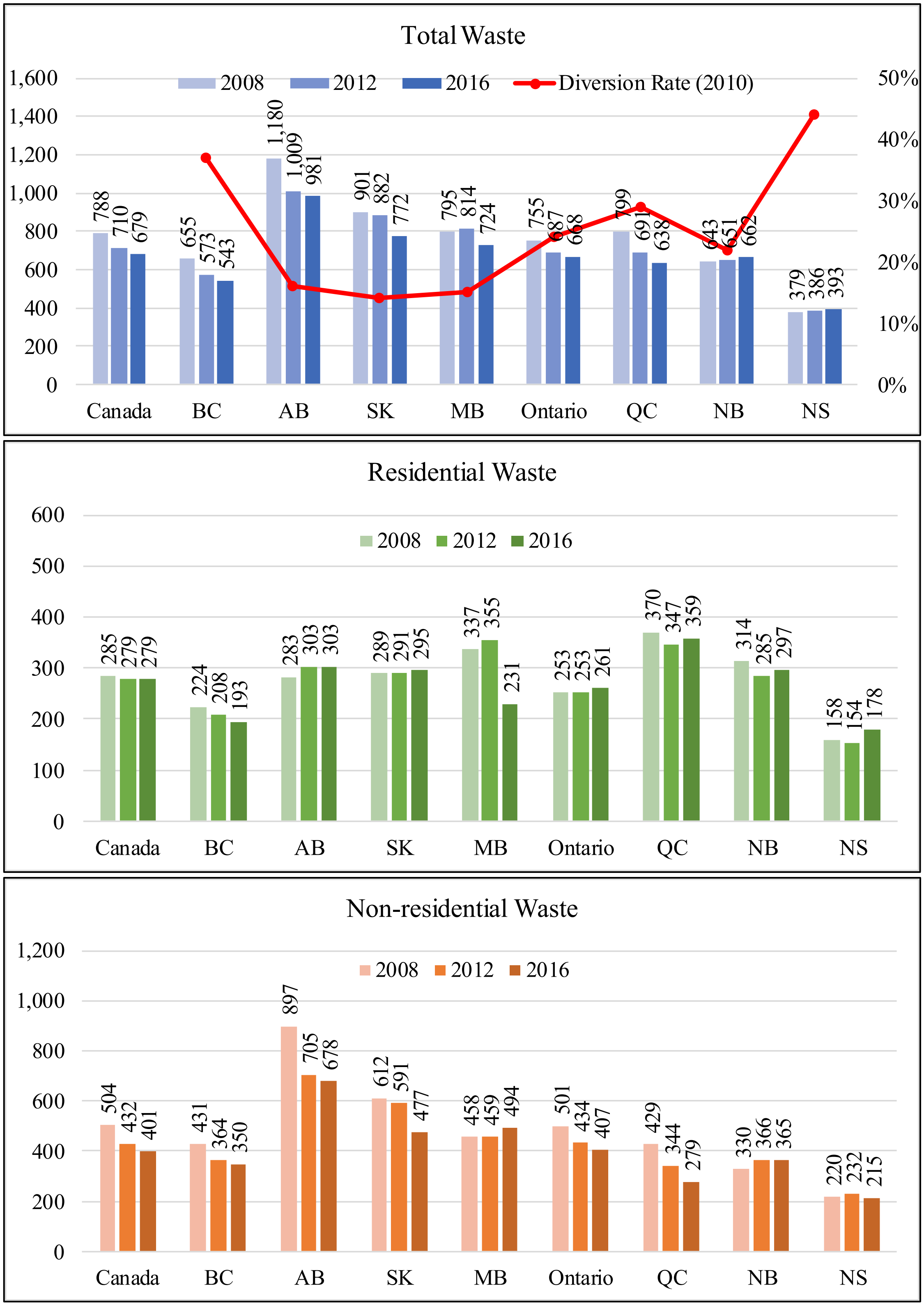

Figure 1-1 Per capita disposal of waste (by source) and waste diversion rate for selected provinces of Canada

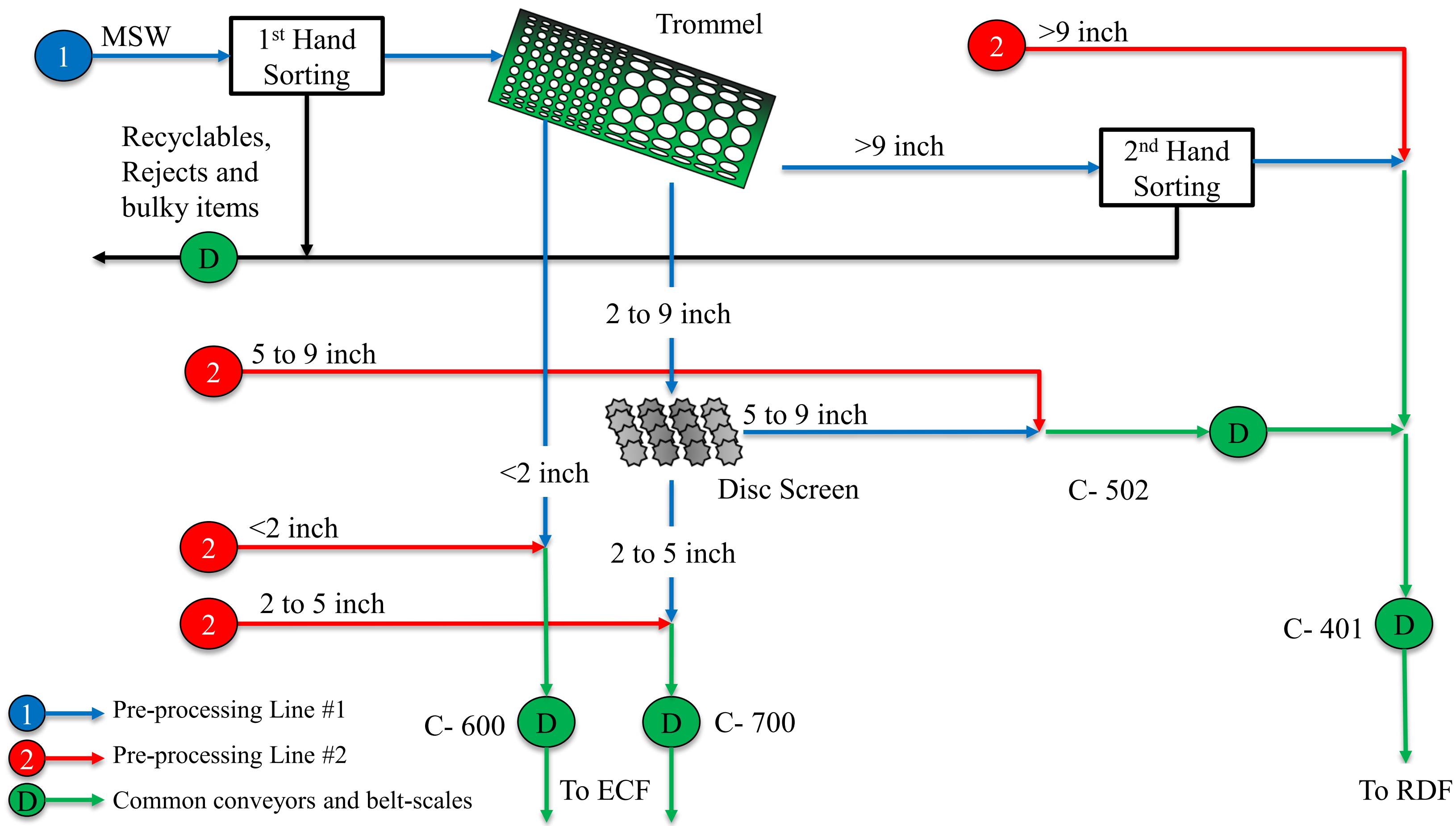

Figure 1-2 Pre-processing flow diagram and automatic data recording system

1.5 Reliability of Waste Separation

Trommel is not entirely reliable or available equipment to fulfill their capacity requirements during operation. In real operation, the actual capacity is typically lower than the designed capacity due to regular maintenance and sporadic system failures that cause downtimes. Initial optimization and simulations modeling studies in waste management assumed that a waste treatment facility was always operable (Baetz, 1990). In later studies, a fixed reliability percentage (or factor <1) was applied to the designed capacity of a facility, accounting for operation uncertainty (Baetz, 1990; Combs, 2012; Franchetti, 2009; Pressley et al., 2015). In recent capacity planning and capacity allocation/optimization studies (Chang et al., 2011; Dai et al., 2014, 2012; Fei et al., 2018b; Huang et al., 1992, 2001; Y.P. Li and Huang, 2010; Yadav et al., 2016; Zhu and Huang, 2011) uncertain capacity has been defined under different probability levels of constraint violation, using information of uncertain waste generation rates, and not based on real operation-related failure data. To date, no specific study was found in the field of waste system planning or optimization that uses the actual operation data similar to typical reliability analysis in system engineering found elsewhere (Bourouni, 2013; Buzacott, 1967; Choi and Chang, 2016; Der Kiureghian et al., 2007; Hajeeh and Chaudhuri, 2000; Kutbi et al., 1982). There is a need for studying the potential impact of seasonality, variation in waste composition and loading rate on reliability of a waste processing facility in full operation. In typical design methods, the capacity of a waste management facility is determined according to per capita rates of waste generation, which may be fixed or vary over time (Dyson and Chang, 2005) and a peak factor that accounts for high season waste generation. This basic appeoach could be improved by taking reliability of the receiving facility into consideration, which turns the design into a more dynamic method.

1.6 Objectives and Scope of the Research

There are two high-level sets of research goals defined in this work, which study (1) screening performance and (2) operation performance of a full-scale trommel. The first set of research objectives is to quantify and assess the impact of feed rate variation and seasonal variation in waste characteristics, in terms of particle size distribution and composition, on trommel's screening performance during full-scale operation throughout the year. It is also intended to determine whether variation in the quantity of feed (i.e., loading rate) or variation in the quality of feed (i.e., feedstock characteristics) has a primary impact on trommel performance. Also considered are impacts of clogging of screen apertures on the screening performance. The outcomes of the first set of objectives mostly cover the knowledge gap regarding the trommel's screening performance reviewed in Sections 1.1 and 1.2 and can be used to improve the case study. The second set of objectives are to characterize the operation performance of the waste processing system, with a primary focus on the trommel, using a system availability and reliability analysis developed in the field of engineering management. The hypothesis is that the reliability (i.e., probability of operating consistently) and throughput of the waste processing system will be adversely affected due to higher loading rates. The extent of such change has not been determined, but could be an increase in number and duration of operation downtime. The outcomes relate to the reliability of the waste separation operation (introduced in Section 1.5) and the bottleneck problem concerning the trommel.

The specific objectives are:

1) To capture the effects of seasonal variation on composition and particle size distribution of MSW feedstock as well as the feed rate (Chapter 3);
2) To quantify the effects of feed rate on the recovery of undersized fractions (Chapter 3);
3) To quantify clogging formation over operation time (Chapter 3);
4) To evaluate the size separation configuration in terms of the quality of separated materials (Chapter 3);
5) To verify whether an increase in the feed rate and/or seasonality can significantly impact the reliability of the waste pre-processing system (Chapter 4);
6) To develop a breakdown of operation downtimes regarding the type, number, duration and frequency of downtimes, and variability with feed rate and season (Chapter 4);
7) To assess the reliability and/or maintainability of the system using probability analysis (Chapter 4), and;
8) To quantify the potential effects of different feed rates and seasons on the system throughput (Chapter 4).

1.7 Limitations

This research study was completed at full-scale within the operations of the IPTF, whose primary day-to-day commitment was to receive and process the City of Edmonton's waste. On the other hand, for consistency in data collection, all experiments and waste sampling were conducted on one specific pre-processing line while the other pre-processing line was shut down for accuracy in data collection, which in turn, caused temporary waste backlog on the tipping floor. Thus, priority was given to the operation to avoid any considerable waste accumulation on the tipping floor that causes non-compliance situations. Overall, the operation restrictions mentioned above limited the number and duration of trials in the experimental design.

The City of Edmonton's comingled residential waste was collected from different sources, including curbside, single-family houses, and multi-family houses. The composition of waste differ from source to source. Each source of waste was collected separately based on a schedule. Depending on the collection schedule, the composition of the waste being stored on the IPTF tipping floor could vary over time. In order to limit the variability of the feed, trials were scheduled on specific days during every experimental event to be consistent with collection schedules, and special events, e.g. Christmas and long weekends, when the quality and quantity of waste varied temporarily but significantly, were avoided. Despite that, variation in the composition of the waste was inevitable, given the heterogeneous nature of solid waste.

Further, the quantitative results, such as feed rate and separation efficiency (%) were calculated using the tonnage data, measured by the belt scales. All belt scales were installed on the post-trommel conveyer system shared between both lines. The bulky and rejected items removed from the feed by the hand-sorting rooms were weighed manually, not continuously, when the storage bin became full. This manually-recorded weight item was not included in loading (feed) rate calculation, applying a minor discrepancy of 1-2% between the actual and calculated loading rates. The significance of this limitation was recognized after the commencement of this research; however, upgrading the belt scale system was implemented after the majority of the required data was collected.

Finally, the high cost of detailed waste characterization (sieving of waste followed by composition analysis) limited the size of the sampling program.

1.8 Organization of Thesis

This thesis follows a paper format and includes the following five (5) chapters. Chapter 1, the present chapter, provides a general overview of the topic and briefly introduced the research team's selected case study. In addition, the scope of the work, the high-level and detailed objectives and limitations of this research were explained in this chapter. Chapter 2 briefly reviews relevant past studies on full- and pilot-scale trommel screen operations, as well as the numerical and empirical models developed for trommel screens in waste management. The literature review in Chapter 2 is independent of the background information regarding the trommel screens in the following chapters and is supplementary to them. Chapters 3 and 4, respectively, address the research objectives 1 to 4 and 5 to 8, as highlighted in Section 1.6. The related methodologies, experimentations and the obtained results of this research are presented and discussed in Chapters 3 and 4. The focus of Chapter 3, in particular, is on trommel performance under different operation conditions, such as the seasonal variation in the quality of feedstock, e.g., particle size distribution, composition and moisture content, and the quantity of feedstock loaded into the trommel screen, i.e., feed rate and overs loading rate. Also discussed are the screening efficiency, the recovery of waste material of different sizes, the clogging of screen apertures. Chapter 4 presents and discusses the results obtained from a reliability analysis of the pre-processing system with a primary focus on the trommel using operation downtime data. Finally, Chapter 5 provides a summary of the conclusions and contributions of this research alongside recommendations for future investigation.

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CHAPTER 2. Literature Review

2.1 Trommel Basics and Applications

Trommels, or rotary screens, are important size separation units in material processing operations (Stessel, 1991; Stessel and Cole, 1996; Stessel and Kranc, 1992) and have been used in different waste management facilities, such as material recovery facilities (MRFs), mechanical-biological treatment (MBT) plants, and refuse-derived fuel (RDF) production plants (Wheeler et al., 1989). The trommel is a rotating drum (or cylinder) with apertures in its surface, and it is inclined at a small angle from the horizontal axial, which creates a continuous cataracting motion to ensure that the particles within the trommel impinge on the rotating screen. Depending on the rotational velocity (speed), from low to high, three different particulate motions are generated inside a trommel: a) slumping (Chen et al., 2010) or clinker or cascade (Stessel and Cole, 1996), b) cataracting and c) centrifuging, as shown in Figure 2-1, of which cataracting is the only favourable motion.

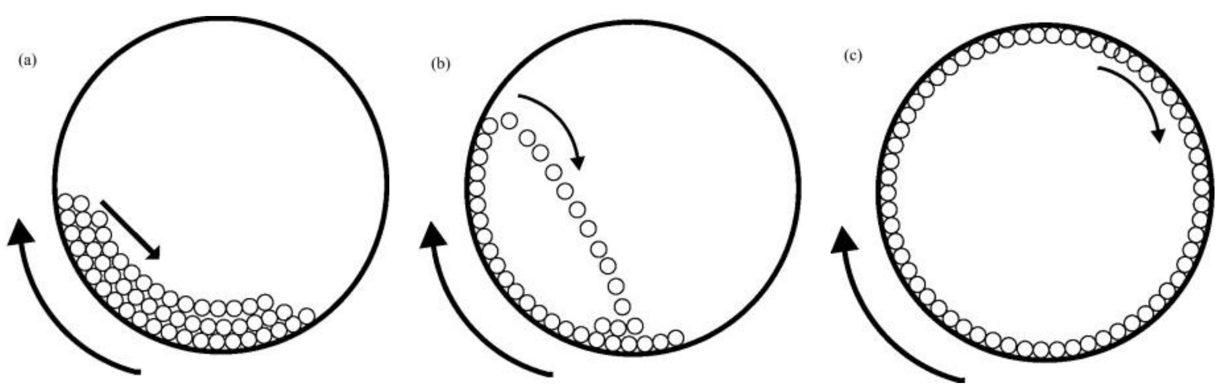

Figure 2-1 Types of particulate motion in rotating cylinders: (a) slumping; (b) cataracting; (c) centrifuging, adapted from Chen et al., (2010).

With cataracting motion, particles that are smaller than the apertures can be separated at each impingement. Usually, spikes (knives) and lifters are used inside a municipal solid waste trommel to improve bag breakage and cataracting motion that ultimately improves the efficiency of screening. In comparison to other size separation equipment, trommels have low maintenance and operating costs, but a higher capital cost (Stessel, 1991).

In waste management, trommels have been frequently used for (a) grit removal from high heating value materials; (b) screening out fine organics for composting or biological treatment prior to landfilling; (c) the separation of recyclables such as aluminum cans and plastic bottles in material recovery facilities; (d) quality enhancement of finished compost; (e) processing construction and demolition waste (Huang et al., 2002; Sullivan et al., 1992); and f) landfill reclamation (Chiemchaisri et al., 2010; Prechthai et al., 2008).

Additionally, trommels may be single-staged, double-staged, or multi-staged, depending on the number of aperture sizes. Accordingly, they emit one, two, or more streams of undersized material (Chen et al., 2010) in addition to the oversized material that leaves the outlet.

2.2 Trommel Specifications

Trommel specification and the uncertainties of trommel modeling and operation are explained in Table 2-1.

Table 2-1 Effective parameters and uncertainties of the trommel, adapted from Wheeler et al. (1989) and Stessel and Kranc (1992)

Independent Parameters	Uncertainties
▪ Rotational speed (ω) ▪ Screen aperture size (D_a) ▪ Screening length (L_T) ▪ Trommel radius (R_T) ▪ Open fractional area (f_a) ▪ Angle of inclination (β) ▪ Presence of lifters ▪ Presence of bag opening tools ▪ Feedstock o Feed rate (Q) o Particle size (D_p) and particle size distribution (PSD) o Particle shape o Density o Composition • Static and dynamic coefficient of friction between material and screen surface	▪ Breakage of bags and the liberation of entrained undersize particles ▪ Particle destruction and particle size reduction ▪ Particle-to-particle interactions ▪ Probability of a particle passing through a given aperture size ▪ Heterogeneous nature of the material ▪ Simulating the effect of lifters

2.3 Trommel Basics

Generally, cataracting motion occurs when the trommel rotates at around 40-60% of its critical rotational speed (ω_c). Critical rotational speed produces an angular acceleration equal to gravity (i.e., 1 g) at the surface of the trommel, causing centripetal motion inside the trommel where the material will remain in contact with the surface of the trommel. 50% of the critical speed usually is favourable and is discussed in Tchobanoglous et al. (1993) and Tchobanoglous and Kreith (2002) textbooks. Intense material agitation will start from rotational speeds greater than 75% of critical rotational speed, keeping waste material away from the screen (Sullivan et al., 1992).

The critical rotational speed is calculated using the particle flight trajectory, as shown in . From the simplified force balance on the vertical axis for a particle at point (1), the angle of departure (α, rad) can be calculated from Equation 1.

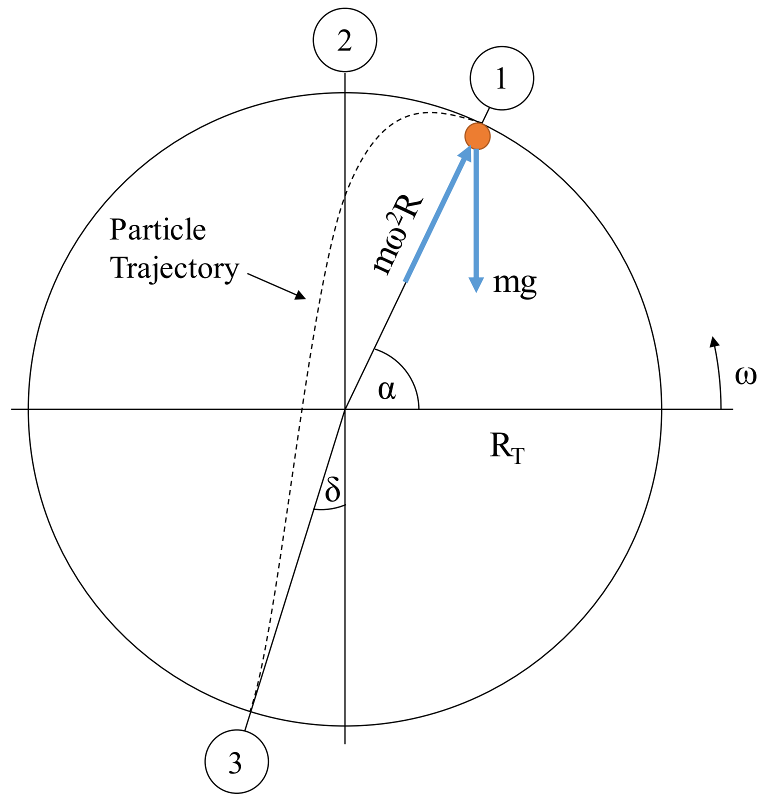

Figure 2-2 Particle trajectory inside a trommel

$$\alpha = \sin^{-1}\left(\frac{\omega^2 R_T}{g\cos\beta}\right) \qquad \text{Equation 1}$$

Where ω is the rotational velocity (rad/sec), R_T (m) is the radius of trthe ommel, and β is the inclination degree (rad). If rotation is at critical speed (ω_c) a particle can reach point (2) in , i.e., $\alpha = \frac{\pi}{2}$. Since the inclination degree is very small (usually between 2-5 degrees) $\cos\beta \approx 1$, thus, the critical speed can be calculated using Equation 2.

$$\omega_c = \sqrt{\left(\frac{g}{R_T}\right)}\,(rad/s) = \sqrt{\left(\frac{g}{R_T}\right)}/2\pi \times 60(rpm)$$ Equation 2

Equations 1 and 2 were calculated assuming a particle does not slip down on the rotating screen. Otherwise, higher rotational velocity is needed when slippage occurs in order to generate the cataracting motion. Lifters can compensate for slippage and improve the cataracting motion; however, their impact has not been modeled.

2.4 Numerical Studies

Since there were a few articles and technical reports found regarding the development of trommel models for processing of residential waste, the relevant information are chronologically reviewed. None of the models considered the effect of lifters and bag opening tools.

Alter et al. (1981) adapted required principles based on the concepts of 1) the probability of passage and 2) geometrically-oriented particle trajectory originally from mineral processing and developed the first trommel model in waste management.

2.4.1.1 Probability of passage

The probability of a particle passing through a screen is given in Equation 3.

$$p = \left[1 - \frac{D_p}{D_a}\right]^2 f_a \text{ (when } D_p < D_a\text{)}$$ Equation 3

Where D_p and D_a are the sizes of particle and aperture, and f_a is the ratio between the area of apertures and the total area of the screen surface.

Glaub et al. (1982) improved the probability of passage by introducing the "reflected" probability of passage that accounted for the aperture area and the area of contact around the edge of an aperture yielding passage via reflection, as shown in Equations 4 and 5.

$$p_r = \frac{(D_a - D_p \cos\lambda_o)^2}{{D_a}^2} f_a \qquad \text{when } D_p < D_a \qquad \text{Equation 4}$$

$$\text{Where } \cos\lambda_0 = \frac{D_p/D_a}{(8-4D_p/D_a)} + \left\{\left[\frac{D_p/D_a}{(8-4D_p/D_a)}\right]^2 + 0.5\right\}^{0.5} \qquad \text{Equation 5}$$

Where λ_0 is the angle yelding reflected passage of a particle. The reflected probability of passage is greater than the one calculated by Equation 3.

When particles are not uniformly sized, the cumulative probability of passage after *n* impingements for particles of size x_1, defined as $P(x_1)$, will be calculated based on Equation 6.

$$P(x_1) = [1-(1-p)^n]f(x_1) \qquad \text{Equation 6}$$

Where, fx_1 is the number fraction of particles of size x_1. $f(x_1)$ is obtainable from the number-based particle size distribution (PSD). Subsequently, the total probability of the passage of particles ranging between size x_0 and x_m after *n* impingements is given in Equation 7.

$$P(x_0, x_m) = \int_{x_0}^{x_m} f_x[1-(1-p)^n]d_x = \int_{x_0}^{x_m} f_x[1-(1+p)^{-n}]d_x \qquad \text{Equation 7}$$

The total fraction of particles ranging between size x_0 and x_m in the feed is obtained from Equation 8.

$$F(x_0, x_m) = \int_{x_0}^{x_m} f(x)d_x \qquad \text{Equation 8}$$

Finally, the efficiency of separation by the trommel is calculated based on Equation 9.

$$E(x_0, x_m) = P(x_0, x_m)/F(x_0, x_m) \qquad \text{Equation 9}$$

In contrary to Alter's model, Glaub et al. (1982) assumed the material bed consists of multiple layers, and particle passage through apertures only occurs with the finite layer that is in contact with the rotating screen, termed as "screening layer". This allowed for studying the effect of bed depth on the screening rate. In addition, they calculated the trommel efficiency based on the PSD obtained from the fractional weight instead of the fractional number. The number-to-mass conversion was not explained though.

Alter's probability of passage related to screening a single-layer of particles (explained by Equations 3 to 7) was replaced with a new method, including a set of calculations that accounted for screening a bed of material consisting of multi-layers through an aperture (Stesscl and Cole, 1996; Stessel, 1991; Stessel and Kranc, 1992). This method assumed that the screening of a multi-layer bed is a function of the probability that any particle larger than an aperture blocks the aperture; therefore, this method relied on obtaining a volume-based PSD (i.e., P_V) from converting the mass-based PSD to a number-based PSD (i.e., P_N) using the particle density.

The total volume of particles passing through an aperture (V_p) is:

$$V_p = \int_{D_{min}}^{D_a} \frac{P_N(D_p)V(D_p)}{\int_{D_a}^{Dmax} P_N(D_p)dD_p} dD_p \qquad \text{Equation 10}$$

Where,

- D_a and D_p are the aperture diameter and particle diameter for circular aperutres;

- D_{min} and D_{max} are the smallest and largest particle sizes;
- $P_N(D_p)$ is the number-based PSD;
- $V(D_p)$ is the volume of the particle of diameter D_p.

Stessel's method finds a maximum limit to the total volume of particles passing through the multi-layer bed (V_T), as shown in Equation 11a.

$$V_T = \begin{cases} V_{PB} \ if \ V_{PB} < V_h \\ V_h \ otherwise \end{cases}$$ Equation 11a

Where V_{PB} is the total particle volume in the multi-layer bed calculated using Equation 11b, and V_h is the volume of particles that passes through the screen calculated by Equation 11c.

$$V_{PB} = V_B \int_{D_{min}}^{D_a} P_V dD_p$$ Equation 11b

Where,

- V_B is the volume of the multi-layer bed;
- P_V is the volume-based PSD;

$$V_h = \begin{cases} E f_a V_P \ if \ V_P < V_c \\ E f_a V_c \ otherwise \end{cases}$$ Equation 11c

Where,

- f_a is the ratio between the area of apertures (holes) and the total area of the screen surface.

- E is a factor (>1) considering additional exposure to the screen as a result of slippage during particle rise.
- V_c is the volume of an individual frustum left after a fraction of the bed passed through the screen.

2.4.1.2 Particle Flight Trajectory

Using the flight trajectory (), Equation 12 is derived geometrically from the vertical distance from particle departure (point 1) and particle landing (point 3), neglecting small inclinations of the trommel.

The total particle horizontal displacement along the trommel length has two components, displacement during flight and displacement during vertical fall. The total horizontal displacement per impingement (*l*) is given in Equation 12, assuming $\sin\beta = \beta$, as β is small.

$$l = R_T\beta(\omega t \cos\alpha + \cos\alpha + \cos\delta) \qquad \text{Equation 12}$$

Equation 12 is rewritten, as Equation 13 below.

$$\frac{l}{\beta R_T} = \Phi = (\omega t \cos\alpha + \cos\alpha + \cos\delta) \qquad \text{Equation 13}$$

Where, *t* is the time of flight between departure and landing points, and can be solved geometrically using Equation 14.

$$\omega t = \sin\alpha\cos\alpha + [sin^2\alpha cos^2\alpha + 2\sin\alpha\,(\cos\delta + \sin\alpha)]^{1/2} \qquad \text{Equation 14}$$

Where geometrically $\delta = 3\alpha - \frac{\pi}{2}$.

Finally, the length of the trommel screen (L_T) for n impingements is given in Equation 15.

$$L_T = nl = \Phi n \beta R_T \qquad \text{Equation 15}$$

Briefly, in order to design a trommel, parameters such as trommel radius (R_T); inclination angle, (β) which is between 2-5 degree; and rotational velocity (ω), which is 40-60% of its critical rotational speed (ω_c) are required. The length of the trommel is a function of the amount of impingements required to satisfy the desired removal efficiency. Alter et al. (1981) developed graphs for the number of impingements required for the specified efficiency.

Glaub et al. (1982) improved on Alter's particle trajectory by considering slippage for the particle in contact with the screen in both the tangential and axial directions. This required incorporating the kinetic coefficient of friction and angle of slippage in the respective equations. The no-slip (or free fall model) simplifies the model to making it very similar to Alters's model though.

Furthermore, Glaub et al. (1982) studied the impact of different feed rates, inclination angles, and rotational velocities on two full-scale and lab-scale trommels used in the processing of MSW and air-classified light fraction material separated from shredded MSW, respectively. Despite this comprehensive work, discrepancies between the experimental results and the model predictions were reported, due to assumptions disregarding variations in composition and feed rate across the full operation cycle.

In a lab-scale study, Stessel (1991),Stessel and Kranc (1992) and Stessel and Cole (1996) incorporated the drag force on particles in both vertical and horizontal directions of the trajectory component developed by Glaub. For this, all particles were assumed to be spherical shape in theory for the numerical modeling and were selected from semi-sphere material for the lab experiment.

Stessel's model was successfully examined at lab-scale (Stessel and Cole, 1996). However, the feed was only made up of two undersize and two oversize ranges of particles and from the same material (i.e., gravel) with a constant bulk density. The bulk density of waste is much lower than that of gravel and there is a large variation in the bulk density of waste due to heterogeneity in the composition of waste. As a result, neither the trommel size nor the tested regimes reflected the realities of municipal solid waste (MSW) processing. The modelled condition was more representative of grit or glass removal.

The numerical studies, with the exception of Glaub's study, were completed using uniformly sized feeds (e.g., solid flakes, wooden blocks, gravel, and ash) to avoid waste heterogeneity and did not take into account critical factors such as shape, material degradation, and moisture variations (Bolczak, 1981; Savage et al., 1983; Stessel and Cole, 1996; Trezek and Wiles, 1977). In addition, the PSD of the feed, which is needed for calculating the amount of undersized material, should be based on the number of particles but is commonly reported based on mass in full-scale operations. The mass-to-number conversion inevitably reduces the accuracy of results, especially when the feed is not uniformly sized, shaped, or of the same material, as in MSW.

2.5 Empirical Studies

The advantage of empirical studies over numerical studies when designing a trommel is that many of the previously explained uncertainties associated with a trommel, which cannot be properly modeled by numerical studies, have been factored into the experimental results (Wheeler et al., 1989). Therefore, experimental results represent the real condition more effectively but are mostly case-specific, and their result may not apply to all cases.

Funded by the United State Department of Energy, Hennon et al. (1983) study was conducted by the Midwest Research Institute with assistance from Glaub's team in CalRecovery who developed the numerical trommel models based on full-scale results shown earlier. The facility studied used a trommel that further processed air-classified RDF material. The trommel studied was 8 m long (7.4 m perforated length) with a diameter of 3.7 m, an inclination angle of 3^{o} and 32 mm (1.25 inch) screen apertures. The overall goal of this study was to assess the effects of rotational velocity, material retention time and feed rate on trommel performance. In addition, trommel tests were conducted during all four seasons to capture any seasonal variation in trommel performance. No specific trommel model was developed, but the results helped provide a better understanding of the trommel performance in full-scale rather than in lab-scale or numerically.

The following are the study's major conclusions:

- Screening efficiency of 32 mm apertures decreased as feed rate increased. + 90% efficiencies were only achieved at very low feed rates. For example, an efficiency of 80% was achieved at feed rates less than 9 tonnes per hour (t/h), which was 10% of the trommel's maximum designed feed rate. A linear correlation was found between efficiency and feed rate (Figure 2-3).
- Generally, screening efficiency increased with rotational velocity. However, this is not very noticeable at low feed rates as lifters compensate for the impact of lower rotational velocities (Figure 2-3).

- The optimum feed rate at which trommel operation was economical, and both energy recovery and screening efficiency were maximized, was 7-13 t/h, that is 18-33% of the designed feed rate.
- Seasonal variation was observed in the properties of feedstock, for example during the summer period, feed material was smallest in size and highest in moisture content, due to lawn and garden waste in the MSW. Despite that, no seasonal variation regarding trommel performance was concluded due to the large variability in the related data.

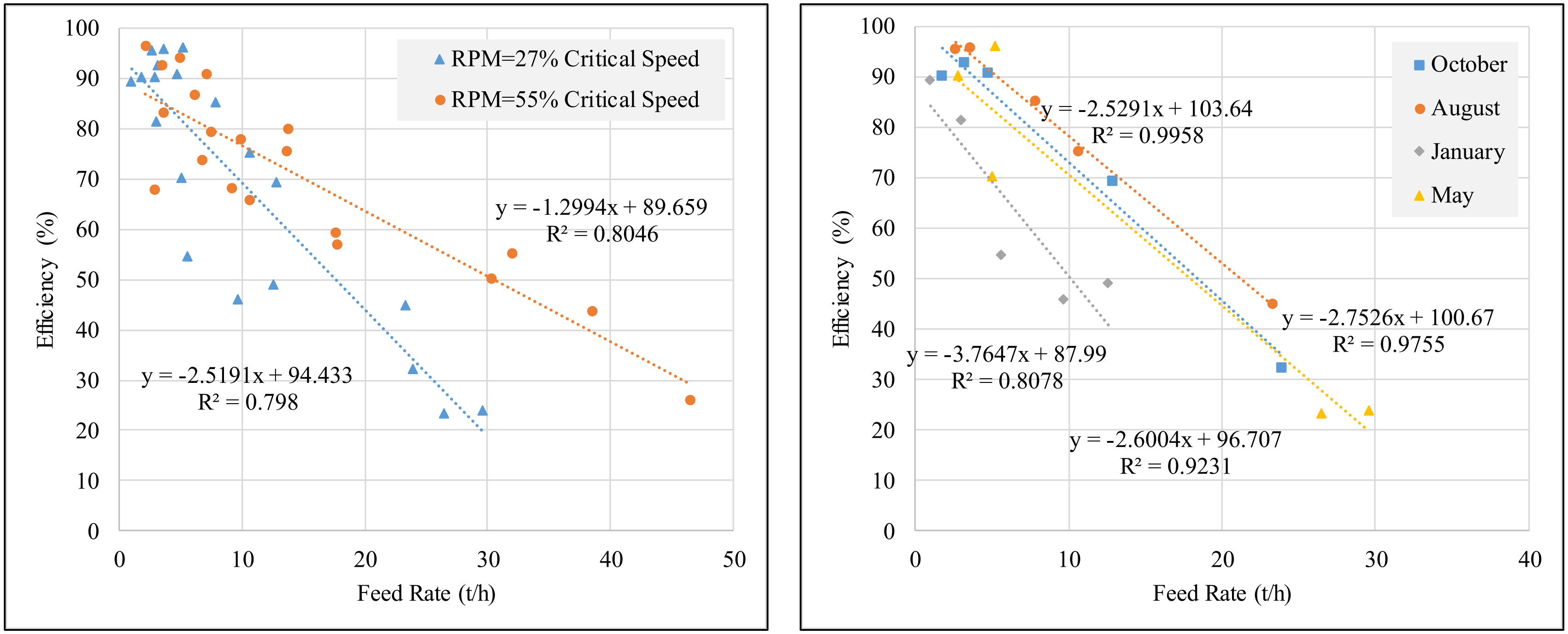

Figure 2-3 Correlations between efficiency and feed rate found by Hennon et al. (1983) (left: all season data obtained at 6 and 12 rpm which equated to 27% and 55% of critical speed; right: different seasons at 6 rpm), the graphs are reproduction of the data presented

Wheeler et al. (1989) used real data from three full-scale trommels operated in refuse processing plants in the UK. The correlation between two defined indexes, feed rate index and recovery index, for different size fractions was studied. Feed rate index was defined as the flowrate of true oversize, that is, the portion of feed rate associated with particles larger than the given diameter D_P, divided by the trommel cross sectional area ($\frac{t}{hm^2}$). The recovery index was expressed as recovery of the undersize fraction (with diameter D_P) per unit length of the trommel (%/m). Feed rate index (Q_I) and recovery index (R_u) for a given particle diameter D_P are given in Equations 16 and 17.

$$Q_I = \frac{Q_{>D_p}}{\pi {R_T}^2} \qquad \text{Equation 16}$$

$$R_u = 1 - exp\left(\frac{\ln(1-R_t)}{L_T}\right) \qquad \text{Equation 17}$$

Where,

- $Q_{>D_p}$ is the feed rate associated with particles larger than size D_p (t/h)
- R_t is the total recovery of targeted undersize (%)
- L_T is the trommel length (m)

The advantage of Q_I and R_u is that these parameters are independent from the trommel's radius and length. A non-linear correlation was found between Q_I and R_u for the different particle sizes that were recovered. These correlations were used for designing a new trommel or upgrading the existing trommel using Equations 16 and 17, but within the context of the collected data. Model predictions were limited to the particular particle size ranges for which recovery data was obtained, i.e., the model predictions concerning recovery of undersize material are not accurate when the screen size differs significantly from those examined.

Sullivan et al. (1992) empirically simplified the dynamics of screening by introducing fill and slope factors that were obtained from several observations. They sized a trommel for a given throughput and feed bulk density within a regime ensuring cataracting motion. The rotational velocity in Sullivan's calculation is 50% of the critical velocity.

The trommel diameter (D_T) and length (L_T) are calculated using Equations 18 and 19.

$$D_T = [11.36Q_m/(d_b F K_v g^{0.5} \tan\beta)] \quad \text{Equation 18}$$

$$L_T = 0.113TD^{0.5} g^{0.5} K_v \tan\beta \quad \text{Equation 19}$$

Where,

- Q_m is the given throughput (t/h)
- d_b is the bulk density of waste (kg/m^3)
- β is the inclination angle (degree)
- F is a fill factor between 25% and 33%
- K_v is the velocity correction factor $\begin{cases} 1.35 \; when \; \beta = 3^o \\ 1.85 \; when \; \beta = 5^o \end{cases}$
- T_R is the trommel residence time (min); no less than 2 min and between 3-5 min; and
- g is gravitational acceleration

This method did not determine the recovery of undersize material removed by the trommel and referred to Alter's model. Sullivan et al. (1992) summarized that screening efficiency barely exceeds 80% when removing particles smaller than half the dimeter of a hole, and particles larger than half-diameter have a screening efficiency of 65% at most, overall. Table 2-2 summarizes the common sizes recommended for the screening of different waste material.

Table 2-2 Recommended aperture size for screening different waste types, adapted from Sullivan et al. (1992)

Type of waste	Recommended screen size
Residential (MSW)	25-51 mm (or 1-2 inch)
Compost	76-102 mm (3-4 inch) for pre-composting 10-19 mm (3/8-1/4 inch) post-composting screening
MRF	25-51 mm for glass and fine grit 152 mm (6 inch) for cans
Construction and demolition	19 mm (3/4 inch) Or 19 ×32-38 mm (3/4 inch ×1 ¼ - 1 ½ inch)
Shredded tire	51 mm (2 inch)

Thanks to its simplicity, it is the design formula most commonly cited in the MSW handbooks, such as Pichtel (2005), Tchobanoglous et al. (1993) and Tchobanoglous and Kreith (2002).

Table 2-3 chronologically summarizes the previous studies.

Table 2-3 Chronological summary of trommel studies.

Reference	Type and scale of study	Location	Disadvantage or limitations
Alter et al. (1981)	Numerical (no experiment)	New Orleans, Louisiana (USA)[1]	1) particle trajectory calculations were geometrically-oriented; 2) PSD of feed was based on fractional number instead of fractional mass (or weight); 3) material was assumed to be regularly spherical shaped, 4) the shape factor for irregularly shaped material was unknown; 5) material density was not reported; 6) reflection from aperture edges was omitted from probability of passage calculations; 7) discrepancy between thickness of material and equivalent feed rate; 8) considered a single layer thickness and probability of passage
Glaub et al. (1982)	Numerical (lab and full scale)	Berkley, California (USA)[2]	1) did not consider drag force on particles; 2) discrepancies were found between model and full-scale results.
Hennon et al. (1983)	Empirical	Baltimore, Maryland (USA)[3]	1) no trommel model was developed. 2) small samples (only 2 kg) were collected from unders and overs waste streams for compositional analysis, which may not be representative. 3) the trommel studied was a post-trommel fed with pre-processed waste material, and not applicable to pre-trommel configuration
Wheeler et al. (1989)	Empirical (lab and full scale)	UK[4]	1) only applicable for designing or upgrading an existing trommel within the context of collected data; 2) assumed the rate of screening was constant along the trommel; 3) did not consider inclination angle, instead, interpolated between recoveries concerning two tested inclination angles to obtain recovery at a non-tested inclination angle; 4) recovery of undersized material was overestimated at lower feed rates, due to low efficiency of waste liberation devices in front of the trommel. 5) did not consider inclination angle of trommel and characteristics of feedstock.

Reference	Type and scale of study	Location	Disadvantage or limitations
Sullivan et al. (1992)	Empirical (full scale)	New Orleans, Louisiana, (USA) [1]	1) did not calculate separation efficiency, referred to Alter et al. (1981); 2) only for simple sizing of a trommel (rotational velocity, radius and length);
Stessel and Cole (1996)Stessel and Kranc (1992)Stessel (1991)	Numerical (lab scale)	Not applicable	1) model was developed based on spherical particles and did not include shape factor; 2) conditions tested at lab-scale represent glass and grit removal, not processing of mixed residential waste; 3) a high constant bulk density of 1687 kg/m^3 was assumed for converting number PSD to mass-PSD, compared to below 250 kg/m^3 of mixed residential waste; 4) given lab-scale experimentation, the feed rates tested were significantly lower than full-scale operation and the size of apertures was not comparable to a full-scale trommel.

[1] The experiment was carried out at the National Centre for Recourse Recovery in New Orleans, Louisiana, USA.
[2] The experiment was carried out by CalRecovery Inc. in Berkley, California, USA.
[3] The experiment was carried out at Baltimore County MSW processing plant in Baltimore, Maryland, USA.
[4] The experiment was carried out at Warren Spring Laboratory, UK.

2.6 Other relevant works

Dynamics of size separation using rotary screens has been further studied in other areas such as food technology (Bellocq et al., 2017) and powder engineering (Chen et al., 2010). However, the majority of investigations in powder technology have focused more on rotating drums that are used for mixing of particle (Morrison et al., 2016; Xiao et al., 2017; Yang et al., 2017) rather than screening, including granule breakage during mixing (Ahmadian et al., 2011); size segregation of particles in rotating drum (Eskin and Kalman, 2000; He et al., 2019); hydrodynamic behavior in a rotating drum (Santos et al., 2013); end-wall effect on mixing of particles (Liu et al., 2018); wet granular segregation in rotating drum (Liao et al., 2016; Liao, 2018; Liao et al., 2016) and effect of friction granular dynamics in rotating drum (Chou et al., 2016). The investigation outlined above were possible mainly due to the consistent characteristics of the material that were processed which were more granular (i.e., regularly-shaped) and homogenous, as opposed to waste material.

2.7 Knowledge Gap

There is no strong agreement upon the recoverable amount within the undersized fractions versus feed rate and aperture size, nor are the models robustly validated in other similar facilities. Additionally, screening of material in full-scale operations may not proceed consistently in the short term (operating cycle) and long term (season). The effect of screening duration has not been investigated completely (or reported). Generally, inconsistency or variation in screening may be originated from seasonal variation in waste composition and characteristics and/or variation in feed rate (c) bag breakage, and (d) the clogging of the apertures, which, to the best of our knowledge, has not been studied significantly (Alter et al., 1981; Sullivan et al., 1992). References to facility shutdowns that have appeared in past literature (Robinson, 1986) underscore the importance of characterizing those uncertainties. In addition, waste quality is variable and site-specific (Velis et al., 2013b). Most of the well-documented trommel studies were selected from facilities in North America, such as in California (Glaub, 1982; Glaub et al., 1982), Louisiana (Alter et al., 1981), Iowa (Robinson, 1986) and Maryland (Hennon et al., 1983), and do not necessarily reflect trommel operations in other locations and weather conditions, particularly winter (freezing) conditions.

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CHAPTER 3. IMPACTS OF SEASONAL VARIATION AND OPERATING PARAMETERS ON DOUBLE-STAGE TROMMEL PERFORMANCE [1]

3.1 Introduction

3.1.1 Background

A rotary screen (trommel) is an inclined rotating drum with apertures in its surface that create a continuous cataracting motion to ensure particles impinge on the rotating screen. Ideally, particles that are smaller than the apertures can be separated. Typically, spikes and lifters are used inside municipal solid waste trommels to improve particle separation, bag breakage, and screening efficiency. In comparison to other size separation equipment, trommels have low maintenance and operating costs (Stessel, 1991) and can handle larger throughputs. Some applications of trommels in solid waste processing are: (a) grit removal from high heating value materials; (b) screening out fine organics for composting or biological treatment prior to landfilling; (c) separation of recyclables such as aluminum cans and plastic bottles in material recovery facilities; (d) quality enhancement of finished compost; and (e) processing construction and demolition waste (Huang et al., 2002; Sullivan et al., 1992); and 6) landfill reclamation (Chiemchaisri et al., 2010; Prechthai et al., 2008). Additionally, trommels may be single-staged, double-staged or multi-staged,

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[1] A version of this chapter has been published in the Journal of Waste Management.
Rajabpour Ashkiki, A., Felske, C., McCartney, D., (2019) Impacts of Seasonal Variation and Operating Parameters on Double-Stage Trommel Performance. Waste Management 86 (36–48) (https://doi.org /10.1016/j.wasman.2019.01.026)

depending on the number of aperture sizes. They may, therefore, emit one, two, or more streams of undersized material. Specifications such as the diameter and length of the trommel, length of screening surface, inclination angle, the shape and size of apertures, and open area ratio should be determined together with the operating parameters, feed rate, and rotational velocity. For an existing trommel, which is the subject of this research, controling factors are limited to feed rate, rotational velocity, and open area ratio of screen unless more costly post-modifications pertaining to trommel dimensions and inclination angle are possible.

The principles of trommel design were originally adapted from mineral processing in the early 1980s. The first trommel model (Alter et al., 1981) considered two sets of equations calculating the probability of passage and geometrically-oriented particle trajectory, which simplified modeling by disregarding the impacts of particle-to-particle interaction and particle passage due to reflection against aperture edges. Because these latter principles were not considered, the model outcomes were not accurate. The next study significantly improved the trommel model by (a) introducing a "screening layer thickness model" and (b) adding the coefficient of friction between waste and screening surface (Glaub, 1982; Glaub et al., 1982). Also investigated were the impacts of different feed rates, inclination angles, and rotational velocities on trommel performance. Despite the comprehensive work, discrepancies between experimental results and model predictions were reported, due to assumptions disregarding variations in composition and feed rate across the full operation cycle. The last model was developed by incorporating the drag force on particles into the trajectory component (Stessel, 1991; Stessel and Kranc, 1992). An algorithm was also developed to control the volume of particles passing through a hole. Stessel's model was successfully examined at lab-scale (Stessel and Cole, 1996). However, neither the trommel size nor the tested regimes reflected realities of municipal solid waste (MSW) processing. First, the feed was composed of gravels. The numerical studies with the exception of Glaub's study was completed using uniformly sized feeds (e.g., solid flakes, wooden blocks, gravel, and ash) to avoid waste heterogeneity and did not take into account critical factors such as shape, material degradation, and moisture variations (Bolczak, 1981; Savage et al., 1983; Stessel and Cole, 1996; Trezek and Wiles, 1977). Additionally, the particle size distribution (PSD) of the feed, which is needed for calculating the amount of undersized material, should be based on the number of particles but is commonly reported based on mass in full-scale operations. The mass-to-number conversion inevitably reduces the accuracy of results, especially when the feed is not uniformly sized, shaped, or of the same material, as in MSW. To date, therefore, numerical models are more valid for other applications of trommel, such as powder technology than in waste management (Chen et al., 2010).

Another approach sought to empirically simplify the dynamics of screening by introducing fill and slope correction factors that were obtained from several observations (Sullivan et al., 1992). Sullivan's model sized a trommel for a given throughput and feed bulk density within a regime (mainly determined by rotational velocity and inclination degree) that created cataracting motion. Thanks to its simplicity, it is the design formula commonly cited in MSW handbooks (Pichtel, 2005; Tchobanoglous et al., 1993; Tchobanoglous and Kreith, 2002), although it refers to Alter's method for estimating the amount of undersized fractions.

As overviewed before, due to the inconsistencies found between model outcomes and experimental results, there is no strong agreement on the recoverable amount within the undersized fractions versus feed rate and aperture size. Additionally, full-scale screening could be unsteady in short term (operating cycle) and long term (season). Generally, due to: (a) seasonal variation in waste composition and characteristics, (b) feed rate variation, (c) bag breakage, and (d) clogging of the apertures, which, to the best of our knowledge, has not been significantly studied although the need to do so has been identified (Alter et al., 1981; Sullivan et al., 1992). Robinson (1986) reported facility shutdowns as a result of inefficient screening operation. In addition, waste quality is variable and site-specific (Velis et al., 2013b). Furthermore, most of the well-documented trommel studies were completed in California (Glaub, 1982; Glaub et al., 1982), Louisiana (Alter et al., 1981), Iowa (Robinson, 1986) and Maryland (Hennon et al., 1983), which do not imitate operation in other locations and weather conditions, particularly an extreme winter.

3.1.2 Case Study

The case study was a double-stage trommel operated in the Integrated Processing and Transfer Facility (IPTF) of the City of Edmonton. At the time, this facility processed more than 250,000 tonnes of single- and multi-family comingled MSW (without recyclables) generated by over 895,000 residents annually (Edmonton, 2016). IPTF produces two organic-rich waste streams for composting, while another two oversized waste streams mostly contain high heating value material that are further processed for refuse-derived fuel (RDF) production. Increasing the organic fraction of compost feedstock (reduction of contamination) and lowering the RDF feedstock moisture content (MC) to below 20% are two important goals of the operation.

The IPTF is currently operating at a maximum capacity of 90 tonnes per hour during peak loading season. In addition, clogging occurs inside the first stage of trommel during the winter season. Both effects eventually impact trommel's screening performance. Therefore, the challenge facing facility managers was to upgrade the trommel using feed rate and size separation perspectives that address qualitative requirements of feedstock preparation, as well as maintaining or increasing the overall waste processing throughput. Although no obvious seasonal trend in trommel performance has been reported (Hennon et al., 1983), the major contributors have not been identified and quantified clearly. Thus, characterizing the current trommel was required prior to any upgrade attempts.

3.1.3 Objectives

The goals of this research were to assess trommel's screening performance at full operation over the course of one year and to identify and quantify the sources affecting trommel performance. The specific objectives of the work presented herein were:

1) To capture the effects of seasonal variation on feedstock, including composition and characteristics (i.e., particle size distribution and moisture content) of MSW feedstock as well as feed rate.
2) To quantify the effects of different feed rates on the recovery of undersized and oversized fractions.
3) To quantify clogging formation over operation time.
4) To evaluate the size separation configuration in terms of the quality of separated materials.

3.2 Material and Methods

3.2.1 Pre-Processing System

The IPTF consists of two parallel lines that operate independently and were fed by a grapple alternately. Waste material was transferred by conveyors between unit operations. A schematic showing a waste pre-processing line is presented in Figure 3-1. The feed system, including a hopper and conveyors, transferred the raw MSW from the tip floor to the first hand-sorting unit, where recognizable hazardous household wastes, or bulky discards were manually removed from the moving waste and disposed of. The hand-sorted waste was fed into a mechanical size-separation compartment equipped with a double-stage trommel (manufactured by McElhanney in 2010) followed by a disc screen.

The trommel was 14 m long, comprised of two 7 m long connected screening stages. The diameter of apertures in the first and second stages were 5 cm (2”) and 23 cm (9”), respectively. The first stage screened out the < 5 cm waste, defined as “first unders.” The second stage separated out the < 23 cm (or < 9”) items, called “second unders,” while the > 23 cm (or > 9”) material and undersized material that escaped from screening left the trommel outlet as oversized waste flow (“overs”). The overs went through the second hand-sorting unit. The trommel’s second unders stream was split into two flows by a disc screen. The disc screen allowed particles smaller than or equal to 12.7 cm (5”) to pass through as the < 12.7 cm (or < 5”) underflow and be separated from the 12.7-23.0 cm (or 5”-9”) overflow material.

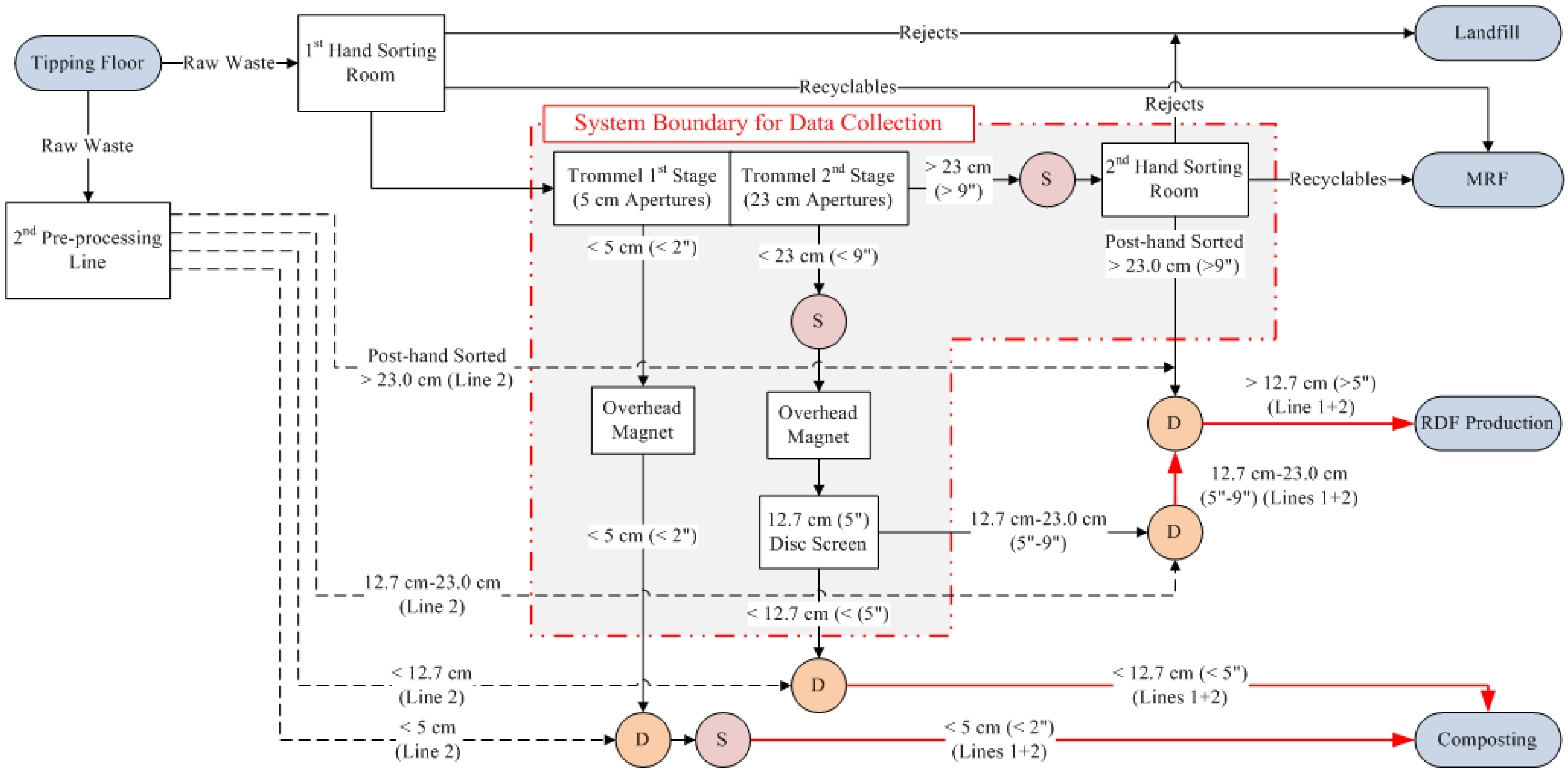

Figure 3-1. Pre-processing flow diagram (D: data collection by belt scale; S: waste sampling point; note for the sake of simplicity, the flow of ferrous metal separated by overhead magnets are not shown).

Following the size separation, the same waste stream from both lines was received by a common conveyor system and weighed automatically by an online belt scale. The belt scales measured the cumulative weight for the following waste streams received from both lines: (1) the trommel's first unders (< 5 cm), (2) the disc screen's underflow (< 12.7 cm), (3) the disc screens' overflow (12.7-23.0 cm), and (4) the total of the hand-sorted trommel's overs (coming from second sort room) and the disc screen's overflow that was already weighed separately prior to combining (i.e., 12.7-23.0 cm + > 23 cm or > 12.7 cm overall). Because of the belt scale system, only the trommel's first unders was weighed directly, but neither the MSW feed, nor the post-hand sorted waste fed into the trommel, nor other trommel outputs (i.e., the trommel's second unders and overs) was weighed directly. Thus, the weight of these waste flows was calculated from the weight of other waste streams being recorded.

In addition, the calibration of belt scales was periodically completed by the operations staff. The same conveyor system transferred the trommel's < 5 cm first unders and the < 12.7 cm disc screen underflow individually to the composting plant, while the disc screen overflow and the trommel's overs together were combined together and transferred as one feedstock to an RDF facility.

3.3 Trommel Specifications

The trommel was designed for a throughput of 55 metric tonnes per hour (t/h), but the design capacity of the feed conveyor was adjustable to between 40 t/h and 70 t/h. The trommel specifications are summarized in Table 3-1.

Table 3-1. Major specifications of studied trommel.

Item	Unit	Value
Total length	m (in)	16 (630)
Total screening length	m (in)	14 (551)
Length of each stage	m (in)	7 (276)
Diameter	m (in)	3.6 (141 ¾)
Inclination angle	Degree	5
Rotational velocity	rpm	9-12*
Retention time	min	2†
Screening ratio of first stage	by area	0.405
Screening ratio of second stage	by area	0.460
Lifters	rows per section	5‡
Bag openers arrangement	rows× spikes per section	5×7§

* The rpm can be adjusted by a variable frequency drives apparatus.
† Retention time was measured during experiment.
‡ Each stage consists of four (4) panels.
§ Shape and arrangement of bag breaking tools installed inside the trommel were not exactly identical.

3.4 Trommel Trials

Required data were obtained during trommel trials and follow-up experiments. Trommel trials were planned for the three seasons when historical data indicated meaningful changes in trommel performance and/or properties of feedstock:

- Winter events representing low load season: Mar 2014, Jan 2015, and Feb 2016.
- Summer events representing high load season, when green yard waste was present: Jun 2015 and Jul 2015.
- Spring events, when large amounts of thatch from yard waste were present, representing a transitional season in terms of disposal tonnage and weather: May 2016.

At the beginning of each test cycle, the trommel was cleaned. Since waste pre-processing lines were not equipped with designated belt scales, only one line was operated during each test cycle, so that belt scale records could be directly related to that line. Additionally, a portion of required data was obtained via follow-up waste characterization.

3.5 System Boundary

Considering the location of existing belt scales, a system boundary that merely included the trommel could not provide all scale data. To resolve this, the system boundary defined included the trommel and expanded over the disc screen and the second sort room (Figure 3-1).

3.6 Feed Rate

The plan was to load a pre-processing line consistently at three different feed loading rates (Q) for at least four hours. The target feed rates defined were 40 and 70 t/h corresponding with the nominal minimum and maximum capacities of the feeding conveyors. The third rate was an intermediate rate of 55 t/h which was the maximum design trommel capacity.

To set a feed rate during each test cycle, the average weight of a regular grapple load was determined. Effort was made to collect a minimum of five equally sized replicates from random locations of the waste pile resting on the tip floor prior to each trial. The variation in grapple loads was investigated by comparing mean and standard deviation of measurements.

To maintain a consistent feed at target rates, appropriate time intervals were allocated between grapple loads to be fed into the system. Higher feeding was implemented by allowing shorter time intervals between grapple loads and vice versa. All downtimes were recorded during the test.

The total weight of waste streams was recorded almost every 15 minutes. This, together with the duration of downtime, was used to calculate the feed rate based on Equation 20.

$$Q = \frac{W_{U1} + W_{U2} + W_{O}}{\text{Operation uptime}} \qquad \text{Equation 20}$$

Where:

- Q is the actual feed rate (t/h) managed during operation uptime, and
- W_{U1}, W_{U2}, and W_{O} are respectively the total weight of the trommel's first and second unders and overs. Therefore, the total of W_{U1}, W_{U2}, and W_{O} is approximately the weight of waste fed into the trommel, excluding the rejects removed by the hand-sorting rooms which were negligible (less than 5% of the total feed).

Where the feed rate deviated significantly from target rates, the results were rejected and the trial was repeated. A descriptive statistical analysis, including mean, 95% confidence interval (CI), and standard deviation (SD), was conducted to investigate seasonal variation in grapple loads and feed rate results. In addition, a two-tailed/two-sample unequal variance t-test was conducted on grapple load results to examine the significance of potential differences found between seasons.

3.7 Waste Sampling

There was no specific standard method for sampling a size-separated (processed) waste. The Standard *"Determination of the Composition of Unprocessed Municipal Solid Waste"* (ASTM Standard D5231, 2008), which recommended sorting a sample of 91-136 kg (200-300 lb), was adapted for sample sizing. Assuming that a pre-tumbled, size-separated waste stream was less heterogeneous than the unprocessed waste, the size of the samples to be collected from post-separated waste streams was reduced proportionally according to the annual average mass balance of the trommel. Approximately 25 kg, 75 kg, and 20 kg of waste were collected, respectively, from the trommel's first unders, second unders, and overs. Unlike the belt scale system, the trommel's output waste streams were directly sampled. Sampling points are shown in the process flow diagram (Figure 3-1).

During each trial, a sample was collected from each waste stream after one hour of operation. During a long trial, two additional samples were collected in the middle and close to the end of the operation. Attempts were made to sample all waste streams at comparable times. All collected samples were covered to prevent contamination from precipitation or moisture loss during material handling. The samples, if not dealt with on the same collection day, were capped and stored at 0-4^{o}C (Test Methods for the Examination of Composting and Compost, 2001a) to hinder potential mass loss through evaporation or the biodegradation of organics.

3.8 Waste Characterization

3.8.1 Sieve Analysis

Collected waste samples were sieved through a series of sieves described in Table 3-2, using a shaker device (Model: Sellbergs Eng.; type: LB/LO; weight: 1200 kg; motor power: 3.0 kW). The unbroken garbage bags were counted and weighed, and their contents were returned to the sample prior to sieving. The net wet weight of each post-sieved fraction (m_i) was determined at the nearest 0.1 kg. The liquid content of bottles and containers was disposed of before weighing. To hasten waste characterization, half of the material that passed through the 5 cm sieve size was further sieved through 3.5 cm and 1.5 cm sieves. The remainder was segregated for compositional analysis with no further sieving. The same was implemented on the samples taken from the trommel's first unders.

Table 3-2. Sieve sizes used in sieve analysis and size fractions samples sorted during composition analysis.

Sieve Size	Size Fraction		Sieve Analysis			Compositional Analysis
			First Unders	Second Unders	Overs	
23.0 cm (9.0 in)	> 23.0 cm	> 9.0 in	-	-	✓	✓
17.8 cm (7.0 in)	17.8 - 23.0 cm	9.0 - 7.0 in	-	✓	✓	✓
15.2 cm (6.0 in)	15.2 - 17.8 cm	6.0 - 7.0 in	-	✓	✓	✓
12.7 cm (5.0in)	12.7 - 15.2 cm	5.0 - 6.0 in	-	✓	✓	✓
8.9 cm (3.5 in)	8.9 - 12.7 cm	3.5 - 5.0 in	-	✓	✓	✓
5.0 cm (2.0 in)	5.0 - 8.9 cm	2.0 - 3.5 in	-	✓	✓	✓
3.5 cm (1.4 in)	3.5 - 5.0 cm	1.4 - 2.0 in	✓	✓	✓	
1.5 cm (0.6 in)	1.5 - 3.5 cm	0.6 - 1.4 in	✓	✓	✓	✓*
Tray	0.0 - 1.5 cm	0.0 - 0.6 in	✓	✓	✓	

* Half of this size fraction was sorted; the remaining half was segregated with no further sieving.

3.8.2 Compositional Analysis

The post-sieved fractions were manually sorted into three main categories: compostables, combustibles (suitable for utilization by RDF facility), and inert material. Nine subcategories were used as shown in Table 3-3. The smallest size-fraction sorted was of the 0-5 cm material. Half of the 0-5 cm fraction was sorted and the remaining half was segregated without being further sieved. The post-sieved fractions used during compositional analysis were given in Table 3-2. The net wet weight of each subcategory was determined to the nearest 0.1 kg. The results were used to determine the fraction weight.

Table 3-3. Waste composition categories.

Subcategory	Description	Main Category		
		Compostable (COMP)	Combustibles (RDF)	Inert
Paper and Cardboard	Writing and computer paper, newspaper, flyers, envelopes, magazines, egg cartons, corrugated cartons, packaging and cardboard boxes, etc.	✓	✓	
Rigid Plastic	Household bottles and containers (shampoo, detergent, sauce, yogurt, etc.), food dishes, beverage bottles, lids, tubs, plastic utensils, etc.		✓	
Film Plastic	Mainly garbage, shopping and grocery bags, etc.		✓	
Yard Waste	Trimmed grass, leaves, garden waste, thatch, tree limbs, or woody bush, etc.	✓		
Food Waste	All types of food waste	✓		
Sanitary	Diapers, napkins, and toilet papers	✓		
Other Combustibles	Polystyrene foam, pellets, wood, textiles and fabrics, shoes, rubber, colourful wrapping plastics, etc.		✓	
Glass	All broken pieces of glass			✓
Metals and Non-Combustibles	ferrous and non-ferrous metals (e.g., tin cans, aluminum foil, aluminum cans), wire (insulated or uninsulated), hangers, utensils, rock, drywalls, etc.			✓

3.8.3 Moisture Content Analysis

Approximately 3L samples were taken from sub-categories to measure MC. The food and yard waste samples were oven-dried immediately after sorting at 75±5°C for 48 hours (Test Methods for the Examination of Composting and Compost, 2001b) to avoid mass loss through decomposition of readily biodegradable matter. The other samples were first air-dried indoors and then dried further in the oven for 24 hours. Drying was maintained at temperatures lower than 105°C to avoid combustion of volatile material (Gabr and Valero, 1995). The MC of a post-sieved fraction (MC_i) was calculated proportionally based on its composition and the measured MC of its sub-categories.

3.8.4 Particle Size Distribution

Rosin-Rammler PSD (RR-PSD) curves were fitted to the dry weight fractions using Equation 21 (ASTM Standard E1037, 2015; Jansen and Glastonbury, 1968; Vesilind, 1980; Vesilind et al., 2002; von Blottnitz et al., 2002).

$$Y_x = 1 - \exp(-x/x_o)^n \qquad \text{Equation 21}$$

Where:

- Y_x is the cumulative passing dry weight fraction of particles smaller than given sieve size x;
- n is "uniformity constant"; and
- x_o is "characteristic particle size," defined as the size at which 63.2 %-db by weight of the particles are smaller.

The dry weight fraction used data were calculated based on wet weight and MC of post-sieved fractions using Equation 22.

$$w_i = \frac{m_i \times (1 - MC_i)}{\sum_i^n [(m_i \times ((1 - MC_i)]} \qquad \text{Equation 22}$$

Where:

- w_i is the dry weight fraction of a post-sieved fraction,
- m_i is the wet weight of a post-sieved fraction, and
- MC_i is the calculated MC of a post-sieved size fraction.

The PSD of the feed was calculated from the PSDs of the first and second unders and the overs, combined based on corresponding separation performance results (i.e., S_{U1}, S_{U2}, and S_O, discussed in section 3.9.1). The PSDs were generated for the total sample and its compostable and RDF sub-categories, respectively, termed as PSD_T, PSD_C, and PSD_R.

3.9 Size Separation Parameters

3.9.1 Separation Percentage

Separation of a waste stream was defined as its total quantity divided by the total quantity of feed at a given time, expressed as % by wet weight. For example, the separation of the first unders (S_{U1}) was calculated using Equation 23.

$$S_{U1} = \frac{W_{U1}}{(W_{U1}+W_{U2}+W_O)} \times 100 \qquad \text{Equation 23}$$

The separation % of the second unders and the overs was defined as S_{U2} and S_O. The variation of S_{U1}, S_{U2}, and S_O under different conditions was studied to understand the mass balance associated with trommeling. The results of the initial 30 minutes were ignored, as weights were not steady during that period.

3.9.2 First Unders Recovery and Overs Loading Rate

An analysis of particles recovered in the trommel's first unders was completed. Specific particle sizes analyzed were particles less than 1.5 cm, 3.5 cm, and 5 cm. For example, recovery of particles less than 3.5 cm in the first unders ($R_{3.5}$) was defined as their amount in the first unders divided by the total amount in the feed, expressed as % by dry weight.

The $R_{1.5}$, $R_{3.5}$, and R_5 were then correlated to the corresponding "overs loading rate" ($OLR_{>x}$, t/h), i.e., the portion of feed associated with waste particles larger than given size x on a dry basis, in this case, they were $OLR_{>1.5}$, $OLR_{>3.5}$, and $OLR_{>5}$, respectively. OLR is similar to feed rate index developed by Wheeler et al. (1989) without a denominator (i.e., being divided by πR_T^2 term, where R_T is the radius of trommel). The correlation between R_x and corresponding $OLR_{>x}$ was investigated for short and long operation periods of 30-60 min and 150-180 min in the spring, summer and winter tests.

3.10 Results and Discussion

3.10.1 Feed Rate

Descriptive statistics on weight of grapple load is presented in Table 3-4. Grapple loads of mixed MSW collected in the summer were significantly (p-value < 0.05) heavier than the winter loads and were nearly twice as heavy as the spring loads. The weight change is attributed to changes in bulk density associated with seasonal variation in waste composition, e.g., yard waste in the summer and a high amount of low MC, such as thatch, in the spring.

Table 3-4. Descriptive statistics on weight of a grapple load (kg).

Season	Number of data	Mean ± 95% CI	SD (RSD, %)
Winter	20	1203.7 ± 97.1	207.3 (17.2)
Spring	6	710.0 ± 105.2	100.3 (14.8)
Summer	30	1362.0 ± 68.9	218.4 (16.0)

Table 3-5 provides descriptive statistics of total feed rate measured every 15 minutes for trials conducted around similar target feed rates. In general, feeding at 71 t/h was more variable than at 41 t/h and 55 t/h, implying that feeding at higher rates was more difficult to control.

Table 3-5. Descriptive statistics on feed rate.[a]

Target feed rate (t/h)	Number of data	Mean (t/h)	CI		SD (t/h)	RSD (%)
			95%	90%		
41	143	41.7	1.1	0.9	6.7	16.0
55	131	55.1	1.1	0.9	6.3	11.4
71	126	68.7	2.0	1.7	11.3	16.0

[a] Minimum and maximum capacity of feeding conveyor was 41 t/h and 71 t/h, respectively. Maximum trommel throughput was 55 t/h.

3.11 Impact of Season and Feed Rate on Separation

To verify whether the overall performance of the trommel varied with respect to season and feed rate, the quantity of the first and second unders and overs, expressed in terms of separation %, was studied during an operation cycle. The separation % represented the real time mass balance of size separation. The separation % results (S_{U1}, S_{U2} and S_O) were plotted versus uptime after being categorized based on season and feed rate (Figure 3-2 and Figure 3-4). The separation results of all trommel trials and a sample calculation are provided in Appendix A-1. The results presented in Appenidx A-1 are subsequently summarized and categorized based on season and feed rate for each separated waste stream in Appendix A-2 in order to generate Figure 3-2 and Figure 3-4.

3.11.1 First Unders

Figure 3-2a shows that the quantity of first unders (S_{U1}) separated from the feed varied seasonally, where the maximum S_{U1} values were 59, 40, and 26%-wb, respectively, during spring, summer, and winter tests. This was primarily due to the seasonal variation in the PSD of the feed, where the spring feed contained smaller material relative to summer and winter seasons (Figure 3-3). It was also found that higher feed rate within a specific season resulted in lower separation (Figure 3-2b). Furthermore, during winter tests, S_{U1} continued to decline throughout an operation cycle. Field observations suggested this was due to clogging of screen apertures. This observation was more profound at higher loading rates due to a buildup of material within the trommel that reduced the effectiveness of bag breaking spikes.

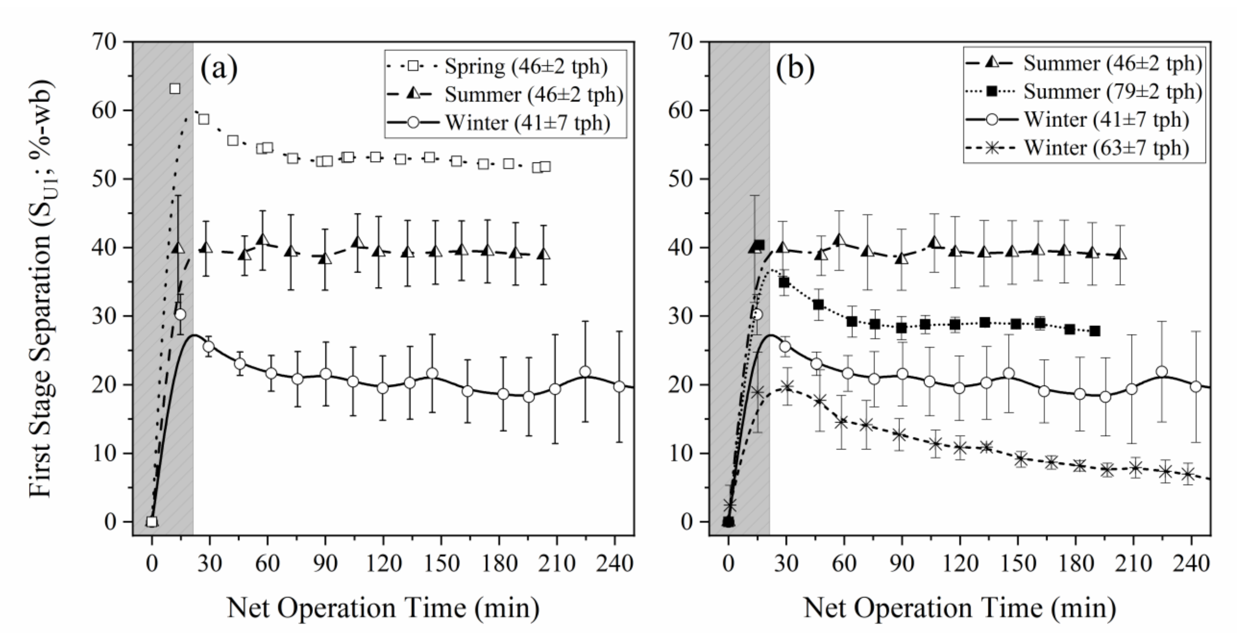

Figure 3-2. Effect of (a) seasonal variation (Q ranged between 41 and 46 t/h) and (b) feed rate variation on first stage separation performance.

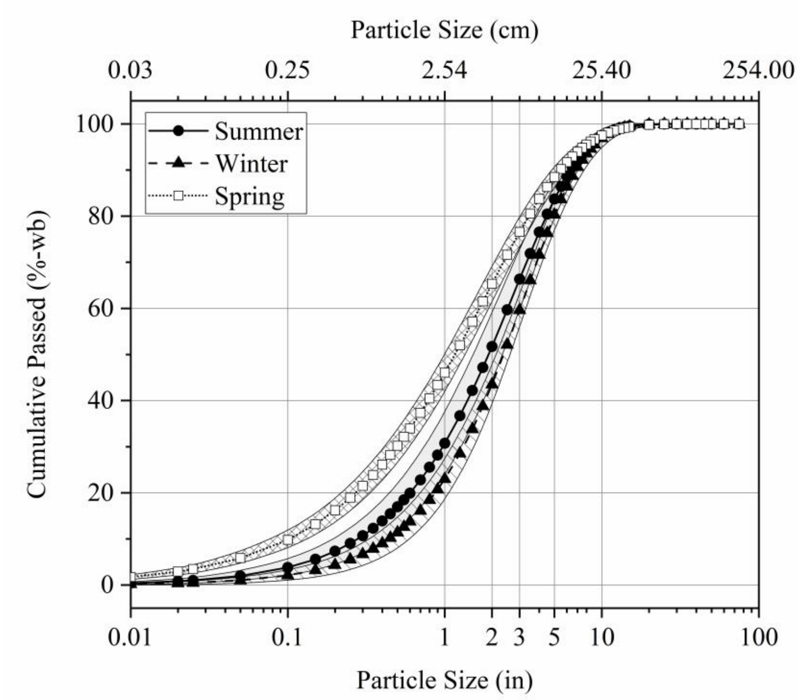

Figure 3-3. Particle size distribution of feed during different seasons. Margins represent one standard deviation.

3.11.2 Second Unders

The screen openings in the second stage of the trommel were 23 cm. The percentage of second unders (S_{U2}) separated from feed varied greatly between a minimum of 42%-wb in the spring at a low feeding rate and a maximum of 84%-wb in the winter at a high feeding rate (Figure 3-4a). As expected, a comparison of Figure 3-2b and Figure 3-4a showed S_{U2} inversely correlated to S_{U1}; when S_{U1} was high, S_{U2} was low and vice versa. Thus, given the fact that no PSD differences were observed at size 23 cm for all feedstocks (Figure 3-3), it was concluded the 23 cm screens in the second stage of the trommel were large enough to compensate for any screening deficiencies that occurred in the first stage.

3.11.3 Overs

The S_O results (Figure 3-4b) indicated that 7 to 13%-wb of the feed left the trommel outlet as overs. However, based on the PSD results (Figure 3-3), the trommel feedstock contained only 3.6±0.6% of > 23 cm material. The difference is attributed mainly to the incomplete removal of < 23 cm material from the two previous screen stages. According to observations made during unopened bag counting, some < 23 cm waste material were found as single particles, while others remained inside incompletely broken or intact bags. Detailed results pertaining to unopened bag analysis are discussed along with particles size distribution in section 3.14.3.

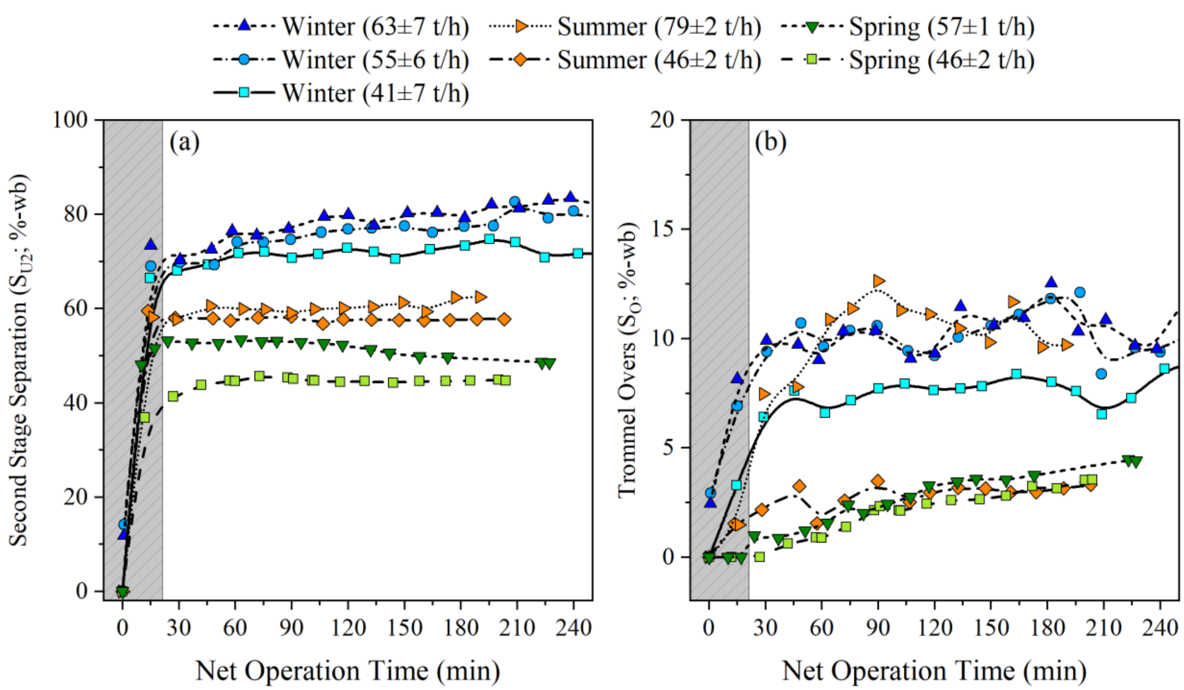

Figure 3-4. Impact of season and feed rate on separation of (a) second unders and (b) overs.

3.12 Recovery

To better understand the performance of the trommel's first stage, a detailed analysis of the first unders was completed. The weight fractions of the first unders are presented in Table 3-6. On average, the dominant particle size range in winter was medium. The majority of first unders in spring and summer were small.

Table 3-6. Weight fractions of first unders for three particle size ranges and season.

Particle size range, D_p (cm)		Season (Mean ± SD, %-db)			Ratio between particle size and 5 cm aperture
		Winter	Spring	Summer	
Large	$3.5 \leq D_p < 5.0$	17.5 ± 16.0	8.3 ± 6.7	11.0 ± 8.6	$0.7 \leq D_P/D_A < 1.0$
Medium	$1.5 \leq D_p < 3.5$	49.0 ± 14.3	26.4 ± 5.1	35.9 ± 5.3	$0.3 \leq D_P/D_A < 0.7$
Small	$0.0 \leq D_p < 1.5$	33.6 ± 24.7	65.4 ± 9.3	53.2 ± 12.8	$0.0 \leq D_P/D_A < 0.3$

Recoveries of particle sizes less than 5 cm, less 3.5 cm, and less than 1.5 cm, respectively, termed R_5, $R_{3.5}$, and $R_{1.5}$, were calculated and plotted against the respective $OLR_{>x}$ during early and late periods of trommel operational cycles in order to assess the performance of the trommel's first stage (Figure 3-5). As discussed in section 3.9.2, $OLR_{>x}$ was the portion of total feed rate associated with the relevant particle size being analyzed.

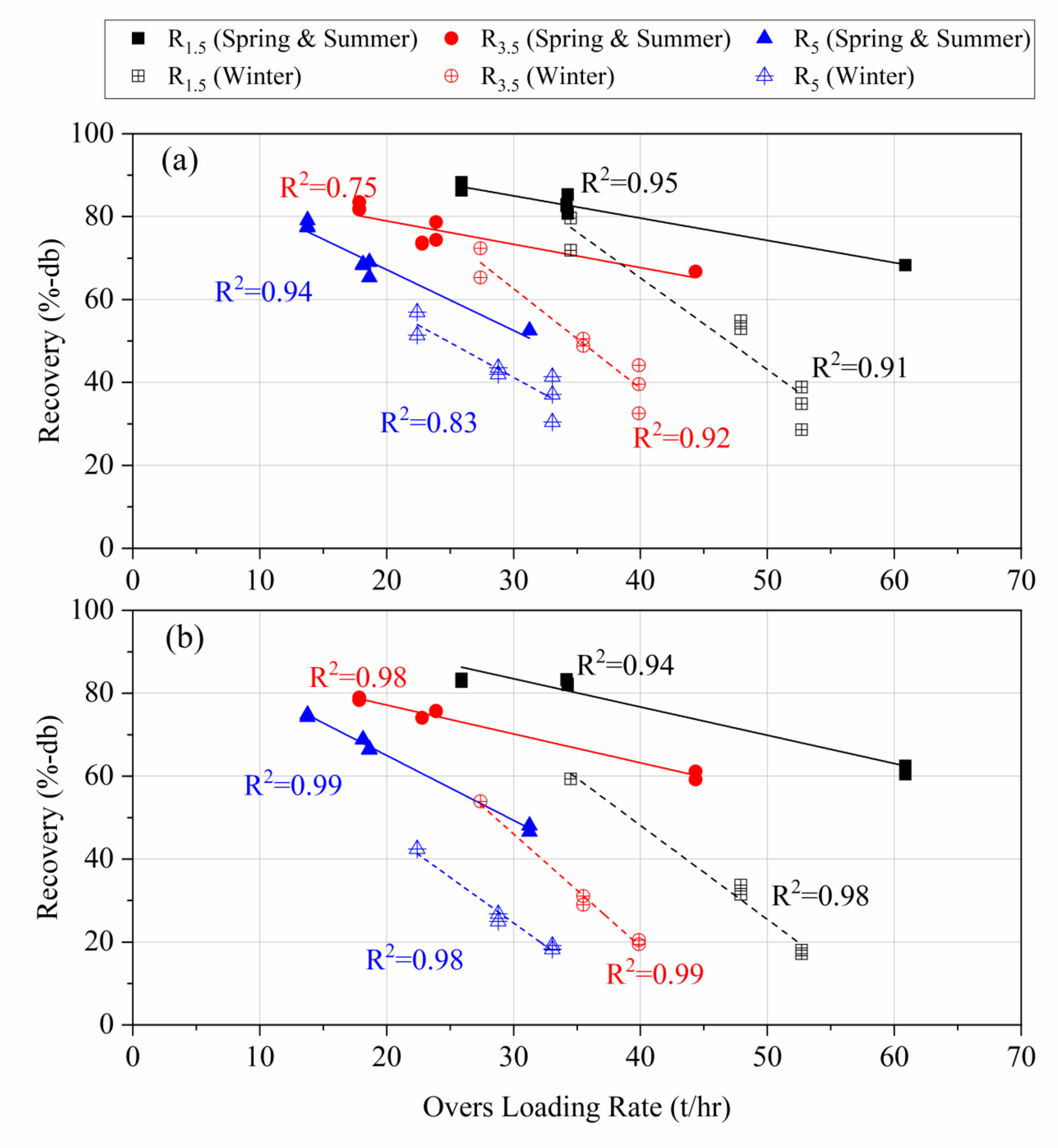

Figure 3-5. Correlation between recovery and overs loading rate during trommel operational cycle: (a) early period (30-60 min) and (b) late period (150-180 min).

A strong linear correlation was found between recovery and overs loading rate. This was similar to previous studies (Lau et al., 2005; Wheeler et al., 1989). In general, recovery decreased when overs loading rate increased. This effect was more dramatic during winter operations. Essentially, particle recovery rate had an inverse correlation with overs loading rate. It was assumed that particle-to-particle interactions increased at higher loading rates. This, in turn, interfered with particle passage through apertures, resulting in lower recovery values.

Theoretically, the probability of passage for a certain particle is a function of the ratio between its size and aperture size (D_P/D_A) (Alter et al., 1981). As a consequence, larger particles have a lower probability of passage. The first unders contained more medium and large particle size ranges in winter operation than in spring and summer (Table 3-6), which explains why recovery rates were more adversely impacted by a higher overs loading rate during winter tests.

Beside the effect of the first unders' particle size on recovery within different seasons, the variation of recovery was considered in terms of duration of trommeling cycle. A comparison of Figure 3-5b to Figure 3-5a indicates that recovery of all particle size ranges decreased with time, particularly during winter tests due to the clogging of 5 cm apertures. Given dominant amounts of medium and large particle size ranges in the first unders that was observed in winter, clogging of apertures was more likely to occur.

3.13 Clogging

One major limitation found during winter operations was the decline in the quantity and recovery of the first unders, mainly attributed to the 5 cm apertures gradually being clogged. This was also confirmed by visual inspections. The causes of clogging were investigated further and it was found that clogging was correlated to temperature and feed rate variations (Figure 3-6). Results obtained under similar temperature and feed rate conditions were averaged and plotted with standard error against the operation uptime. The outdoor ambient temperature was calculated from the average hourly measurements recorded within the last 72 hours of trial end.

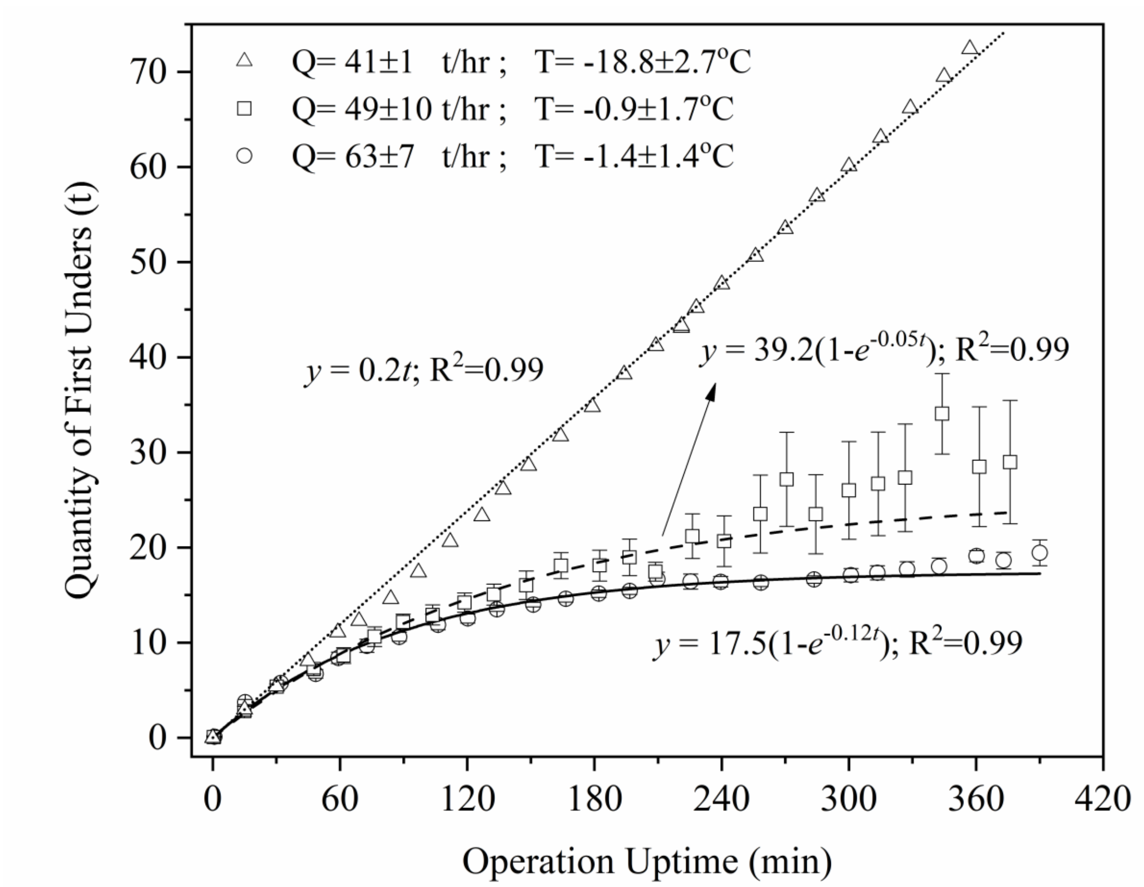

Figure 3-6. Major screening trends found during winter tests.

Against the majority of winter trials, the first unders were removed consistently with no evidence of significant clogging during a trial that was conducted at a low feed rate and freezing temperature (Q = 41±1 t/h and T = -18.2±2.7°C). In contrast, at near-freezing temperature (Q = 49±10 t/h and T = -0.9±1.7°C) the total tonnage of first unders did not increase steadily;

instead, after a certain time, it gradually reached a plateau due to clogging of 5 cm apertures. According to local temperature records (Government of Canada, 2016), all near-freezing experiments were conducted during thawing weather (i.e., whereby material stored outside would have been exposed to freezing and then thawing temperatures). Thawing resulted in material property changes, especially for organics and their adhesion to the rotating screen surface. This resulted in accumulation of material inside the trommel and blocking of aperture and/or material bridging over apertures. Consequently, the effective area of screening was reduced gradually and a lower quantity of first unders was removed. On the other hand, freezing temperatures allowed waste particles, especially wet organics, to maintain their water content and remain more intact in the solid phase. The frozen material adhered less to the surface of the rotating screen and did not accumulate inside the trommel.

In general, when operating around near-freezing temperatures, a higher loading rate was found to accelerate clogging. The quantity of first unders separated at Q = 63±7 t/h was not only lower, but also it plateaued earlier than results obtained at Q = 49±10 t/h (Figure 3-6). As discussed in the previous section, the first unders mostly comprised of medium and large particle size ranges in winter (Table 3-6). Their accumulation inside the trommel was accelerated at higher feed rates, which subsequently accelerated the clogging.

The unsteady screening shown in Figure 3-6 was quantified by Equation 24, which can be used to numerically predict the effective clogging time.

$$W_{U1} = W_{Max}\left(1 - e^{-kt}\right) \qquad \text{Equation 24}$$

Where:

- W_{U1} is the total quantity (wet tonne) of first unders separated at any given time t,
- t is time (min),
- W_{Max} is defined as the maximum separable quantity (wet tonnes) of first unders, and
- k is defined as declining coefficient (min^{-1}).

The rate of screening (t/min) can be represented by the first derivative of Equation 5, i.e., $\frac{dW_{U1}}{dt} = kW_{Max}e^{-kt}$. Assuming PSD of feedstock and the rate of feeding maintained steady, solving $\lim_{t \to t_{clogging}} \left(kW_{Max}e^{-kt}\right) \approx 0$ delivers the approximate time by which clogging was completed, in other words, when the quantity of first unders reached a plateau (Figure 3-6). According to equations presented in Figure 3-6, at near-freezing temperatures, clogging was completed at approximately 180 min at 49±10 t/h and 90 min at 63±7 t/h.

3.14 Particle Size Distribution

The size of waste particles before and after trommeling was characterized using particle-size distribution (PSD) curves of the feed and the waste streams separated from the trommel. The variation in PSD was investigated with respect to season, compostable fraction, and RDF fraction. In addition, the PSD results were used to assess the 5 cm and 23 cm openings in the trommel screen and the existing "Compost-RDF cut-off" size of 12.7 cm (defined in section 3.1.2). The PSDs were generated for the total sample and its compostable and RDF sub-categories, respectively, termed as PSD_T, PSD_C, and PSD_R. To be consistent with the study's overall goal−screening out the organic-rich fines for composting and retaining oversized material to RDF production−the PSD_T and PSD_C showed cumulative percent passed through any given screen size, and the PSD_R indicated cumulative percent retained above any given screen size. Due to the large number of

PSDs generated, only the average and standard errors of PSDs and respective uniformity constants (n) and characteristic particle size (x_o) were presented in this chapter. All PSD results and a sample calculation are provided in Appendix B.

3.14.1 PSD of Feed

The PSD of the feed was calculated from the PSDs of the first and second unders and the overs and then combined based on corresponding separation performance results (i.e., S_{U1}, S_{U2}, and S_O). This approach does not represent an exact replication of the actual feed PSD as the particle size of the material inside the trommel probably becomes smaller or deformed when contacting the rotating screen while progressing through the trommel. So, presumably, the calculated PSD_T in this study would be different from that of the actual feed; however, the extent of such variation is complex and beyond the scope of this study. Calculating the PSD in this way has the advantages of (a) avoiding the complexities concerning PSD variation during the screening operation, (b) representing the PSD of materials leaving the trommel, (c) calculating the recovery of fines more accurately (Figure 3-5) since the weight fractions associated with size-reduced material were known, and (d) better assessing the effectiveness of the trommel screen size.

The seasonal $PSD_{T,C,R}$ are presented along with the characteristic particle size (x_o) and the uniformity constant (n) in Figure 3-7a-c. The PSD_T curves (Figure 3-7a) indicated the finest and least uniform waste material was processed during the spring and summer operations when an average of 62%-dw and 47%-dw of the total feed, respectively, was < 5 cm, which hypothetically could be removed as first unders. However, it was found (based on Figure 3-5) that recovery of < 5 cm material ranged from 53% to 80% of the < 5 cm material at an overs (> 5 cm) loading rate of 31 t/hr and 14 t/hr, respectively, in spring and summer seasons.

More distinct seasonal variation was observed in PSD_C (Figure 3-7b) compared to PSD_T. In addition, the characteristic particle size (x_o) decreased significantly in spring and summer compared to winter, which was probably due to increased disposal of thatch and grass.

Unlike PSD_T and PSD_C, which varied seasonally, x_o values of the PSD_R were similar throughout the year (Figure 3-7c). The PSD_R curves had sharper sigmoid shapes with breakthroughs in the 11.4-12.7 cm range. Moving away from the breakthrough range resulted in large variations in the % of RDF remaining, making RDF material sensitive to sieve size, as opposed to the compostables. The existing Compost-RDF cut-off-size of 12.7 cm implemented by the disc screen happened to be around the upper limit of that range. A potential process improvement could be to decrease the cut-off size in order to retain more RDF material. This potential process improvement is discussed further in section 3.14.4.

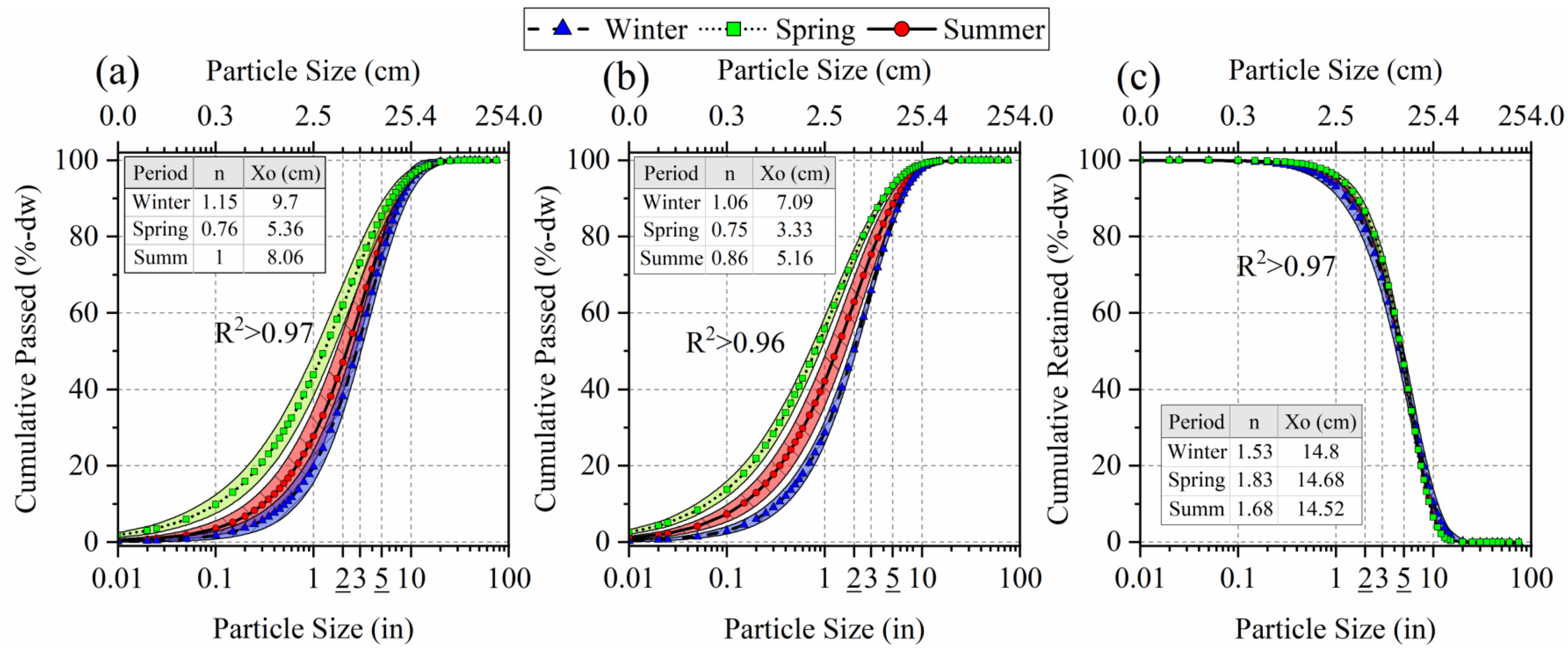

Figure 3-7. Average of PSDs fitted to the feed: (a) PSD_T, (b) PSD_C, and (c) PSD_R. Note that the PSD_T and PSD_C are presented as cumulative passed through any given size and the PSD_R is presented as cumulative retained above any given size. The margins represent standard error. Values shown in the tables are uniformity constant (n) and characteristic particle size (x_o).

3.14.2 PSD of Second Unders

As expected, because portions of the feed were removed earlier in the first stage of the trommel, the resultant $PSD_{T,C}$ of the second unders became more coarse and more uniform in size (Figure 3-8a and b) compared to the feed. However, the main observation was that the seasonal variation found in the feed $PSD_{T,C}$ (Figure 3-7a and b) was no longer evident among the second unders. In general, the only meaningful seasonal differences were found among total second unders and their compostable fractions that were smaller than 2.5 cm (1").

In addition, the PSD_T of the second unders also depended on the performance of the trommel's first stage. To further investigate this, a correlation was drawn between the change of uniformity constant (Δn) between the PSD_T of the feed and the corresponding second unders and the related recovery of first unders (R_5) at early period (shown in Figure 3-5a). Another correlation was drawn between the Δx_o of the above-mentioned PSD_T curves and R_5. Strong linear correlations were found between both (Δn and R_5) and (Δx_o and R_5), which are presented as supplementary results in Appendix A-3, indicated the second unders removed following high recoveries−which happened during the spring/summer operations when the feed contained more < 5 cm waste−was comparatively similar with respect to PSD_T of the second unders removed after low recoveries during winter operations when the feed contained less < 5 cm material. This clarified the weak seasonal variation found in the PSD_T of the second unders (Figure 3-8a) as well as the inverse correlation found between S_{U1} (Figure 3-2b) and S_{U2} (Figure 3-4a).

Overall, the upper limit of PSD_T shown in Figure 3-8a found finer and less uniform second unders removed in the trommel's second stage at higher loading rates. Inversely, the lower limit found coarser and more uniform second unders removed at lower loading rates. However, the effect of loading rate on the PSD_T of second unders was outlined more speculatively, due to uncertainties causing variability in PSD_T.

One source of uncertainty was unopened bags. On average, less than 8%-dw of the second unders sampled for characterization remained inside unopened bags or was not liberated completely (Table 3-7). Their content when emptied altered the PSD of sampled material. Another source of uncertainty was loss of material due to accumulation inside the trommel. Additionally, sample representativeness and error of sampling could cause variability in PSD. As illustrated in Figure 3-8b, the PSD_C of second unders was analogous to the PSD_T, but it varied with larger standard errors. Basically, the variation of measurements increases within the sub-categories according to statistical principles of sampling for waste characterization (Edjabou et al., 2015; Klee, 1993; Nørup et al., 2018; Sharma and McBean, 2008, 2007). This could have been resolved by increasing the number of samples but would have been too costly.

The variability of unbroken bags found in the second unders was analyzed in Table 3-7. On average, between 5.8% and 7.5% by dry weight of the second unders sampled remained inside unbroken bags or was not liberated completely. Statistically, there were no significance differences among the results, except between the weight of bags in winter and summer, examined by a two-tailed t-test conducted at 95% CI.

The second unders included the majority of RDF material. As a result, the related PSD_R were analogous to the RDF_R of the total feed and did not vary seasonally (Figure 3-8c). In addition, because fine portions of the RDF material were removed through the first stage, the uniformity of RDF material remained within the second unders was increased slightly.

Table 3-7. Unbroken bag results for samples taken from second unders. Values reported are mean ± one standard deviation of measurements.

Season	Waste remained in bag (% by weight)	Bag weight (kg)	No. of bags per 10 kg sample
Winter	7.5 ± 6.2	0.9 ± 0.3	1.0 ± 0.7
Spring	5.8 ± 2.8	0.7 ± 0.3	1.0 ± 0.3
Summer	7.3 ± 6.8	0.5 ± 0.4	1.3 ± 0.8

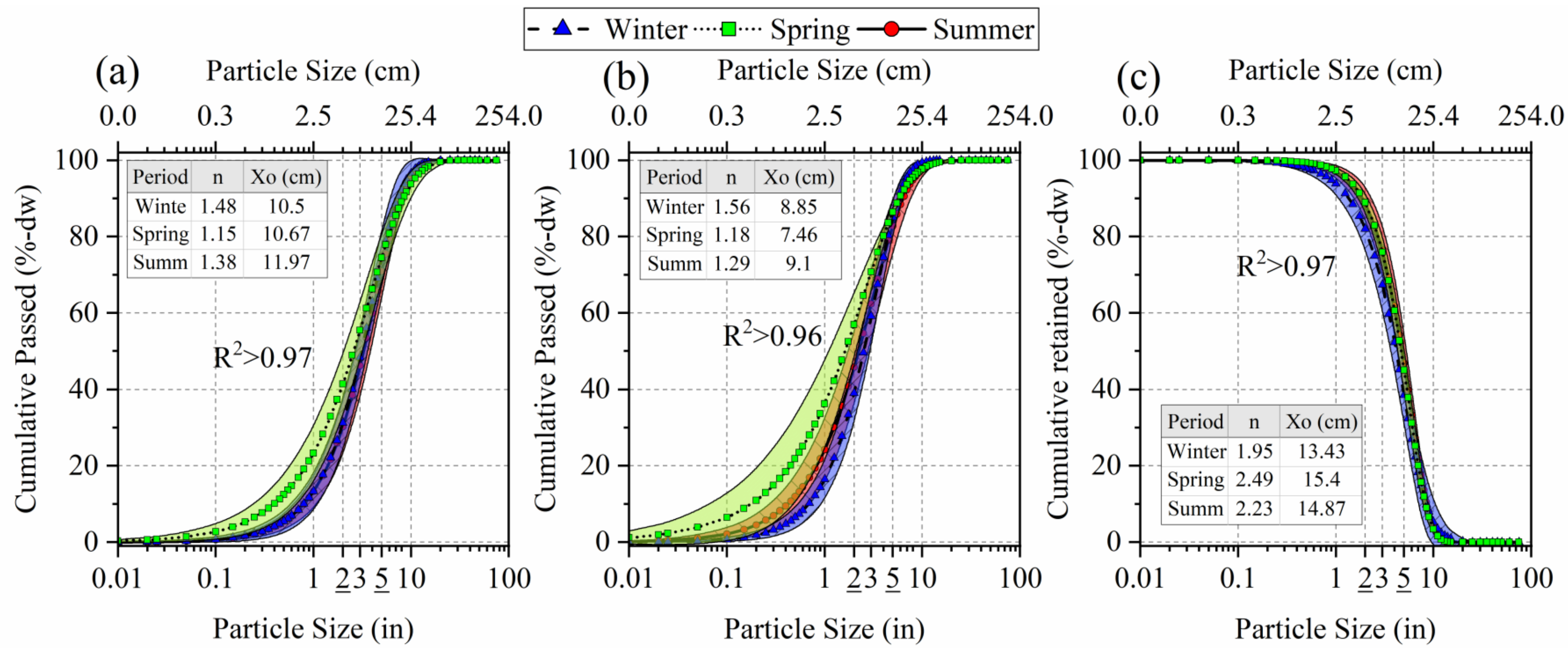

Figure 3-8. Average PSD fitted to second unders: (a) PSD_T, (b) PSD_C, and (c) PSD_R. Note that the PSD_T and PSD_C are presented as cumulative passed through any given size and the PSD_R is presented as cumulative retained above any given size. The margins represent one standard error. Values shown in the tables are uniformity constant (n) and characteristic particle size (x_o).

3.14.3 PSD of Overs

As illustrated by the PSD_T of the overs (Figure 3-9a), on average as high as 30% by dry weight of the overs that left the trommel outlet still passed through the 5 cm sieve. This was very dramatic in terms of compostable fraction (Figure 3-9b), mainly due to unopened bags containing fine yard waste. The results of unopened bags are shown in Table 3-8. Again, on average 31.8 ± 22.0 %-wb of the overs samples collected during the winter tests remained inside unbroken bags or were not liberated completely. This was more than twice as much as the spring and summer results, although given high standard deviations, it was not statistically significant at 95% CI. Regardless, the fine thatch and yard waste caused higher variations as shown in Figure 3-9b.

In comparison with the second unders (Table 3-7), the weight of material which remained in unopened bags was doubled in the overs samples during spring and summer cycle operations and was increased four times during winter operations (Table 3-8). Accordingly, more and heavier bags were found during the winter tests than in spring and summer tests, attributed to the reduced effectiveness of bag breaking spikes mainly caused by material accumulation inside the trommel. Finally, slight variations appeared in the PSD_R of overs, but more than 80%-dw of RDF material within overs were larger than the existing Compost-RDF cut-off size (Figure 3-9b).

Table 3-8. Unbroken bag results for samples taken from overs. Values reported are mean ± one standard deviation of measurements.

Season	Waste remained in bag (% by weight)	Bag weight (kg)	No. of bags per 10 kg sample
Winter	31.8 ± 22.0	2.3 ± 2.6	2.0 ± 1.1
Spring	13.6 ± 6.4	1.1 ± 0.2	1.3 ± 0.6
Summer	15.6 ± 18.4	0.7 ± 0.7	1.3 ± 1.3

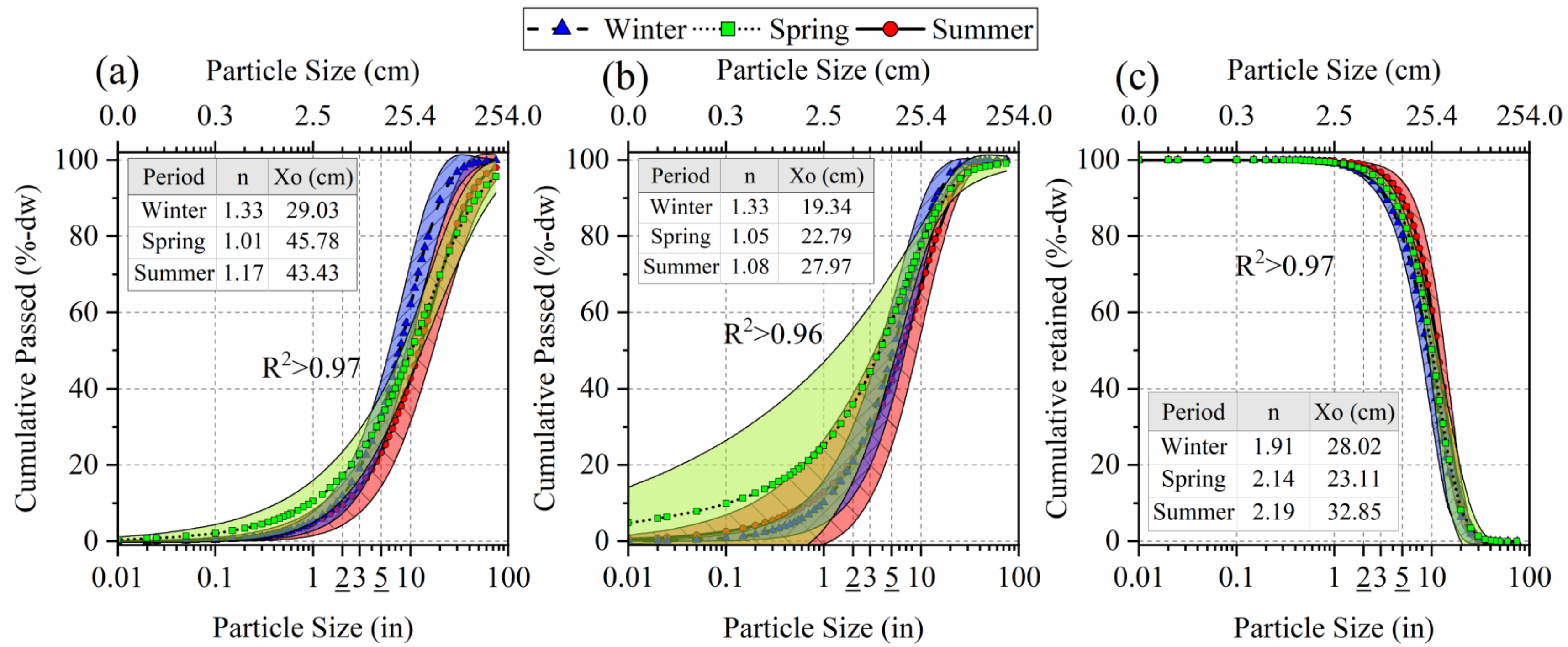

Figure 3-9. Average PSD fitted to the overs: (a) PSD_T, (b) PSD_C, and (c) PSD_R. Note that the PSDT and PSDC are presented as cumulative passed through any given size and the PSDR is presented as cumulative retained above any given size. The margins represent one standard error. Values shown in the tables are uniformity constant (n) and characteristic particle size (xo).

3.14.4 Application of Particle Size Distribution Data

The existing waste processing could be improved to: (a) eliminate clogging of apertures in the trommel's first stage; (b) recover further organic-rich fine material through the first unders as the main compost feedstock rather than in the second stage; and subsequently, (c) modify waste processing in the second stage. All of the above positively affect the performance of the disc screen by reducing the loading rate to it. In addition, the existing Compost-RDF cut-off size implemented by the disc screen could be adjusted to retain more RDF material if needed. The PSD of the feedstock and the second unders could be used to theoretically assess the existing process and suggest potential improvement options.

Perhaps the most beneficial improvement is to increase the size of apertures in the first stage. There is no specific consensus on selecting a new aperture size; however, the PSD_C of feed (Figure 3-7b) indicated that the characteristic particle size in summer (i.e., 5.2 cm) was still slightly larger than the apertures. So, for instance, the new aperture size could target that characteristic particle size. In this study, strong correlations found between recoveries and overs loading rates in the first stage (Figure 3-5) showed that material smaller than 3.5 cm (i.e., have $D_P/D_A < 0.7$) were recovered consistently at high rates. This concept could be relatively applicable to increasing the size of apertures; thus, in order to target particles with $D_P < x_o$ of 5.2 cm reasonably, apertures with a minimum diameter of 7.4 cm (3") are required. Sullivan et al. (1992) recommended $D_P/D_A < 0.5$ as a rule of thumb for empirically sizing the aperture. Using the $D_P/D_A < 0.5$ recommendation, the apertures should be a minimum of 10.4 cm (4"). The 7.4-10.4 cm (3-4") range is still smaller than the overall Compost-RDF cut-off size of 12.7 cm (5"); otherwise, additional modifications might be required. Regardless, the main concern regarding the compostables is that they were less uniform in size, making them less sensitive to sieve size. This key property should be considered in conjunction with PSD_R.

Theoretically, the existing Compost-RDF cut-off size could remove 84-93%-dw of the compostables (Figure 3-7b), while retaining only 40%-dw of the RDF material (Figure 3-7c). Any RDF material that passed through would therefore be contamination to the organic fines−except paper and cardboard, which were common between both. So, another potential process improvement that allows retaining more RDF material is to reduce the Compost-RDF cut-off size. This option, however, is subject to factoring in the potential improvements associated with increasing the size of apertures in the trommel's first stage, which potentially removes more fine compostables prior to the second stage. Another potential benefit of reducing the Compost-RDF cut-off size would be lower contamination levels associated with RDF material in the undersized fraction. This option is supported by both PSD_C and PSD_R of feedstock (Figure 3-7b,c) in spring and summer operations. Following the reduction of the Compost-RDF cut-off size, the % of oversized RDF material retained increases, whereas the % of undersized compostable passed decreases. However, the increase in % of RDF retained is greater than the decrease in % of compostable passed. To better understand this, an analysis comparing the % of RDF retained (Figure 3-7c) and % of compostable passed (Figure 3-7b) according to change of Compost-RDF cut-off size was completed (Figure 3-10). As the Compost-RDF cut-off size decreased, the increase in % of RDF retained was greater than the decrease in % of compostable passed. The results shown included data with bags opened.

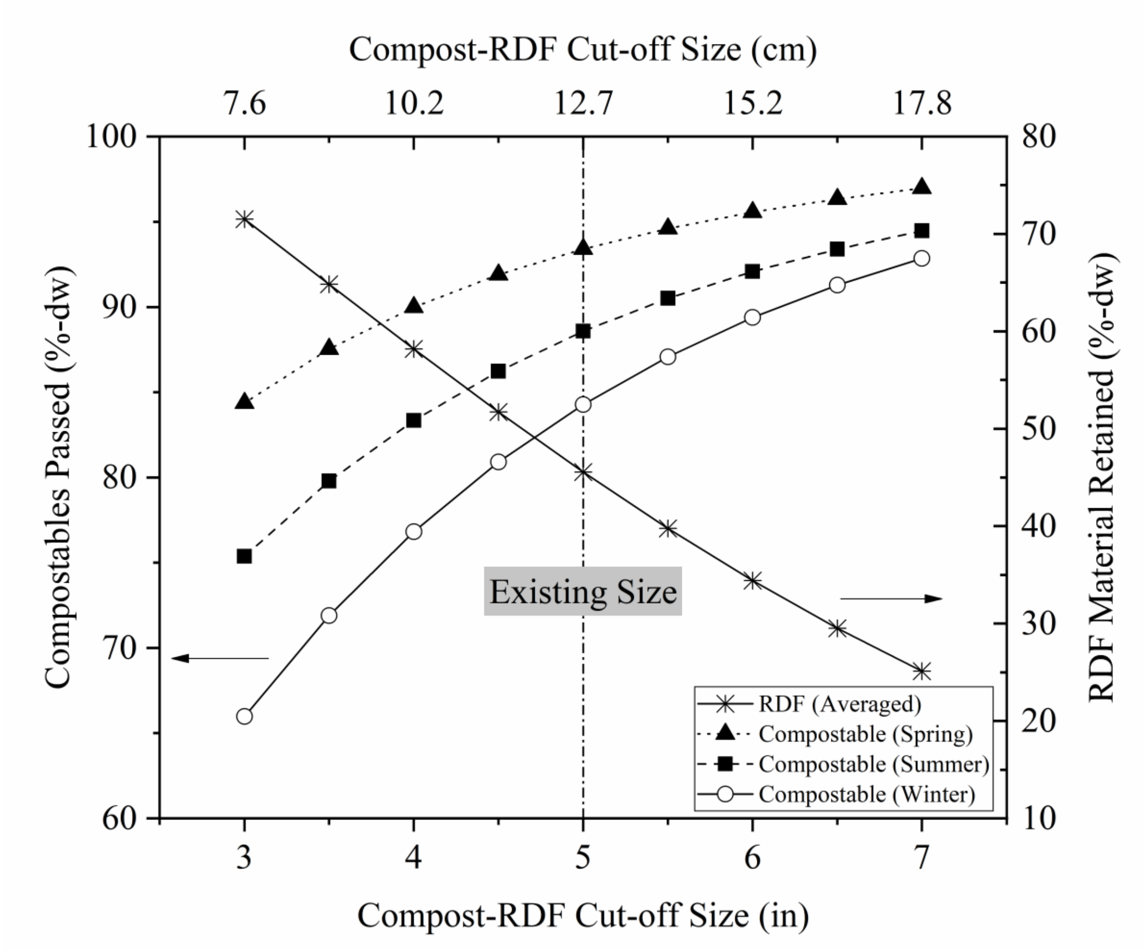

Figure 3-10 Average quantities of the RDF material retained and the compostables passed in the total feedstock at Compost-RDF cut-off sizes between 7.6 cm (3 in) and 17.8 cm (7 in); adapted from PSD_C and PSD_R of feedstock.

The second unders represent the waste material fed into the disc screen. The RDF_R of second unders (Figure 3-8c) verified the existing Compost-RDF cut-off size could only retain an average of 30-40%-dw RDF material in this waste material, whilst the rest of the RDF material passed through the discs. This was further evidence that reducing the Compost-RDF cut-off size could be an effective process improvement option that also favours higher RDF removal. Decreasing the Compost-RDF cut-off size would cause the disc screen to be exposed to higher loading rates, although enlarging of apertures in the first stage of the trommel could, to some extent, offset this loading to the disc screen. Given that larger particles probably contain more RDF material, reducing the size of apertures in the second stage of the trommel not only retains more RDF material in the second unders, but also reduces loading into the disc screen. Again, the aperture size can be adjusted in accordance with the $D_P/D_A<0.7$, adapted from recovery results in this study (Figure 3-5). For example, to retain RDF material larger than 12.7 cm (5”), the aperture in the second stage could be 18 cm (or 7”) or smaller.

3.15 Moisture Content and Composition Analyses

Moisture content and composition were two waste properties studied to understand the effect of size separation on the quality of material separated for compost and RDF production. Therefore, waste composition analysis was completed in terms of compostable and RDF subcategories. The compostable fraction and moisture content in the total undersized waste passing through any given sieve size were defined as $COMP_U$ and MC_U. The RDF fraction and moisture content in the total oversized material retained at any given sieve size were also defined as RDF_O and MC_O. Both $COMP_U$ and RDF_O were expressed as % by dry weight. The (MC_U and $COMP_U$) and (MC_O and RDF_O) pairs were presented on dual y-axes graphs versus log-sieve size.

3.15.1 MC_U and $COMP_U$

In all seasons, the MC_U in feed (Figure 3-11a) maximized around a 5 cm sieve size and then decreased while larger, less moist waste was removed and added to the undersized fraction. This verifies that in the full processing of comingled residential waste that, at the minimum, removal of 5 cm waste particles should be attempted in order to effectively remove high MC undersized waste, which accordingly reduces the MC in the oversized particles and favours RDF production. As illustrated in Figure 3-11a, the driest feedstock was processed in the spring, followed by that processed in the winter and summer. Essentially, disposal of yard waste mixed with residential waste was a major contributor to high MC in summer feedstock.

In contrast, the $COMP_U$ of feedstock (Figure 3-11a) decreased linearly with the log of the sieve size, as inorganic contamination associated with the undersized RDF material was added gradually to the organic undersized fraction. The $COMP_U$ also indicated the spring feedstock, with an average $COMP_U$ of 71.6±1.1%-db, was the most organic-rich waste, compared to 61.7±2.5%-dw in the summer and 56.5±5.2%-db in the winter. However, considering the error bars (Figure 3-11a), no significant difference was recognized between the compostable fractions of summer and winter feedstock that passed through a sieve size of 17.8 cm (7") and larger.

MC_U and $COMP_U$ in the second unders are shown in Figure 3-11b. MC_U in the second unders also maximized at 5 cm similar to that of the total feed (Figure 3-11a). In comparison with the feed, both MC_U and $COMP_U$ in the second unders varied to a much more extreme extent as indicated by their error bars (Figure 3-11b), a result that was mainly dependent on the performance of the trommel's first stage in removing the wet fine organics. Given the high error bars in $COMP_U$, no significant seasonal difference was confirmed among the compostable fractions of the second unders that passed through the 12.7 cm (5") and larger sieve. In general, high recovery of first unders resulted in lower MC_U and $COMP_U$ (represented by their lower limits shown on their respective graphs), and vice versa.

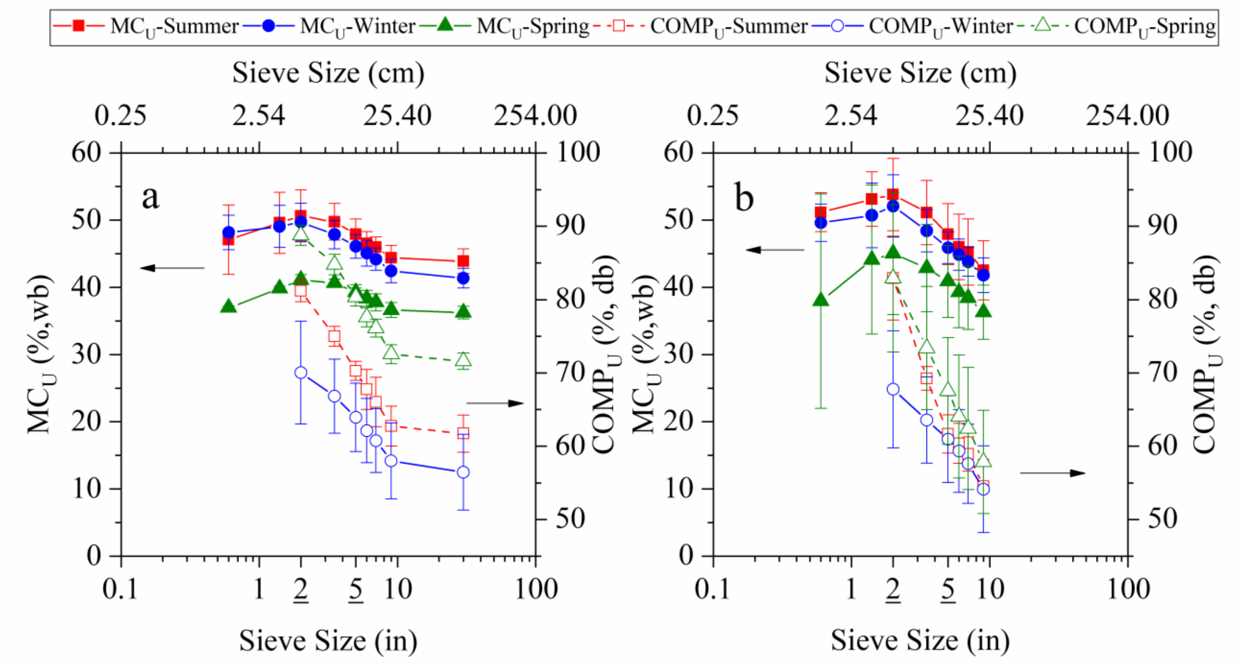

Figure 3-11. MCU and COMPU variations in (a) feedstock and (b) trommel second unders in different seasons. The largest particle size was assumed to be 76.2 cm (or 30 in).

3.15.2 MC_O and RDF_O

The moisture content and RDF fraction in the total oversized material retained at any given sieve size, i.e., MC_O and RDF_O, were calculated for the total feedstock, the second unders, and the overs (Figure 3-12). The MC_O was compared with the maximum preferred limit of 20% required by the receiving RDF production facility in this study. However, as mentioned in section 3.1.2, the RDF production facility was constructed relatively recently and there were no MC requirements when the IPTF was originally designed. The < 20% MC requirement is technically more applicable to the total RDF feedstock, i.e., the trommel overs and the disc screen overs combined on a common conveyor belt prior to the RDF facility.

MC_O in the feedstock (Figure 3-12a) decreased noticeably with an increased sieve size as more fine organics were removed, which was exactly the opposite of MC_U (Figure 3-11a). Only ideal screening of the spring feedstock using the existing Compost-RDF cut-off size (i.e., 12.7 cm or 5”) could fulfill the < 20% MC requirement, whereas the average MC_O in the summer and winter feedstocks were 26.9±4.0%-wb and 22.6±1.8%-wb, respectively. Processing of the winter feedstock using a larger Compost-RDF cut-off sizes larger could meet the low MC requirement; however, given high variation in MC_O (Figure 3-12a), this was not a prmissing option for the summer feedstock. In terms of composition, the total feedstock contained an average of 30%-36%-dw of RDF material in the spring/summer and 45%-dw in the winter, which then increased in larger fractions. For example, the RDF_O in the feed retained at the existing Compost-RDF cut-off size was 71%-81%-dw in spring and summer and 84%-dw in the winter. Using a larger Compost-RDF cut-off size enriched the RDF_O further (i.e., removed more orgnic contamination from the RDF material retained), although according to PSD_R (Figure 3-7c), the majority of the RDF material was not captured. Thus, selecting larger Compost-RDF cut-off sizes could improve the quality of the material retained (i.e., lower MC_O and higher RDF_O) to some degree. However, this option strongly contradicts the process improvement option of using smaller Compost-RDF cut-off sizes, suggested in section 3.14.4, to retain more RDF material. Given that the receiving composting facility is at capacity and inorganic contamination will be increased in the final compost product, using smaller Compost-RDF cut-off sizes provides a more favourable process improvement option.

MC_O and RDF_O trends in the second unders (Figure 3-12b) were similar to those of the feedstock. However, the maximum preferred MC was barely met at the existing Compost-RDF cut-off size even during spring operation. RDF_O varied dramatically in larger fractions of the second unders retained in response to the variation of compostables ($COMP_U$, Figure 3-11b) and as a result of the trommel's first stage performance. The high variation in the second unders' RDF_O observed at larger sieve sizes indicated uncertainties in the composition of oversized material being utilized for RDF production.

MC_O and RDF_O for the overs were shown in Figure 3-12c. In comparison with the second unders (Figure 3-12c), the overs contained more RDF material, despite accounting for less than 15%-dw of the total feedstock fed into the trommel (Figure 3-4b). An average of 72%-80%-dw of total overs material, depending on the season, were useful for RDF production. However, the value of MC_O indicated that this waste stream also containd wet material, especially during summer and winter operations. The average MC_O in the spring was slightly higher than the preferred value. It should be noted that at the time the overs did not undergo any further waste processing except for the second hand-sorting.

Finally, it should be noted that RDF_O and PSD_R in both second unders and overs are two independent RDF-related parameters; therefore, the variation of RDF_O and the consistency of the PSD_R waste stream should not be mistaken for and do not contradict each other.

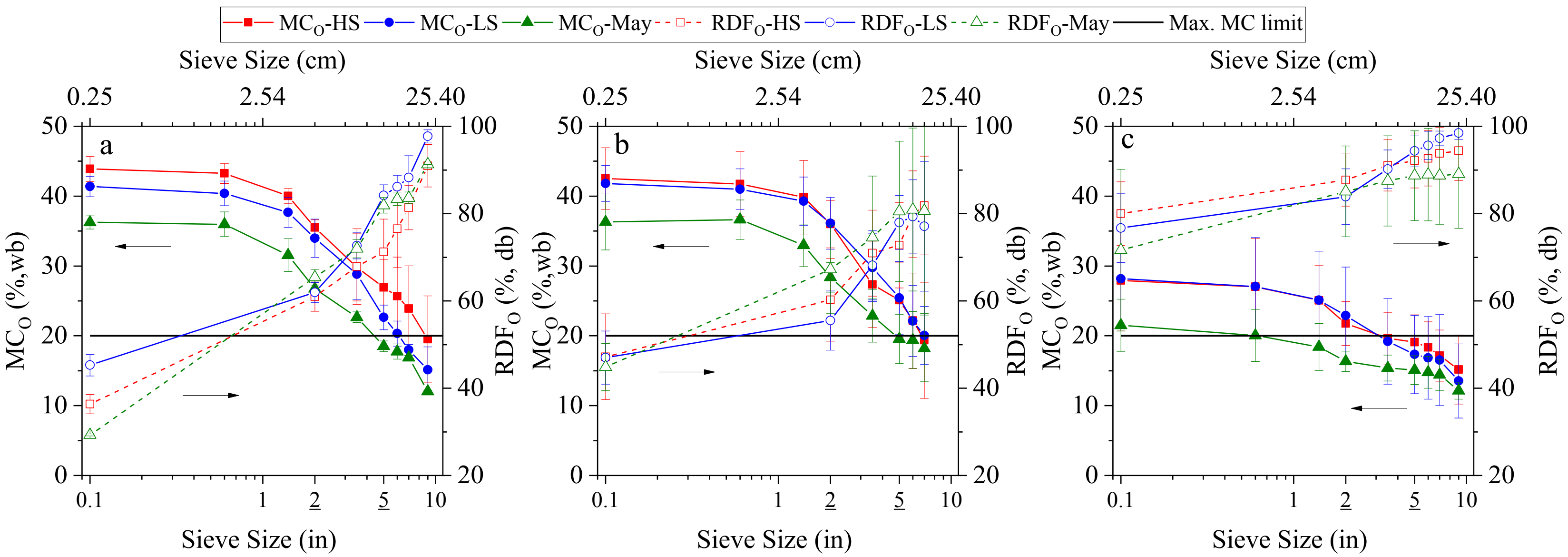

Figure 3-12. MC$_O$ and RDF$_O$ variations in (a) feedstock, (b) trommel second (2[nd]) unders, and (c) trommel overs in different seasons. The smallest sieve size which was assumed on a log axis was 0.25 cm (or 0.1 in).

3.16 Conclusions

The separation and recovery results validated the hypothesis that the performance of the trommel's first stage, removing fine organic-rich waste mostly, varied seasonally. This was primarily due to the seasonal variation in the PSD of the feedstock. Disposal of thatch and fresh yard waste during the spring and summer significantly reduced the characteristic particle size of the feedstock's PSD. Consequently, this resulted in at least an average 10%-dw higher recovery of fine organics, compared to the winter when food waste with larger particles was the dominant organic waste.

Following PSD of the feedstock, feed rate was the second most effective parameter of trommel performance. Generally, higher feed rates resulted in lower separation performance and recoveries within a season. This was well-quantified by the inverse linear correlations found between recoveries and corresponding overs loading rates that were developed for different particle sizes analyzed. Further, the above-mentioned correlation verified that the recovery of fines was more consistent during spring and summer operation cycles than in the winter, despite the fact that the spring and summer feedstock contained more fine waste. The inconsistency found in winter tests was mainly attributed to accumulation of waste inside the trommel, which clogged the screen apertures and reduced the effectiveness of bag-breaking tools. Therefore, the impacts of seasonality and clogging should be taken into consideration when assessing the trommel performance in full operation.

Clogging of apertures in the trommel's first stage worstened severely during particle thawing effect around near-freezing temperatures. This changed the property of organics and caused adhesionof material to the rotating screen surface, and ultimately blocked and/or bridged over the apertures. The 5 cm apertures clogged completely after approximately 180 min at 59±10 t/h and 90 min at 63±7 t/h. In contrast, screening of fines proceeded consistently at temperatures well below freezing without any clogging.

Three distinct PSDs were found for the compostable fraction of feedstock in the winter, spring, and summer seasons. In contrast, not only did the PSD of the RDF fraction not vary seasonally, but also it was more uniform in size; thus, the RDF fraction became more sensitive to sieving size compared with the compostable fraction. These two opposite properties of the RDF and compostable fractions can support system upgrading that retains more RDF material.

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CHAPTER 4. A SYSTEM RELIABILITY ANALYSIS OF A WASTE PRE-PROCESSING FACILITY[4]

4.1 Introduction

4.1.1 Background

Integrated solid waste management (ISWM) includes major components, such as waste generation, waste collection, separation processing, material recovery, waste treatment, final disposal and the managerial planning (Dai et al., 2014; Yadav et al., 2016). Within ISWM, managers and decision-makers need to take into consideration economic, technical, and environmental factors, in addition to political concerns, and the utilization and conservation of resources (Huang et al., 1992). Effective waste management planning directs efforts toward sustainable socio-economic development in urban communities (Li and Huang, 2010).

With the global population growth and an increase in the average per capita of MSW generation (Ghiani et al., 2012; Li and Huang, 2010), municipalities have been implementing customized programs for planning of waste management systems, in order to efficiently manage the increasing waste generation (Y. Li and Huang, 2010; Li et al., 2008). However, there are conflicts among system components, environmental requirements and minimizing system costs in waste management systems, which require more sophisticated analysis techniques for optimal decision-making (Y. F. Huang et al., 2002). Furthermore, there are complex parameters and factors

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with interactive, dynamic, and uncertain features (Li et al., 2008). Examples are the waste generation rate, waste disposal capacity, and waste treatment cost and their interactions, facility capacity and diversion goal, which are deterministic values (Dai et al., 2014; Wang et al., 2012), creating complexities that are beyond the capabilities of deterministic approaches (Li and Huang, 2010). In addition to the above difficulties, other sources of uncertainties in MSW planning can originate from (i) the varying composition of MSW generated; (ii) the amount of MSW allocated to different receiving facilities; (iii) the estimated parameters for long-term planning; (vi) the inadequate skills of the staff collecting and maintaining data (Yadav et al., 2018); and (v) uncertainty or variation in the performance of a waste treatment system's components, e.g., separation efficiencies (Rajabpour Ashkiki et al., 2019; Pressley et al., 2015).

Furthermore, the interactions among components of a large-scale complex waste management system will cause a variety of uncertainties within the waste management planning stage (Davila and Chang, 2005; Li and Huang, 2010). Also, long-term projects have been reported to have higher degrees of complexity and broader ranges of scenarios with uncertainty (Chang and Pires, 2015).

Various system-engineering models have been developed as a multi decision-making tool for waste management planning and optimization under uncertainty. According to the literature, probabilistic methods, including (stochastics) probability theory, grey/inexact/interval system theory, and fuzzy set theory and the hybrid of all these approaches have been used recently (Chang et al., 2011; Fei et al., 2018b; Li and Huang, 2010; Yadav et al., 2016). A comprehensive review of waste management planning studies can be found elsewhere (Chang et al., 2011; Chang and Pires, 2015).

The focus of this study was on the waste management models and optimization methods that considered facility reliability, particularly in models with the primary goals of capacity planning and optimal capacity expansion. A few relevant waste management studies were found and summarized in Table 4-1.

The general assumption of previous studies was that a waste treatment facility is always available for operation. In practical, however, it may have downtimes resulting from regular maintenance or random downtimes requiring immediate maintenance during the operation (Baetz, 1990). Facility reliability was defined as the percentage of operation cycle or the probability the facility is operable during a certain operation period (Baetz, 1990). Therefore, the actual capacity of a facility is a function of its reliability. Numerically, this equates to [facility reliability × developed capacity], where the facility reliability varies within a 0-100% range (Baetz, 1990). In system engineering, however, the so-called reliability has been also technically termed as system availability (%), which can be used to characterize the whole system as well as its components (Elsayed, 2012; Sillivant and Farrington, 2012).

Reliability (or again, system availability) was considered for a waste-to-energy (WTE) facility using fixed theoretical levels of 100%, 90%, 80% and 70% when optimizing a capacity planning study. The results showed that with decreased reliability, the overall operation cost increased due to decreased utilization of the target facility, and, accordingly, increased utilization of external facilities (Baetz, 1990). Similarly, a fixed reliability level of 85% was assumed in a feasibility expansion study when siting of a new material recovery facility (MRF) (Franchetti, 2009). Pressley et al. (2015) adopted a fixed parameter of 0.85 (or 85%) from Combs (2012) analogous to reliability when evaluating four different MRF configurations. This 0.85 factor was defined as the fraction of the maximum capacity of the equipment being utilized, which can be interpreted as the facility reliability (or availability).

In a capacity allocation study using grey-linear programming (Huang et al., 1992), a sensitivity analysis was conducted for investigating the impact of a treatment facility's capacity on the operation cost where no specific reliability level was assumed; only a maximum constraint was set on the capacity. Likewise, a capacity constraint with no defined reliability level was assigned to facilities in a waste flow and capacity allocation studied using genetic algorithm (Yeomans, 2003). In a facility locating study, Yadav et al. (2017, 2018) also defined capacity constraints for the transfer stations, waste pre-processing, composting and RDF facilities; however, univariate and multivariate sensitivity analyses were performed to determine the most prominent parameter on model outputs, which could account for reliability to some degree. In other optimal capacity planning using grey-linear programming integrated with mixed integer linear programming (Huang et al., 1997) and fuzzy theory (Chang and Wang, 1997), facility capacity was defined as an uncertain parameter varying within a predefined (min, max) range (or a fuzzy set). Except for allowable variation within the range defined, capacity was not affected by any type of reliability level.

Table 4-1 Summary of studies with uncertain capacity assumptions (COL=Collection; COM=Composting facility; LF=Landfill; MRF=Material Recovery Facility; PP: pre-processing (or pre-sorting) facility; RDF=Refuse-derived Fuel facility; REC=Recycling Facility; TS=Transfer Station; WTE=waste-to-energy facility).

Reference	Method	Main objectives	Facilities	Methods/Assumptions to apply capacity uncertainty to the model
(Baetz, 1990)	Integrated optimization and simulation model	Optimal capacity expansion	LF; WTE	Seasonal fluctuation demand levels and theoretical reliability levels of 100%, 90%, 80%, and 70% were applied.
(Huang et al., 1992)	Grey-linear programming	Minimum cost flow allocation	LF, WTE	Sensitivity analysis was conducted on capacity assuming the facility is 100% reliable (available) at any assumed capacity.
(Chang and Wang, 1995)	Non-linear seemingly unrelated regression	Capital and operation cost concerning throughput	LF, WTE	Not considered.
(Chang and Wang, 1997)	Fuzzy modeling	Optimal planning	LF, WTE	Set minimum and maximum range to the capacity of different facilities involved. For new facilities was subject to the design specifications.
(Huang et al., 1997)	Grey-linear programming integrated with mixed integer linear programming	Total cost minimization; optimal facility expansion, optimal waste flow allocation	COL, TS, LF, WTE, COM,	Set minimum and maximum range to the capacity of different facilities involved.
(Huang et al., 2001)	Integrated fuzzy-stochastic linear programming model	Minimizing system costs over the planning	LF, TS and three types of waste processing: COMP, WTE, REC	Uncertain capacity was generated using probability distributions, i.e., (1-p_i), developed based on distribution information of waste generation rates under different probability levels of constraint violation.
(Yeomans, 2003)	Genetic algorithm with simulation	Determine waste flow and capacity allocation planning	TS, LF, WTE	Set maximum designed capacities as limits. No specific reliability assumed (i.e., 100% reliable).
(Davila and Chang, 2005)	Grey-linear programming	Siting of best location and	LF, MRF, TS	Set capacity limitation at or below the respective design value.

Reference	Method	Main objectives	Facilities	Methods/Assumptions to apply capacity uncertainty to the model
		optimal design capacity for a MRF		
(Franchetti, 2009)	Simple feasibility study	Identifying potential MRF sites	MRF	Fixed reliability of 85% and efficiency of 90% for all system components based on historical data
(Zhu and Huang, 2011)	Stochastic linear fractional programming	Flow allocation	LF, COM, PP	Adapted from G. H. Huang et al. (2001)
(Dai et al., 2014, 2012)	Interval-parameter chance-constrained dynamic programming	Examine the reliability of satisfying (or risk of violating) system constraints under uncertainty	LF, COM, REC	Uncertain facility capacity was generated and presented as assumed probability interval levels (p = 0.01, 0.05, 0.1 and 0.2) and probability distribution
(Pressley et al., 2015)	Life Cycle Assessment	Assessment of four MRF types: single-stream, dual-stream, pre-sorted recyclables, and mixed-waste.	MRF	Assumed a fraction of equipment maximum capacity being utilized (0.85 for most of the equipment)
(Yadav et al., 2018, 2017)	Interval analysis	Facility locating	TS, COM, PP, RDF	Univariate and multivariate sensitivity analyses.

In contrast to the few waste management models where a fixed <100% reliability factor was directly applied to the uncertain capacity to account for a variable operable period, other models comprising a centralized waste processing, composting, material recovery, and WTE facilities did not include any specific reliability factor. Instead, a grey/interval programing study and a mixed model developed based on the integration of the stochastic (or probability) theories with the fuzzy set theory (Huang et al., 2001; Zhu and Huang, 2011) incorporated capacity reliability for treatment facilities using probability distributions. This requires sufficient data for generating robust probability distributions though (Huang et al., 1992). Huang et al. (2001) and Zhu and Huang (2011) generated cumulative distributions of waste disposal/treatment capacities based on the distribution information of uncertain waste generation rates of related cities. The uncertain capacity was determined under different probability levels of constraint violation (p_i), which were the probabilities of violating the capacity constraints (Dai et al., 2014, 2012). Therefore, the probability of having a capacity higher than the defined constraint (i.e., $1 - p_i$) was lower under higher constraint violation. This method allows an increase in valuthe e of uncertain capacity under a lower probable condition (or higher probability of constraint violation) and vice versa. However, this numerical method disregarded the risk or the effect of facility performance on capacity, which significantly but inversely could contribute to the facility capacity. This model defect was fixed by defining upper and lower bounds for the capacity constraint (Dai et al., 2014, 2012). The reliability that was defined through probability distributions and constraint violation level was the probability of the facility fulfilling its capacity requirements (Huang et al., 2001; Zhu and Huang, 2011), but without characterizing the risks to real operation, which can change capacity constraints eventually.

The impact of facility performance or its behaviors on capacity under uncertainty could be covered among the numerous probabilities and scenarios generated when optimizing a capacity planning model. However, an in-depth, independent characterization of the facility performance and its impact on capacity, and inversely, the impact of capacity on the reliability of the facility at full-scale is required, which is the high-level goal of this study.

Since capacity could be used for both feed rate and throughput alternately, hereafter in this study, capacity will be replaced with “feed rate” for better differentiation from throughput.

4.1.2 Case study

The investigated case study was a waste pre-processing facility located in the Integrated Processing and Transfer Facility of the City of Edmonton, Canada. This facility processed more than 250,000 tonnes of single- and multi-family comingled MSW annually (Edmonton, 2016). The schematic of the waste pre-processing is shown in Figure 4-1. The pre-processing system consisted of two parallel lines, fed by a grapple. The feeding system, comprising of a hopper and conveyors, transferred the raw MSW from the tipping floor to the first hand-sort-room, where hazardous household wastes and bulky discards were manually removed. Afterward, the post-sorted waste was mechanically size separated into different waste streams using a two-stage trommel followed by a disc screen.

The aperture sizes in the first and second stage were 5 cm (2”) and 23 cm (9”). The first stage screened out the <5 cm fraction, defined as first unders. Theoretically, the second stage separated the 5 to 23 cm (2 to 9”) as the second unders (aka <23 cm or <9”); whilst the >23 cm (>9”) material left the trommel outlet as the oversized waste flow (overs), and went through a secondary hand-sort-room. The second unders stream was fed into the disc screen for further size separation. With a cut-off size of 12.7 cm (5”), the disc screen separated the 5 to 12.7 cm (2 to 5”) underflow (aka <13 cm or <5”) from the 12.7 to 23 cm (5 to 9”) overflow material. Hence, the outcome of the mechanical size separation was four waste streams. The trommel first unders and the disc screen underflow were transferred individually and utilized by a compost facility; while the disc screen overflow and trommel post-sorted overs were combined and transferred to a refuse-derived fuel (RDF) production facility. Online belt scales measured the cumulative weight of the mechanically separated waste streams automatically. The manually sorted wastes and small ferrous materials removed by overhead magnets were stored in bins and weighed by an industrial scale on site. The data collection locations are shown in Figure 4-1.

This configuration of mixed residential waste pre-processing represents a large number of similar facilities that are alternately termed as “dirty MRF” in North America (Cimpan et al., 2015). The pre-processing explained above is also similar to the mechanical compartment of the mechanical-biological treatment (MBT) facility that is widely used in Europe.

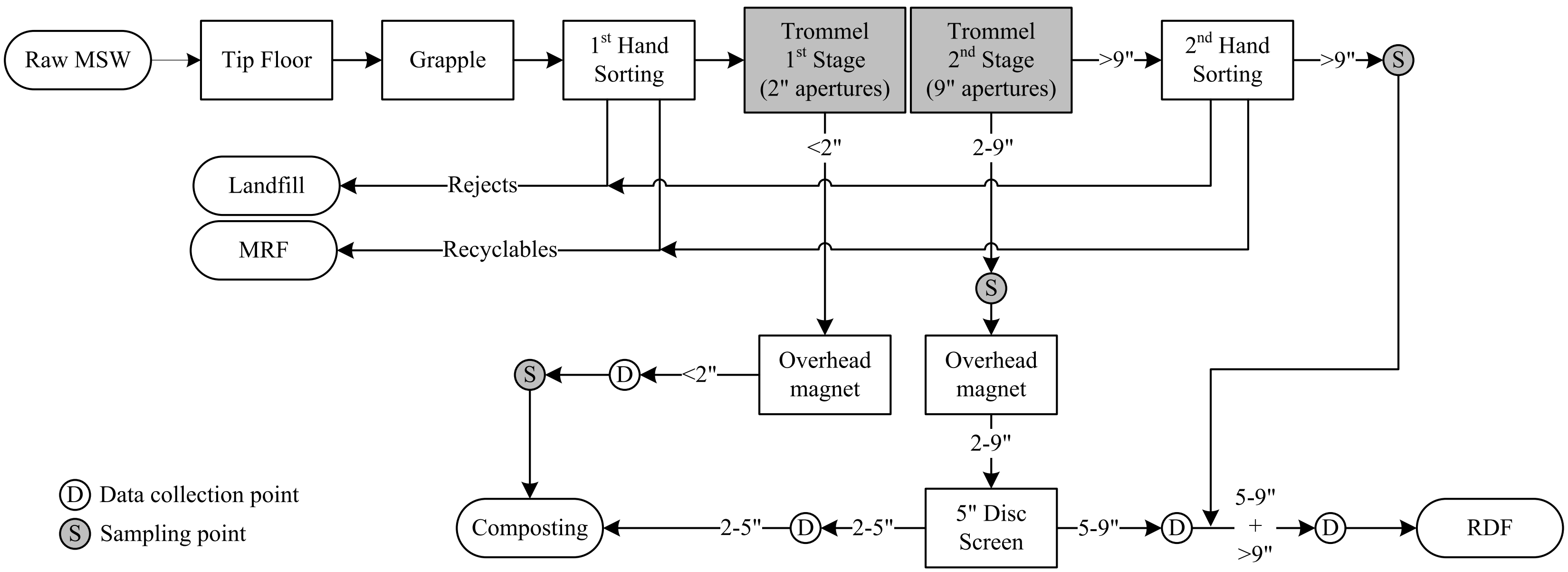

Figure 4-1. Pre-processing flow diagram (the flows of ferrous metals separated by overhead magnets are not shown for simplicity).

4.1.3 Objectives

The high-level goals of this research were to conduct a system reliability analysis on a residential waste pre-processing system and characterize the performance of the overall system, including system availability, maintainability and throughput during different operational conditions. The specific objectives were:

1) To verify whether an increase in the feed rate and seasonality can significantly impact the reliability of the waste pre-processing system;
2) To develop a breakdown of operation downtimes in terms of type (reason), number, duration and frequency;
3) To assess the maintainability of the system using probability analysis, and;
4) To quantify the potential effects of different feed rates and seasons on the system throughput.

4.2 Material and Methods

4.2.1 Trials

The data was collected using experimental events that included full-scale trials and waste characterization experiments. The experimental events were conducted during:

- Low load season (winter event) when the weather was cold; waste generation was at the minimum according to historical data; and in term of composition, food waste was the main organic matter in waste.

- High load season (summer and fall event) when waste generation peaked due to the large disposal of green yard waste, significantly dominating in the waste composition.
- Short transitional season when low load season transitioned into high load season (spring event). During the spring season, large amounts of thatch from yard waste was present.

Overall, thirty-three trials were conducted throughout this research project.

4.2.2 Data Collection

The data required were the weight of the size-separated waste streams and the operation downtimes information. The total weight of the size-separated waste streams was determined automatically by online belt scales as well as manually every 15 minutes using the system control software. The bulky waste and other rejects removed by the hand-sort-rooms and the small metal removed by overhead magnets were weighed by an offline scale when their designated storage bin was full, which was inconsistent with the frequency of data recorded by the online belt scale. Therefore, these weight items which were 1-2% of the total feedstock were neglected.

The start and end time of every system failure, along with the reason of occurrence were recorded using operations control software. Subsequently, the duration of operation downtimes (DT) and uptimes (UT) were calculated based on the start and end times of system failures.

4.2.3 Feed Rate

During each experiment event, it was regulated to feed the pre-processing system consistently around three target rates of 40, 55 and 70 metric tonnes per hour (t/h) for at least four hours. The upper and lower rates (i.e. 40 and 70 t/h) correspond with the minimum and maximum capacities of the feeding conveyors. The maximum designed throughput of the trommel 55 t/h was estimated based on Sullivan et al. (1992).

Before each test cycle, the average weight of a regular grapple load was determined. A minimum of five equally-sized replicates were collected randomly from the waste pile resting on the plant tip floor. Feeding was implemented by allowing for specific time intervals between grapple loads that roughly result in feeding around the targeted rates. Additionally, the variation of actual exerted feed rate was monitored throughout the test cycle and adjusted, if needed, by changing the time intervals. The feed rate was determined based on Equation 25.

$$Q = \frac{\text{Total feed}}{\text{Total uptime}} = \frac{\sum W_x}{\sum_i^n UT_i} \qquad \text{(Equation 25)}$$

Where,

- Q is the total feed rate, estimated every 15 min (t/h)
- $\sum W_x$ is the total weight of all post-separated waste streams, measured by the belt scale system.
- $\sum_i^n UT_i$ is the total duration of *n* corresponding uptimes within the respective 15 minutes

4.2.4 Reliability Analysis

4.2.4.1 Mean Time Between Failures and Mean Time To Repair

Downtimes were initiated either manually by staffs in the control room or the hand-sort-rooms, or automatically by mechanical equipment due to any failure. Two parameters of interest in the system reliability, i.e., the mean time between failures (MTBF) and the mean time to repair

(MTTR) were considered (Elsayed, 2012). The MTBF is defined as the average time the system (or an individual component) functions between failures (Elsayed, 2012). The MTTR is defined as the average time required to repair any unplanned failures that occurred to the system, excluding preventive repairs. MTTR it the most important parameter to characterize the maintainability of the system (Gupta et al., 2013). A schematic of uptime and downtime is shown in Figure 4-2. MTBF and MTTR are calculated based on operation uptimes (UT) and downtimes (DT) using Equations 26 and 27.

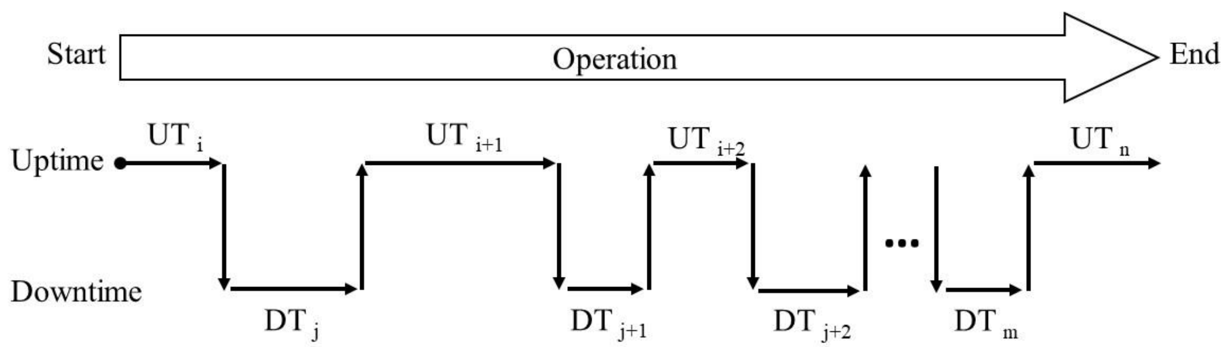

Figure **4-2** Schematic of MTBF and MTTR. (UT and DT represent the duration of uptimes and downtimes measured during the operation.)

$$\text{MTBF} = \sum_{i=1}^{n} UT_i/n \qquad \text{Equation 26}$$

$$\text{MTTR} = \sum_{j=1}^{m} DT_j/m \qquad \text{Equation 27}$$

Where,

- UT_i is the duration (min) of the i*th* operation uptime out of *n* number of uptimes, and
- DT_j is the duration (min) of the j*th* operation downtime out of *m* number of downtimes.

It should be noted that in this research study, there is no differentiation in terms of the type of failure when calculating MTBF and MTTR. More comprehensive system engineering studies calculate MTBF and MTTR for every type of failure identified within the system. However, in this research, a portion of historical data pertaining to failures within the existing pre-processing system did not support the detailed calculation of MTBF and MTTR, as the feed rate was not monitored precisely. Therefore, an extensive failure-related data collection under controlled operating conditions was needed, which required a large number of costly trials and was not deemed to be practical within the scope of this research Project.

4.2.4.2 System Availability

System availability, also termed as operational availability, is defined as the probability (%) a system is functioning when needed, under normal operating conditions, and is calculated based on Equation 28 (Elsayed, 2012; Sillivant and Farrington, 2012). Similar to MTBF and MTTR, the values of system availability were calculated without differentiating between types of failures in this study.

$$\text{System Availability (\%)} = \frac{\sum_{i=1}^{n} UT_i}{(\sum_{i=1}^{n} UT_i + \sum_{j=1}^{m} DT_j)} = \frac{MTBF}{MTBF+MTTR} \qquad \text{Equation 28}$$

4.2.4.3 Distribution Functions

A Log-normal probability density function (PDF) was fitted to downtime durations (represented by MTTR) in order to statistically determine the probability of occurrence regarding downtime duration under different operating conditions in terms of feed rate and seasons

(McPherson, 2010). The fitted PDF was utilized as an indication to assess the maintainability of the system. A Log-normal PDF is shown in Equation 29.

$$N(\ln x;\ \mu, \sigma) = \frac{1}{x\sigma\sqrt{2\pi}} exp\left[-\frac{(lnx-\mu)^2}{2\sigma^2}\right] \qquad \text{Equation 29}$$

Where μ and σ are the mean and standard deviation of the variable's natural logarithm.

In addition, a Weibull cumulative distribution function (CDF) was fitted to the uptimes in order to determine the probability of the system being operated for a given duration under different operating conditions. The fitted CDF was utilized as an indication to assess the reliability of the system. A Weibull CDF is shown in Equation 30.

$$F(x; k, \lambda) = 1 - e^{-\left(x/\lambda\right)^k} \qquad \text{Equation 30}$$

Where $k > 0$ and $\lambda > 0$ are the shape and scale parameters of the distribution.

Both Weibull CDFs and Log-normal PDFs are commonly used in reliability analysis (Gedam, 2012; Myrefelt, 2004; Pourhosseini and Nasiri, 2018). The PDF and CDF results obtained unders different feed rate and seasons were compared with each other in order to investigate the impacts of feed rate variation and seasonality on the reliability of the system. Therefore, uptimes and downtimes were grouped based on feeding rate and season of trials before fitting any PDF and CDF.

4.3 Results and Discussion

4.3.1 System Availability and Feed Rate

To verify whether the operational availability of the waste processing system was affected at greater feed rates, the average of system availabilities estimated during each trial is plotted against corresponding averaged feed rates. The feed rates were calculated based on dry and wet weights. The system availability decreased non-linearly while feed rate increased among the summer and fall season results (Figure 4-3), indicating that the percentage of total operation duration associated with downtimes was relatively a function of feed rate. In other words, the pre-processing system was less available when it was operated at higher feed rates and vice versa. This has been further investigated by a probability distribution analysis of operation downtime in section 4.3.2.2. The correlation found between system availability and feed rate also indicated that the overall throughput of the system could be affected at a higher feed rate, which has been further investigated in section 0.

The waste processing system consisted primarily of mechanical equipment, such as the trommel and the disc screen that implemented basic size separation techniques for preparing waste streams suitable feedstocks for composting and RDF production. In both pre- and post-trommel hand-sorting unit operations, bulky waste was removed manually based on their size. Thus, the size of the waste material can potentially be the first main contributor to system failure, causing operation downtime. Likely, this could be the main reason for the system availability being correlated with dry feed rate (R^2 = 0.86) more strongly than with wet feed rate (R^2 = 0.76). In theory, dry feed represents the solid fraction of feedstock loaded into the system, which directly contributes to the structure and dimensions (size) of waste material processed through the system.

Instead, the wet feed contains the water content as well, which contributes more to the density of waste materials rather than their size. Therefore, system availability was found to correlate more strongly with dry feed rate than with wet feed.

However, in a full-scale waste management facility, the weight off incoming waste material is measured and reported based on a wet basis. Thus, a wet to dry basis conversion is useful here. Figure 4-4 shows the correlation found between wet and dry feed rates of the summer and fall trials, presented previously in Figure 4-3. On average, dry feed rate was approximately 60% of wet feed rate in this study. Detailed results are provided in Table C-1 of Appendix C. The wet feed rate was calculated based on belt-scale records, and the dry feed rate was calculated after deducting the water content of the waste feedstock, obtained during waste characterization. Details of moisture content measurement were discussed in Chapter 3.

Another attempt was made to develop a more comprehensive trend between system availability and feed rate results than the trend found for the summer and fall trials. Subsequently, additional correlation analysis was conducted using the results of all seasons, including spring and winter trials. However, there was no correlation applicable to all year results. Overall, the pre-processing system's availability varied between 79-96% during the spring and winter operation cycles without being meaningfully correlated to the feed rate; 88% available on average.

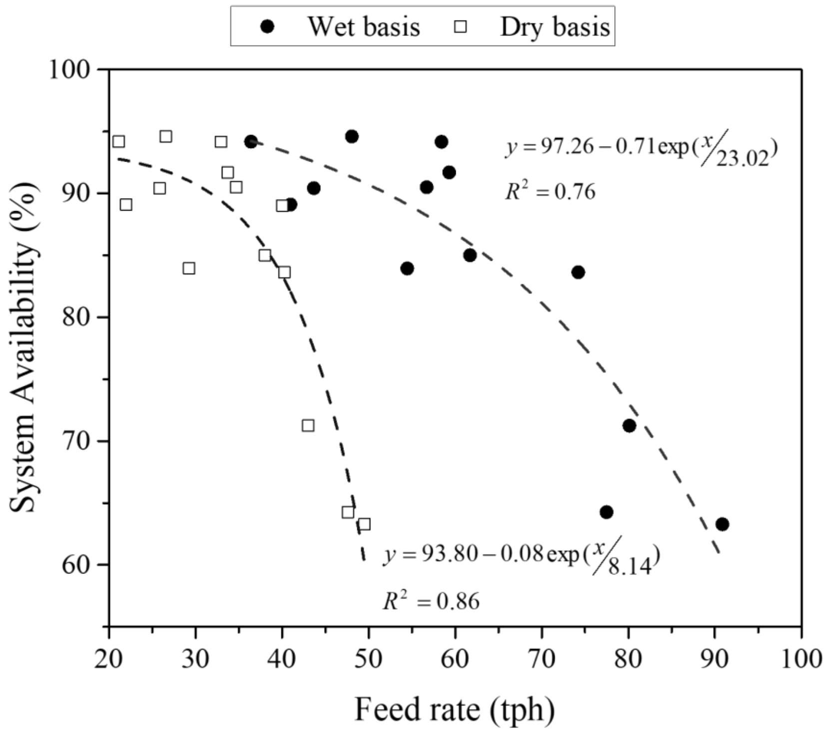

Figure 4-3 Correlation between system availability and feed rates during summer and fall trials.

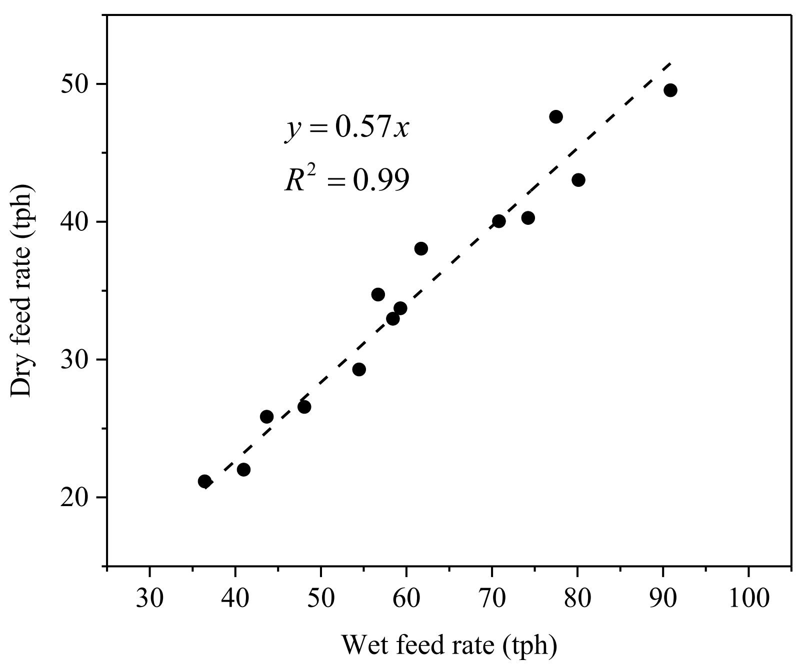

Figure 4-4 Correlation between wet feed rate and dry feed rate during summer and fall tests.

4.3.2 Downtimes Analysis

4.3.2.1 Downtime Breakdown

The general relationship between the total duration of downtimes and feed rates was indirectly studied by the correlation found between system availability and feed rate results. This has been further investigated in this section by directly looking more deeply at the cause of downtimes. To find the longest and most dominant downtimes, all recorded downtimes were first categorized based on the reason of occurrence, i.e., the equipment or unit operation that failed to operate or triggered a downtime during experiment operation cycles. For each type of downtime identified, the total number and total duration recorded under different seasons and feed rates are expressed, respectively, as % of the total number and total duration of all downtimes recorded throughout corresponding operation cycles (Table 4-2). Subsequently, for downtimes shown in Table 4-2, the mean time between failures (MTBF) and the mean time to repair (MTTR) are presented in Table 4-3. All operation downtimes data are provided in Table C-2 of Appendix C. Summary of downtimes categorized based on the season and feed rate are provided in Table C-3 and Table C-4 of Appendix C. The supporting data for Tables 4-2 and 4-3 are provided in Table C-5 and Table C-6 in Appendix C.

4.3.2.1.1 Winter and spring trials

The most often occurring downtimes found among the winter-spring trials were those initiated from either the first or the second sorting rooms, which together represented 91-93% of all downtimes (by number), which approximately equated to 59-63% of the total duration of downtimes (Table 4-2). The majority of downtimes mentioned above (66-89% by number) originated from the first sorting room rather than the second. The first sorting room processed all waste feedstock fed into the system, while the second room dealt with only 15% (by weight) of the feed that left the trommel outlet.

During the winter-spring trials, the total number and duration of downtimes caused by the first sort room increased at higher feed rates (Table 4-2). This was also evident in Table 4-3 where the mean time between relevant downtimes (i.e., MTBF) decreased remarkably from 204.4 min to 59.3 min, verifying that the average uptime during which the first sort room operated was shortened when the system was fed at higher rates.

The above-mentioned impacts of a greater feed rate on the number and duration of downtimes associated with the first sorting room – which was also confirmed by related MTBF and MTTR results − were not clearly observed among the downtimes associated with the second sorting room, specifically, when feed rate varied higher than 65 t/h (Table 4-2). Only, a general increasing trend was recognized in the number of downtimes related to the second sorting room, which was also indicated by Table 4-3 where the corresponding MTBF significantly decreased from 919.4 min at <40 t/h to 133.4 min at a feed rate as high as 65 t/h.

In addition to frequent hand-sorting room downtimes, there were infrequent system failures identified during the winter-spring operation cycles, such as jammed waste in the conveyor feeding the disc screen, jammed waste in disc screen, failure in the post second sorting room conveyors, as well as the overhead magnet − where the latter was very rare. Even though these downtimes were infrequent in number, their duration was somewhat comparable to the downtimes of hand-sorting rooms. No specific relationship was found between the number and duration of above-mentioned infrequent downtimes and the feeding rate in the winter-spring trials.

4.3.2.1.2 Summer and fall trials

Similar to the winter-spring trials, the main type of downtime identified during the summer-fall trials related to the hand-sorting rooms, accounting for 88-94% (by number) and 50-88% (by duration) of all respective downtimes recorded (Table 4-2). Again, the contribution of the first sorting room in the initiation of downtimes was more than that of the second sorting room in terms of both number and duration. However, contrary to the winter-spring operation cycles, the number and duration of downtimes did not increase with a greater feed rate. Possibly, this was because of a significant change in the feedstock composition, which ultimately caused other types of failure elsewhere and is further explained herein. During the summer (peak) season, a large fraction of waste disposed at the facility contained yard waste, which increased the density of the disposed waste (Rajabpour Ashkiki et al. 2019). Generally, the trommels do not have a high efficiency. Due to an intensified particle-to-particle interaction between waste material inside the trommel resulting from increased waste density, especially at greater feed rates, a fraction of undersized waste, including yard waste, was not appropriately removed through the 2-inch screens in the first stage of the trommel. Instead, this fraction of waste was more removed through the 9-inch screens of the second stage, albeit some material escaped and appeared in the trommel outlet. In consequence, the amount of the second unders (<23 cm) increased remarkably and overloaded the receiving conveyor and caused a material jam on top of it. This conveyor is the disc screen feeder also. Ultimately, this caused a waste jam in the disc screen. In addition to failures related to waste jam, there were other failures caused by the overloaded conveyor system, which mostly occurred at a feed rate > 65 t/h. These downtimes, together with the jammed disc screen, accounted for 45% of the total downtime duration recorded in the summer operation cycles.

Table 4-2 Number and duration of downtimes measured during trials (Note that all values are expressed as percentages).

Downtime	Winter and spring tests						Summer and fall tests			
	< 40 t/h		45-65 t/h		> 65 t/h		< 50 t/h		> 65 t/h	
	No.	Duration	No.	Duration	No.	Duration	No.	Duration	No.	Duration
Requested from sorting rooms:										
First sort room (pre-trommel)	13.1	7.2	35.2	19.7	45.6	23.5	76.5	69.2	61.5	32.4
Second sort room (post-trommel)	1.6	1.5	18.5	12.5	19.3	10.6	17.6	18.7	26.9	16.8
Unspecified sort room*	77.0	50.5	38.9	22.5	28.1	29.1	0.0	0.0	0.0	0.0
Subtotal (all sort rooms)	91.8	59.2	92.6	54.7	93.0	63.2	94.1	87.9	88.5	49.2
Conveyor feeding disc screen	1.6	1.5	1.9	19.1	1.8	15.3	0.0	0.0	2.6	2.7
Jammed disc screen	0.0	0.0	1.9	23.1	1.8	18.5	5.9	12.1	7.7	45.6
Post second sort room conveyors	1.6	33.2	0.0	0.0	1.8	1.9	0.0	0.0	1.3	2.5
Minus 2” collecting conveyors	1.6	3.7	1.9	1.5	1.8	1.2	0.0	0.0	0.0	0.0
Overhead magnets	3.3	2.5	1.9	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Details of downtimes during the four trial operations were not recorded entirely.

Table 4-3 Estimated average mean time between failures (MTBF) and average mean time to repair (MTTR) for each downtime (Note that all values shown are in minutes).

Downtime	Winter and spring tests						Summer and fall tests			
	< 40 t/h		45-65 t/h		> 65 t/h		< 50 t/h		> 65 t/h	
	MTTR	MTBF	MTTR	MTBF	MTTR	MTBF	MTTR	MTBF	MTTR	MTBF
Requested from sorting room										
First sort room (pre-trommel)	1.2	204.3	1.4	68.5	1.5	59.3	1.2	30.2	1.3	14.5
Second sort room (post-trommel)	2.0	919.4	1.7	124.5	1.6	133.4	1.4	116.4	1.5	32.3
Unspecified sort room*	1.5	38.3	1.4	62.2	3.1	94.2	-	-	-	-
Subtotal (all sort rooms)	1.4	32.3	1.5	26.8	2.0	29.7	1.2	24.7	1.4	10.2
Conveyor feeding disc screen	2.0	919.4	25.6	684.6	25.6	800.6	-	-	2.6	237.1
Jammed disc screen	-	-	31.0	684.6	31.0	800.6	-	-	-	-
Post second sort room conveyors	44.8	919.4	-	-	3.1	800.6	-	-	4.8	355.6
Minus 2” collecting conveyors	5.0	919.4	2.0	684.6	2.0	800.6	-	-	-	-
Overhead magnets	1.7	612.9	2.2	684.6	-	-	-	-	-	-

4.3.2.2 Maintainability

Any equipment or unit operation that failed or was down in this study was repaired and returned to the operation. To better understand the maintainability of the overall waste processing system (not each single unit operation), a simple maintainability analysis was completed. Maintainability was defined as the probability of system restoration within a specified downtime. A Log-normal probability density function was fitted to the downtimes recorded during the summer-fall trials (Figure 4-5).

As a closure to the findings of Table 4-2 and Table 4-3 the strongly fitted Log-normal probability density functions (PDFs) with R^2 >0.94 proved the hypothesis that the overall maintainability of the waste processing system was adversely affected by the feed rate. The x-centre point of the fitted log-normal PDFs indicated that the duration of the most probable downtime recorded during the summer-fall trials at <50 t/h had an averaged duration of 47.6 ± 1.1 sec with a probability of > 50%. Whereas, the most probable downtime recorded at feed rates greater than 65 t/h had a duration of 72.5 ± 0.8 sec with a probability of <35%; i.e., 25 sec longer, on average. This evidence suggests that longer downtimes were more probable when feeding reached the maximum design rate. In other words, the waste processing system returned to working condition faster (or was more maintainable) when it was less loaded.

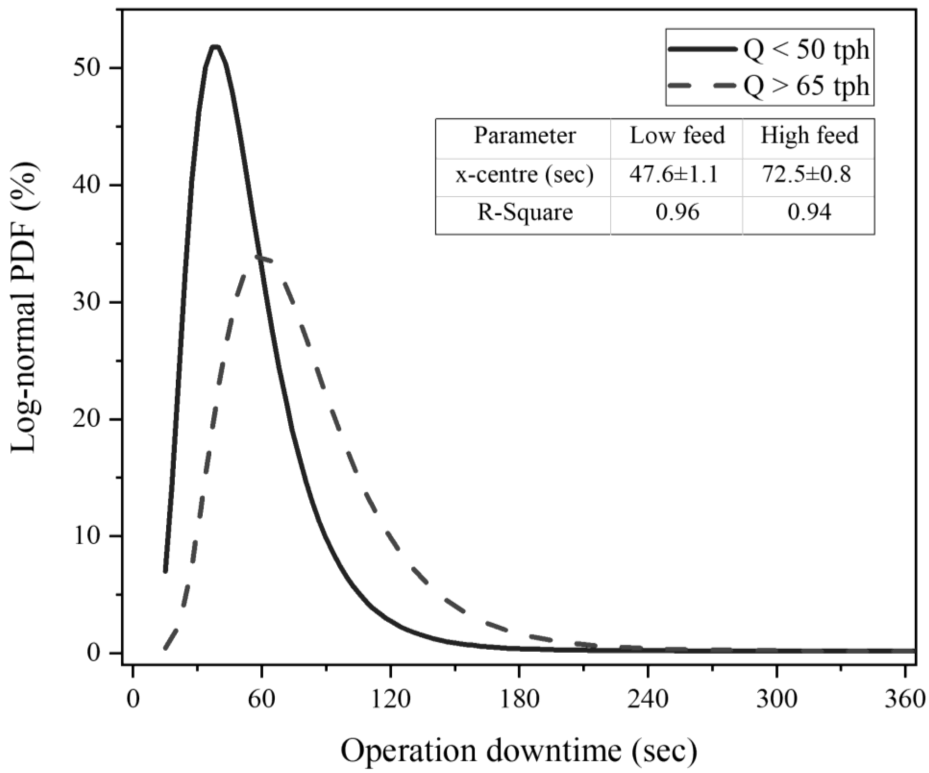

Figure 4-5 Log-normal probability density functions fitted downtimes measured at different feed rates during the summer-fall tests.

4.3.2.3 Frequency of downtimes

The final set of results concerning downtimes is the frequency of all downtimes combined, irrespective to type (Table 4-4). During the summer-fall season operations, the frequency of downtimes at a feed rate of > 65 t/h was found to be at least twice as high as compared to a feed rate of < 50 t/h. The winter-spring results did not show any significant change in the frequency of downtime versus the feed rate increment.

Table 4-4 Frequency of downtimes in different testing conditions.

Season	Test configurations		Downtime	
	Feed rate (t/h)	Net duration (min)	No. of occurrences	Frequency (min^{-1})
Summer-fall	>65	972	81	0.083*
	<50	848	34	0.040
Winter-spring	>60	1683	57	0.034
	45-60	1450	54	0.037
	<40	1813	61	0.034

* 0.083 (min^{-1}) = 81 ⁄ 972 min.

4.3.3 Uptime analysis

To further assess the reliability of the waste processing system against the loading rate, a probability distribution analysis was completed on the uptimes represented by the MTBF, using the Weibull cumulative distribution function (CDF). The Weibull CDF was fitted to two sets of MTBF results associated with (a) the entire waste processing facility and (b) only the pre-trommel feeding conveyors during the summer-fall season (Figure 4-6). As opposed to the downtimes, which were analyzed using PDFs for finding the most probable downtime, the CDF analysis is a more beneficial reliability analysis tool to evaluate the ability of the systems to operate more continuously. The fitted CDFs in Figure 4-6a showed, for example, that 73% of uptimes measured at feed rates < 50 t/h lasted for 20 min or shorter, while 27% of uptimes continued beyond 20 min. In comparison, 91% of the uptimes measured at feed rates > 65 t/h lasted for 20 min or shorter periods, and only 9% of them were longer than 20 min. This indicated that the probability of the system to operate continuously for longer periods was higher when it was fed at lower rates. A similar conclusion was drawn for the uptimes relevant only to the pre-trommel conveyors, including the first-hand-sort room (Figure 4-6b). Details of fitting Weibull CFD are provided in Appendix C.

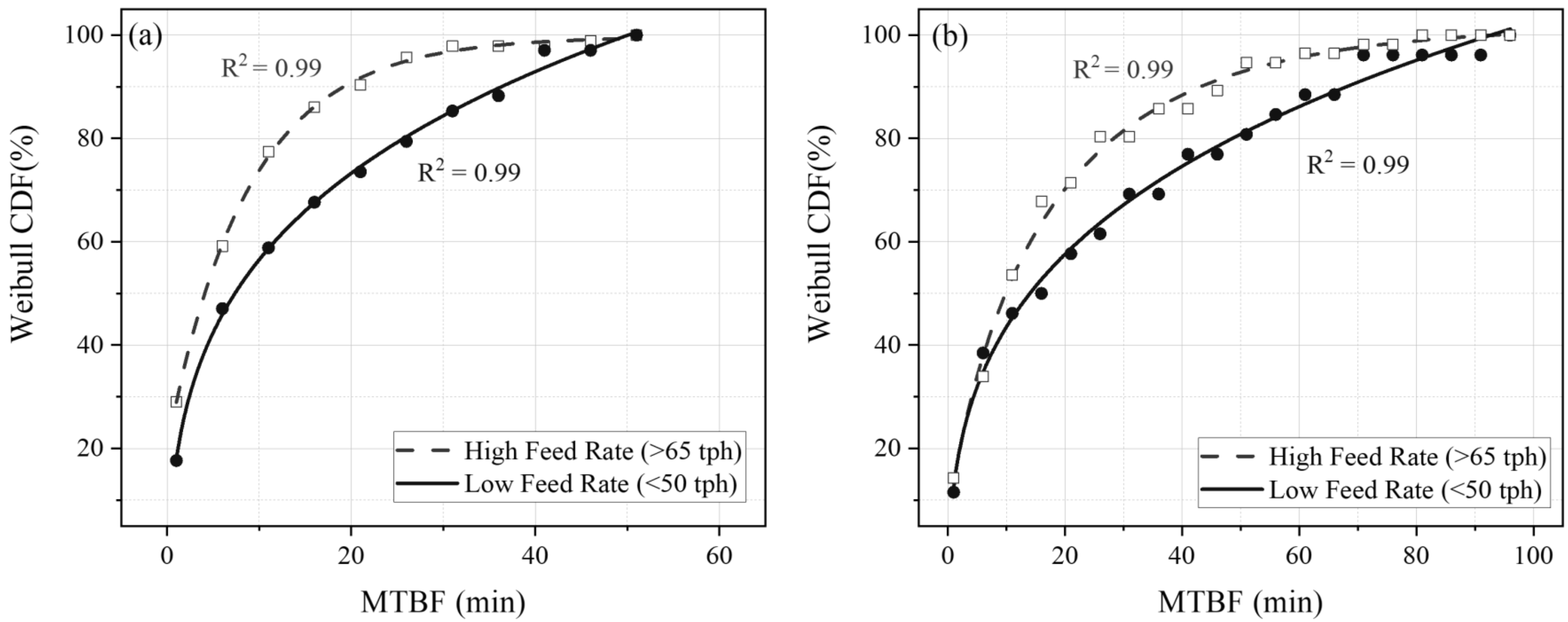

Figure 4-6 Weibull CDFs fitted to (a) all uptimes and (b) only uptimes associated with pre-trommel conveyors (feeding conveyors), measured during the summer-fall tests.

Additionally, the mean and standard error of the MTBF results are tabulated for further comparison ( ). The entire system had shorter MTBFs than its pre-trommel and post-trommel components since other system components with variable uptimes were also involved. Further, the post-trommel conveyor in the second sort-room operated 3.5 times longer than the pre-trommel conveyor in the first sort-room at feeding < 50 t/h, decreasing to 1.7 times when feeding was increased to > 65 t/h.

Table 4-5 MTBF results of the summer-fall trials. Values reported are mean ± one standard deviation of measurements

Loading rate	Entire line (min)	Pre-trommel Conveyor (min)	Post-Trommel Conveyor (min)	Ratio between pre- and post-trommel conveyors
Low (< 50 t/h)	15.6±2.7	27.3±5.3	94.8±38.7	3.5
High (> 65 t/h)	9.4±1.0	19.3±2.6	32.1±6.7	1.7

4.3.4 Throughput

The trommel was the system's first size separation equipment, loaded almost by the majority of feedstock; thus it could become the system bottleneck where its theoretical throughput somewhat determined the rate of loading into the whole system. Theoretically, the trommel had a throughput of 55 t/h and showed the best size separating results when filled to 25-33% capacity based on Sullivan et al. (1992) study. Each processing line was designed for an overall throughput of 46 t/h, which is approximately 84% of the trommel's throughput. In this study, the pre-trommel conveyors had an adjustable feeding rate between 40 t/h and 70 t/h, as needed. During the peak season, when the facility is at capacity, it is likely that loading the system temporarily exceeds the trommel's theoretical capacity, affecting its screening performance. The impact of high feed rate on screening performance has been studied earlier in Chapter 3 or Rajabpour Ashkiki et al. (2019).

Given the trommel was the potential system bottleneck that received the entire feedstock loaded into the processing line, the negative impact of the increased loading rate on the availability of the system, including the trommel (as shown in Figure 4-3) can also affect the overall daily throughput accordingly. The goal of this section is to determine the theoretical feed rate that maximizes the throughput of the waste pre-processing system. The system throughput was calculated for three operation durations (shifts) of 8 hours per day (h/d), 9 h/d and 10 h/d (to represent the operation in the low, average and high waste generation seasons. The overall throughput was calculated from Equation 31.

$$\text{Throughput (t/d)} = \text{Feed rate (t/h)} \times \text{Shift duration (h/d)} \times \text{Availability (\%)}$$

Equation 31

Where availability was obtained from its correlation with feed rate (Figure 4-3).

As expected, throughput increased with higher feed rate (Figure 4-7). However, due to the adverse impact of higher feed rate on the system's availability that was indicated by the non-linear correlation between feed rate and system availability (Figure 4-3), the estimated system throughput maximized and subsequently decreased when the feed rate exceeded 80 t/h. This rate was defined as the "maximum theoretical feed rate" that the system can manage. Any feed rate greater than the determined value results in a lower throughput because the negative impact of decreased system availability (i.e., shortened operation) was more significant and that disrupted the positive impact of feeding at greater rates.

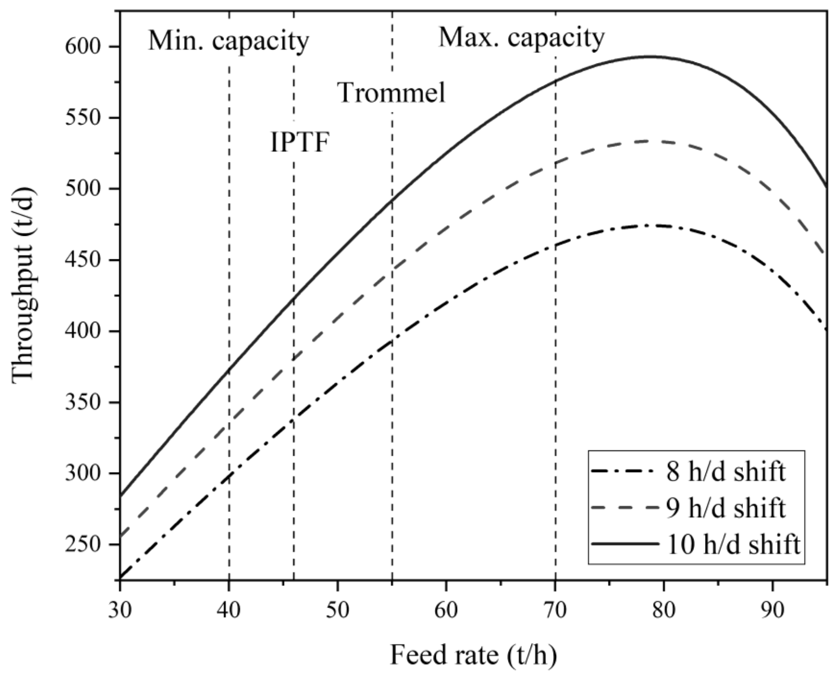

Figure 4-7 Maximum achievable throughput under different daily shifts.

Given that the feeding conveyors could support feeding up to 70 t/h, overloading the trommel at 80 t/h is rare in a real operation. Irrespective to the tommel's throughput, providing conveyors could support feeding at a higher rate, the "maximum theoretical feed rate" of 80 t/h could be used as the maximum feed rate allowable that ensures the throughput of the waste pre-processing system can be maximized. It should be mentioned that loading the trommel at high rates not only affected the quantity of waste streams separated from it, but also deteriorated the quality of the material for further processing. This jeopardized the performance and efficiency of the system, which has been studied elsewhere (Rajabpour Ashkiki et al., 2019).

4.4 Conclusions

This research study was the first attempt to conduct a system reliability analysis on a residential waste pre-processing system. The high-level goal of this research was to characterize the system availability and maintainability, downtimes and uptimes as represented by MTTR and MTBF, as well as the throughput of the overall system during different seasons and loading rates, with a focus on the trommel screen.

The majority of downtimes (by total number and duration) were originated from the first sort-room followed by the second sort-room during both the winter-spring and summer-fall seasons. Other types of downtimes, such as a jammed disc screen and conveyors mostly occurred when the system was overloaded, especially during peak season. In addition, the most probable downtime measured at $Q < 50$ t/h was 47.6 ± 1.1 sec (with a probability > 50%), which increased by 25 sec when feeding exceeded 65 t/h, as indicated by the log-normal PDFs. Accordingly, the CDFs fitted to the MTBFs showed that the probability of operating for longer periods was higher when the feeding was managed at lower rates. The overall availability of the system along with its throughput decreased non-linearly as a result of an increased feed rate.

The focus of this work was on system reliability only, so the performance of the system in terms of quality and quantity of the separated waste streams was not in the scope of work. The PDFs and CDFs obtained as part of the system reliability and maintainability analyses, and the correlations found between the system availability and feed rates, and between the throughput and feed rates can be used for a detailed system analysis using discrete event simulations in the future. The simulation can also include both quantitative and qualitative aspects of waste processing published in another study (Rajabpour Ashkiki et al., 2019).

The number of trials in this study was limited to the operations. The validity of the statistical analyses could be improved by increasing the number of trials. The minimum number of trials, which relates to the sample size, can be calculated based on critical values of the t-distribution, assumed confidence interval (which relates to type one error; $1-\alpha$ one-sided test and $1-\alpha/2$ for two-sided test), power (or $1-\beta$ or type two error), standard deviation and desired level of precision.

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CHAPTER 5. SUMMARY AND CONCLUSIONS

5.1 Conclusions

A summary of the contributions drawn from this thesis:

1) The seasonal variation in the particle size distribution (PSD) of feedstock, which was also evident in this research study, should be taken into consideration during the design and operation of size separating equipment, such as a trommel screen. Disposal of organic waste, such as thatch and yard waste during the spring and summer, contributed the most to the variation of the feedstock's total PSD (PSD_T). As a result, the finest and least uniform waste material was processed during the spring and summer operation cycles. The characteristic particle size of the related PSD_T was 5.4 cm (spring) and 8.1 cm (summer). The related PSD_T curves showed that, on average, 65% and 52% by wet weight of the total feed loaded into the trommel during the spring and summer operation cycles was <5 cm (i.e., the size of the apertures in the trommel's first stage), as compared to 42% by wet weight of the winter feed. Winter feedstock had the largest waste material with an average characteristic particle size of 9.7 cm and the lowest amount of organics processed.
2) The particle sizes of the compostable material (PSD_C) varied seasonally, whereas the particle sizes of the refuse-derived fuel (RDF) material (PSD_R) remained similar throughout the year. The PSD_R sigmoid curves were steeper around the breakthrough points, ranging within 11.4-12.7 cm, compared to the PSD_C curves. The breakthrough point is the particle (or sieve) size at which the PSD curve deflects the most. Slightly moving away from the breakthrough results in large variations in the percent of RDF retaining on any given size. This implies not

only that the size of the RDF material was more uniformly distributed, but also was consequently more sensitive to sieve size. These properties of RDF material can be taken advantage by adjusting the cut-off -size between the compost and RDF material to an appropriate size. In this study, the cut-off-size between the compost and RDF feedstock was 12.7 cm (or 5”). The <12.7 cm disc screen’s underflow and the <5 cm (2”) trommel’s first unders were utilized as compost feedstock. The >12.7 cm disc screen’s overflow combined with the >23 cm trommel’s overs were utilized for RDF production. The existing Compost-RDF cut-off-size was very close to the 11.4-12.7 cm range in which the breakthrough points of PSD_R varied. Theoretically, given the sensitivity found in the PSD_R, the Compost-RDF cut-off-size should be set reasonably smaller than the PSD_R breakthrough points, at the minimum, to retain at least 50% dry weight of total RDF material.

3) Both quantities of first unders separated from the total feed (represented by S_{U1}) and related recoveries (R_x) validated that the performance of the trommel’s first stage varied seasonally, primarily due to the seasonal variation of the PSD of the feedstock. On average, the maximum S_{U1} was 59% by wet weight in the spring trials, 40% by wet weight in the summer trials, and 26% by wet weight in the winter trials, while the average loading rate was low (i.e., varied between 41 t/h and 46 t/h). The feed rate was the second most effective parameter on trommel performance in terms of reducing the separation efficiency and recovery results. Generally, the separation performance and recoveries within a season decreased with higher feed rates.

4) The performance of the existing trommel was assessed quantitatively using the inverse linear correlations found between the recovery (R_x) and the corresponding overs loading rate ($OLR_{>x}$). In brief, the $OLR_{>x}$ was defined as a portion of the feed rate associated with the waste material larger than a given particle diameter (D_P) of x, for which R_x was calculated. Hence,

the $OLR_{>x}$ was only developed for waste material smaller than the diameter of screen apertures (D_A). The main advantage of an $OLR_{>x}$ is its association with both PSD and the rate of the feedstock being loaded into the trommel, making the $OLR_{>x}$ a good representation of oversize particle-to-undersize particle interactions. Two main findings were (a) R_x in the summer and spring operation cycles was higher than in the winter cycles at any $OLR_{>x}$, and (b) R_x dropped more with a greater $OLR_{>x}$ during the winter operations than in the spring and summer. Essentially, both effects were because the dominant particle range within the <5 cm undersized waste stream in the winter had a D_P/D_A ratio varying between 0.3 and 0.7, as compared to D_P/D_A <0.3 in the spring and summer cycles. Theoretically, the probability of passage through the trommel drops with a greater D_P/D_A ratio and is directly affected by particle-to-particle interactions. This was well illustrated in the linear correlations found between the R_x and $OLR_{>x}$. A minimum of 68% by dry weight of total waste particles with D_P <3.5 cm (i.e., D_P/D_A <0.7) were recovered in the spring and summer tests. Recovery was even higher at lower $OLR_{>x}$; e.g., 88% by dry weight for particles with D_P/D_A<0.3 and 83% by dry weight for particles with D_P/D_A<0.7. The former recovery results were consistent with Sullivan et al. (1992), mentioning that recovery exceeds 80% when removing particles with a D_P/D_A<0.5. However, the latter recovery results exceeded their general limit of 65% recommended for particles half sized and larger ($D_P/D_A \geq 0.5$). The new limits found in this research study can be used to upgrade the existing trommel or elsewhere.

5) The decline found in all results pertaining to separation, recovery and correlations between recovery and OLR over operation time in winter operation cycles, was directly attributed to the accumulation of waste inside the trommel, which clogged the screen apertures. Clogging also diminished the effectiveness of bag-breaking tools. The clogging of apertures became so

severe due to the thawing effect around near-freezing temperatures, changing the property of organics, causing adhesion to the rotating screen's surface, and ultimately blocking and bridging over the apertures. Based on Equation (1) developed in Chapter 3, the 5 cm apertures were clogged completely after approximately 180 min at 49±10 t/h and 90 min at 63±7 t/h. In contrast, the screening of fines proceeded consistently at freezing temperatures without any clogging.

6) Operation downtimes were inevitable and caused the waste pre-processing system to be, at most, 95% available during a shift. The overall availability of the system decreased non-linearly from 95% as a result of any increased feed rate. This was only observed during summer and fall (peak seasons) operation cycles though. No significant correlation between system availability and the feed rate was noticed in other seasons. A stronger correlation was found between system availability and dry feed rate (water content was not included).

7) The majority of downtimes, both by total number and duration, originated from the first-hand-sort room followed by the second-hand-sort room. Other types of downtime, such as a jammed disc screen and conveyors mostly occurred when the system was overloaded, especially during peak season.

8) The lognormal probability density functions fitted to downtimes indicated that greater feed rates affected the maintainability of the pre-processing system. The duration of the most probable downtime when feeding rates were <50 t/h was 47.6 ± 1.1 sec (probability >50%), which was elongated by 25 seconds on average when the feeding rate was increased to >65 t/h (probability >35%). This implied that the probability of downtimes changed from shorter downtimes to longer downtimes with an increased feeding rate. Accordingly, the Weibull cumulative distribution functions fitted to mean-time-between-failures showed that the

probability of operating for more extended periods was higher when the feeding was managed at lower rates.

9) Irrespective of the trommel's design throughput, the ultimate throughput the system can manage was affected by the negative impacts of greater feed rates on availability and maintainability of the system. The estimated throughput was maximized at a specific feed rate, termed the "maximum theoretical feed rate," and declined at any exceeding rate due to the adversely affected system availability. In this study, the "maximum theoretical feed rate" was approximately 1.5 times the trommel's design throughput. Knowing that larger throughputs are not necessarily guaranteed merely at higher feed rates helps to better design, operate and upgrade a pre-processing facility. It should be noted that the design is also highly subject to the quality requirements for separated waste streams.

5.2 Recommendations and Future Research Work

Based on this research study, these are recommendations for future research:

1) The most straightforward approach to design a waste processing facility is to size it for a specific throughput based on the population and waste generation per capita projections of the target communities. The design follows related regulations and guidelines and typically considers peak conditions and future waste diversion plans also. The required number of pre-processing lines depends on the throughput of a single line, which is a function of the treatment technologies and equipment selection, fulfilling waste treatment/processing goals. However, a waste processing facility can be designed more sophisticatedly when seasonality and variations in quantity and qualities of waste material (e.g., composition and moisture content) are taken into consideration. This research showed that the performance of a facility or equipment could

vary as a result of variation in feed rate and seasonal variation in quality and quality of the feedstock. It was also found that the reliability of a waste processing facility (or equipment) was challenged at high loading rates, i.e., the facility was less available and consistently operated which reduced its overall throughput. Understanding the effect of abovementioned variations on waste processing performance and incorporating them along with uncertainties of waste processing into a simulation model is recommended as a more appropriate approach to design, size and site a waste facility. The simulation method can be used to assess the existing system and optimize it for different future conditions (scenarios) within the context it has been developed. While most of the models in waste management attempted to optimize siting a waste management facility with a primary focus on landfills, the proposed simulation model can be used as a tool to optimize a waste processing system to meet a different set of requirements, e.g., maximum throughput, maximum recovery of compost or RDF material with minimum contamination, etc. Furthermore, the context of recommended work can be extended towards the additional operation lines. It can evaluate whether the entire system effectively benefits qualitatively and quantitatively from the start-up of the third line, particularly in the long-term when waste generation exceeds the existing throughput. The model can be used for transitioning situation when an additional line or a new treatment facility is added to the system. Building on the research presented, a detailed research proposal was prepared in collaboration with the Mining Optimization Laboratory at the University of Alberta and submitted to the City of Edmonton regarding the development of a reusable simulation tool for the IPTF using a discrete event simulation (DES) model, including the studied trommel system. However, the approval of the submitted proposal was postponed to the future.

2) Before simulating the pre-processing facility, a detailed reliability analysis, including maintainability analysis on the waste pre-processing line is recommended. The reliability analysis accomplished in this study was a preliminary with the primary focus on the trommel; however, the system was more complex and included other equipment, which were not investigated, as they were not included in the scope of this research. The outcomes can then be integrated with the results of this research and be used in the DES model recommended.
3) In the next step, the recommended model can be further developed to be utilized within a Life-Cycle Assessment (LCA) simulation model. LCA is a useful tool to waste management, to assess environmental impacts associated and resources used during the production life of a product, from raw material acquisition stage to disposal or recycling stage (Finnveden et al., 2009). The LCA simulation model can be used as a decision-making tool for assessing the sustainability aspect of the existing system and potential future waste management scenarios.

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APPENDIX A: TONNAGE AND SEPARATION DATA

A-1: Tonnage and Results for Each Trial

This section includes the information data collected from 20 trommel trials that were completed at different feed rates and seasons. The trial information includes trial number and season, date and temperature information obtained from www.climate.weather.gc.ca. The collected data are: 1) operation time (total time and net time after deducting operation downtimes); 2) cumulative quantity (tonnage) of different waste streams either downloaded directly from the belt scales installed on conveyor belts (#C-401, #C-502, #C-600 and #C-700) or estimated using belt scales data. Also included are the observed and corrected feed rates (based on wet tonnage), which are estimated respectively based on total and net operation time.

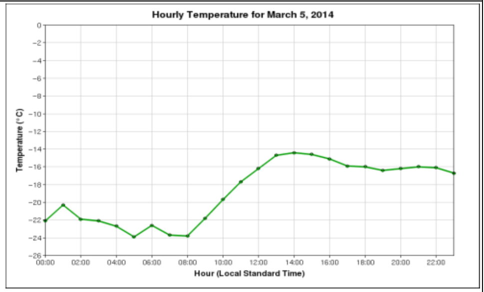
Sample Calculation for Highlighted Row

Column #	Description
- C1	Record row
- C2 and C3	Operation time in (hr:mm) format and total operation time in minutes from start time.
- C4 to C7	Cumulative wet tonnage of separated waste streams recorded directly by respective belt scales (#C-401, #C-502, #C-600 and #C-700)
- C8 to C10	Cumulative wet tonnage of separated waste streams and total feed estimated based on belt scales' (#C-401, #C-502, #C-600 and #C-700) data shown in C4 to C#7 data. • C8 = C4 - C5 (4.5 t = 25.8 t - 21.3 t) • C9 = C5 + C7 (62.7 t =21.3 t + 41.4 t) • C 10= C4 + C6 + C7 (93.3 t = 25.8 t + 26.1 t + 41.4 t)
C11 & C12	Observed feed rate estimated based on total feed tonnage (C10) and total operation time (C3), expressed in tonnage per minute (t/min) and tonnage per hour (t/h) units. • C11 = C10 / C3 (0.6 t/min = 93.3 t / 150 min) • C12 = C11 x 60 (37.3 t/h = 0.6 t/min x 60 min /h)
C13 to C18	Quantity of each waste stream separated from the total feed (shown in C10), defined as Separation, which is calculated as wet weight of respective waste stream divided by the total feed, expressed as % by wet weight, %-wt) • S_O (in C13) = C8/C10 (4.8%-wt = 4.5 t / 93.3 t x 100) • C14 = C5/C10 (22.8%-wt = 21.3 t / 93.3 t x 100) • S_{U1} (in C15) = C6/C10 (28.0%-wt = 26.1 t / 93.3 t x 100) • C16 = C7/C10 (44.4%-wt = 41.4 t / 93.3 t x 100) • S_{U1} (in C17) = (C5+C7)/C10 (67.2%-wt = (21.3 t2+44.1 t)/ 93.3 t x 100) • C18 = (C15+C17) (95.2%-wt = 67.2%-wt+28.0%-wt)
C19	Net operation time in in minutes from start time.
C20 & C21	Corrected (actual) feed rate estimated based on total feed tonnage (C10) and net total operation time (C19), expressed in tonnage per minute (t/min) and tonnage per hour (t/h) units. • C20 = C10 / C19 (0.7 t/min = 93.3 t / 137 min) • C21 = C20 x 60 (40.6 t/h = 0.7 t/min x 60 min /h)

Trial Information

Trial Number and Season	Trail 1 - Winter (Low Season)	
Date:	March 5, 2014	
Temperature		
Max	-19.1	°C
Min	-25	°C
Mean	-13.1	°C

http://climate.weather.gc.ca/climate_data/hourly_data_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&Day=5&Year=2014&Month=3



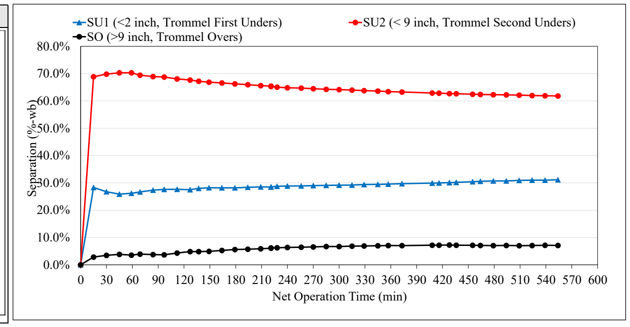


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

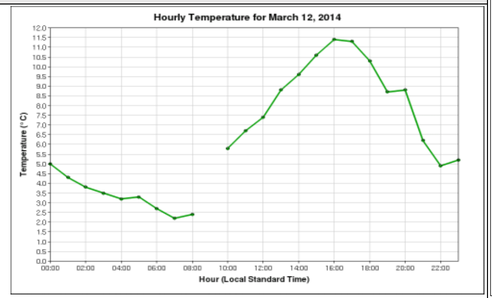
Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour: Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:10 AM	0	0.0	0.0	0	0	-	-	-			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0		
1	8:25 AM	15	2.6	2.3	3.0	5.0	0.3	7.3	10.6	0.7	42.4	2.8%	21.7%	28.3%	47.2%	68.9%	97.2%	15	0.7	42.4
2	8:40 AM	30	5.3	4.6	5.4	9.5	0.7	14.1	20.2	0.7	40.4	3.5%	22.8%	26.7%	47.0%	69.8%	96.5%	30	0.7	40.4
3	8:55 AM	45	8.4	7.2	8.1	14.8	1.2	22.0	31.3	0.7	41.7	3.8%	23.0%	25.9%	47.3%	70.3%	96.2%	45	0.7	41.7
4	9:10 AM	60	11.3	9.8	11.1	20.0	1.5	29.8	42.4	0.7	42.4	3.5%	23.1%	26.2%	47.2%	70.3%	96.5%	59	0.7	43.1
5	9:25 AM	75	12.3	10.5	12.3	21.5	1.8	32.0	46.1	0.6	36.9	3.9%	22.8%	26.7%	46.6%	69.4%	96.1%	69	0.7	40.1
6	9:40 AM	90	14.1	12.1	14.6	24.7	2.0	36.8	53.4	0.6	35.6	3.7%	22.7%	27.3%	46.3%	68.9%	96.3%	84	0.6	38.1
7	9:55 AM	105	16.7	14.4	17.4	28.9	2.3	43.3	63.0	0.6	36.0	3.7%	22.9%	27.6%	45.9%	68.7%	96.3%	97	0.6	39.0
8	10:10 AM	120	20.3	17.1	20.6	33.6	3.2	50.7	74.5	0.6	37.3	4.3%	23.0%	27.7%	45.1%	68.1%	95.7%	112	0.7	39.9
9	10:25 AM	135	23.5	19.4	23.3	37.9	4.1	57.3	84.7	0.6	37.6	4.8%	22.9%	27.5%	44.7%	67.7%	95.2%	127	0.7	40.0
10	10:40 AM	150	25.8	21.3	26.1	41.4	4.5	62.7	93.3	0.6	37.3	4.8%	22.8%	28.0%	44.4%	67.2%	95.2%	137	0.7	40.9
11	10:55 AM	165	28.0	23.0	28.6	44.8	5.0	67.8	101.4	0.6	36.9	4.9%	22.7%	28.2%	44.2%	66.9%	95.1%	149	0.7	40.8
12	11:10 AM	180	31.1	25.2	31.7	49.7	5.9	74.9	112.5	0.6	37.5	5.2%	22.4%	28.2%	44.2%	66.6%	94.8%	164	0.7	41.2
13	11:25 AM	195	34.5	27.6	34.8	54.2	6.9	81.8	123.5	0.6	38.0	5.6%	22.3%	28.2%	43.9%	66.2%	94.4%	179	0.7	41.4
14	11:40 AM	210	37.8	30.1	38.2	58.7	7.7	88.8	134.7	0.6	38.5	5.7%	22.3%	28.4%	43.6%	65.9%	94.3%	194	0.7	41.7
15	11:55 AM	225	40.7	32.2	41.2	62.6	8.5	94.8	144.5	0.6	38.5	5.9%	22.3%	28.5%	43.3%	65.6%	94.1%	209	0.7	41.5
16	12:10 PM	240	42.9	33.7	43.1	65.3	9.2	99.0	151.3	0.6	37.8	6.1%	22.3%	28.5%	43.2%	65.4%	93.9%	221	0.7	41.1
17	12:25 PM	255	43.0	33.6	43.3	65.5	9.4	99.1	151.8	0.6	35.7	6.2%	22.1%	28.5%	43.1%	65.3%	93.8%	221	0.7	41.2
18	12:40 PM	270	44.4	34.6	45.2	67.7	9.8	102.3	157.3	0.6	35.0	6.2%	22.0%	28.7%	43.0%	65.0%	93.8%	228	0.7	41.4
19	12:55 PM	285	46.7	36.2	47.7	71.0	10.5	107.2	165.4	0.6	34.8	6.3%	21.9%	28.8%	42.9%	64.8%	93.7%	240	0.7	41.4
20	1:11 PM	301	49.7	38.4	50.6	75.0	11.3	113.4	175.3	0.6	34.9	6.4%	21.9%	28.9%	42.8%	64.7%	93.6%	256	0.7	41.1
21	1:25 PM	315	52.5	40.4	53.5	78.6	12.1	119.0	184.6	0.6	35.2	6.6%	21.9%	29.0%	42.6%	64.5%	93.4%	270	0.7	41.0
22	1:40 PM	330	55.9	42.8	56.9	82.9	13.1	125.7	195.7	0.6	35.6	6.7%	21.9%	29.1%	42.4%	64.2%	93.3%	285	0.7	41.2
23	1:55 PM	345	59.0	45.2	60.1	87.0	13.8	132.2	206.1	0.6	35.8	6.7%	21.9%	29.2%	42.2%	64.1%	93.3%	300	0.7	41.2
24	2:10 PM	360	62.2	47.4	63.1	90.9	14.8	138.3	216.2	0.6	36.0	6.8%	21.9%	29.2%	42.0%	64.0%	93.2%	315	0.7	41.2
25	2:25 PM	375	64.9	49.4	66.2	94.3	15.5	143.7	225.4	0.6	36.1	6.9%	21.9%	29.4%	41.8%	63.8%	93.1%	329	0.7	41.1
26	2:41 PM	391	68.4	51.9	69.5	98.3	16.5	150.2	236.2	0.6	36.2	7.0%	22.0%	29.4%	41.6%	63.6%	93.0%	345	0.7	41.1
27	2:55 PM	405	71.2	53.9	72.4	101.5	17.3	155.4	245.1	0.6	36.3	7.1%	22.0%	29.5%	41.4%	63.4%	92.9%	357	0.7	41.2
28	3:12 PM	422	74.3	56.3	75.9	105.4	18.0	161.7	255.6	0.6	36.3	7.0%	22.0%	29.7%	41.2%	63.3%	93.0%	373	0.7	41.1
29	3:47 PM	457	83.5	63.1	85.0	115.6	20.4	178.7	284.1	0.6	37.3	7.2%	22.2%	29.9%	40.7%	62.9%	92.8%	408	0.7	41.8
30	3:55 PM	465	85.2	64.4	86.8	117.6	20.8	182.0	289.6	0.6	37.4	7.2%	22.2%	30.0%	40.6%	62.8%	92.8%	416	0.7	41.8
31	4:10 PM	480	87.4	65.9	89.2	120.0	21.5	185.9	296.6	0.6	37.1	7.2%	22.2%	30.1%	40.5%	62.7%	92.8%	428	0.7	41.6
32	4:25 PM	495	89.9	68.0	92.1	123.2	21.9	191.2	305.2	0.6	37.0	7.2%	22.3%	30.2%	40.4%	62.6%	92.8%	436	0.7	42.0
33	4:46 PM	516	94.5	71.6	97.5	128.6	22.9	200.2	320.6	0.6	37.3	7.1%	22.3%	30.4%	40.1%	62.4%	92.9%	455	0.7	42.3
34	4:55 PM	525	97.1	73.7	100.7	131.8	23.4	205.5	329.6	0.6	37.7	7.1%	22.4%	30.6%	40.0%	62.3%	92.9%	464	0.7	42.6
35	5:10 PM	540	100.4	76.4	104.8	136.2	24.0	212.6	341.4	0.6	37.9	7.0%	22.4%	30.7%	39.9%	62.3%	93.0%	479	0.7	42.8
36	5:25 PM	555	105.2	80.0	109.3	141.4	25.2	221.4	355.9	0.6	38.5	7.1%	22.5%	30.7%	39.7%	62.2%	92.9%	494	0.7	43.2
37	5:40 PM	570	109.4	83.4	114.5	146.8	26.0	230.2	370.7	0.7	39.0	7.0%	22.5%	30.9%	39.6%	62.1%	93.0%	509	0.7	43.7
38	5:55 PM	585	113.5	86.4	118.8	151.3	27.1	237.7	383.6	0.7	39.3	7.1%	22.5%	31.0%	39.4%	62.0%	92.9%	524	0.7	43.9
39	6:10 PM	600	118.3	89.9	123.4	156.6	28.4	246.5	398.3	0.7	39.8	7.1%	22.6%	31.0%	39.3%	61.9%	92.9%	539	0.7	44.3
40	6:25 PM	615	122.0	92.9	128.0	161.1	29.1	254.0	411.1	0.7	40.1	7.1%	22.6%	31.1%	39.2%	61.8%	92.9%	554	0.7	44.5
Summary of Results						AVERAGE	12.9	123.9	194.7	0.6	37.5	5.9%	22.4%	28.9%	42.8%	65.1%	94.1%	278	0.7	41.5
						STDEV	8.9	71.1	116.5	0.0	1.9	1.4%	0.4%	1.4%	2.5%	2.6%	1.4%	160	0.0	1.3
						CV(%)	69%	57%	60%	5%	5%	22.7%	1.7%	4.7%	5.8%	4.0%	1.4%	57.6%	3%	3%

See Next Page for Sample Calculation for the Highlighted Row

Trial Information

Trial Number and Season	Trail 2 - Winter (Low Season)	
Date:	March 12, 2014	
Temperature		
Max	12	°C
Min	1.6	°C
Mean	6.8	°C

http://climate.weather.gc.ca/climate_data/hourly_data_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&Day=14&Year=2014&Month=3&type=line&MeasTypeID=temp



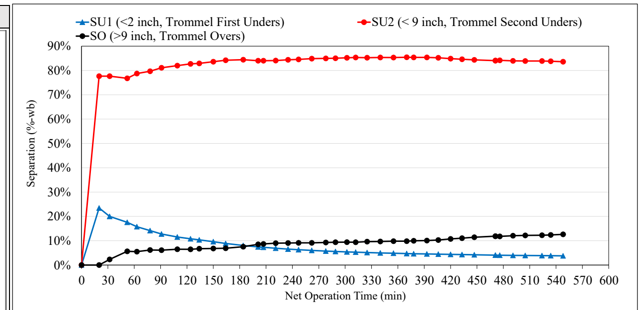


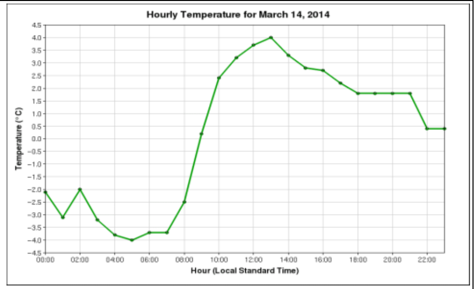
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	7:52 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:12 AM	20	4.6	4.8	4.2	9.1	-	13.9	17.9	0.9	53.7	0%	27%	23%	51%	78%	101%	20	0.9	53.7
2	8:24 AM	32	9.2	8.5	6.0	14.8	0.7	23.3	30.0	0.9	56.3	2%	28%	20%	49%	78%	98%	32	0.9	56.3
3	8:39 AM	47	15.7	13.1	8.1	22.3	2.6	35.4	46.1	1.0	58.9	6%	28%	18%	48%	77%	94%	52	0.9	53.2
4	8:55 AM	63	21.4	17.9	10.0	32.1	3.5	50.0	63.5	1.0	60.5	6%	28%	16%	51%	79%	94%	63	1.0	60.5
5	9:11 AM	79	26.8	22.0	11.0	40.0	4.8	62.0	77.8	1.0	59.1	6%	28%	14%	51%	80%	94%	78	1.0	59.8
6	9:26 AM	94	33.2	27.4	12.1	49.5	5.8	76.9	94.8	1.0	60.5	6%	29%	13%	52%	81%	94%	91	1.0	62.5
7	9:44 AM	112	39.4	32.2	12.8	58.9	7.2	91.1	111.1	1.0	59.5	6%	29%	12%	53%	82%	94%	109	1.0	61.2
8	9:59 AM	127	44.5	36.4	13.5	67.1	8.1	103.5	125.1	1.0	59.1	6%	29%	11%	54%	83%	94%	124	1.0	60.5
9	10:10 AM	138	46.8	38.0	13.6	70.8	8.8	108.8	131.2	1.0	57.0	7%	29%	10%	54%	83%	93%	134	1.0	58.7
10	10:26 AM	154	53.3	43.2	14.2	80.7	10.1	123.9	148.2	1.0	57.7	7%	29%	10%	54%	84%	93%	150	1.0	59.3
11	10:40 AM	168	59.0	47.7	14.5	89.8	11.3	137.5	163.3	1.0	58.3	7%	29%	9%	55%	84%	93%	164	1.0	59.7
12	11:00 AM	188	67.7	53.7	14.9	102.9	14.0	156.6	185.5	1.0	59.2	8%	29%	8%	55%	84%	92%	184	1.0	60.5
13	11:17 AM	205	75.5	58.2	15.1	112.1	17.3	170.3	202.7	1.0	59.3	9%	29%	7%	55%	84%	91%	201	1.0	60.5
14	11:25 AM	213	77.8	59.7	15.2	115.3	18.1	175.0	208.3	1.0	58.7	9%	29%	7%	55%	84%	91%	207	1.0	60.4
15	11:40 AM	228	83.8	63.8	15.4	123.4	20.0	187.2	222.6	1.0	58.6	9%	29%	7%	55%	84%	91%	221	1.0	60.4
16	11:55 AM	243	89.9	68.4	15.6	132.1	21.5	200.5	237.6	1.0	58.7	9%	29%	7%	56%	84%	91%	235	1.0	60.7
17	12:10 PM	258	94.2	71.5	15.7	139.0	22.7	210.5	248.9	1.0	57.9	9%	29%	6%	56%	85%	91%	247	1.0	60.5
18	12:25 PM	273	100.1	76.0	15.9	148.5	24.1	224.5	264.5	1.0	58.1	9%	29%	6%	56%	85%	91%	262	1.0	60.6
19	12:41 PM	289	107.2	81.0	16.2	158.6	26.2	239.6	282.0	1.0	58.5	9%	29%	6%	56%	85%	91%	278	1.0	60.9
20	12:55 PM	303	111.1	83.7	16.3	164.7	27.4	248.4	292.1	1.0	57.8	9%	29%	6%	56%	85%	91%	289	1.0	60.6
21	1:25 PM	333	115.5	86.9	16.4	172.5	28.6	259.4	304.4	0.9	54.8	9%	29%	5%	57%	85%	91%	302	1.0	60.5
22	1:40 PM	348	118.8	89.3	16.6	179.0	29.5	268.3	314.4	0.9	54.2	9%	28%	5%	57%	85%	91%	312	1.0	60.5
23	1:55 PM	363	125.1	93.4	16.9	187.5	31.7	280.9	329.5	0.9	54.5	10%	28%	5%	57%	85%	90%	325	1.0	60.8
24	2:10 PM	378	131.3	97.9	17.1	196.0	33.4	293.9	344.4	0.9	54.7	10%	28%	5%	57%	85%	90%	340	1.0	60.8
25	2:25 PM	393	137.0	101.8	17.4	204.1	35.2	305.9	358.5	0.9	54.7	10%	28%	5%	57%	85%	90%	355	1.0	60.6
26	2:40 PM	408	142.9	106.2	17.7	212.9	36.7	319.1	373.5	0.9	54.9	10%	28%	5%	57%	85%	90%	370	1.0	60.6
27	2:55 PM	423	147.5	109.2	17.8	218.8	38.3	328.0	384.1	0.9	54.5	10%	28%	5%	57%	85%	90%	378	1.0	61.0
28	3:10 PM	438	152.4	112.5	18.1	226.2	39.9	338.7	396.7	0.9	54.3	10%	28%	5%	57%	85%	90%	393	1.0	60.6
29	3:26 PM	454	158.3	116.0	18.4	234.0	42.3	350.0	410.7	0.9	54.3	10%	28%	4%	57%	85%	90%	406	1.0	60.7
30	3:40 PM	468	165.6	119.8	18.7	241.8	45.8	361.6	426.1	0.9	54.6	11%	28%	4%	57%	85%	89%	420	1.0	60.9
31	3:55 PM	483	171.9	123.3	19.0	249.1	48.6	372.4	440.0	0.9	54.7	11%	28%	4%	57%	85%	89%	433	1.0	61.0
32	4:10 PM	498	180.5	128.1	19.3	258.6	52.4	386.7	458.4	0.9	55.2	11%	28%	4%	56%	84%	89%	447	1.0	61.5
33	4:40 PM	528	192.1	134.7	19.7	271.9	57.4	406.6	483.7	0.9	55.0	12%	28%	4%	56%	84%	88%	471	1.0	61.6
34	4:55 PM	543	192.1	134.7	19.6	272.5	57.4	407.2	484.2	0.9	53.5	12%	28%	4%	56%	84%	88%	471	1.0	61.7
35	5:10 PM	558	195.9	137.5	20.0	279.4	58.4	416.9	495.3	0.9	53.3	12%	28%	4%	56%	84%	88%	476	1.0	62.4
36	5:25 PM	573	204.7	142.6	20.4	289.5	62.1	432.1	514.6	0.9	53.9	12%	28%	4%	56%	84%	88%	491	1.0	62.9
37	5:40 PM	588	211.5	146.9	20.8	298.1	64.6	445.0	530.4	0.9	54.1	12%	28%	4%	56%	84%	88%	505	1.1	63.0
38	5:59 PM	607	221.4	153.6	21.4	310.7	67.8	464.3	553.5	0.9	54.7	12%	28%	4%	56%	84%	88%	524	1.1	63.4
39	6:10 PM	618	226.5	156.6	21.7	316.9	69.9	473.5	565.1	0.9	54.9	12%	28%	4%	56%	84%	88%	534	1.1	63.5
40	6:25 PM	633	235.4	161.7	22.1	326.7	73.7	488.4	584.2	0.9	55.4	13%	28%	4%	56%	84%	87%	548	1.1	64.0
Summary of Results						AVERAGE	30.7	250.9	297.6	0.9	56.4	9%	28%	8%	55%	84%	91%	291.1	1.0	60.6
						STDEV	21.7	140.1	165.4	0.0	2.2	3%	1%	5%	2%	2%	3%	157.3	0.0	2.1
						CV(%)	71%	56%	56%	4%	4%	31%	2%	63%	4%	3%	3%	54%	0.0	0.0

Trial Information

Trial Number and Season	Trail 3 - Winter (Low Season)	
Date:	March 14, 2014	
Temperature		
Max	4.1	°C
Min	-4.3	°C
Mean	-0.1	°C

http://climate.weather.gc.ca/climate_data/hourly_data_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&Day=14&Year=2014&Month=3&type=line&MeasTypeID=temp



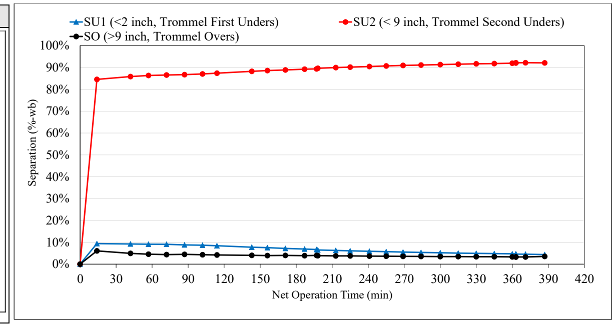


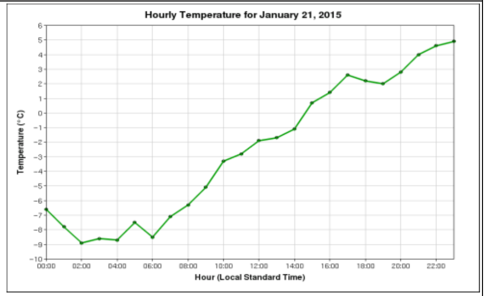
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	9:40 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	9:54 AM	14	5.0	3.0	3.1	24.9	2.0	27.9	33.0	2.4	141.4	6%	9%	9%	75%	85%	94%	14	2.4	141.4
2	10:30 AM	50	10.2	7.0	6.0	48.8	3.2	55.8	65.0	1.3	78.0	5%	11%	9%	75%	86%	95%	42	1.5	92.9
3	10:45 AM	65	12.5	8.9	7.2	59.2	3.6	68.1	78.9	1.2	72.8	5%	11%	9%	75%	86%	95%	57	1.4	83.1
4	11:00 AM	80	16.2	12.0	8.7	70.9	4.2	82.9	95.8	1.2	71.9	4%	13%	9%	74%	87%	96%	72	1.3	79.8
5	11:15 AM	95	19.5	14.5	9.8	82.0	5.0	96.5	111.3	1.2	70.3	4%	13%	9%	74%	87%	96%	87	1.3	76.8
6	11:31 AM	111	23.3	17.8	11.1	93.7	5.5	111.5	128.1	1.2	69.2	4%	14%	9%	73%	87%	96%	102	1.3	75.4
7	11:46 AM	126	26.2	20.2	12.0	104.3	6.0	124.5	142.5	1.1	67.9	4%	14%	8%	73%	87%	96%	114	1.3	75.0
8	12:16 PM	156	34.1	27.0	13.7	128.9	7.1	155.9	176.7	1.1	68.0	4%	15%	8%	73%	88%	96%	143	1.2	74.1
9	12:29 PM	169	37.2	29.8	14.3	138.3	7.4	168.1	189.8	1.1	67.4	4%	16%	8%	73%	89%	96%	156	1.2	73.0
10	12:44 PM	184	40.2	32.1	14.6	148.6	8.1	180.7	203.4	1.1	66.3	4%	16%	7%	73%	89%	96%	171	1.2	71.4
11	1:00 PM	200	42.4	34.0	14.9	158.6	8.4	192.6	215.9	1.1	64.8	4%	16%	7%	73%	89%	96%	187	1.2	69.3
12	1:15 PM	215	43.4	34.5	15.0	166.0	8.9	200.5	224.4	1.0	62.6	4%	15%	7%	74%	89%	96%	197	1.1	68.3
13	1:30 PM	230	43.7	34.7	15.0	172.9	9.0	207.6	231.6	1.0	60.4	4%	15%	6%	75%	90%	96%	198	1.2	70.2
14	1:45 PM	245	46.8	37.5	15.5	184.5	9.3	222.0	246.8	1.0	60.4	4%	15%	6%	75%	90%	96%	213	1.2	69.5
15	2:00 PM	260	49.9	40.1	15.9	195.2	9.8	235.3	261.0	1.0	60.2	4%	15%	6%	75%	90%	96%	225	1.2	69.6
16	2:16 PM	276	53.5	43.4	16.3	206.8	10.1	250.2	276.6	1.0	60.1	4%	16%	6%	75%	90%	96%	241	1.1	68.9
17	2:31 PM	291	57.7	47.0	16.7	219.2	10.7	266.2	293.6	1.0	60.5	4%	16%	6%	75%	91%	96%	255	1.2	69.1
18	2:46 PM	306	61.0	50.0	17.0	230.3	11.0	280.3	308.3	1.0	60.5	4%	16%	6%	75%	91%	96%	269	1.1	68.8
19	3:01 PM	321	64.6	53.2	17.4	242.0	11.4	295.2	324.0	1.0	60.6	4%	16%	5%	75%	91%	96%	284	1.1	68.5
20	3:17 PM	337	69.0	57.2	17.8	254.7	11.8	311.9	341.5	1.0	60.8	3%	17%	5%	75%	91%	97%	300	1.1	68.3
21	3:32 PM	352	73.6	61.2	18.1	267.3	12.4	328.5	359.0	1.0	61.2	3%	17%	5%	74%	92%	97%	315	1.1	68.4
22	3:47 PM	367	77.3	64.6	18.5	279.3	12.7	343.9	375.1	1.0	61.3	3%	17%	5%	74%	92%	97%	330	1.1	68.2
23	4:02 PM	382	81.3	68.0	18.9	291.4	13.3	359.4	391.6	1.0	61.5	3%	17%	5%	74%	92%	97%	345	1.1	68.1
24	4:17 PM	397	85.4	71.8	19.3	303.5	13.6	375.3	408.2	1.0	61.7	3%	18%	5%	74%	92%	97%	360	1.1	68.0
25	4:33 PM	413	88.7	74.8	19.8	314.8	13.9	389.6	423.3	1.0	61.5	3%	18%	5%	74%	92%	97%	363	1.2	70.0
26	4:48 PM	428	90.2	76.0	19.9	323.4	14.2	399.4	433.5	1.0	60.8	3%	18%	5%	75%	92%	97%	363	1.2	71.7
27	5:03 PM	443	93.5	78.8	20.4	334.8	14.7	413.6	448.7	1.0	60.8	3%	18%	5%	75%	92%	97%	371	1.2	72.6
28	5:19 PM	459	102.7	85.9	20.8	351.2	16.8	437.1	474.7	1.0	62.1	4%	18%	4%	74%	92%	96%	387	1.2	73.6
Summary of Results						AVERAGE	9.4	235.0	259.4	1.1	67.0	4%	15%	7%	74%	90%	96%	220.0	1.2	74.8
						STDEV	3.9	119.0	127.2	0.3	15.3	1%	2%	2%	1%	2%	1%	112.6	0.2	14.2
						CV(%)	41%	51%	49%	23%	23%	16%	15%	26%	1%	3%	1%	51%	19%	19%

Trial Information

Trial Number and Season	Trail 4 - Winter (Low Season)	
Date:	January 21, 2015	
Temperature		
Max	5.1	°C
Min	-9.9	°C
Mean	-2.4	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=1&Day=21#



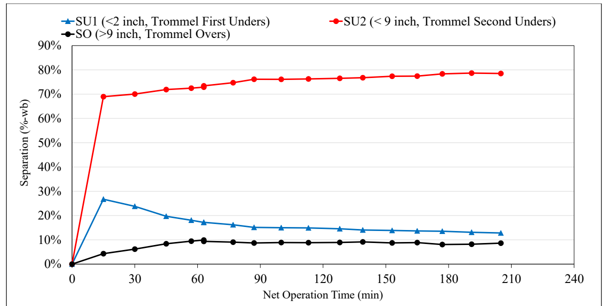


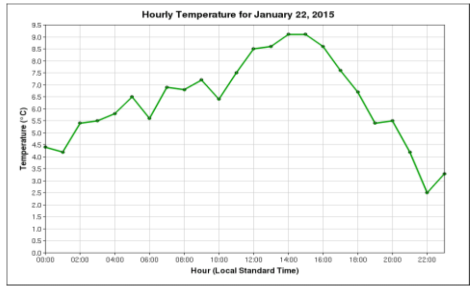
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:21 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:36 AM	15	4.1	3.6	3.1	4.4	0.5	8.0	11.6	0.8	46.4	4%	31%	27%	38%	69%	96%	15	0.8	46.4
2	8:51 AM	30	9.0	7.6	5.4	8.3	1.4	15.9	22.7	0.8	45.4	6%	33%	24%	37%	70%	94%	30	0.8	45.4
3	9:06 AM	45	16.0	12.9	7.3	13.7	3.1	26.6	37.0	0.8	49.3	8%	35%	20%	37%	72%	92%	45	0.8	49.3
4	9:21 AM	60	20.6	16.2	8.4	17.5	4.4	33.7	46.5	0.8	46.5	9%	35%	18%	38%	72%	91%	57	0.8	48.9
5	9:36 AM	75	23.5	18.3	9.0	19.9	5.2	38.2	52.4	0.7	41.9	10%	35%	17%	38%	73%	90%	63	0.8	49.9
6	9:51 AM	90	23.4	18.5	9.0	19.9	4.9	38.4	52.3	0.6	34.9	9%	35%	17%	38%	73%	91%	63	0.8	49.8
7	10:06 AM	105	28.2	22.5	10.2	24.5	5.7	47.0	62.9	0.6	35.9	9%	36%	16%	39%	75%	91%	77	0.8	49.0
8	10:21 AM	120	33.0	26.6	11.1	29.3	6.4	55.9	73.4	0.6	36.7	9%	36%	15%	40%	76%	91%	87	0.8	50.6
9	10:36 AM	135	37.2	29.8	12.5	33.6	7.4	63.4	83.3	0.6	37.0	9%	36%	15%	40%	76%	91%	100	0.8	50.0
10	10:51 AM	150	41.7	33.4	14.0	38.3	8.3	71.7	94.0	0.6	37.6	9%	36%	15%	41%	76%	91%	113	0.8	49.9
11	11:06 AM	165	47.3	37.8	15.5	43.7	9.5	81.5	106.5	0.6	38.7	9%	35%	15%	41%	77%	91%	128	0.8	49.9
12	11:21 AM	180	51.9	41.3	16.3	47.7	10.6	89.0	115.9	0.6	38.6	9%	36%	14%	41%	77%	91%	139	0.8	50.0
13	11:36 AM	195	56.4	45.3	17.6	52.9	11.1	98.2	126.9	0.7	39.0	9%	36%	14%	42%	77%	91%	153	0.8	49.8
14	11:51 AM	210	61.1	48.9	18.8	57.6	12.2	106.5	137.5	0.7	39.3	9%	36%	14%	42%	77%	91%	165	0.8	50.0
15	12:06 PM	225	64.4	52.6	19.8	61.9	11.8	114.5	146.1	0.6	39.0	8%	36%	14%	42%	78%	92%	177	0.8	49.5
16	12:21 PM	240	70.1	57.1	20.8	67.7	13.0	124.8	158.6	0.7	39.7	8%	36%	13%	43%	79%	92%	191	0.8	49.8
17	12:36 PM	255	73.7	59.4	21.2	70.3	14.3	129.7	165.2	0.6	38.9	9%	36%	13%	43%	79%	91%	205	0.8	48.4
Summary of Results						AVERAGE	7.6	67.2	87.8	0.7	40.3	8%	35%	16%	40%	75%	92%	106.4	0.8	49.2
						STDEV	4.2	38.6	48.3	0.1	4.2	1%	1%	4%	2%	3%	1%	58.4	0.0	1.4
						CV(%)	54%	57%	55%	10%	10%	16%	4%	23%	5%	4%	1%	55%	3%	3%

Trial Information

Trial Number and Season	Trail 5 - Winter (Low Season)	
Date:	January 22, 2015	
Temperature		
Max	9.4	°C
Min	2.5	°C
Mean	6	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=1&Day=22



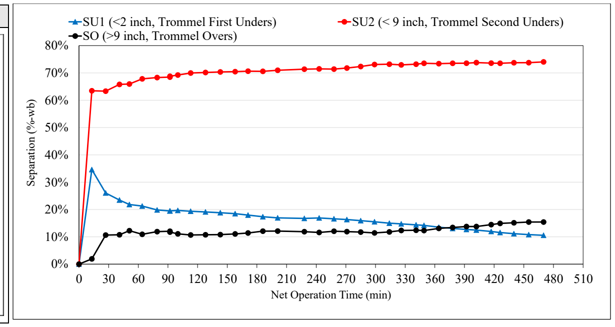
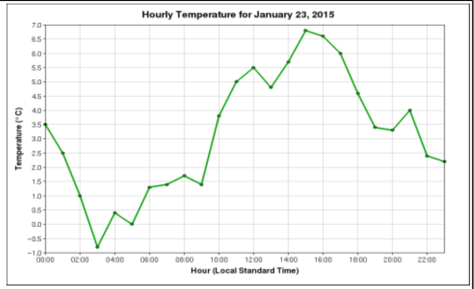


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	12:33 PM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	12:48 PM	15	1.6	1.5	1.8	1.8	0.1	3.3	5.2	0.3	20.2	2%	29%	35%	35%	63%	98%	13	0.4	24.0
2	1:03 PM	31	6.8	5.0	4.4	5.7	1.8	10.7	16.9	0.6	33.2	11%	30%	26%	34%	63%	89%	27	0.6	37.6
3	1:18 PM	45	12.7	9.4	7.2	10.8	3.3	20.2	30.7	0.7	40.5	11%	31%	23%	35%	66%	89%	41	0.7	44.9
4	1:33 PM	60	17.8	12.7	9.1	14.8	5.1	27.5	41.7	0.7	41.4	12%	30%	22%	35%	66%	88%	51	0.8	49.1
5	1:48 PM	76	21.5	15.8	11.1	19.6	5.7	35.4	52.2	0.7	41.4	11%	30%	21%	38%	68%	89%	64	0.8	48.9
6	2:03 PM	91	27.5	19.7	13.0	25.1	7.8	44.8	65.6	0.7	43.4	12%	30%	20%	38%	68%	88%	79	0.8	49.8
7	2:18 PM	106	31.7	22.6	14.7	29.1	9.1	51.7	75.5	0.7	42.8	12%	30%	19%	39%	68%	88%	92	0.8	49.2
8	2:34 PM	121	31.9	23.0	14.8	29.2	8.9	52.2	75.9	0.6	37.7	12%	30%	19%	38%	69%	88%	92	0.8	49.5
9	2:49 PM	136	32.9	24.1	15.6	30.8	8.8	54.9	79.3	0.6	35.0	11%	30%	20%	39%	69%	89%	100	0.8	47.6
10	3:04 PM	151	37.7	28.0	17.6	35.6	9.7	63.6	90.9	0.6	36.1	11%	31%	19%	39%	70%	89%	113	0.8	48.3
11	3:19 PM	166	41.3	30.6	19.0	39.2	10.7	69.8	99.5	0.6	36.0	11%	31%	19%	39%	70%	89%	128	0.8	46.6
12	3:34 PM	181	45.9	34.0	20.7	43.4	11.9	77.4	110.0	0.6	36.5	11%	31%	19%	39%	70%	89%	143	0.8	46.2
13	3:49 PM	196	51.0	37.6	22.4	47.8	13.4	85.4	121.2	0.6	37.1	11%	31%	18%	39%	70%	89%	158	0.8	46.0
14	4:04 PM	211	56.0	41.0	23.6	51.9	15.0	92.9	131.5	0.6	37.4	11%	31%	18%	39%	71%	89%	171	0.8	46.1
15	4:19 PM	226	63.3	45.7	25.3	57.2	17.6	102.9	145.8	0.6	38.7	12%	31%	17%	39%	71%	88%	186	0.8	47.0
16	4:34 PM	241	70.7	51.1	27.4	63.8	19.6	114.9	161.9	0.7	40.3	12%	32%	17%	39%	71%	88%	201	0.8	48.3
17	5:01 PM	268	73.8	53.8	28.2	66.4	20.0	120.2	168.4	0.6	37.7	12%	32%	17%	39%	71%	88%	228	0.7	44.3
18	5:16 PM	283	74.2	54.3	29.0	68.3	19.9	122.6	171.5	0.6	36.3	12%	32%	17%	40%	71%	88%	243	0.7	42.3
19	5:31 PM	298	80.0	57.8	30.6	73.9	22.2	131.7	184.5	0.6	37.1	12%	31%	17%	40%	71%	88%	258	0.7	42.9
20	5:46 PM	313	85.0	61.6	32.1	79.7	23.4	141.3	196.8	0.6	37.7	12%	31%	16%	40%	72%	88%	271	0.7	43.6
21	6:01 PM	328	91.0	66.2	33.7	86.8	24.8	153.0	211.5	0.6	38.7	12%	31%	16%	41%	72%	88%	285	0.7	44.5
22	6:16 PM	343	96.4	70.7	34.9	93.9	25.7	164.6	225.2	0.7	39.4	11%	31%	15%	42%	73%	89%	299	0.8	45.2
23	6:31 PM	358	103.5	75.1	36.1	101.1	28.4	176.2	240.7	0.7	40.3	12%	31%	15%	42%	73%	88%	314	0.8	46.0
24	6:46 PM	373	108.7	77.7	37.1	105.9	31.0	183.6	251.7	0.7	40.4	12%	31%	15%	42%	73%	88%	326	0.8	46.3
25	7:01 PM	388	114.4	81.6	38.0	111.7	32.8	193.3	264.1	0.7	40.8	12%	31%	14%	42%	73%	88%	341	0.8	46.5
26	7:16 PM	403	118.0	84.5	38.6	115.8	33.5	200.3	272.4	0.7	40.5	12%	31%	14%	43%	74%	88%	349	0.8	46.8
27	7:31 PM	418	127.8	89.7	39.4	124.0	38.1	213.7	291.2	0.7	41.8	13%	31%	14%	43%	73%	87%	364	0.8	48.0
28	7:46 PM	434	136.0	94.7	40.2	131.6	41.3	226.3	307.8	0.7	42.6	13%	31%	13%	43%	74%	87%	378	0.8	48.9
29	8:01 PM	449	143.1	98.8	40.8	137.8	44.3	236.6	321.7	0.7	43.0	14%	31%	13%	43%	74%	86%	392	0.8	49.2
30	8:17 PM	464	147.6	102.0	41.3	142.5	45.6	244.5	331.4	0.7	42.9	14%	31%	12%	43%	74%	86%	402	0.8	49.5
31	8:32 PM	479	158.0	107.3	41.9	150.7	50.7	258.0	350.6	0.7	43.9	14%	31%	12%	43%	74%	86%	417	0.8	50.4
32	8:47 PM	494	167.0	112.2	42.5	158.3	54.8	270.5	367.8	0.7	44.7	15%	31%	12%	43%	74%	85%	426	0.9	51.8
33	9:02 PM	509	176.0	117.7	43.0	166.4	58.3	284.1	385.4	0.8	45.4	15%	31%	11%	43%	74%	85%	440	0.9	52.6
34	9:17 PM	524	185.5	123.2	43.7	174.8	62.3	298.0	404.0	0.8	46.3	15%	30%	11%	43%	74%	85%	455	0.9	53.3
35	9:32 PM	539	192.9	128.2	44.2	182.3	64.7	310.5	419.4	0.8	46.7	15%	31%	11%	43%	74%	85%	470	0.9	53.5
Summary of Results						AVERAGE	24.9	138.2	190.6	0.7	39.5	12%	31%	17%	40%	71%	88%	237.6	0.8	46.7
						STDEV	18.4	90.3	120.8	0.1	4.7	2%	1%	5%	3%	3%	2%	141.1	0.1	5.1
						CV(%)	74%	65%	63%	12%	12%	19%	2%	28%	7%	4%	3%	59%	11%	11%

Trial Information		
Trial Number and Season	Trail 6 - Winter (Low Season)	
Date:	January 23, 2015	
Temperature		
Max	9.4	°C
Min	2.5	°C
Mean	6	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=1&Day=23



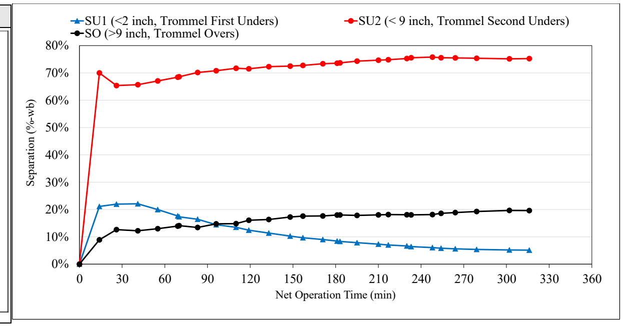


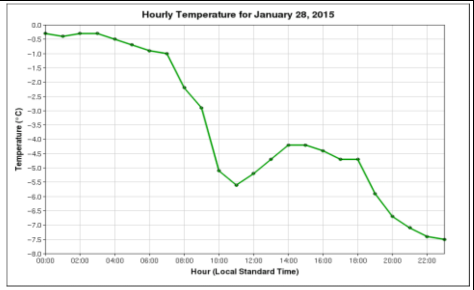
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:10 AM	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0%	0%	0%	0%	0%	0%	0		
1	8:24 AM	14	4.1	3.3	1.9	3.0	0.8	6.3	9.0	0.6	38.0	9%	37%	21%	33%	70%	91%	14	0.6	38.6
2	8:39 AM	30	8.2	5.9	4.0	6.0	2.3	11.9	18.2	0.6	36.7	13%	32%	22%	33%	65%	87%	26	0.7	42.0
3	8:54 AM	45	15.2	11.0	7.6	11.6	4.2	22.6	34.4	0.8	46.1	12%	32%	22%	34%	66%	88%	41	0.8	50.3
4	9:09 AM	60	22.6	16.1	10.0	17.5	6.5	33.6	50.1	0.8	50.3	13%	32%	20%	35%	67%	87%	55	0.9	54.7
5	9:25 AM	75	31.5	22.1	11.9	24.1	9.4	46.2	67.5	0.9	53.9	14%	33%	18%	36%	68%	86%	69	1.0	58.7
6	9:40 AM	90	31.9	22.3	11.8	24.4	9.6	46.7	68.1	0.8	45.2	14%	33%	17%	36%	69%	86%	70	1.0	58.4
7	9:55 AM	106	37.4	26.6	13.2	29.8	10.8	56.4	80.4	0.8	45.5	13%	33%	16%	37%	70%	87%	83	1.0	58.1
8	10:10 AM	121	47.2	32.6	14.3	37.5	14.6	70.1	99.0	0.8	49.1	15%	33%	14%	38%	71%	85%	96	1.0	61.9
9	10:26 AM	136	53.9	37.2	15.2	43.6	16.7	80.8	112.7	0.8	49.7	15%	33%	13%	39%	72%	85%	110	1.0	61.5
10	10:41 AM	151	61.5	41.2	15.7	49.1	20.3	90.3	126.3	0.8	50.2	16%	33%	12%	39%	71%	84%	119	1.1	63.7
11	10:56 AM	166	70.7	47.1	16.4	57.3	23.6	104.4	144.4	0.9	52.2	16%	33%	11%	40%	72%	84%	133	1.1	65.1
12	11:11 AM	181	81.4	53.0	16.9	66.3	28.4	119.3	164.6	0.9	54.5	17%	32%	10%	40%	72%	83%	148	1.1	66.7
13	11:26 AM	196	88.0	56.9	17.1	71.8	31.1	128.7	176.9	0.9	54.1	18%	32%	10%	41%	73%	82%	157	1.1	67.6
14	11:41 AM	211	96.9	62.6	17.5	80.1	34.3	142.7	194.5	0.9	55.3	18%	32%	9%	41%	73%	82%	171	1.1	68.2
15	11:56 AM	226	104.5	67.1	17.6	86.0	37.4	153.1	208.1	0.9	55.2	18%	32%	8%	41%	74%	82%	181	1.1	69.0
16	12:11 PM	241	106.0	68.1	17.5	87.0	37.9	155.1	210.5	0.9	52.3	18%	32%	8%	41%	74%	82%	183	1.2	69.0
17	12:26 PM	256	113.9	73.5	17.8	95.0	40.4	168.5	226.7	0.9	53.0	18%	32%	8%	42%	74%	82%	195	1.2	69.8
18	12:41 PM	271	124.5	80.0	18.1	104.3	44.5	184.3	246.9	0.9	54.6	18%	32%	7%	42%	75%	82%	210	1.2	70.5
19	12:56 PM	286	130.3	83.5	18.1	109.5	46.8	193.0	257.9	0.9	54.0	18%	32%	7%	42%	75%	82%	217	1.2	71.3
20	1:11 PM	302	139.4	89.6	18.3	117.7	49.8	207.3	275.4	0.9	54.8	18%	33%	7%	43%	75%	82%	230	1.2	71.8
21	1:26 PM	317	144.4	92.9	18.3	122.7	51.5	215.6	285.4	0.9	54.1	18%	33%	6%	43%	76%	82%	233	1.2	73.5
22	1:41 PM	332	154.7	99.2	18.5	132.5	55.5	231.7	305.7	0.9	55.3	18%	32%	6%	43%	76%	82%	248	1.2	74.0
23	1:56 PM	347	161.0	102.1	18.5	137.2	58.9	239.3	316.7	0.9	54.8	19%	32%	6%	43%	76%	81%	254	1.2	74.8
24	2:11 PM	362	168.7	106.2	18.6	143.8	62.5	250.0	331.1	0.9	54.9	19%	32%	6%	43%	76%	81%	264	1.3	75.3
25	2:26 PM	377	177.8	110.8	18.7	151.2	67.0	262.0	347.7	0.9	55.4	19%	32%	5%	43%	75%	81%	279	1.2	74.8
26	2:50 PM	400	182.4	112.7	18.4	153.9	69.7	266.6	354.7	0.9	53.2	20%	32%	5%	43%	75%	80%	302	1.2	70.5
27	3:03 PM	414	182.5	112.9	18.2	154.1	69.6	267.0	354.8	0.9	51.4	20%	32%	5%	43%	75%	80%	316	1.1	67.4
Summary of Results						AVERAGE	33.5	139.0	187.7	0.9	51.3	16%	33%	11%	40%	72%	84%	163.1	1.1	64.7
						STDEV	22.3	85.5	111.6	0.1	5.0	3%	1%	6%	3%	3%	3%	87.7	0.2	9.6
						CV(%)	67%	62%	59%	10%	10%	17%	3%	51%	9%	4%	3%	54%	15%	15%

Trial Information

Trial Number and Season	Trail 7 - Winter (Low Season)	
Date:	January 28, 2015	
Temperature		
Max	-0.2	°C
Min	-7.5	°C
Mean	-3.9	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=1&Day=23



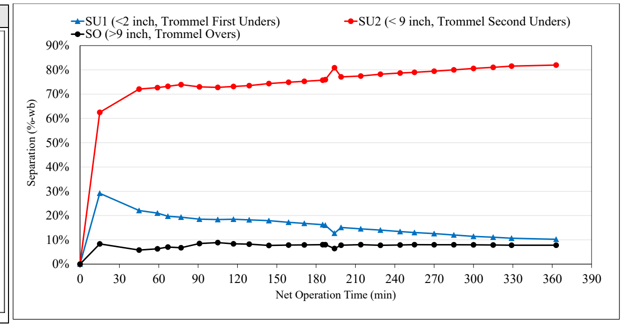


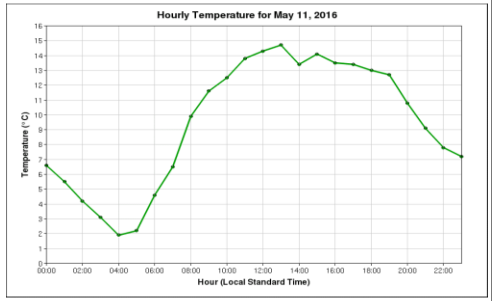
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	10:00 AM	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0%	0%	0%	0%	0%	0%	0		
1	10:15 AM	15	0.9	0.7	0.7	0.8	0.2	1.5	2.4	0.2	9.5	8%	29%	29%	33%	63%	92%	15	0.2	9.6
2	10:45 AM	45	6.6	5.6	3.8	6.8	1.0	12.4	17.2	0.4	22.9	6%	33%	22%	40%	72%	94%	45	0.4	22.9
3	11:00 AM	60	9.3	7.8	5.0	9.5	1.5	17.3	23.8	0.4	23.8	6%	33%	21%	40%	73%	94%	59	0.4	24.2
4	11:15 AM	75	11.4	9.4	5.6	11.4	2.0	20.8	28.4	0.4	22.7	7%	33%	20%	40%	73%	93%	67	0.4	25.4
5	11:30 AM	90	13.0	10.8	6.3	13.3	2.2	24.1	32.6	0.4	21.7	7%	33%	19%	41%	74%	93%	77	0.4	25.4
6	11:45 AM	105	16.5	13.1	7.4	16.1	3.4	29.2	40.0	0.4	22.8	9%	33%	19%	40%	73%	92%	91	0.4	26.4
7	12:00 PM	120	19.7	15.5	8.7	19.0	4.2	34.5	47.4	0.4	23.7	9%	33%	18%	40%	73%	91%	105	0.5	27.1
8	12:15 PM	135	23.3	18.6	10.4	22.6	4.7	41.2	56.3	0.4	25.0	8%	33%	18%	40%	73%	92%	117	0.5	28.9
9	12:30 PM	150	26.2	21.0	11.5	25.4	5.2	46.4	63.1	0.4	25.2	8%	33%	18%	40%	74%	92%	129	0.5	29.3
10	12:45 PM	165	29.6	24.1	12.8	29.0	5.5	53.1	71.4	0.4	25.9	8%	34%	18%	41%	74%	92%	144	0.5	29.8
11	1:01 PM	181	33.8	27.5	13.8	32.5	6.3	60.0	80.1	0.4	26.6	8%	34%	17%	41%	75%	92%	159	0.5	30.2
12	1:15 PM	195	36.5	29.7	14.4	34.9	6.8	64.6	85.8	0.4	26.4	8%	35%	17%	41%	75%	92%	171	0.5	30.1
13	1:30 PM	210	40.3	32.8	15.2	38.2	7.5	71.0	93.7	0.4	26.7	8%	35%	16%	41%	76%	92%	185	0.5	30.4
14	1:45 PM	226	40.9	33.3	15.2	38.8	7.6	72.1	94.9	0.4	25.2	8%	35%	16%	41%	76%	92%	187	0.5	30.4
15	2:01 PM	241	42.7	35.0	15.2	61.9	7.7	96.9	119.8	0.5	29.8	6%	29%	13%	52%	81%	94%	194	0.6	37.1
16	2:16 PM	256	43.5	35.7	15.1	41.5	7.8	77.2	100.1	0.4	23.5	8%	36%	15%	41%	77%	92%	199	0.5	30.2
17	2:31 PM	271	47.1	38.5	15.6	44.7	8.6	83.2	107.4	0.4	23.8	8%	36%	15%	42%	77%	92%	214	0.5	30.1
18	2:46 PM	286	51.0	42.0	16.3	48.9	9.0	90.9	116.2	0.4	24.4	8%	36%	14%	42%	78%	92%	229	0.5	30.4
19	3:01 PM	301	54.7	44.9	16.7	53.1	9.8	98.0	124.5	0.4	24.8	8%	36%	13%	43%	79%	92%	244	0.5	30.6
20	3:16 PM	316	57.6	47.1	17.0	56.2	10.5	103.3	130.8	0.4	24.8	8%	36%	13%	43%	79%	92%	255	0.5	30.8
21	3:31 PM	331	60.4	49.4	17.3	60.1	11.0	109.5	137.8	0.4	25.0	8%	36%	13%	44%	79%	92%	270	0.5	30.6
22	3:46 PM	346	64.5	52.8	17.6	64.5	11.7	117.3	146.6	0.4	25.4	8%	36%	12%	44%	80%	92%	285	0.5	30.9
23	4:01 PM	361	68.8	56.4	17.8	69.2	12.4	125.6	155.8	0.4	25.9	8%	36%	11%	44%	81%	92%	300	0.5	31.2
24	4:16 PM	376	71.8	59.0	18.0	72.7	12.8	131.7	162.5	0.4	25.9	8%	36%	11%	45%	81%	92%	315	0.5	31.0
25	4:31 PM	391	75.4	62.1	18.2	77.1	13.3	139.2	170.7	0.4	26.2	8%	36%	11%	45%	82%	92%	329	0.5	31.1
26	5:06 PM	426	77.4	63.8	17.8	79.1	13.6	142.9	174.3	0.4	24.5	8%	37%	10%	45%	82%	92%	363	0.5	28.8
Summary of Results						AVERAGE	7.2	71.7	91.7	0.4	24.3	8%	34%	16%	42%	76%	92%	182.6	0.5	28.6
						STDEV	4.0	42.0	50.8	0.1	3.4	1%	2%	4%	3%	4%	1%	95.2	0.1	4.8
						CV(%)	56%	59%	55%	14%	14%	9%	6%	26%	8%	6%	1%	52%	17%	17%

Trial Information

Trial Number and Season	Trail 8 - Spring	
Date:	May 11, 2016	
Temperature		
Max	15.6	°C
Min	1.6	°C
Mean	8.6	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=1&Day=23



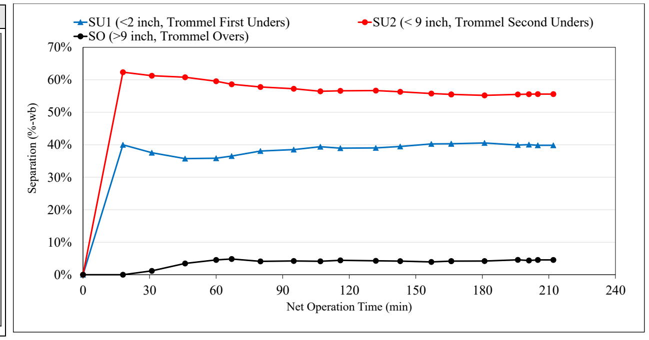
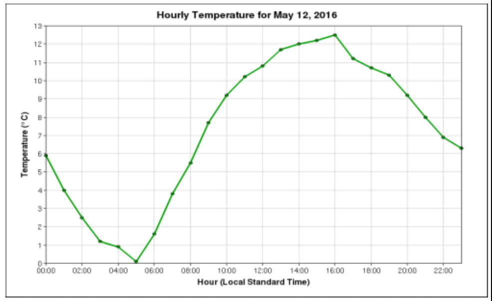


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	7:51 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:09 AM	19	2.9	3.1	3.4	2.2	-	5.3	8.5	0.4	26.9	0%	36%	40%	26%	62%	102%	18	0.5	28.3
2	8:25 AM	34	8.8	8.5	9.5	7.0	0.3	15.5	25.3	0.7	44.4	1%	34%	38%	28%	61%	99%	31	0.8	49.0
3	8:41 AM	50	16.3	14.7	16.4	13.2	1.6	27.9	45.9	0.9	54.9	3%	32%	36%	29%	61%	97%	46	1.0	59.9
4	8:56 AM	65	21.2	18.5	21.2	16.7	2.7	35.2	59.1	0.9	54.3	5%	31%	36%	28%	60%	95%	60	1.0	59.1
5	9:14 AM	83	23.6	20.4	24.1	18.3	3.2	38.7	66.0	0.8	47.5	5%	31%	37%	28%	59%	95%	67	1.0	59.1
6	9:29 AM	98	27.3	24.0	30.5	22.3	3.3	46.3	80.1	0.8	48.9	4%	30%	38%	28%	58%	96%	80	1.0	60.1
7	9:44 AM	113	32.7	28.6	37.2	26.7	4.1	55.3	96.6	0.9	51.1	4%	30%	39%	28%	57%	96%	95	1.0	61.0
8	9:59 AM	129	36.0	31.5	42.7	29.7	4.5	61.2	108.4	0.8	50.4	4%	29%	39%	27%	56%	96%	107	1.0	60.8
9	10:14 AM	144	41.0	35.6	47.4	33.3	5.4	68.9	121.7	0.8	50.8	4%	29%	39%	27%	57%	96%	116	1.0	62.9
10	10:29 AM	159	45.5	39.7	52.8	37.0	5.8	76.7	135.3	0.9	51.1	4%	29%	39%	27%	57%	96%	132	1.0	61.5
11	10:45 AM	174	49.3	43.1	58.4	40.2	6.2	83.3	147.9	0.9	51.0	4%	29%	39%	27%	56%	96%	143	1.0	62.1
12	11:00 AM	189	52.9	46.5	65.4	44.1	6.4	90.6	162.4	0.9	51.5	4%	29%	40%	27%	56%	96%	157	1.0	62.1
13	11:15 AM	204	56.2	49.0	69.3	46.4	7.2	95.4	171.9	0.8	50.5	4%	29%	40%	27%	55%	96%	166	1.0	62.1
14	11:30 AM	220	56.2	49.0	69.3	46.4	7.2	95.4	171.9	0.8	47.0	4%	29%	40%	27%	55%	96%	166	1.0	62.1
15	12:16 PM	266	61.3	53.4	75.8	49.8	7.9	103.2	186.9	0.7	42.2	4%	29%	41%	27%	55%	96%	181	1.0	62.0
16	12:32 PM	281	67.1	57.9	80.3	53.8	9.2	111.7	201.2	0.7	42.9	5%	29%	40%	27%	56%	95%	196	1.0	61.6
17	12:37 PM	286	68.2	59.2	82.2	54.9	9.0	114.1	205.3	0.7	43.1	4%	29%	40%	27%	56%	96%	201	1.0	61.3
18	12:41 PM	290	69.6	60.1	82.9	55.6	9.5	115.7	208.1	0.7	43.0	5%	29%	40%	27%	56%	95%	205	1.0	60.9
19	12:48 PM	297	69.6	60.1	82.9	55.6	9.5	115.7	208.1	0.7	42.0	5%	29%	40%	27%	56%	95%	212	1.0	58.9
Summary of Results						AVERAGE	5.4	71.4	126.9	0.8	47.0	4%	30%	39%	27%	57%	96%	125.2	1.0	58.7
						STDEV	3.0	35.6	65.4	0.1	6.4	1%	2%	2%	1%	2%	2%	62.4	0.1	7.9
						CV(%)	56%	50%	52%	14%	14%	31%	7%	4%	2%	4%	2%	50%	14%	14%

Trial Information		
Trial Number and Season	Trail 9 - Spring	
Date:	May 12, 2016	
Temperature		
Max	13.3	°C
Min	-0.1	°C
Mean	6.6	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2016&Month=5&Day=11#



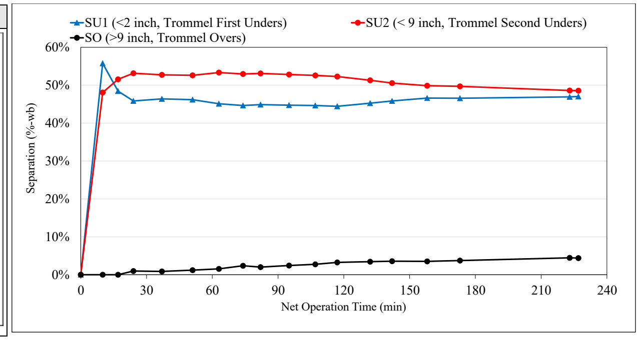


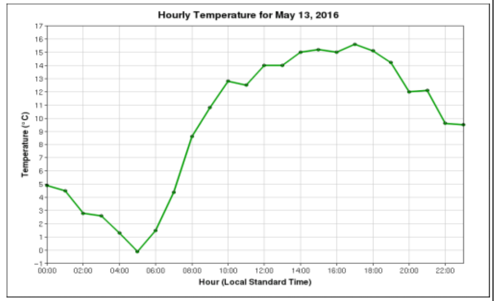
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	7:50 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:00 AM	10	1.0	1.2	2.9	1.3	-	2.5	5.2	0.5	31.2	0%	23%	56%	25%	48%	104%	10	0.5	31.2
2	8:06 AM	17	3.2	3.2	6.2	3.4	-	6.6	12.8	0.8	46.2	0%	25%	48%	27%	52%	100%	17	0.8	45.2
3	8:15 AM	26	5.3	5.1	9.4	5.8	0.2	10.9	20.5	0.8	47.9	1%	25%	46%	28%	53%	99%	24	0.9	51.3
4	8:30 AM	41	9.0	8.7	16.1	9.6	0.3	18.3	34.7	0.8	50.9	1%	25%	46%	28%	53%	99%	37	0.9	56.3
5	8:46 AM	56	13.0	12.4	23.0	13.8	0.6	26.2	49.8	0.9	53.3	1%	25%	46%	28%	53%	99%	51	1.0	58.6
6	9:01 AM	71	17.2	16.2	29.0	18.1	1.0	34.3	64.3	0.9	54.2	2%	25%	45%	28%	53%	98%	63	1.0	61.2
7	9:16 AM	87	20.4	18.6	33.8	21.5	1.8	40.1	75.7	0.9	52.5	2%	25%	45%	28%	53%	98%	74	1.0	61.4
8	9:31 AM	102	22.5	20.8	38.1	24.3	1.7	45.1	84.9	0.8	50.1	2%	24%	45%	29%	53%	98%	82	1.0	62.1
9	9:46 AM	117	26.4	24.0	44.2	28.2	2.4	52.2	98.8	0.8	50.8	2%	24%	45%	29%	53%	98%	95	1.0	62.4
10	10:02 AM	132	29.6	26.6	48.9	31.0	3.0	57.6	109.5	0.8	49.8	3%	24%	45%	28%	53%	97%	107	1.0	61.4
11	10:17 AM	147	32.9	29.0	53.2	33.6	3.9	62.6	119.7	0.8	48.8	3%	24%	44%	28%	52%	97%	117	1.0	61.4
12	10:32 AM	162	35.4	30.9	59.1	36.1	4.5	67.0	130.6	0.8	48.3	3%	24%	45%	28%	51%	97%	132	1.0	59.4
13	10:47 AM	178	37.8	32.8	64.2	38.0	5.0	70.8	140.0	0.8	47.3	4%	23%	46%	27%	51%	96%	142	1.0	59.2
14	11:02 AM	193	40.0	34.7	69.9	40.1	5.3	74.8	150.0	0.8	46.7	4%	23%	47%	27%	50%	96%	158	0.9	57.0
15	11:17 AM	208	44.0	37.8	77.1	44.5	6.2	82.3	165.6	0.8	47.8	4%	23%	47%	27%	50%	96%	173	1.0	57.4
16	12:12 PM	263	54.7	45.7	94.7	52.4	9.0	98.1	201.8	0.8	46.1	4%	23%	47%	26%	49%	96%	223	0.9	54.3
17	12:17 PM	267	54.7	45.8	95.1	52.4	8.9	98.2	202.2	0.8	45.4	4%	23%	47%	26%	49%	96%	227	0.9	53.4
Summary of Results						AVERAGE	3.2	49.9	98.0	0.8	48.1	2%	24%	46%	27%	51%	98%	101.9	0.9	56.1
						STDEV	3.0	30.5	62.4	0.1	5.1	1%	1%	3%	1%	2%	2%	67.3	0.1	7.9
						CV(%)	93%	61%	64%	11%	11%	60%	4%	6%	4%	4%	2%	66%	14%	14%

Trial Information

Trial Number and Season	Trail 10 - Spring	
Date:	May 13, 2016	
Temperature		
Max	16.1	°C
Min	-0.3	°C
Mean	7.9	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2016&Month=5&Day=13



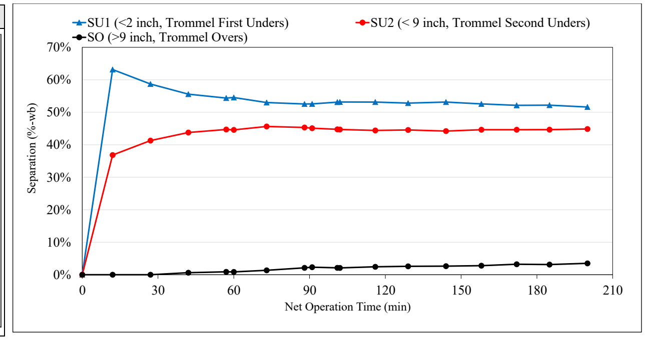
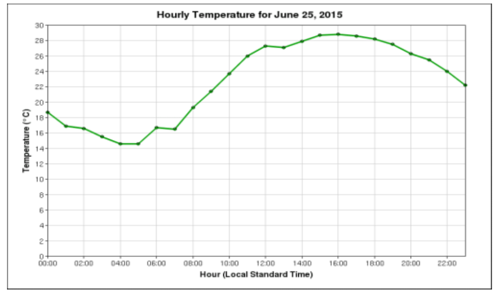


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:01 AM	0	0.2	0.2	0.2	0	-	0.2	0.4			0%	0%	0%	0%	0%	0%	0		
1	8:13 AM	12	1.1	1.1	4.8	1.7	-	2.8	7.6	0.7	39.1	0%	14%	63%	22%	37%	100%	12	0.6	38.0
2	8:28 AM	27	3.3	3.3	11.8	5.0	-	8.3	20.1	0.8	45.0	0%	16%	59%	25%	41%	100%	27	0.7	44.7
3	8:43 AM	42	6.1	5.9	17.9	8.2	0.2	14.1	32.2	0.8	46.1	1%	18%	56%	25%	44%	99%	42	0.8	46.0
4	8:58 AM	57	8.8	8.4	24.2	11.5	0.4	19.9	44.5	0.8	46.8	1%	19%	54%	26%	45%	99%	57	0.8	46.8
5	9:17 AM	76	9.1	8.7	25.2	11.9	0.4	20.6	46.2	0.6	36.6	1%	19%	55%	26%	45%	99%	60	0.8	46.2
6	9:32 AM	91	12.2	11.4	31.0	15.3	0.8	26.7	58.5	0.6	38.6	1%	19%	53%	26%	46%	99%	73	0.8	48.1
7	9:47 AM	106	15.3	13.8	37.1	18.2	1.5	32.0	70.6	0.7	40.0	2%	20%	53%	26%	45%	98%	88	0.8	48.1
8	10:02 AM	121	16.2	14.5	38.6	18.6	1.7	33.1	73.4	0.6	36.4	2%	20%	53%	25%	45%	98%	91	0.8	48.4
9	10:20 AM	138	17.5	15.8	42.5	20.0	1.7	35.8	80.0	0.6	34.7	2%	20%	53%	25%	45%	98%	101	0.8	47.5
10	10:20 AM	139	17.6	15.9	42.8	20.1	1.7	36.0	80.5	0.6	34.8	2%	20%	53%	25%	45%	98%	102	0.8	47.4
11	10:35 AM	153	19.8	17.6	48.0	22.5	2.2	40.1	90.3	0.6	35.3	2%	19%	53%	25%	44%	98%	116	0.8	46.7
12	10:50 AM	169	22.3	19.7	53.1	25.1	2.6	44.8	100.5	0.6	35.8	3%	20%	53%	25%	45%	97%	129	0.8	46.7
13	11:05 AM	184	24.3	21.4	58.4	27.2	2.9	48.6	109.9	0.6	35.9	3%	19%	53%	25%	44%	97%	144	0.8	45.8
14	11:20 AM	199	27.3	23.9	64.1	30.5	3.4	54.4	121.9	0.6	36.7	3%	20%	53%	25%	45%	97%	158	0.8	46.3
15	11:36 AM	214	30.4	26.1	69.4	33.3	4.3	59.4	133.1	0.6	37.3	3%	20%	52%	25%	45%	97%	172	0.8	46.4
16	11:51 AM	229	32.7	28.2	74.8	35.8	4.5	64.0	143.3	0.6	37.5	3%	20%	52%	25%	45%	97%	185	0.8	46.5
17	12:06 PM	245	35.9	30.5	79.4	38.5	5.4	69.0	153.8	0.6	37.7	4%	20%	52%	25%	45%	96%	200	0.8	46.1
18	12:10 PM	249	36.1	30.6	80.4	38.7	5.5	69.3	155.2	0.6	37.4	4%	20%	52%	25%	45%	96%	204	0.8	45.6
Summary of Results						AVERAGE	2.18	37.72	84.53	0.6	38.4	2%	19%	54%	25%	44%	98%	108.9	0.8	46.2
						STDEV	1.82	20.33	45.27	0.1	3.8	1%	1%	3%	1%	2%	1%	58.9	0.0	2.3
						CV(%)	84%	54%	54%	0.1	0.1	56%	7%	5%	3%	5%	1%	54%	5%	5%

Trial Information		
Trial Number and Season	Trail 11 - Summer	
Date:	June 25, 2015	
Temperature		
Max	29.6	°C
Min	13.7	°C
Mean	21.7	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2016&Month=5&Day=13



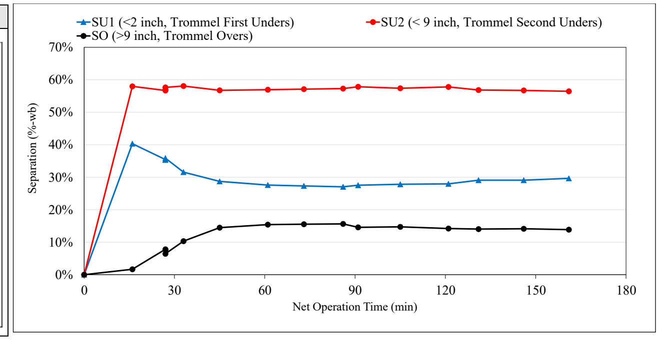


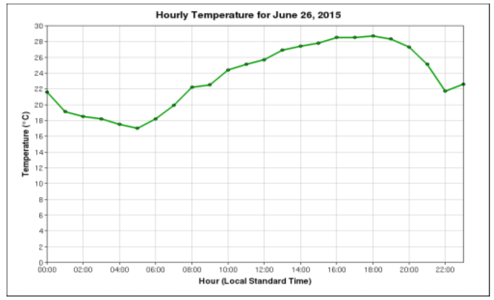
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	10:56 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	11:12 AM	16	3.6	3.4	4.8	3.5	0.2	6.9	11.9	0.7	44.6	2%	29%	40%	29%	58%	98%	16	0.7	44.6
2	11:27 AM	31	9.3	7.2	9.5	8.0	2.1	15.2	26.8	0.9	51.9	8%	27%	35%	30%	57%	92%	27	1.0	59.6
3	11:42 AM	46	9.9	7.7	10.1	8.6	2.2	16.3	28.6	0.6	37.3	8%	27%	35%	30%	57%	92%	27	1.1	63.6
4	11:56 AM	60	10.7	8.6	11.7	10.2	2.1	18.8	32.6	0.5	32.6	6%	26%	36%	31%	58%	94%	27	1.2	72.4
5	12:12 PM	76	18.5	13.2	16.2	16.6	5.3	29.8	51.3	0.7	40.5	10%	26%	32%	32%	58%	90%	33	1.6	93.3
6	12:26 PM	90	27.7	17.3	20.6	23.4	10.4	40.7	71.7	0.8	47.8	15%	24%	29%	33%	57%	85%	45	1.6	95.6
7	12:42 PM	106	36.4	22.2	25.4	30.2	14.2	52.4	92.0	0.9	52.1	15%	24%	28%	33%	57%	85%	61	1.5	90.5
8	12:56 PM	120	43.6	26.6	29.9	35.9	17.0	62.5	109.4	0.9	54.6	16%	24%	27%	33%	57%	84%	73	1.5	89.9
9	1:11 PM	135	47.3	28.8	32.0	39.0	18.5	67.8	118.3	0.9	52.5	16%	24%	27%	33%	57%	84%	86	1.4	82.5
10	1:26 PM	150	52.7	33.1	37.0	44.6	19.6	77.7	134.3	0.9	53.6	15%	25%	28%	33%	58%	85%	91	1.5	88.5
11	1:41 PM	166	60.6	37.9	42.9	50.5	22.7	88.4	154.0	0.9	55.8	15%	25%	28%	33%	57%	85%	105	1.5	88.0
12	1:57 PM	181	64.5	41.0	46.2	54.5	23.5	95.5	165.2	0.9	54.7	14%	25%	28%	33%	58%	86%	121	1.4	81.9
13	2:12 PM	196	71.1	45.1	53.9	60.2	26.0	105.3	185.2	0.9	56.7	14%	24%	29%	33%	57%	86%	131	1.4	84.8
14	2:27 PM	211	78.9	49.9	59.6	66.3	29.0	116.2	204.8	1.0	58.2	14%	24%	29%	32%	57%	86%	146	1.4	84.2
15	2:42 PM	226	84.5	53.8	65.6	71.1	30.7	124.9	221.2	1.0	58.7	14%	24%	30%	32%	56%	86%	161	1.4	82.4
Summary of Results						AVERAGE	14.90	61.23	107.15	0.8	50.1	12%	25%	31%	32%	57%	88%	76.67	1.3	80.1
						STDEV	10.57	39.30	69.14	0.1	7.9	4%	1%	4%	1%	1%	4%	47.94	0.2	14.2
						CV(%)	71%	64%	65%	16%	16%	35%	5%	13%	4%	1%	5%	63%	18%	18%

Trial Information

Trial Number and Season	Trail 12 - Summer	
Date:	June 26, 2015	
Temperature		
Max	29.0	°C
Min	16.7	°C
Mean	22.9	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=6&Day=26



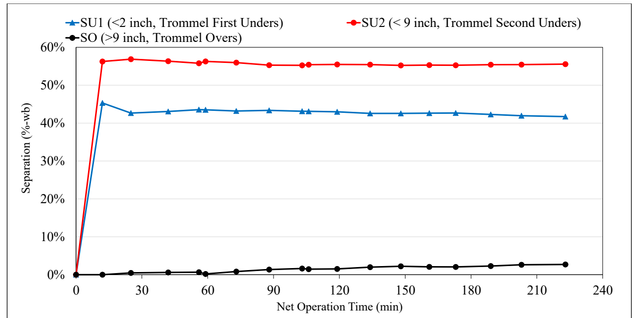


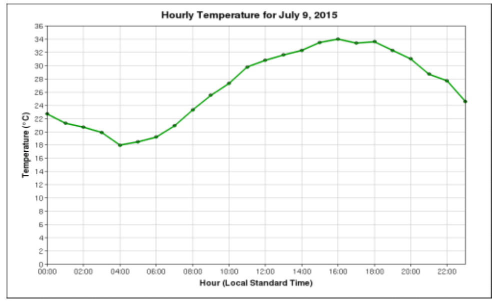
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:02 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:15 AM	14	1.6	1.7	2.9	1.9	-	3.6	6.4	0.5	28.4	0%	27%	45%	30%	56%	102%	12	0.5	32.0
2	8:28 AM	27	5.7	5.6	9.0	6.4	0.1	12.0	21.1	0.8	47.6	0%	27%	43%	30%	57%	100%	25	0.8	50.6
3	8:45 AM	44	9.0	8.8	14.6	10.3	0.2	19.1	33.9	0.8	46.5	1%	26%	43%	30%	56%	99%	42	0.8	48.4
4	9:00 AM	59	12.1	11.8	19.9	13.7	0.3	25.5	45.7	0.8	46.7	1%	26%	44%	30%	56%	99%	56	0.8	49.0
5	9:15 AM	74	12.7	12.6	21.1	14.7	0.1	27.3	48.5	0.7	39.5	0%	26%	44%	30%	56%	100%	59	0.8	49.3
6	9:30 AM	89	15.7	15.2	25.7	18.1	0.5	33.3	59.5	0.7	40.2	1%	26%	43%	30%	56%	99%	73	0.8	48.9
7	9:46 AM	104	19.5	18.5	32.0	22.3	1.0	40.8	73.8	0.7	42.6	1%	25%	43%	30%	55%	99%	88	0.8	50.3
8	10:01 AM	119	22.9	21.5	37.0	25.9	1.4	47.4	85.8	0.7	43.3	2%	25%	43%	30%	55%	98%	103	0.8	50.0
9	10:16 AM	134	23.5	22.2	38.2	26.9	1.3	49.1	88.6	0.7	39.7	1%	25%	43%	30%	55%	99%	106	0.8	50.2
10	10:31 AM	149	26.2	24.7	42.3	29.9	1.5	54.6	98.4	0.7	39.6	2%	25%	43%	30%	55%	98%	119	0.8	49.6
11	10:46 AM	164	29.7	27.5	46.9	33.6	2.2	61.1	110.2	0.7	40.3	2%	25%	43%	30%	55%	98%	134	0.8	49.3
12	11:01 AM	180	32.7	30.0	51.7	37.1	2.7	67.1	121.5	0.7	40.6	2%	25%	43%	31%	55%	98%	148	0.8	49.3
13	11:16 AM	195	34.7	32.0	55.4	39.9	2.7	71.9	130.0	0.7	40.1	2%	25%	43%	31%	55%	98%	161	0.8	48.4
14	11:31 AM	210	37.8	34.9	60.3	43.2	2.9	78.1	141.3	0.7	40.4	2%	25%	43%	31%	55%	98%	173	0.8	49.0
15	11:46 AM	225	41.3	37.8	64.5	46.7	3.5	84.5	152.5	0.7	40.7	2%	25%	42%	31%	55%	98%	189	0.8	48.4
16	12:01 PM	240	45.1	40.8	69.0	50.4	4.3	91.2	164.5	0.7	41.2	3%	25%	42%	31%	55%	97%	203	0.8	48.6
17	12:22 PM	260	46.9	42.3	71.1	52.4	4.6	94.7	170.4	0.7	39.3	3%	25%	42%	31%	56%	97%	223	0.8	45.8
Summary of Results						AVERAGE	1.7	50.7	91.3	0.7	41.0	1%	25%	43%	30%	56%	99%	112.588	0.8	48.1
						STDEV	1.5	28.1	50.9	0.1	4.2	1%	1%	1%	0%	0%	1%	63.789	0.1	4.3
						CV(%)	88%	55%	56%	10%	10%	59%	3%	2%	1%	1%	1%	57%	9%	9%

Trial Information

Trial Number and Season	Trail 13 - Spring	
Date:	July 9, 2015	
Temperature		
Max	34.1	°C
Min	16.7	°C
Mean	25.4	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=7&Day=9#



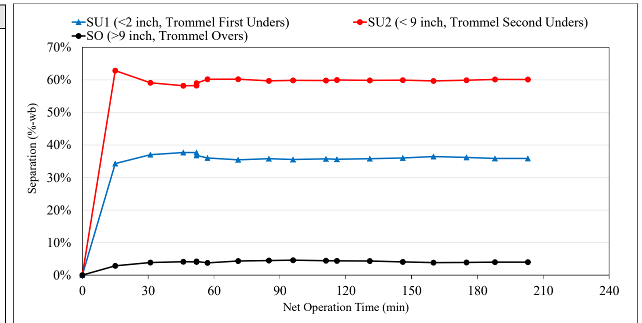
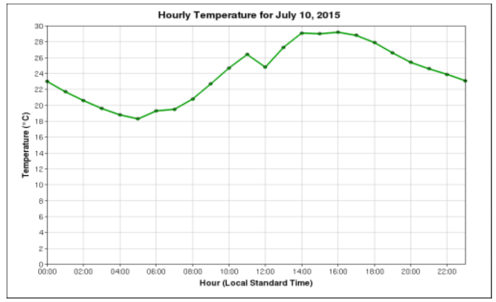


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	11:49 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	12:04 PM	15	2.0	1.8	2.4	2.6	0.2	4.4	7.0	0.5	27.4	3%	26%	34%	37%	63%	97%	15	0.5	28.0
2	12:20 PM	31	5.2	4.5	6.7	6.2	0.7	10.7	18.1	0.6	35.6	4%	25%	37%	34%	59%	96%	31	0.6	35.0
3	12:35 PM	46	8.4	7.2	11.0	9.8	1.2	17.0	29.2	0.6	38.4	4%	25%	38%	34%	58%	96%	46	0.6	38.1
4	12:41 PM	52	10.0	8.6	13.0	11.5	1.4	20.1	34.5	0.7	39.6	4%	25%	38%	33%	58%	96%	52	0.7	39.8
5	12:50 PM	61	10.3	8.8	13.1	12.2	1.5	21.0	35.6	0.6	35.0	4%	25%	37%	34%	59%	96%	52	0.7	41.1
6	1:05 PM	76	11.2	9.7	14.3	14.2	1.5	23.9	39.7	0.5	31.3	4%	24%	36%	36%	60%	96%	57	0.7	41.8
7	1:20 PM	91	14.9	12.7	18.0	17.9	2.2	30.6	50.8	0.6	33.4	4%	25%	35%	35%	60%	96%	71	0.7	42.9
8	1:35 PM	106	18.4	15.6	22.3	21.6	2.8	37.2	62.3	0.6	35.2	4%	25%	36%	35%	60%	96%	85	0.7	44.0
9	1:50 PM	121	22.1	18.7	26.3	25.6	3.4	44.3	74.0	0.6	36.6	5%	25%	36%	35%	60%	95%	96	0.8	46.3
10	2:05 PM	136	25.5	21.7	30.6	29.5	3.8	51.2	85.6	0.6	37.7	4%	25%	36%	34%	60%	96%	111	0.8	46.3
11	2:21 PM	151	27.3	23.2	32.9	32.2	4.0	55.4	92.4	0.6	36.6	4%	25%	36%	35%	60%	96%	116	0.8	47.8
12	2:36 PM	167	31.3	26.7	37.9	36.7	4.6	63.4	105.9	0.6	38.1	4%	25%	36%	35%	60%	96%	131	0.8	48.5
13	2:51 PM	182	34.8	30.0	42.6	40.9	4.8	70.9	118.3	0.7	39.1	4%	25%	36%	35%	60%	96%	146	0.8	48.6
14	3:06 PM	197	37.8	32.8	47.4	44.8	5.0	77.6	130.0	0.7	39.7	4%	25%	36%	34%	60%	96%	160	0.8	48.8
15	3:21 PM	212	41.4	35.9	51.1	48.7	5.5	84.6	141.2	0.7	40.0	4%	25%	36%	34%	60%	96%	175	0.8	48.4
16	3:36 PM	227	44.8	38.7	54.6	52.9	6.1	91.6	152.3	0.7	40.3	4%	25%	36%	35%	60%	96%	188	0.8	48.6
17	3:51 PM	242	48.3	41.7	59.1	57.4	6.6	99.1	164.8	0.7	40.9	4%	25%	36%	35%	60%	96%	203	0.8	48.7
Summary of Results						AVERAGE	3.3	47.2	78.9	0.6	36.8	4%	25%	36%	35%	60%	96%	102.1	0.7	43.7
						STDEV	2.0	29.9	49.7	0.1	3.6	0%	0%	1%	1%	1%	0%	57.8	0.1	5.9
						CV(%)	61%	63%	63%	10%	10%	10%	1%	2%	2%	2%	0%	57%	13%	13%

Trial Information		
Trial Number and Season	Trail 14 - Summer	
Date:	July 10, 2015	
Temperature		
Max	29.9	°C
Min	18.2	°C
Mean	24.1	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=7&Day=10



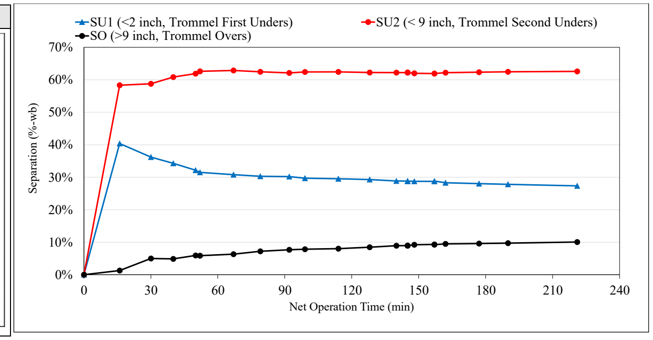


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	9:29 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	9:44 AM	16	4.7	4.5	6.3	4.6	0.2	9.1	15.6	1.0	59.1	1%	29%	40%	29%	58%	99%	16	1.0	58.5
2	9:59 AM	31	12.3	10.5	13.0	10.6	1.8	21.1	35.9	1.2	69.6	5%	29%	36%	30%	59%	95%	30	1.2	71.8
3	10:15 AM	46	17.0	14.6	16.9	15.4	2.4	30.0	49.3	1.1	64.3	5%	30%	34%	31%	61%	95%	40	1.2	74.0
4	10:30 AM	61	23.4	19.5	21.1	21.1	3.9	40.6	65.6	1.1	64.2	6%	30%	32%	32%	62%	94%	50	1.3	78.7
5	10:45 AM	76	24.7	20.6	22.0	23.1	4.1	43.7	69.8	0.9	54.9	6%	30%	32%	33%	63%	94%	52	1.3	80.5
6	10:59 AM	91	31.1	25.6	26.8	29.1	5.5	54.7	87.0	1.0	57.4	6%	29%	31%	33%	63%	94%	67	1.3	77.9
7	11:14 AM	106	37.1	29.7	31.1	34.4	7.4	64.1	102.6	1.0	58.1	7%	29%	30%	34%	62%	93%	79	1.3	77.9
8	11:29 AM	121	43.8	34.5	36.6	40.8	9.3	75.3	121.2	1.0	60.2	8%	28%	30%	34%	62%	92%	92	1.3	79.0
9	11:45 AM	136	48.7	38.2	39.7	45.2	10.5	83.4	133.6	1.0	58.9	8%	29%	30%	34%	62%	92%	99	1.3	81.0
10	12:00 PM	151	54.4	42.4	44.2	51.0	12.0	93.4	149.6	1.0	59.4	8%	28%	30%	34%	62%	92%	114	1.3	78.7
11	12:15 PM	166	61.7	47.4	49.5	57.8	14.3	105.2	169.0	1.0	61.0	8%	28%	29%	34%	62%	92%	128	1.3	79.2
12	12:30 PM	181	67.2	50.8	52.9	63.3	16.4	114.1	183.4	1.0	60.8	9%	28%	29%	35%	62%	91%	140	1.3	78.6
13	12:45 PM	196	69.5	52.5	54.7	65.6	17.0	118.1	189.8	1.0	58.1	9%	28%	29%	35%	62%	91%	145	1.3	78.5
14	1:00 PM	211	69.6	52.6	54.7	65.6	17.0	118.2	189.9	0.9	53.9	9%	28%	29%	35%	62%	91%	145	1.3	78.6
15	1:15 PM	226	69.6	52.6	54.7	65.6	17.0	118.2	189.9	0.8	50.3	9%	28%	29%	35%	62%	91%	145	1.3	78.6
16	1:30 PM	241	70.8	52.9	55.7	67.2	17.9	120.1	193.7	0.8	48.1	9%	27%	29%	35%	62%	91%	148	1.3	78.5
17	1:45 PM	257	75.1	55.8	59.4	72.2	19.3	128.0	206.7	0.8	48.3	9%	27%	29%	35%	62%	91%	157	1.3	79.0
18	2:00 PM	272	75.2	55.8	60.5	74.1	19.4	129.9	209.8	0.8	46.3	9%	27%	29%	35%	62%	91%	157	1.3	80.2
19	2:15 PM	287	77.8	57.3	61.1	77.0	20.5	134.3	215.9	0.8	45.2	9%	27%	28%	36%	62%	91%	162	1.3	80.0
20	2:30 PM	302	86.3	63.5	66.6	84.5	22.8	148.0	237.4	0.8	47.2	10%	27%	28%	36%	62%	90%	177	1.3	80.5
21	2:45 PM	317	93.7	68.7	71.5	91.9	25.0	160.6	257.1	0.8	48.7	10%	27%	28%	36%	62%	90%	190	1.4	81.2
22	3:18 PM	350	99.1	71.7	74.4	98.6	27.4	170.3	272.1	0.8	46.7	10%	26%	27%	36%	63%	90%	221	1.2	73.9
Summary of Results						AVERAGE	13.2	94.6	152.0	0.9	55.5	8%	28%	30%	34%	62%	92%	116.1	1.3	77.5
						STDEV	8.0	46.3	74.1	0.1	6.9	2%	1%	3%	2%	1%	2%	56.2	0.1	4.8
						CV(%)	60%	49%	49%	12%	12%	27%	4%	10%	5%	2%	2%	48%	6%	6%

Trial Information

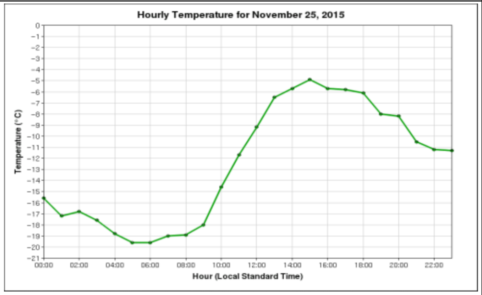
Trial Number and Season: Trail 15 - Fall

Date: November 25, 2015

Temperature

Max	-4.8	°C
Min	-20.3	°C
Mean	-12.6	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=11&Day=25#



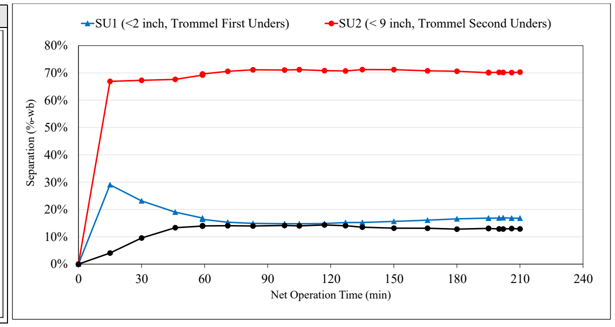


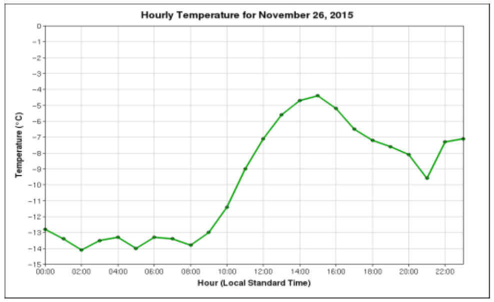
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:19 AM	0	0.0	0.0	1.3	1.1	-	1.1	2.4			0%	0%	0%	0%	0%	0%	0		
1	8:34 AM	15	4.7	4.1	4.3	5.8	0.6	9.9	14.8	1.0	58.4	4%	28%	29%	39%	67%	96%	15	1.0	59.2
2	8:49 AM	30	13.4	9.8	8.7	15.5	3.6	25.3	37.6	1.2	74.5	10%	26%	23%	41%	67%	90%	30	1.3	75.2
3	9:05 AM	46	21.6	14.1	10.7	23.9	7.5	38.0	56.2	1.2	73.5	13%	25%	19%	43%	68%	87%	46	1.2	73.3
4	9:20 AM	61	29.0	18.6	12.6	33.1	10.4	51.7	74.7	1.2	73.7	14%	25%	17%	44%	69%	86%	59	1.3	76.0
5	9:29 AM	70	30.1	19.2	12.8	34.6	10.9	53.8	77.5	1.1	66.5	14%	25%	17%	45%	69%	86%	59	1.3	78.8
6	9:35 AM	76	30.1	19.2	12.8	35.1	10.9	54.3	78.0	1.0	61.6	14%	25%	16%	45%	70%	86%	59	1.3	79.3
7	9:50 AM	91	36.7	23.4	14.5	43.3	13.3	66.7	94.5	1.0	62.0	14%	25%	15%	46%	71%	86%	71	1.3	79.9
8	10:06 AM	107	40.7	26.0	15.7	48.9	14.7	74.9	105.3	1.0	59.0	14%	25%	15%	46%	71%	86%	83	1.3	76.1
9	10:21 AM	123	45.6	28.7	17.7	56.2	16.9	84.9	119.5	1.0	58.5	14%	24%	15%	47%	71%	86%	98	1.2	73.2
10	10:37 AM	138	47.6	29.9	18.7	60.1	17.7	90.0	126.4	0.9	55.1	14%	24%	15%	48%	71%	86%	105	1.2	72.2
11	10:52 AM	153	52.2	32.3	20.6	66.0	19.9	98.3	138.8	0.9	54.5	14%	23%	15%	48%	71%	86%	117	1.2	71.2
12	11:07 AM	168	54.6	33.8	22.5	70.8	20.8	104.6	147.9	0.9	52.9	14%	23%	15%	48%	71%	86%	127	1.2	69.9
13	11:22 AM	183	57.0	35.8	23.9	75.8	21.2	111.6	156.7	0.9	51.4	14%	23%	15%	48%	71%	86%	135	1.2	69.6
14	11:37 AM	198	60.7	38.4	26.5	82.3	22.3	120.7	169.5	0.9	51.3	13%	23%	16%	49%	71%	87%	150	1.1	67.8
15	11:53 AM	214	66.2	41.7	30.0	90.3	24.5	132.0	186.5	0.9	52.3	13%	22%	16%	48%	71%	87%	166	1.1	67.4
16	12:08 PM	229	69.9	44.3	33.1	96.8	25.6	141.1	199.8	0.9	52.4	13%	22%	17%	48%	71%	87%	180	1.1	66.6
17	12:23 PM	244	76.4	47.9	36.7	104.7	28.5	152.6	217.8	0.9	53.6	13%	22%	17%	48%	70%	87%	195	1.1	67.0
18	12:29 PM	250	77.1	48.3	37.0	106.3	28.8	154.6	220.4	0.9	52.9	13%	22%	17%	48%	70%	87%	195	1.1	67.8
19	12:38 PM	259	78.1	49.1	38.0	108.9	29.0	158.0	225.0	0.9	52.1	13%	22%	17%	48%	70%	87%	200	1.1	67.5
20	12:40 PM	261	78.7	49.5	38.5	109.9	29.2	159.4	227.1	0.9	52.1	13%	22%	17%	48%	70%	87%	202	1.1	67.5
21	12:44 PM	266	79.7	49.8	38.6	111.0	29.9	160.8	229.3	0.9	51.8	13%	22%	17%	48%	70%	87%	206	1.1	66.8
22	12:48 PM	270	79.5	49.9	38.7	111.7	29.6	161.6	229.9	0.9	51.2	13%	22%	17%	49%	70%	87%	210	1.1	65.7
Summary of Results						AVERAGE	18.9	100.2	142.4	1.0	57.8	13%	24%	17%	47%	70%	87%	123.09	1.2	70.8
						STDEV	9.0	48.6	68.8	0.1	7.7	2%	2%	3%	3%	1%	2%	64.29	0.1	5.2
						CV(%)	47%	48%	48%	13%	13%	17%	7%	19%	6%	2%	3%	52%	7%	7%

Trial Information

Trial Number and Season	Trail 16 - Fall	
Date:	November 26, 2015	
Temperature		
Max	-4.0	°C
Min	-15.0	°C
Mean	-9.5	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=11&Day=26



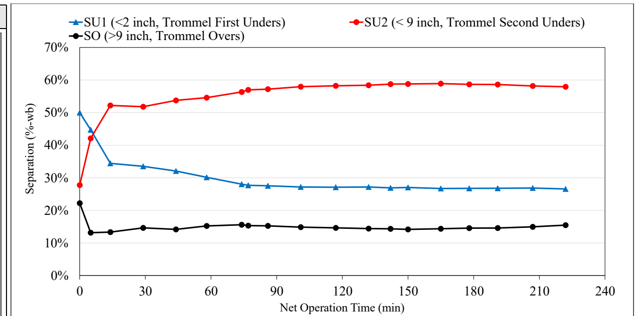


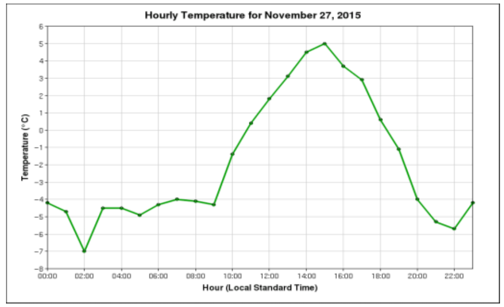
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	7:58 AM	0	0.7	0.3	0.9	0.2	0.4	0.5	1.8			22%	17%	50%	11%	28%	78%	0		
1	8:04 AM	6	1.1	0.6	1.7	1.0	0.5	1.6	3.8	0.6	37.1	13%	16%	45%	26%	42%	87%	5	0.8	45.6
2	8:13 AM	15	2.9	1.7	3.1	3.0	1.2	4.7	9.0	0.6	35.4	13%	19%	34%	33%	52%	87%	14	0.6	38.6
3	8:28 AM	30	5.2	2.8	5.5	5.7	2.4	8.5	16.4	0.5	32.5	15%	17%	34%	35%	52%	85%	29	0.6	33.9
4	8:43 AM	46	7.4	4.0	7.7	8.9	3.4	12.9	24.0	0.5	31.6	14%	17%	32%	37%	54%	86%	44	0.5	32.7
5	8:58 AM	61	9.9	5.1	9.5	12.1	4.8	17.2	31.5	0.5	31.2	15%	16%	30%	38%	55%	85%	58	0.5	32.6
6	9:13 AM	76	13.2	6.8	11.5	16.3	6.4	23.1	41.0	0.5	32.5	16%	17%	28%	40%	56%	84%	74	0.6	33.2
7	9:28 AM	91	13.7	7.0	12.1	17.9	6.7	24.9	43.7	0.5	28.8	15%	16%	28%	41%	57%	85%	77	0.6	34.1
8	9:44 AM	106	14.5	7.3	13.0	19.7	7.2	27.0	47.2	0.4	26.7	15%	15%	28%	42%	57%	85%	86	0.5	32.9
9	9:59 AM	121	16.8	8.6	15.0	23.4	8.2	32.0	55.2	0.5	27.4	15%	16%	27%	42%	58%	85%	101	0.5	32.8
10	10:14 AM	136	19.6	10.1	17.6	27.7	9.5	37.8	64.9	0.5	28.6	15%	16%	27%	43%	58%	85%	117	0.6	33.3
11	10:29 AM	151	24.0	12.6	21.5	33.6	11.4	46.2	79.1	0.5	31.4	14%	16%	27%	42%	58%	86%	132	0.6	36.0
12	10:44 AM	166	27.2	14.4	24.0	38.0	12.8	52.4	89.2	0.5	32.2	14%	16%	27%	43%	59%	86%	142	0.6	37.7
13	10:59 AM	182	27.8	14.6	25.2	40.2	13.2	54.8	93.2	0.5	30.8	14%	16%	27%	43%	59%	86%	150	0.6	37.3
14	11:14 AM	197	31.5	16.5	27.9	45.0	15.0	61.5	104.4	0.5	31.9	14%	16%	27%	43%	59%	86%	165	0.6	38.0
15	11:29 AM	212	34.6	18.0	30.5	48.9	16.6	66.9	114.0	0.5	32.3	15%	16%	27%	43%	59%	85%	178	0.6	38.4
16	11:44 AM	227	37.8	19.6	33.4	53.5	18.2	73.1	124.7	0.6	33.0	15%	16%	27%	43%	59%	85%	191	0.7	39.2
17	11:59 AM	242	41.9	21.5	36.6	57.8	20.4	79.3	136.3	0.6	33.8	15%	16%	27%	42%	58%	85%	207	0.7	39.5
18	12:14 PM	257	46.3	23.4	39.3	62.3	22.9	85.7	147.9	0.6	34.5	15%	16%	27%	42%	58%	85%	222	0.7	40.0
Summary of Results						AVERAGE	10.0	39.4	68.1	0.5	31.8	15%	16%	29%	40%	56%	85%	110.67	0.6	36.4
						STDEV	6.7	26.6	45.0	0.0	2.7	1%	1%	5%	5%	4%	1%	66.96	0.1	3.5
						CV(%)	67%	68%	66%	8%	8%	5%	5%	16%	11%	7%	1%	61%	10%	10%

Trial Information

Trial Number and Season	Trail 17 - Fall	
Date:	November 27, 2015	
Temperature		
Max	5.8	℃
Min	-9.0	℃
Mean	-1.6	℃

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2015&Month=11&Day=27



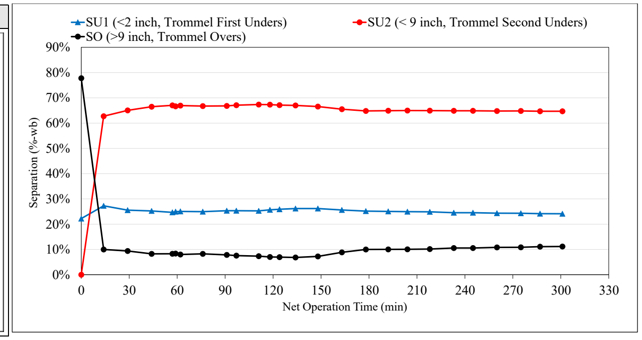


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	7:55 AM	0	0.7	0.0	0.2	0	0.7	-	0.9			78%	0%	22%	0%	0%	22%	0		
1	8:10 AM	14	4.4	3.3	3.0	3.6	1.1	6.9	11.0	0.8	45.7	10%	30%	27%	33%	63%	90%	14	0.8	47.1
2	8:25 AM	30	10.6	8.1	6.8	9.2	2.5	17.3	26.6	0.9	53.9	9%	30%	26%	35%	65%	91%	29	0.9	55.0
3	8:40 AM	45	16.1	12.7	10.4	14.7	3.4	27.4	41.2	0.9	55.3	8%	31%	25%	36%	67%	92%	44	0.9	56.2
4	8:55 AM	60	20.8	16.4	13.1	19.2	4.4	35.6	53.1	0.9	53.2	8%	31%	25%	36%	67%	92%	57	0.9	55.9
5	9:10 AM	75	21.8	17.1	14.0	20.3	4.7	37.4	56.1	0.7	44.9	8%	30%	25%	36%	67%	92%	59	1.0	57.1
6	9:25 AM	90	22.6	17.9	14.7	21.4	4.7	39.3	58.7	0.7	39.1	8%	30%	25%	36%	67%	92%	62	0.9	56.8
7	9:40 AM	105	26.9	21.1	17.5	25.7	5.8	46.8	70.1	0.7	40.1	8%	30%	25%	37%	67%	92%	76	0.9	55.3
8	9:55 AM	120	31.3	24.8	21.0	30.6	6.5	55.4	82.9	0.7	41.4	8%	30%	25%	37%	67%	92%	91	0.9	54.7
9	10:10 AM	135	33.4	26.6	22.8	33.8	6.8	60.4	90.0	0.7	40.0	8%	30%	25%	38%	67%	92%	97	0.9	55.7
10	10:25 AM	150	36.9	29.5	25.4	38.2	7.4	67.7	100.5	0.7	40.1	7%	29%	25%	38%	67%	93%	111	0.9	54.3
11	10:40 AM	165	37.7	30.4	26.7	39.6	7.3	70.0	104.0	0.6	37.8	7%	29%	26%	38%	67%	93%	118	0.9	52.9
12	10:55 AM	180	38.8	31.3	27.9	41.0	7.5	72.3	107.7	0.6	35.9	7%	29%	26%	38%	67%	93%	124	0.9	52.1
13	11:10 AM	195	40.6	32.8	29.9	43.7	7.8	76.5	114.2	0.6	35.1	7%	29%	26%	38%	67%	93%	134	0.9	51.1
14	11:25 AM	210	45.2	36.0	33.2	48.4	9.2	84.4	126.8	0.6	36.2	7%	28%	26%	38%	67%	93%	148	0.9	51.4
15	11:40 AM	225	52.6	39.9	36.7	53.9	12.7	93.8	143.2	0.6	38.2	9%	28%	26%	38%	66%	91%	163	0.9	52.7
16	11:55 AM	240	60.1	44.1	40.2	59.4	16.0	103.5	159.7	0.7	39.9	10%	28%	25%	37%	65%	90%	178	0.9	53.8
17	12:10 PM	255	65.8	48.3	43.7	65.0	17.5	113.3	174.5	0.7	41.0	10%	28%	25%	37%	65%	90%	192	0.9	54.5
18	12:25 PM	270	70.1	51.4	46.3	69.2	18.7	120.6	185.6	0.7	41.2	10%	28%	25%	37%	65%	90%	204	0.9	54.6
19	12:41 PM	285	75.2	55.0	49.5	74.2	20.2	129.2	198.9	0.7	41.8	10%	28%	25%	37%	65%	90%	218	0.9	54.7
20	12:56 PM	300	82.3	59.5	53.0	80.5	22.8	140.0	215.8	0.7	43.1	11%	28%	25%	37%	65%	89%	233	0.9	55.6
21	1:11 PM	316	86.5	62.4	55.9	85.4	24.1	147.8	227.8	0.7	43.3	11%	27%	25%	37%	65%	89%	245	0.9	55.8
22	1:25 PM	330	92.2	65.9	59.1	91.3	26.3	157.2	242.6	0.7	44.1	11%	27%	24%	38%	65%	89%	260	0.9	56.0
23	1:41 PM	345	96.9	69.1	62.4	97.1	27.8	166.2	256.4	0.7	44.5	11%	27%	24%	38%	65%	89%	275	0.9	55.9
24	1:56 PM	360	102.3	72.3	65.2	102.2	30.0	174.5	269.7	0.7	44.9	11%	27%	24%	38%	65%	89%	287	0.9	56.4
25	2:11 PM	375	106.6	75.2	67.9	106.8	31.4	182.0	281.3	0.7	45.0	11%	27%	24%	38%	65%	89%	301	0.9	56.1
Summary of Results						AVERAGE	13.1	89.0	135.9	0.7	42.6	9%	29%	25%	37%	66%	91%	148.8	0.9	54.5
						STDEV	9.5	51.9	80.9	0.1	5.3	1%	1%	1%	1%	1%	1%	86.5	0.0	2.2
						CV(%)	73%	58%	59%	12%	12%	16%	5%	3%	3%	2%	2%	58%	4%	4%

Trial Information

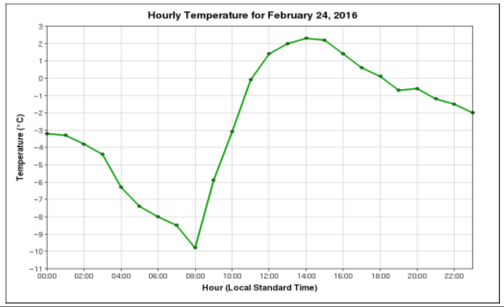
Trial Number and Season: Trail 18 - Winter

Date: February 24, 2016

Temperature

Max	2.5	℃
Min	-10.0	℃
Mean	-3.8	℃

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2016&Month=2&Day=24#



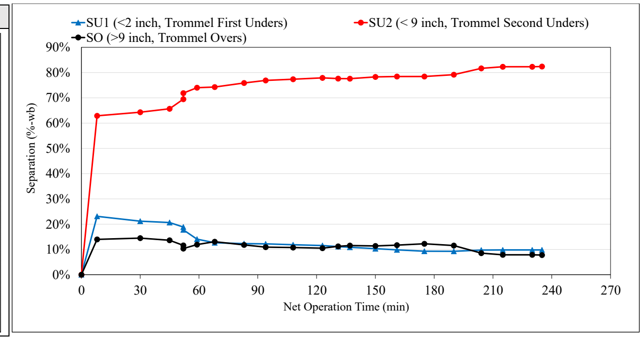


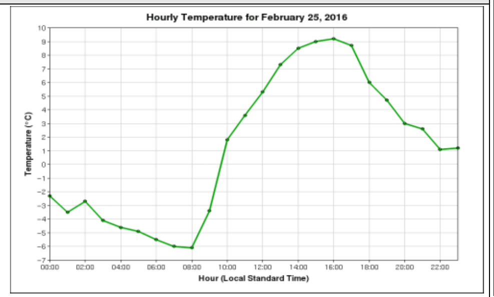
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:22 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:37 AM	15	7.7	5.1	4.3	6.6	2.6	11.7	18.6	1.2	73.2	14%	27%	23%	35%	63%	86%	8	2.3	139.5
2	8:53 AM	30	11.4	7.5	5.7	9.8	3.9	17.3	26.9	0.9	53.0	14%	28%	21%	36%	64%	86%	30	0.9	53.8
3	9:08 AM	46	11.6	7.9	5.6	9.9	3.7	17.8	27.1	0.6	35.6	14%	29%	21%	37%	66%	86%	45	0.6	36.1
4	9:23 AM	61	14.8	10.8	6.5	13.1	4.0	23.9	34.4	0.6	33.9	12%	31%	19%	38%	69%	88%	52	0.7	39.7
5	9:38 AM	76	18.0	13.7	7.4	16.2	4.3	29.9	41.6	0.5	32.9	10%	33%	18%	39%	72%	90%	52	0.8	48.0
6	9:53 AM	91	28.4	21.2	8.5	23.5	7.2	44.7	60.4	0.7	39.8	12%	35%	14%	39%	74%	88%	59	1.0	61.4
7	10:09 AM	106	35.1	25.5	9.3	29.1	9.6	54.6	73.5	0.7	41.5	13%	35%	13%	40%	74%	87%	68	1.1	64.9
8	10:24 AM	122	38.2	28.5	10.1	33.8	9.7	62.3	82.1	0.7	40.5	12%	35%	12%	41%	76%	88%	83	1.0	59.3
9	10:39 AM	137	42.3	32.2	11.3	39.0	10.1	71.2	92.6	0.7	40.6	11%	35%	12%	42%	77%	89%	94	1.0	59.1
10	10:54 AM	152	44.8	34.2	11.7	42.1	10.6	76.3	98.6	0.6	38.9	11%	35%	12%	43%	77%	89%	108	0.9	54.8
11	11:09 AM	167	47.2	36.2	12.1	45.3	11.0	81.5	104.6	0.6	37.6	11%	35%	12%	43%	78%	89%	123	0.9	51.0
12	11:25 AM	182	53.2	40.0	13.1	51.3	13.2	91.3	117.6	0.6	38.7	11%	34%	11%	44%	78%	89%	131	0.9	53.9
13	11:40 AM	198	57.5	42.8	13.8	55.9	14.7	98.7	127.2	0.6	38.6	12%	34%	11%	44%	78%	88%	137	0.9	55.7
14	11:55 AM	213	63.8	47.7	14.6	63.0	16.1	110.7	141.4	0.7	39.9	11%	34%	10%	45%	78%	89%	150	0.9	56.6
15	12:10 PM	228	71.1	52.7	15.5	70.6	18.4	123.3	157.2	0.7	41.4	12%	34%	10%	45%	78%	88%	161	1.0	58.6
16	12:25 PM	243	80.1	58.6	16.3	79.0	21.5	137.6	175.4	0.7	43.3	12%	33%	9%	45%	78%	88%	175	1.0	60.1
17	12:40 PM	258	83.2	62.1	16.9	82.3	21.1	144.4	182.4	0.7	42.4	12%	34%	9%	45%	79%	88%	190	1.0	57.6
18	12:56 PM	273	83.2	67.5	17.9	82.3	15.7	149.8	183.4	0.7	40.3	9%	37%	10%	45%	82%	91%	204	0.9	53.9
19	1:00 PM	278	83.2	68.7	18.0	82.3	14.5	151.0	183.5	0.7	39.6	8%	37%	10%	45%	82%	92%	215	0.9	51.2
20	1:05 PM	283	83.2	68.7	18.0	82.3	14.5	151.0	183.5	0.6	39.0	8%	37%	10%	45%	82%	92%	230	0.8	47.9
21	1:13 PM	291	83.2	68.9	18.0	82.3	14.3	151.2	183.5	0.6	37.9	8%	38%	10%	45%	82%	92%	235	0.8	46.9
Summary of Results						AVERAGE	11.5	85.7	109.3	0.7	41.4	11%	34%	13%	42%	76%	89%	121.4	1.0	57.6
						STDEV	5.7	50.3	60.1	0.1	8.3	2%	3%	4%	3%	6%	2%	69.4	0.3	20.0
						CV(%)	50%	59%	55%	20%	20%	17%	8%	33%	8%	8%	2%	57%	35%	35%

Trial Information

Trial Number and Season	Trail 19 - Winter	
Date:	February 25, 2016	
Temperature		
Max	9.5	°C
Min	-6.6	°C
Mean	1.5	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2016&Month=2&Day=25



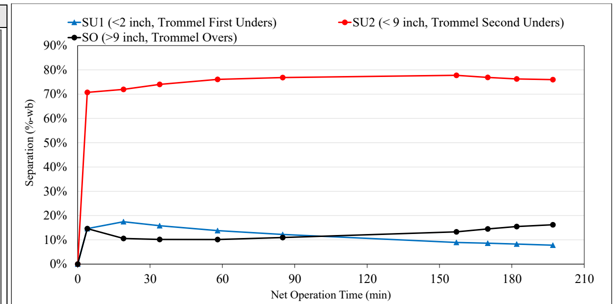


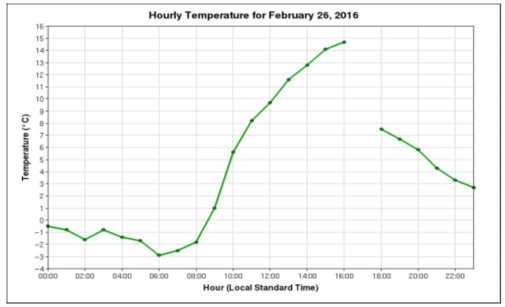
Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour:Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:22 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:26 AM	4	1.9	1.3	0.6	1.6	0.6	2.9	4.1	1.0	59.0	15%	32%	15%	39%	71%	85%	4	1.0	61.5
2	8:41 AM	19	8.3	6.3	3.3	7.3	2.0	13.6	18.9	1.0	58.8	11%	33%	17%	39%	72%	89%	19	1.0	59.7
3	8:56 AM	34	15.3	11.7	5.6	14.5	3.6	26.2	35.4	1.0	61.7	10%	33%	16%	41%	74%	90%	34	1.0	62.5
4	9:34 AM	72	24.6	18.8	7.9	24.8	5.8	43.6	57.3	0.8	47.8	10%	33%	14%	43%	76%	90%	58	1.0	59.3
5	10:05 AM	103	33.9	25.2	9.7	35.8	8.7	61.0	79.4	0.8	46.1	11%	32%	12%	45%	77%	89%	85	0.9	56.0
6	11:39 AM	197	64.9	45.2	13.2	69.9	19.7	115.1	148.0	0.8	45.1	13%	31%	9%	47%	78%	87%	157	0.9	56.6
7	11:54 AM	212	70.6	47.4	13.8	75.7	23.2	123.1	160.1	0.8	45.3	14%	30%	9%	47%	77%	86%	170	0.9	56.5
8	12:09 PM	227	77.8	50.7	14.5	82.9	27.1	133.6	175.2	0.8	46.2	15%	29%	8%	47%	76%	85%	182	1.0	57.8
9	12:24 PM	243	87.5	55.9	15.2	92.2	31.6	148.1	194.9	0.8	48.2	16%	29%	8%	47%	76%	84%	197	1.0	59.4
Summary of Results						AVERAGE	13.6	74.1	97.0	0.8	50.9	13%	31%	12%	44%	75%	87%	100.67	1.0	58.8
						STDEV	11.9	56.2	73.1	0.1	6.8	2%	2%	4%	4%	2%	2%	76.16	0.0	2.3
						CV(%)	87%	76%	75%	13%	13%	19%	6%	31%	8%	3%	3%	76%	4%	4%

Trial Information

Trial Number and Season	Trail 20 - Winter	
Date:	February 26, 2016	
Temperature		
Max	15.3	°C
Min	-3.8	°C
Mean	1.5	°C

http://climate.weather.gc.ca/climate_data/generate_chart_e.html?StationID=27214&timeframe=1&StartYear=1840&EndYear=2019&type=line&MeasTypeID=temp&Year=2016&Month=2&Day=26



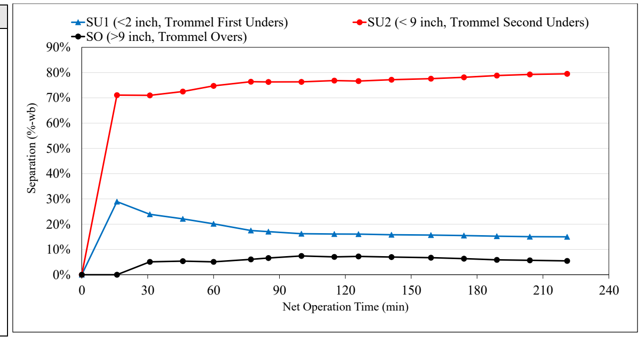


Figure: Separation (%-wet base) Results for the Trommel's First and Second Unders and Overs Waste Streams

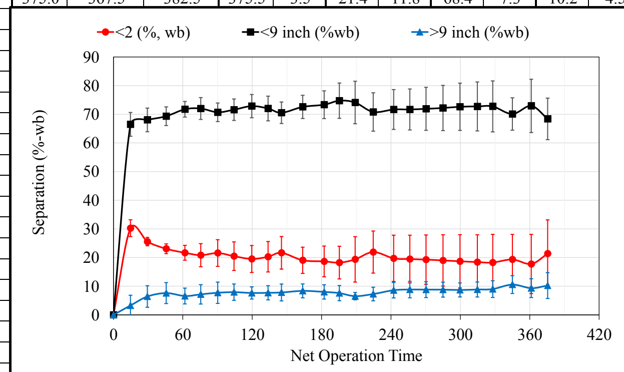
Record Number	Operation Time		Cumulative Quantity of Separated Waste Streams (Tonnage)							Calculated Observed Feed Rate (Q)		Estimated Separation Percentage (%-wb)						Net Operation Time (min)	Calculated Corrected Feed Rate (Q)	
			C-401	C-502	C-600	C-700	Estimated													
	Actual Time (Hour: Minute)	Minutes from Beginning	5 to 9 + >9 inch	5 to 9 inch (Disc screen overflow)	<2 inch (Trommel First Unders)	2 to 5 inch (Disc screen underflow)	>9 inch (Trommel Overs)	< 9 inch (Trommel Second Unders)	Total Feed	t/min	t/hr	S_O (>9 inch, Trommel Overs)	5 to 9 inch (Disc screen overflow)	S_{U1} (<2 inch, Trommel First Unders)	2 to 5 inch (Disc screen underflow)	S_{U2} (< 9 inch, Trommel Second Unders)	First Unders + Second Unders		t/min	t/hr
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
0	8:00 AM	0	0.0	0.0	0	0	-	-	-			0%	0%	0%	0%	0%	0%	0		
1	8:15 AM	16	4.5	4.5	3.5	4.1	-	8.6	12.1	0.8	46.7	0%	37%	29%	34%	71%	100%	16	0.8	45.4
2	8:30 AM	31	10.3	9.0	6.1	9.1	1.3	18.1	25.5	0.8	49.9	5%	35%	24%	36%	71%	95%	31	0.8	49.4
3	8:46 AM	46	14.8	12.8	8.2	14.1	2.0	26.9	37.1	0.8	48.5	5%	35%	22%	38%	73%	95%	46	0.8	48.4
4	9:01 AM	61	19.0	16.5	9.9	20.2	2.5	36.7	49.1	0.8	48.3	5%	34%	20%	41%	75%	95%	60	0.8	49.1
5	9:42 AM	102	24.8	20.9	11.2	28.0	3.9	48.9	64.0	0.6	37.7	6%	33%	18%	44%	76%	94%	77	0.8	49.9
6	9:57 AM	117	27.4	22.7	12.1	31.4	4.7	54.1	70.9	0.6	36.3	7%	32%	17%	44%	76%	93%	85	0.8	50.0
7	10:12 AM	132	31.8	25.8	13.1	35.8	6.0	61.6	80.7	0.6	36.6	7%	32%	16%	44%	76%	93%	100	0.8	48.4
8	10:27 AM	147	33.5	27.4	13.9	38.9	6.1	66.3	86.3	0.6	35.1	7%	32%	16%	45%	77%	93%	115	0.8	45.0
9	10:54 AM	175	34.7	28.2	14.4	40.4	6.5	68.6	89.5	0.5	30.7	7%	32%	16%	45%	77%	93%	126	0.7	42.6
10	11:48 AM	229	37.4	30.6	15.4	44.5	6.8	75.1	97.3	0.4	25.5	7%	31%	16%	46%	77%	93%	141	0.7	41.4
11	12:08 PM	249	41.5	34.2	17.0	49.9	7.3	84.1	108.4	0.4	26.2	7%	32%	16%	46%	78%	93%	159	0.7	40.9
12	12:24 PM	264	45.1	37.6	18.2	54.2	7.5	91.8	117.5	0.4	26.7	6%	32%	15%	46%	78%	94%	174	0.7	40.5
13	12:39 PM	279	48.8	41.3	19.4	58.9	7.5	100.2	127.1	0.5	27.3	6%	32%	15%	46%	79%	94%	189	0.7	40.3
14	12:54 PM	294	52.8	45.0	20.6	63.5	7.8	108.5	136.9	0.5	27.9	6%	33%	15%	46%	79%	94%	204	0.7	40.3
15	1:11 PM	311	54.1	46.4	21.1	65.4	7.7	111.8	140.6	0.5	27.1	5%	33%	15%	47%	80%	95%	221	0.6	38.2
Summary of Results						AVERAGE	5.17	64.09	82.87	0.6	35.4	6%	33%	18%	43%	76%	94%	116.27	0.7	44.7
						STDEV	2.61	32.22	39.97	0.2	9.1	2%	2%	4%	4%	3%	2%	64.38	0.1	4.2
						CV(%)	50%	50%	48%	26%	26%	31%	5%	22%	10%	4%	2%	55%	10%	10%

A-2: Summary of Trials

This section summarizes the separation result of 20 trommel trials that were presented in Appendix A-1, and categorizes them into groups based on season and feed rate. The summary tables provide support data for Figure 3-2 and 3-4 in Chapter 3 of this thesis.

Summary of Separation Results for Winter - Low Feed Rate (40±7 t/h)

Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch		>9 inch	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
March (1)	41.6 ± 1.4	27 ± 0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.5	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			15.0	28.3	68.9	2.8	47.2	21.7	15.0	7.5	22.5	14.8	1.3	30.3	2.9	66.5	4.2	3.3	3.6
			30.0	26.7	69.8	3.5	47.0	22.8	30.0	22.5	37.5	29.3	2.1	25.6	1.5	68.0	4.1	6.4	3.8
			45.0	25.9	70.3	3.8	47.3	23.0	45.0	37.5	52.5	45.6	3.6	23.1	1.7	69.3	3.3	7.6	3.7
			59.0	26.2	70.3	3.5	47.2	23.1	60.0	52.5	67.5	61.8	3.6	21.7	2.6	71.8	2.7	6.6	2.8
			69.0	26.7	69.4	3.9	46.6	22.8	75.0	67.5	82.5	75.5	4.4	20.8	4.0	72.0	3.8	7.2	3.4
			84.0	27.3	68.9	3.7	46.3	22.7	90.0	82.5	97.5	90.2	4.9	21.6	4.7	70.7	3.2	7.7	3.7
			97.0	27.6	68.7	3.7	45.9	22.9	105.0	97.5	112.5	104.3	5.7	20.5	5.0	71.6	3.7	7.9	2.8
			112.0	27.7	68.1	4.3	45.1	23.0	120.0	112.5	127.5	119.6	6.5	19.5	4.7	72.9	4.1	7.6	2.1
			127.0	27.5	67.7	4.8	44.7	22.9	135.0	127.5	142.5	133.8	6.3	20.3	5.3	72.0	4.3	7.7	2.5
			137.0	28.0	67.2	4.8	44.4	22.8	150.0	142.5	157.5	145.3	3.2	21.7	5.7	70.5	3.8	7.8	2.9
			149.0	28.2	66.9	4.9	44.2	22.7	165.0	157.5	172.5	163.7	6.1	19.1	4.6	72.6	4.1	8.4	2.4
			164.0	28.2	66.6	5.2	44.2	22.4	180.0	172.5	187.5	182.2	5.5	18.7	5.4	73.3	4.8	8.0	2.5
			179.0	28.2	66.2	5.6	43.9	22.3	195.0	187.5	202.5	195.4	4.7	18.2	5.7	74.7	6.2	7.6	2.7
			194.0	28.4	65.9	5.7	43.6	22.3	210.0	202.5	217.5	209.0	5.0	19.4	7.9	74.1	7.4	6.5	1.3
			209.0	28.5	65.6	5.9	43.3	22.3	225.0	217.5	232.5	224.7	4.0	21.9	7.3	70.8	6.7	7.3	2.4
			221.0	28.5	65.4	6.1	43.2	22.3	240.0	232.5	247.5	242.3	2.1	19.7	8.1	71.7	7.0	8.6	2.7
			221.0	28.5	65.3	6.2	43.1	22.1	255.0	247.5	262.5	256.3	1.5	19.5	8.3	71.7	7.1	8.8	2.9
			228.0	28.7	65.0	6.2	43.0	22.0	270.0	262.5	277.5	270.3	0.6	19.3	8.6	71.9	7.5	8.8	2.8
			240.0	28.8	64.8	6.3	42.9	21.9	285.0	277.5	292.5	285.0	0.0	19.0	8.9	72.2	7.9	8.8	2.6
			256.0	28.9	64.7	6.4	42.8	21.9	300.0	292.5	307.5	299.7	0.6	18.7	9.3	72.6	8.2	8.7	2.4
			270.0	29.0	64.5	6.6	42.6	21.9	315.0	307.5	322.5	314.7	0.6	18.4	9.5	72.7	8.5	8.8	2.6
			285.0	29.1	64.2	6.7	42.4	21.9	330.0	322.5	337.5	328.0	1.7	18.3	9.8	72.7	8.9	9.0	2.9
			300.0	29.2	64.1	6.7	42.2	21.9	345.0	337.5	352.5	345.0	4.0	19.3	8.7	70.1	5.6	10.6	3.1
			315.0	29.2	64.0	6.8	42.0	21.9	360.0	352.5	367.5	361.3	3.8	17.8	10.3	72.9	9.3	9.3	3.3
			329.0	29.4	63.8	6.9	41.8	21.9	375.0	367.5	382.5	375.5	3.5	21.4	11.8	68.4	7.3	10.2	4.5
			345.0	29.4	63.6	7.0	41.6	22.0											
			357.0	29.5	63.4	7.1	41.4	22.0											
			373.0	29.7	63.3	7.0	41.2	22.0											
			408.0	29.9	62.9	7.2	40.7	22.2											
			416.0	30.0	62.8	7.2	40.6	22.2											
			428.0	30.1	62.7	7.2	40.5	22.2											
			436.0	30.2	62.6	7.2	40.4	22.3											
			455.0	30.4	62.4	7.1	40.1	22.3											
			464.0	30.6	62.3	7.1	40.0	22.4											
			479.0	30.7	62.3	7.0	39.9	22.4											
			494.0	30.7	62.2	7.1	39.7	22.5											
			509.0	30.9	62.1	7.0	39.6	22.5											
			524.0	31.0	62.0	7.1	39.4	22.5											
			539.0	31.0	61.9	7.1	39.3	22.6											
			554.0	31.1	61.8	7.1	39.2	22.6											
January (2)	46.8 ± 5.2	28.3 ± 3.1	0.0	0.0	0.0	0.0	0.0	0.0											
			13.0	34.6	63.5	1.9	34.6	28.8											
			27.0	26.0	63.3	10.7	33.7	29.6											
			41.0	23.5	65.8	10.7	35.2	30.6											
			51.0	21.8	65.9	12.2	35.5	30.5											
			64.0	21.3	67.8	10.9	37.5	30.3											



Winter Season - Low Feed Rate (41±7 t/h)

Summary of Separation Results for Winter - Low Feed Rate (40±7 t/h)

Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch		>9 inch	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
January (2)	46.8 ± 5.2	28.3 ± 3.1	79.0	19.8	68.3	11.9	38.3	30.0											
			92.0	19.5	68.5	12.1	38.5	29.9											
			92.0	19.5	68.8	11.7	38.5	30.3											
			100.0	19.7	69.2	11.1	38.8	30.4											
			113.0	19.4	70.0	10.7	39.2	30.8											
			128.0	19.1	70.2	10.8	39.4	30.8											
			143.0	18.8	70.4	10.8	39.5	30.9											
			158.0	18.5	70.5	11.1	39.4	31.0											
			171.0	17.9	70.6	11.4	39.5	31.2											
			186.0	17.4	70.6	12.1	39.2	31.3											
			201.0	16.9	71.0	12.1	39.4	31.6											
			228.0	16.7	71.4	11.9	39.4	31.9											
			243.0	16.9	71.5	11.6	39.8	31.7											
			258.0	16.6	71.4	12.0	40.1	31.3											
			271.0	16.3	71.8	11.9	40.5	31.3											
			285.0	15.9	72.3	11.7	41.0	31.3											
			299.0	15.5	73.1	11.4	41.7	31.4											
			314.0	15.0	73.2	11.8	42.0	31.2											
			326.0	14.7	72.9	12.3	42.1	30.9											
			341.0	14.4	73.2	12.4	42.3	30.9											
			349.0	14.2	73.5	12.3	42.5	31.0											
			364.0	13.5	73.4	13.1	42.6	30.8											
			378.0	13.1	73.5	13.4	42.8	30.8											
			392.0	12.7	73.5	13.8	42.8	30.7											
			402.0	12.5	73.8	13.8	43.0	30.8											
			417.0	12.0	73.6	14.5	43.0	30.6											
			426.0	11.6	73.5	14.9	43.0	30.5											
			440.0	11.2	73.7	15.1	43.2	30.5											
			455.0	10.8	73.8	15.4	43.3	30.5											
			470.0	10.5	74.0	15.4	43.5	30.6											
January (4)	28.6 ± 4.8	16 ± 2.7	0.0	0.0	0.0	0.0	0.0	0.0											
			15.0	29.2	62.5	8.3	33.3	29.2											
			45.0	22.1	72.1	5.8	39.5	32.6											
			59.0	21.0	72.7	6.3	39.9	32.8											
			67.0	19.7	73.2	7.0	40.1	33.1											
			77.0	19.3	73.9	6.7	40.8	33.1											
			91.0	18.5	73.0	8.5	40.3	32.8											
			105.0	18.4	72.8	8.9	40.1	32.7											
			117.0	18.5	73.2	8.3	40.1	33.0											
			129.0	18.2	73.5	8.2	40.3	33.3											
			144.0	17.9	74.4	7.7	40.6	33.8											
			159.0	17.2	74.9	7.9	40.6	34.3											
			171.0	16.8	75.3	7.9	40.7	34.6											
			185.0	16.2	75.8	8.0	40.8	35.0											
			187.0	16.0	76.0	8.0	40.9	35.1											
			194.0	15.6	80.9	6.4	51.7	29.2											
			199.0	15.1	77.1	7.8	41.5	35.7											

Summary of Separation Results for Winter - Low Feed Rate (40±7 t/h)

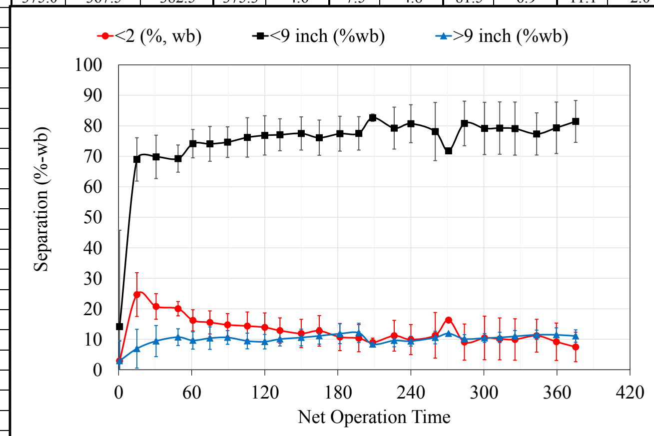
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch		>9 inch	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
January (4)	28.6 ± 4.8	16 ± 2.7	214.0	14.5	77.5	8.0	41.6	35.8											
			229.0	14.0	78.2	7.7	42.1	36.1											
			244.0	13.4	78.7	7.9	42.7	36.1											
			255.0	13.0	79.0	8.0	43.0	36.0											
			270.0	12.6	79.5	8.0	43.6	35.8											
			285.0	12.0	80.0	8.0	44.0	36.0											
			300.0	11.4	80.6	8.0	44.4	36.2											
			315.0	11.1	81.0	7.9	44.7	36.3											
			329.0	10.7	81.5	7.8	45.2	36.4											
			363.0	10.2	82.0	7.8	45.4	36.6											
February (6)	44.7 ± 4.3	26.2 ± 2.5	0.0	0.0	0.0	0.0	0.0	0.0											
			16.0	28.9	71.1	0.0	33.9	37.2											
			31.0	23.9	71.0	5.1	35.7	35.3											
			46.0	22.1	72.5	5.4	38.0	34.5											
			60.0	20.2	74.7	5.1	41.1	33.6											
			77.0	17.5	76.4	6.1	43.8	32.7											
			85.0	17.1	76.3	6.6	44.3	32.0											
			100.0	16.2	76.3	7.4	44.4	32.0											
			115.0	16.1	76.8	7.1	45.1	31.7											
			126.0	16.1	76.6	7.3	45.1	31.5											
			141.0	15.8	77.2	7.0	45.7	31.4											
			159.0	15.7	77.6	6.7	46.0	31.5											
			174.0	15.5	78.1	6.4	46.1	32.0											
			189.0	15.3	78.8	5.9	46.3	32.5											
			204.0	15.0	79.3	5.7	46.4	32.9											
			221.0	15.0	79.5	5.5	46.5	33.0											

Column Description:

- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
- C#10 represents 15 minute time intervals, with ± 7.5 minutes lower and upper limits in Columns C#11 & C#12.
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

Summary of Separation Results for Winter - Average Feed Rate (55±6 t/h)

Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
March (2)	59.9 ± 1.9	33 ± 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.5	7.5	0.8	1.8	2.9	6.5	14.1	31.6	2.9	6.5
			20.0	23.5	77.7	1.2	50.8	26.8	15.0	7.5	22.5	15.0	5.6	24.7	7.2	69.0	7.1	6.9	6.3
			32.0	20.0	77.7	2.3	49.3	28.3	30.0	22.5	37.5	30.8	3.0	20.8	4.2	69.8	7.1	9.4	5.1
			52.0	17.6	76.8	5.6	48.4	28.4	45.0	37.5	52.5	48.8	4.7	20.0	2.4	69.3	4.5	10.7	2.7
			63.0	15.7	78.7	5.5	50.6	28.2	60.0	52.5	67.5	61.0	2.9	16.2	3.5	74.2	4.7	9.6	2.8
			78.0	14.1	79.7	6.2	51.4	28.3	75.0	67.5	82.5	75.0	6.1	15.5	3.8	74.1	5.7	10.4	3.7
			91.0	12.8	81.1	6.1	52.2	28.9	90.0	82.5	97.5	89.5	4.4	14.7	3.7	74.7	5.0	10.6	2.2
			109.0	11.5	82.0	6.5	53.0	29.0	105.0	97.5	112.5	105.7	4.9	14.4	4.6	76.2	6.5	9.4	2.6
			124.0	10.8	82.7	6.5	53.6	29.1	120.0	112.5	127.5	120.0	6.1	13.9	4.7	76.9	6.4	9.2	2.4
			134.0	10.4	82.9	6.7	54.0	29.0	135.0	127.5	142.5	132.5	3.9	12.9	4.2	77.1	5.3	10.1	2.3
			150.0	9.6	83.6	6.8	54.5	29.1	150.0	142.5	157.5	150.0	5.7	11.9	4.6	77.5	5.4	10.6	2.7
			164.0	8.9	84.2	6.9	55.0	29.2	165.0	157.5	172.5	164.8	5.6	12.8	5.0	76.1	5.8	11.1	2.7
			184.0	8.0	84.4	7.5	55.5	28.9	180.0	172.5	187.5	181.8	4.8	10.7	4.4	77.4	5.7	11.8	3.3
			201.0	7.4	84.0	8.5	55.3	28.7	195.0	187.5	202.5	197.3	5.2	10.4	4.4	77.5	5.5	12.1	3.2
			207.0	7.3	84.0	8.7	55.4	28.7	210.0	202.5	217.5	208.7	5.7	9.0	1.4	82.7	1.2	8.4	0.4
			221.0	6.9	84.1	9.0	55.4	28.7	225.0	217.5	232.5	226.3	4.7	11.2	5.1	79.3	6.9	9.6	2.1
			235.0	6.6	84.4	9.0	55.6	28.8	240.0	232.5	247.5	240.0	6.0	9.9	4.9	80.7	6.2	9.4	1.6
			247.0	6.3	84.6	9.1	55.8	28.7	255.0	247.5	262.5	260.0	2.8	11.3	7.5	78.1	9.5	10.6	2.1
			262.0	6.0	84.9	9.1	56.1	28.7	270.0	262.5	277.5	271.0	#DIV/0!	16.3	#DIV/0!	71.8	#DIV/0!	11.9	#DIV/0!
			278.0	5.7	85.0	9.3	56.2	28.7	285.0	277.5	292.5	284.0	5.6	9.1	5.9	80.8	7.3	10.1	1.4
			289.0	5.6	85.0	9.4	56.4	28.7	300.0	292.5	307.5	300.5	2.1	10.4	7.1	79.2	8.6	10.4	1.4
			302.0	5.4	85.2	9.4	56.7	28.5	315.0	307.5	322.5	313.0	1.4	10.1	6.9	79.3	8.6	10.6	1.7
			312.0	5.3	85.3	9.4	56.9	28.4	330.0	322.5	337.5	325.5	0.7	9.9	6.8	79.1	8.7	11.0	1.9
			325.0	5.1	85.3	9.6	56.9	28.3	345.0	337.5	352.5	343.3	4.9	11.2	5.4	77.4	6.9	11.5	1.5
			340.0	5.0	85.3	9.7	56.9	28.4	360.0	352.5	367.5	359.5	6.4	9.2	6.1	79.4	8.4	11.5	2.3
			355.0	4.9	85.3	9.8	56.9	28.4	375.0	367.5	382.5	375.3	4.6	7.5	4.8	81.5	6.9	11.1	2.0
			370.0	4.7	85.4	9.8	57.0	28.4											
			378.0	4.6	85.4	10.0	57.0	28.4											
			393.0	4.6	85.4	10.1	57.0	28.4											
			406.0	4.5	85.2	10.3	57.0	28.2											
			420.0	4.4	84.9	10.7	56.7	28.1											
			434.0	4.3	84.6	11.0	56.6	28.0											
			449.0	4.2	84.4	11.4	56.4	27.9											
			479.0	4.1	84.1	11.9	56.2	27.8											
			494.0	4.0	84.1	11.9	56.3	27.8											
			509.0	4.0	84.2	11.8	56.4	27.8											
			524.0	4.0	84.0	12.1	56.3	27.7											
			539.0	3.9	83.9	12.2	56.2	27.7											
			558.0	3.9	83.9	12.2	56.1	27.8											
			569.0	3.8	83.8	12.4	56.1	27.7											
			584.0	3.8	83.6	12.6	55.9	27.7											
January (2)	46.8 ± 5.2	28.3 ± 3.1	0.0	0.0	0.0	0.0	0.0	0.0											
			13.0	34.6	63.5	1.9	34.6	28.8											
			27.0	26.0	63.3	10.7	33.7	29.6											
			41.0	23.5	65.8	10.7	35.2	30.6											
			51.0	21.8	65.9	12.2	35.5	30.5											
			64.0	21.3	67.8	10.9	37.5	30.3											
			79.0	19.8	68.3	11.9	38.3	30.0											
			92.0	19.5	68.5	12.1	38.5	29.9											
			92.0	19.5	68.8	11.7	38.5	30.3											



Winter Season - Average Feed Rate (55±6 t/h)

Summary of Separation Results for Winter - Average Feed Rate (55±6 t/h)

Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
January (2)	46.8 ± 5.2	28.3 ± 3.1	100.0	19.7	69.2	11.1	38.8	30.4											
			113.0	19.4	70.0	10.7	39.2	30.8											
			128.0	19.1	70.2	10.8	39.4	30.8											
			143.0	18.8	70.4	10.8	39.5	30.9											
			158.0	18.5	70.5	11.1	39.4	31.0											
			171.0	17.9	70.6	11.4	39.5	31.2											
			186.0	17.4	70.6	12.1	39.2	31.3											
			201.0	16.9	71.0	12.1	39.4	31.6											
			228.0	16.7	71.4	11.9	39.4	31.9											
			243.0	16.9	71.5	11.6	39.8	31.7											
			258.0	16.6	71.4	12.0	40.1	31.3											
			271.0	16.3	71.8	11.9	40.5	31.3											
			285.0	15.9	72.3	11.7	41.0	31.3											
			299.0	15.5	73.1	11.4	41.7	31.4											
			314.0	15.0	73.2	11.8	42.0	31.2											
			326.0	14.7	72.9	12.3	42.1	30.9											
			341.0	14.4	73.2	12.4	42.3	30.9											
			349.0	14.2	73.5	12.3	42.5	31.0											
			364.0	13.5	73.4	13.1	42.6	30.8											
			378.0	13.1	73.5	13.4	42.8	30.8											
			392.0	12.7	73.5	13.8	42.8	30.7											
			402.0	12.5	73.8	13.8	43.0	30.8											
			417.0	12.0	73.6	14.5	43.0	30.6											
			426.0	11.6	73.5	14.9	43.0	30.5											
			440.0	11.2	73.7	15.1	43.2	30.5											
			455.0	10.8	73.8	15.4	43.3	30.5											
			470.0	10.5	74.0	15.4	43.5	30.6											
February (4)	57.7 ± 20.1	35.1 ± 12.2	0.0	0.0	0.0	0.0	0.0	0.0											
			8.0	23.1	62.9	14.0	35.5	27.4											
			30.0	21.2	64.3	14.5	36.4	27.9											
			45.0	20.7	65.7	13.7	36.5	29.2											
			52.0	18.9	69.5	11.6	38.1	31.4											
			52.0	17.8	71.9	10.3	38.9	32.9											
			59.0	14.1	74.0	11.9	38.9	35.1											
			68.0	12.7	74.3	13.1	39.6	34.7											
			83.0	12.3	75.9	11.8	41.2	34.7											
			94.0	12.2	76.9	10.9	42.1	34.8											
			108.0	11.9	77.4	10.8	42.7	34.7											
			123.0	11.6	77.9	10.5	43.3	34.6											
			131.0	11.1	77.6	11.2	43.6	34.0											
			137.0	10.8	77.6	11.6	43.9	33.6											
			150.0	10.3	78.3	11.4	44.6	33.7											
			161.0	9.9	78.4	11.7	44.9	33.5											
			175.0	9.3	78.4	12.3	45.0	33.4											
			190.0	9.3	79.2	11.6	45.1	34.0											
			204.0	9.8	81.7	8.6	44.9	36.8											
			215.0	9.8	82.3	7.9	44.9	37.4											
			230.0	9.8	82.3	7.9	44.9	37.4											
			235.0	9.8	82.4	7.8	44.9	37.5											

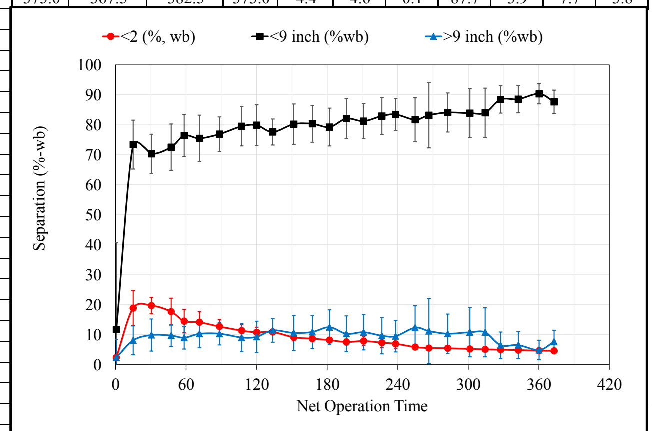
Summary of Separation Results for Winter - Average Feed Rate (55±6 t/h)																			
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
February (4)	58.8 ± 2.3	34.2 ± 1.4	0.0	0.0	0.0	0.0	0.0	0.0											
			4.0	14.6	70.7	14.6	39.0	31.7											
			19.0	17.5	72.0	10.6	38.6	33.3											
			34.0	15.8	74.0	10.2	41.0	33.1											
			58.0	13.8	76.1	10.1	43.3	32.8											
			85.0	12.2	76.8	11.0	45.1	31.7											
			157.0	8.9	77.8	13.3	47.2	30.5											
			170.0	8.6	76.9	14.5	47.3	29.6											
			182.0	8.3	76.3	15.5	47.3	28.9											
			197.0	7.8	76.0	16.2	47.3	28.7											

Column Description:

- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
- C#10 represents 15 minute time intervals, with ± 7.5 minutes lower and upper limits in Columns C#11 & C#12.
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

Summary of Separation Results for Winter - High Feed Rate (64±5 t/h)

Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch		>9 inch	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
March (2)	59.9 ± 1.9	33 ± 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.5	7.5	0.7	1.6	2.4	6.0	11.8	28.9	2.4	6.0
			20.0	23.5	77.7	1.2	50.8	26.8	15.0	7.5	22.5	15.0	4.8	18.9	5.8	73.4	8.2	8.1	4.8
			32.0	20.0	77.7	2.3	49.3	28.3	30.0	22.5	37.5	30.5	3.4	19.7	2.7	70.3	6.5	9.9	5.4
			52.0	17.6	76.8	5.6	48.4	28.4	45.0	37.5	52.5	47.3	5.3	17.7	4.5	72.6	7.7	9.7	3.6
			63.0	15.7	78.7	5.5	50.6	28.2	60.0	52.5	67.5	58.4	3.0	14.5	3.9	76.4	7.0	9.0	3.8
			78.0	14.1	79.7	6.2	51.4	28.3	75.0	67.5	82.5	71.4	4.0	14.2	3.5	75.5	7.7	10.3	4.7
			91.0	12.8	81.1	6.1	52.2	28.9	90.0	82.5	97.5	88.4	5.3	12.7	2.3	76.9	5.7	10.4	3.7
			109.0	11.5	82.0	6.5	53.0	29.0	105.0	97.5	112.5	107.3	3.6	11.4	2.0	79.5	6.5	9.1	4.7
			124.0	10.8	82.7	6.5	53.6	29.1	120.0	112.5	127.5	120.0	4.5	10.8	1.7	79.9	6.8	9.3	5.2
			134.0	10.4	82.9	6.7	54.0	29.0	135.0	127.5	142.5	133.8	2.5	10.9	0.4	77.6	4.3	11.5	3.9
			150.0	9.6	83.6	6.8	54.5	29.1	150.0	142.5	157.5	151.6	5.3	9.1	1.1	80.2	6.7	10.6	5.8
			164.0	8.9	84.2	6.9	55.0	29.2	165.0	157.5	172.5	167.4	4.6	8.7	1.0	80.3	6.2	10.9	5.5
			184.0	8.0	84.4	7.5	55.5	28.9	180.0	172.5	187.5	182.0	4.0	8.2	0.8	79.3	6.3	12.5	5.8
			201.0	7.4	84.0	8.5	55.3	28.7	195.0	187.5	202.5	196.3	3.7	7.6	1.0	82.1	6.6	10.3	6.0
			207.0	7.3	84.0	8.7	55.4	28.7	210.0	202.5	217.5	211.0	4.9	7.9	1.5	81.2	5.8	10.8	5.9
			221.0	6.9	84.1	9.0	55.4	28.7	225.0	217.5	232.5	226.5	4.4	7.4	1.7	83.0	6.1	9.7	6.0
			235.0	6.6	84.4	9.0	55.6	28.8	240.0	232.5	247.5	238.2	5.8	7.0	1.6	83.5	5.4	9.5	5.3
			247.0	6.3	84.6	9.1	55.8	28.7	255.0	247.5	262.5	254.8	5.7	5.9	0.2	81.7	7.4	12.4	7.3
			262.0	6.0	84.9	9.1	56.1	28.7	270.0	262.5	277.5	266.5	3.5	5.6	0.1	83.2	10.9	11.2	10.8
			278.0	5.7	85.0	9.3	56.2	28.7	285.0	277.5	292.5	282.5	5.1	5.5	0.2	84.1	6.5	10.4	6.5
			289.0	5.6	85.0	9.4	56.4	28.7	300.0	292.5	307.5	301.3	1.2	5.3	0.1	83.9	8.2	10.8	8.2
			302.0	5.4	85.2	9.4	56.7	28.5	315.0	307.5	322.5	314.3	2.1	5.2	0.1	84.0	8.2	10.8	8.2
			312.0	5.3	85.3	9.4	56.9	28.4	330.0	322.5	337.5	327.5	3.5	5.0	0.1	88.5	4.5	6.5	4.4
			325.0	5.1	85.3	9.6	56.9	28.3	345.0	337.5	352.5	342.5	3.5	4.9	0.1	88.6	4.6	6.5	4.5
			340.0	5.0	85.3	9.7	56.9	28.4	360.0	352.5	367.5	360.3	3.8	4.7	0.1	90.4	3.4	4.9	3.3
			355.0	4.9	85.3	9.8	56.9	28.4	375.0	367.5	382.5	373.0	4.4	4.6	0.1	87.7	3.9	7.7	3.8
			370.0	4.7	85.4	9.8	57.0	28.4											
			378.0	4.6	85.4	10.0	57.0	28.4											
			393.0	4.6	85.4	10.1	57.0	28.4											
			406.0	4.5	85.2	10.3	57.0	28.2											
			420.0	4.4	84.9	10.7	56.7	28.1											
			434.0	4.3	84.6	11.0	56.6	28.0											
			449.0	4.2	84.4	11.4	56.4	27.9											
			479.0	4.1	84.1	11.9	56.2	27.8											
			494.0	4.0	84.1	11.9	56.3	27.8											
			509.0	4.0	84.2	11.8	56.4	27.8											
			524.0	4.0	84.0	12.1	56.3	27.7											
			539.0	3.9	83.9	12.2	56.2	27.7											
			558.0	3.9	83.9	12.2	56.1	27.8											
			569.0	3.8	83.8	12.4	56.1	27.7											
			584.0	3.8	83.6	12.6	55.9	27.7											
March (3)	72.4 ± 5.7	40.9 ± 3.2	0.0	0.0	0.0	0.0	0.0	0.0											
			14.0	9.4	84.5	6.1	75.5	9.1											
			42.0	9.2	85.8	4.9	75.1	10.8											
			57.0	9.1	86.3	4.6	75.0	11.3											
			72.0	9.1	86.5	4.4	74.0	12.5											
			87.0	8.8	86.7	4.5	73.7	13.0											
			102.0	8.7	87.0	4.3	73.1	13.9											
			114.0	8.4	87.4	4.2	73.2	14.2											



Winter Season - High Feed Rate (63±5 t/h)

Summary of Separation Results for Winter - High Feed Rate (64±5 t/h)																			
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch		>9 inch	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
March (3)	72.4 ± 5.7	40.9 ± 3.2	143.0	7.8	88.2	4.0	72.9	15.3											
			156.0	7.5	88.6	3.9	72.9	15.7											
			171.0	7.2	88.8	4.0	73.1	15.8											
			187.0	6.9	89.2	3.9	73.5	15.7											
			197.0	6.7	89.3	4.0	74.0	15.4											
			198.0	6.5	89.6	3.9	74.7	15.0											
			213.0	6.3	90.0	3.8	74.8	15.2											
			225.0	6.1	90.2	3.8	74.8	15.4											
			241.0	5.9	90.5	3.7	74.8	15.7											
			255.0	5.7	90.7	3.6	74.7	16.0											
			269.0	5.5	90.9	3.6	74.7	16.2											
			284.0	5.4	91.1	3.5	74.7	16.4											
			300.0	5.2	91.3	3.5	74.6	16.7											
			315.0	5.0	91.5	3.5	74.5	17.0											
			330.0	4.9	91.7	3.4	74.5	17.2											
			345.0	4.8	91.8	3.4	74.4	17.4											
			360.0	4.7	91.9	3.3	74.4	17.6											
			363.0	4.7	92.0	3.3	74.4	17.7											
			363.0	4.6	92.1	3.3	74.6	17.5											
			371.0	4.5	92.2	3.3	74.6	17.6											
			387.0	4.4	92.1	3.5	74.0	18.1											
January (3)	64.8 ± 9.6	37.6 ± 5.6	0.0	0.0	0.0	0.0	0.0	0.0											
			14.0	21.1	70.0	8.9	33.3	36.7											
			26.0	22.0	65.4	12.6	33.0	32.4											
			41.0	22.1	65.7	12.2	33.7	32.0											
			55.0	20.0	67.1	13.0	34.9	32.1											
			69.0	17.6	68.4	13.9	35.7	32.7											
			70.0	17.3	68.6	14.1	35.8	32.7											
			83.0	16.4	70.1	13.4	37.1	33.1											
			96.0	14.4	70.8	14.7	37.9	32.9											
			110.0	13.5	71.7	14.8	38.7	33.0											
			119.0	12.4	71.5	16.1	38.9	32.6											
			133.0	11.4	72.3	16.3	39.7	32.6											
			148.0	10.3	72.5	17.3	40.3	32.2											
			157.0	9.7	72.8	17.6	40.6	32.2											
			171.0	9.0	73.4	17.6	41.2	32.2											
			181.0	8.5	73.6	18.0	41.3	32.2											
			183.0	8.3	73.7	18.0	41.3	32.4											
			195.0	7.9	74.3	17.8	41.9	32.4											
			210.0	7.3	74.6	18.0	42.2	32.4											
			217.0	7.0	74.8	18.1	42.5	32.4											
			230.0	6.6	75.3	18.1	42.7	32.5											
			233.0	6.4	75.5	18.0	43.0	32.6											
			248.0	6.1	75.8	18.2	43.3	32.5											
			254.0	5.8	75.6	18.6	43.3	32.2											
			264.0	5.6	75.5	18.9	43.4	32.1											
			279.0	5.4	75.4	19.3	43.5	31.9											
			302.0	5.2	75.2	19.7	43.4	31.8											
			316.0	5.1	75.3	19.6	43.4	31.8											

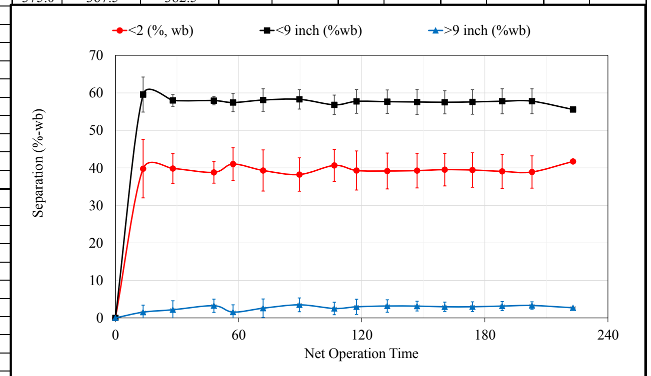
Summary of Separation Results for Winter - High Feed Rate (64±5 t/h)																			
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch		>9 inch	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
February (4)	57.7 ± 20.1	35.1 ± 12.2	0.0	0.0	0.0	0.0	0.0	0.0											
			8.0	23.1	62.9	14.0	35.5	27.4											
			30.0	21.2	64.3	14.5	36.4	27.9											
			45.0	20.7	65.7	13.7	36.5	29.2											
			52.0	18.9	69.5	11.6	38.1	31.4											
			52.0	17.8	71.9	10.3	38.9	32.9											
			59.0	14.1	74.0	11.9	38.9	35.1											
			68.0	12.7	74.3	13.1	39.6	34.7											
			83.0	12.3	75.9	11.8	41.2	34.7											
			94.0	12.2	76.9	10.9	42.1	34.8											
			108.0	11.9	77.4	10.8	42.7	34.7											
			123.0	11.6	77.9	10.5	43.3	34.6											
			131.0	11.1	77.6	11.2	43.6	34.0											
			137.0	10.8	77.6	11.6	43.9	33.6											
			150.0	10.3	78.3	11.4	44.6	33.7											
			161.0	9.9	78.4	11.7	44.9	33.5											
			175.0	9.3	78.4	12.3	45.0	33.4											
			190.0	9.3	79.2	11.6	45.1	34.0											
			204.0	9.8	81.7	8.6	44.9	36.8											
			215.0	9.8	82.3	7.9	44.9	37.4											
			230.0	9.8	82.3	7.9	44.9	37.4											
			235.0	9.8	82.4	7.8	44.9	37.5											
February (5)	58.8 ± 2.3	34.2 ± 1.4	0.0	0.0	0.0	0.0	0.0	0.0											
			4.0	14.6	70.7	14.6	39.0	31.7											
			19.0	17.5	72.0	10.6	38.6	33.3											
			34.0	15.8	74.0	10.2	41.0	33.1											
			58.0	13.8	76.1	10.1	43.3	32.8											
			85.0	12.2	76.8	11.0	45.1	31.7											
			157.0	8.9	77.8	13.3	47.2	30.5											
			170.0	8.6	76.9	14.5	47.3	29.6											
			182.0	8.3	76.3	15.5	47.3	28.9											
			197.0	7.8	76.0	16.2	47.3	28.7											

Column Description:

- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
- C#10 represents 15 minute time intervals, with ± 7.5 minutes lower and upper limits in Columns C#11 & C#12.
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

Summary of Separation Results for Summer - Low Feed Rate (46±2 t/h)

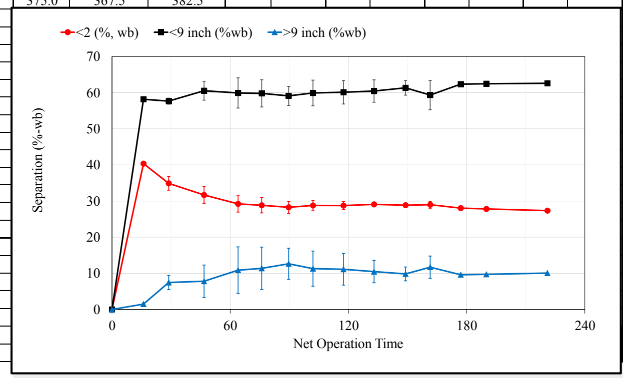
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
June (2)	48.1 ± 4.3	26.6 ± 2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.5	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			12.0	45.3	56.3	0.2	29.7	26.6	15.0	7.5	22.5	13.5	2.1	39.8	7.8	59.6	4.7	1.5	1.9
			25.0	42.7	56.9	0.5	30.3	26.5	30.0	22.5	37.5	28.0	4.2	39.8	4.0	58.0	1.6	2.2	2.4
			42.0	43.1	56.3	0.6	30.4	26.0	45.0	37.5	52.5	48.0	4.9	38.8	2.9	58.0	1.1	3.2	1.8
			56.0	43.5	55.8	0.7	30.0	25.8	60.0	52.5	67.5	57.3	1.5	41.0	4.3	57.4	2.4	1.5	1.9
			59.0	43.5	56.3	0.2	30.3	26.0	75.0	67.5	82.5	72.0	1.4	39.3	5.5	58.1	3.0	2.6	2.5
			73.0	43.2	56.0	0.8	30.4	25.5	90.0	82.5	97.5	89.7	5.7	38.2	4.4	58.3	2.6	3.5	1.8
			88.0	43.4	55.3	1.4	30.2	25.1	105.0	97.5	112.5	106.7	4.0	40.7	4.3	56.8	2.6	2.5	1.7
			103.0	43.1	55.2	1.6	30.2	25.1	120.0	112.5	127.5	117.5	2.1	39.3	5.2	57.7	3.2	3.0	2.0
			106.0	43.1	55.4	1.5	30.4	25.1	135.0	127.5	142.5	132.5	2.1	39.2	4.8	57.7	3.1	3.2	1.7
			119.0	43.0	55.5	1.5	30.4	25.1	150.0	142.5	157.5	147.0	1.4	39.3	4.6	57.6	3.3	3.1	1.3
			134.0	42.6	55.4	2.0	30.5	25.0	165.0	157.5	172.5	160.5	0.7	39.5	4.4	57.5	3.1	3.0	1.3
			148.0	42.6	55.2	2.2	30.5	24.7	180.0	172.5	187.5	174.0	1.4	39.4	4.6	57.6	3.3	3.0	1.3
			161.0	42.6	55.3	2.1	30.7	24.6	195.0	187.5	202.5	188.5	0.7	39.1	4.6	57.8	3.3	3.2	1.2
			173.0	42.7	55.3	2.1	30.6	24.7	210.0	202.5	217.5	203.0	0.0	38.9	4.3	57.8	3.3	3.3	1.0
			189.0	42.3	55.4	2.3	30.6	24.8	225.0	217.5	232.5	223.0	#DIV/0!	41.7	#DIV/0!	55.6	#DIV/0!	2.7	#DIV/0!
			203.0	41.9	55.4	2.6	30.6	24.8	240.0	232.5	247.5								
			223.0	41.7	55.6	2.7	30.8	24.8	255.0	247.5	262.5								
June (3)	43.7 ± 5.9	25.9 ± 3.5	0.0	0.0	0.0	0.0	0.0	0.0	270.0	262.5	277.5								
			15.0	34.3	62.9	2.9	37.1	25.7	285.0	277.5	292.5								
			31.0	37.0	59.1	3.9	34.3	24.9	300.0	292.5	307.5								
			46.0	37.7	58.2	4.1	33.6	24.7	315.0	307.5	322.5								
			52.0	37.7	58.3	4.1	33.3	24.9	330.0	322.5	337.5								
			52.0	36.8	59.0	4.2	34.3	24.7	345.0	337.5	352.5								
			57.0	36.0	60.2	3.8	35.8	24.4	360.0	352.5	367.5								
			71.0	35.4	60.2	4.3	35.2	25.0	375.0	367.5	382.5								
			85.0	35.8	59.7	4.5	34.7	25.0											
			96.0	35.5	59.9	4.6	34.6	25.3											
			111.0	35.7	59.8	4.4	34.5	25.4											
			116.0	35.6	60.0	4.4	34.9	25.1											
			131.0	35.8	59.9	4.3	34.7	25.2											
			146.0	36.0	59.9	4.1	34.6	25.4											
			160.0	36.5	59.7	3.8	34.5	25.2											
			175.0	36.2	59.9	3.9	34.5	25.4											
			188.0	35.9	60.1	4.0	34.7	25.4											
			203.0	35.9	60.1	4.0	34.8	25.3											



Summer Season - Low Feed Rate (46±2 t/h)

Column Description:
- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
- C#10 represents 15 minute time intervals, with ± 7.5 minutes lower and upper limits in Columns C#11 & C#12.
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

Summary of Separation Results for Summer - Low Feed Rate (79±1 t/h)																			
Trial Information				Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)	Net Operation Time (min)	<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
June (1)	80.2 ± 14.2	43.1 ± 7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.5	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			16.0	40.3	58.0	1.7	29.4	28.6	15.0	7.5	22.5	16.0	0.0	40.4	0.0	58.2	0.2	1.5	0.3
			27.0	35.4	56.7	7.8	29.9	26.9	30.0	22.5	37.5	28.8	2.7	34.9	1.9	57.6	0.8	7.5	2.0
			27.0	35.3	57.0	7.7	30.1	26.9	45.0	37.5	52.5	46.8	5.4	31.7	2.3	60.5	2.6	7.8	4.5
			27.0	35.9	57.7	6.4	31.3	26.4	60.0	52.5	67.5	64.0	4.2	29.2	2.3	59.9	4.2	10.9	6.4
			33.0	31.6	58.1	10.3	32.4	25.7	75.0	67.5	82.5	76.0	4.2	28.8	2.1	59.8	3.8	11.4	5.9
			45.0	28.7	56.8	14.5	32.6	24.1	90.0	82.5	97.5	89.7	3.2	28.3	1.7	59.1	2.6	12.6	4.3
			61.0	27.6	57.0	15.4	32.8	24.1	105.0	97.5	112.5	102.0	4.2	28.8	1.3	59.9	3.6	11.3	4.9
			73.0	27.3	57.1	15.5	32.8	24.3	120.0	112.5	127.5	117.5	4.9	28.8	1.1	60.1	3.3	11.1	4.4
			86.0	27.0	57.3	15.6	33.0	24.3	135.0	127.5	142.5	133.0	6.2	29.1	0.2	60.4	3.1	10.5	3.1
			91.0	27.6	57.9	14.6	33.2	24.6	150.0	142.5	157.5	149.0	5.6	28.8	0.1	61.3	2.0	9.8	1.9
			105.0	27.9	57.4	14.7	32.8	24.6	165.0	157.5	172.5	161.5	0.7	29.0	1.0	59.3	4.1	11.7	3.1
			121.0	28.0	57.8	14.2	33.0	24.8	180.0	172.5	187.5	177.0	#DIV/0!	28.1	#DIV/0!	62.3	#DIV/0!	9.6	#DIV/0!
			131.0	29.1	56.9	14.0	32.5	24.4	195.0	187.5	202.5	190.0	#DIV/0!	27.8	#DIV/0!	62.5	#DIV/0!	9.7	#DIV/0!
			146.0	29.1	56.7	14.2	32.4	24.4	210.0	202.5	217.5	221.0	#DIV/0!	27.3	#DIV/0!	62.6	#DIV/0!	10.1	#DIV/0!
			161.0	29.7	56.5	13.9	32.1	24.3	225.0	217.5	232.5								
June (4)	77.5 ± 4.9	47.7 ± 3	0.0	0.0	0.0	0.0	0.0	0.0	240.0	232.5	247.5								
			16.0	40.4	58.3	1.3	29.5	28.8	255.0	247.5	262.5								
			30.0	36.2	58.8	5.0	29.5	29.2	270.0	262.5	277.5								
			40.0	34.3	60.9	4.9	31.2	29.6	285.0	277.5	292.5								
			50.0	32.2	61.9	5.9	32.2	29.7	300.0	292.5	307.5								
			52.0	31.5	62.6	5.9	33.1	29.5	315.0	307.5	322.5								
			67.0	30.8	62.9	6.3	33.4	29.4	330.0	322.5	337.5								
			79.0	30.3	62.5	7.2	33.5	28.9	345.0	337.5	352.5								
			92.0	30.2	62.1	7.7	33.7	28.5	360.0	352.5	367.5								
			99.0	29.7	62.4	7.9	33.8	28.6	375.0	367.5	382.5								
			114.0	29.5	62.4	8.0	34.1	28.3											
			128.0	29.3	62.2	8.5	34.2	28.0											
			140.0	28.8	62.2	8.9	34.5	27.7											
			145.0	28.8	62.2	9.0	34.6	27.7											
			145.0	28.8	62.2	9.0	34.5	27.7											
			145.0	28.8	62.2	9.0	34.5	27.7											
			148.0	28.8	62.0	9.2	34.7	27.3											
			157.0	28.7	61.9	9.3	34.9	27.0											
			157.0	28.8	61.9	9.2	35.3	26.6											
			162.0	28.3	62.2	9.5	35.7	26.5											
			177.0	28.1	62.3	9.6	35.6	26.7											
			190.0	27.8	62.5	9.7	35.7	26.7											
			221.0	27.3	62.6	10.1	36.2	26.4											

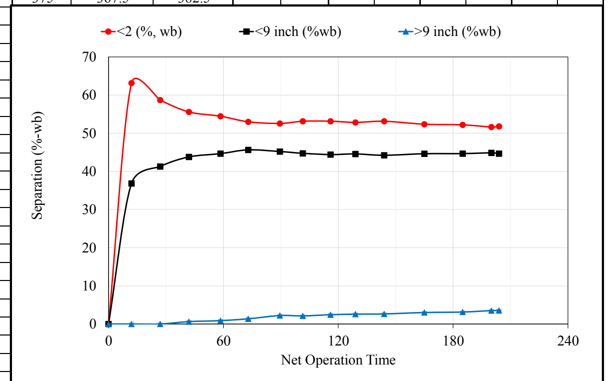


Summer Season - High Feed Rate (79±1 t/h)

Column Description:

- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
- C#10 represents 15 minute time intervals, with ± 7.5 minutes lower and upper limits in Columns C#11 & C#12.
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

Summary of Separation Results for Spring - Low Feed Rate (46±0 t/h)																			
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
May (3)	46.2 ± 2.3	30 ± 1.5	0.00	0.00	0.00	0.00	0.00	0.00	0	-7.5	7.5	0.00		0.00		0.00		0.00	
			12.00	63.16	36.84	0.00	22.37	14.47	15	7.5	22.5	12.00		63.16		36.84		0.00	
			27.00	58.71	41.29	0.00	24.88	16.42	30	22.5	37.5	27.00		58.71		41.29		0.00	
			42.00	55.59	43.79	0.62	25.47	18.32	45	37.5	52.5	42.00		55.59		43.79		0.62	
			57.00	54.38	44.72	0.90	25.84	18.88	60	52.5	67.5	58.50		54.46		44.65		0.88	
			60.00	54.55	44.59	0.87	25.76	18.83	75	67.5	82.5	73.00		52.99		45.64		1.37	
			73.00	52.99	45.64	1.37	26.15	19.49	90	82.5	97.5	89.50		52.57		45.21		2.22	
			88.00	52.55	45.33	2.12	25.78	19.55	105	97.5	112.5	101.50		53.15		44.74		2.12	
			91.00	52.59	45.10	2.32	25.34	19.75	120	112.5	127.5	116.00		53.16		44.41		2.44	
			101.00	53.13	44.75	2.13	25.00	19.75	135	127.5	142.5	129.00		52.84		44.58		2.59	
			102.00	53.17	44.72	2.11	24.97	19.75	150	142.5	157.5	144.00		53.14		44.22		2.64	
			116.00	53.16	44.41	2.44	24.92	19.49	165	157.5	172.5	165.00		52.36		44.63		3.01	
			129.00	52.84	44.58	2.59	24.98	19.60	180	172.5	187.5	185.00		52.20		44.66		3.14	
			144.00	53.14	44.22	2.64	24.75	19.47	195	187.5	202.5	200.00		51.63		44.86		3.51	
			158.00	52.58	44.63	2.79	25.02	19.61	210	202.5	217.5	204.00		51.80		44.65		3.54	
			172.00	52.14	44.63	3.23	25.02	19.61	225	217.5	232.5								
			185.00	52.20	44.66	3.14	24.98	19.68	240	232.5	247.5								
			200.00	51.63	44.86	3.51	25.03	19.83	255	247.5	262.5								
			204.00	51.80	44.65	3.54	24.94	19.72	270	262.5	277.5								
									285	277.5	292.5								
									300	292.5	307.5								
									315	307.5	322.5								
									330	322.5	337.5								
									345	337.5	352.5								
									360	352.5	367.5								
									375	367.5	382.5								



Spring Season - Low Feed Rate (46±0 t/h)

Column Description:
- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
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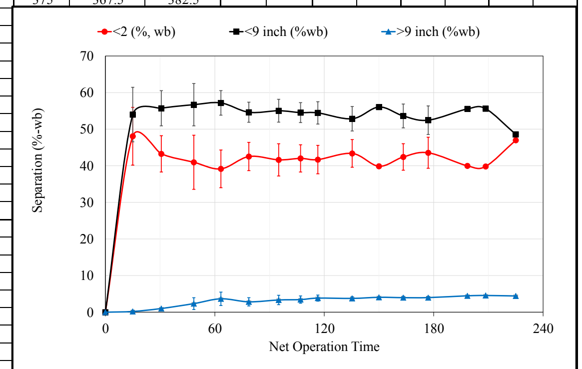
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

Summary of Separation Results for Spring - Average Feed Rate (57±3 t/h)

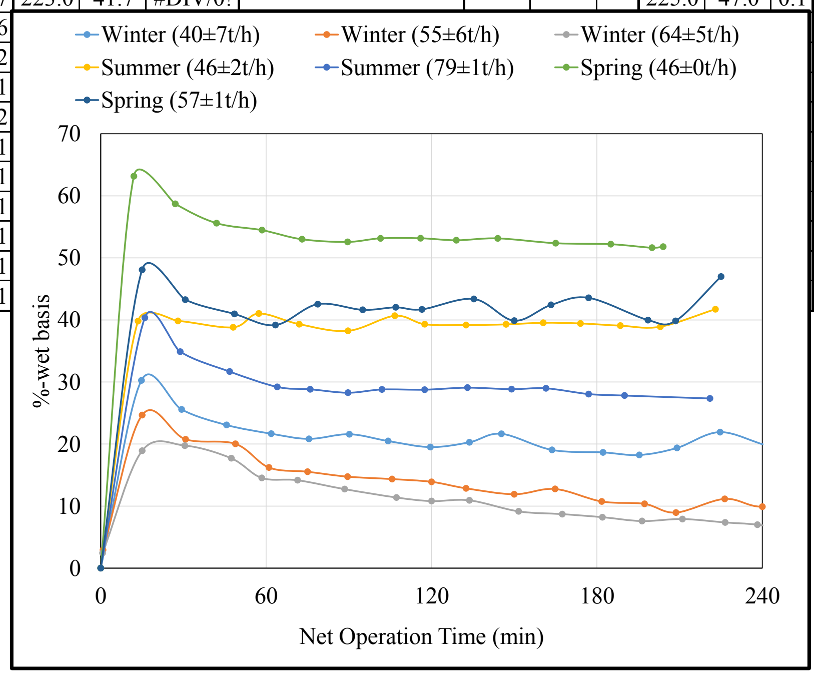
Trial Information			Net Operation Time (min)	Separation Results (wet basis)					Time Control			Time Ave		<2 (%, wb)		<9 inch (%wb)		>9 inch (%wb)	
Trial Name	Wet Feed (t/h)	Dry Feed (t/h)		<2 inch (%wb)	<9 inch (%wb)	>9 inch (%wb)	5-9 in (%-wb)	2-5 in (%-wb)	Time set	Lower Limit	Upper Limit	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C#1	C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9	C#10	C#11	C#12	C#13	C#14	C#15	C#16	C#17	C#18	C#19	C#20
May (1)	58.7 ± 8	37.6 ± 5.1	0.00	0.00	0.00	0.00	0.00	0.00	0	-7.5	7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			18.00	40.00	62.35	0.59	25.88	36.47	15	7.5	22.5	15.00	4.36	48.07	7.89	54.00	7.44	0.20	0.34
			31.00	37.55	61.26	1.19	27.67	33.60	30	22.5	37.5	30.67	6.51	43.27	4.96	55.72	4.80	1.01	0.16
			46.00	35.73	60.78	3.49	28.76	32.03	45	37.5	52.5	48.50	3.54	40.96	7.39	56.70	5.78	2.35	1.61
			60.00	35.87	59.56	4.57	28.26	31.30	60	52.5	67.5	63.33	3.51	39.16	5.15	57.18	3.35	3.66	1.83
			67.00	36.52	58.64	4.85	27.73	30.91	75	67.5	82.5	78.67	4.16	42.53	3.86	54.63	2.75	2.83	1.13
			80.00	38.08	57.80	4.12	27.84	29.96	90	82.5	97.5	95.00	0.00	41.62	4.40	55.04	3.12	3.34	1.28
			95.00	38.51	57.25	4.24	27.64	29.61	105	97.5	112.5	107.00	0.00	42.02	3.72	54.53	2.73	3.45	1.00
			107.00	39.39	56.46	4.15	27.40	29.06	120	112.5	127.5	116.50	0.71	41.70	3.89	54.46	3.05	3.85	0.83
			116.00	38.95	56.61	4.44	27.36	29.25	135	127.5	142.5	135.33	5.77	43.38	3.78	52.85	3.34	3.77	0.45
			132.00	39.02	56.69	4.29	27.35	29.34	150	142.5	157.5	150.00	9.90	39.88	0.55	56.06	0.38	4.07	0.18
			143.00	39.49	56.32	4.19	27.18	29.14	165	157.5	172.5	163.33	4.62	42.41	3.63	53.62	3.25	3.97	0.38
			157.00	40.27	55.79	3.94	27.16	28.63	180	172.5	187.5	177.00	5.66	43.56	4.24	52.46	3.90	3.99	0.34
			166.00	40.31	55.50	4.19	26.99	28.50	195	187.5	202.5	198.50	3.54	39.97	0.09	55.55	0.04	4.48	0.13
			166.00	40.31	55.50	4.19	26.99	28.50	210	202.5	217.5	208.50	4.95	39.84	0.00	55.60	0.00	4.57	0.00
			181.00	40.56	55.22	4.23	26.65	28.57	225	217.5	232.5	225.00	2.83	46.98	0.07	48.59	0.03	4.43	0.04
			196.00	39.91	55.52	4.57	26.74	28.78	240	232.5	247.5								
			201.00	40.04	55.58	4.38	26.74	28.84	255	247.5	262.5								
			205.00	39.84	55.60	4.57	26.72	28.88	270	262.5	277.5								
			212.00	39.84	55.60	4.57	26.72	28.88	285	277.5	292.5								
May (3)	56.1 ± 7.9	35.3 ± 5	0.00	0.00	0.00	0.00	0.00	0.00	300	292.5	307.5								
			10.00	55.77	48.08	0.00	25.00	23.08	315	307.5	322.5								
			17.00	48.44	51.56	0.00	26.56	25.00	330	322.5	337.5								
			24.00	45.85	53.17	0.98	28.29	24.88	345	337.5	352.5								
			37.00	46.40	52.74	0.86	27.67	25.07	360	352.5	367.5								
			51.00	46.18	52.61	1.20	27.71	24.90	375	367.5	382.5								
			63.00	45.10	53.34	1.56	28.15	25.19											
			74.00	44.65	52.97	2.38	28.40	24.57											
			82.00	44.88	53.12	2.00	28.62	24.50											
			95.00	44.74	52.83	2.43	28.54	24.29											
			107.00	44.66	52.60	2.74	28.31	24.29											
			117.00	44.44	52.30	3.26	28.07	24.23											
			132.00	45.25	51.30	3.45	27.64	23.66											
			142.00	45.86	50.57	3.57	27.14	23.43											
			158.00	46.60	49.87	3.53	26.73	23.13											
			173.00	46.56	49.70	3.74	26.87	22.83											
			223.00	46.93	48.61	4.46	25.97	22.65											
			227.00	47.03	48.57	4.40	25.91	22.65											



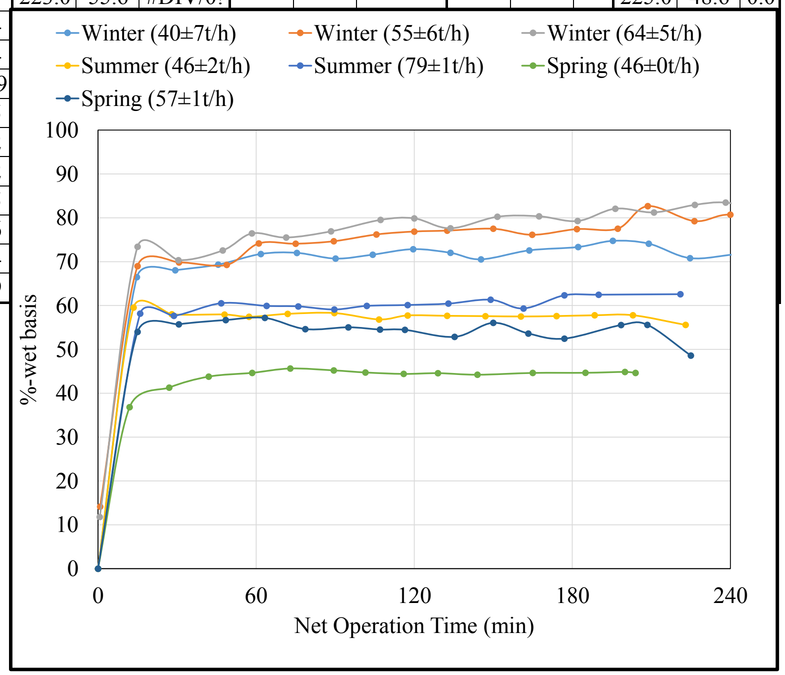
Spring Season - Average Feed Rate (57±1 t/h)

Column Description:
- C#1 to C#3 are trial information, including trial month and number, wet and dry feed rates in tonnage per hour units.
- C#4 is Net Operation Time.
- C#5 to C#9 are calculated quantities of different waste streams separated from the feedstock at corresponding net operation time, i.e., total cumulative weight of the waste stream divided by the total amount of material in feed (expressed as % by wet weight).
- C#10 represents 15 minute time intervals, with ± 7.5 minutes lower and upper limits in Columns C#11 & C#12.
- C#13 and C#14 are the mean and standard deviation of the net operation times in C#7 that fall within every lower and upper limits range shown in C#5 and C#6.
- C#15 and C#16 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's first unders (<2 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#17 and C#18 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's second unders (<9 inch waste material) corresponding to the mean net operation time calculated in C#13.
- C#19 and C#20 are the mean and standard deviation of Separation Results (S-%) regarding the trommel's overs (>9 inch waste material) corresponding to the mean net operation time calculated in C#13.

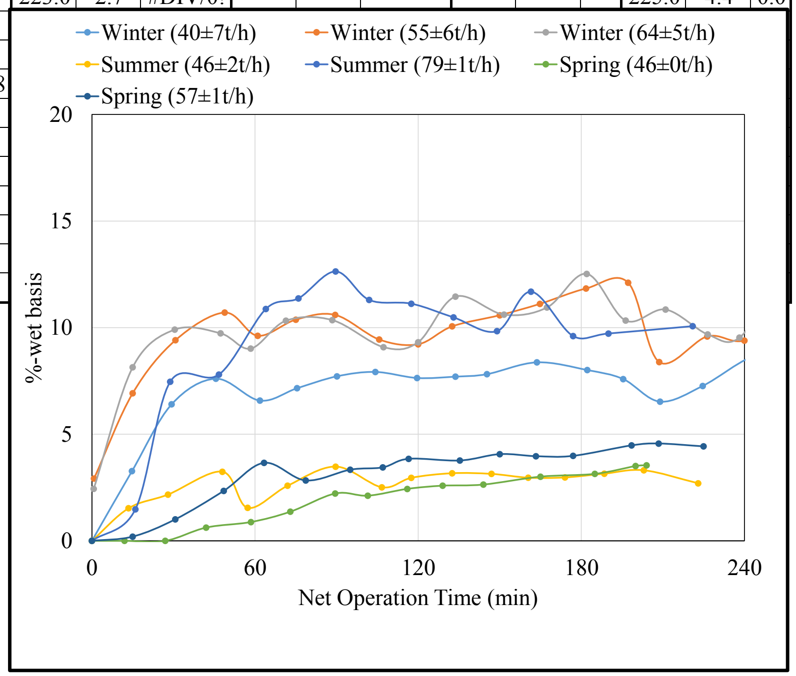
Separation of Trommel's First Unders																				
Winter (40±7t/h)			Winter (55±6t/h)			Winter (64±5t/h)			Summer (46±2t/h)			Summer (79±1t/h)			Spring (46±0t/h)			Spring (57±1t/h)		
Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD
0.0	0.0	0.0	0.8	2.9	6.5	0.7	2.4	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
14.8	30.3	2.9	15.0	24.7	7.2	15.0	18.9	5.8	13.5	39.8	7.8	16.0	40.4	0.0	12.0	63.2		15.0	48.1	7.9
29.3	25.6	1.5	30.8	20.8	4.2	30.5	19.7	2.7	28.0	39.8	4.0	28.8	34.9	1.9	27.0	58.7		30.7	43.3	5.0
45.6	23.1	1.7	48.8	20.0	2.4	47.3	17.7	4.5	48.0	38.8	2.9	46.8	31.7	2.3	42.0	55.6		48.5	41.0	7.4
61.8	21.7	2.6	61.0	16.2	3.5	58.4	14.5	3.9	57.3	41.0	4.3	64.0	29.2	2.3	58.5	54.5		63.3	39.2	5.2
75.5	20.8	4.0	75.0	15.5	3.8	71.4	14.2	3.5	72.0	39.3	5.5	76.0	28.8	2.1	73.0	53.0		78.7	42.5	3.9
90.2	21.6	4.7	89.5	14.7	3.7	88.4	12.7	2.3	89.7	38.2	4.4	89.7	28.3	1.7	89.5	52.6		95.0	41.6	4.4
104.3	20.5	5.0	105.7	14.4	4.6	107.3	11.4	2.0	106.7	40.7	4.3	102.0	28.8	1.3	101.5	53.1		107.0	42.0	3.7
119.6	19.5	4.7	120.0	13.9	4.7	120.0	10.8	1.7	117.5	39.3	5.2	117.5	28.8	1.1	116.0	53.2		116.5	41.7	3.9
133.8	20.3	5.3	132.5	12.9	4.2	133.8	10.9	0.4	132.5	39.2	4.8	133.0	29.1	0.2	129.0	52.8		135.3	43.4	3.8
145.3	21.7	5.7	150.0	11.9	4.6	151.6	9.1	1.1	147.0	39.3	4.6	149.0	28.8	0.1	144.0	53.1		150.0	39.9	0.6
163.7	19.1	4.6	164.8	12.8	5.0	167.4	8.7	1.0	160.5	39.5	4.4	161.5	29.0	1.0	165.0	52.4		163.3	42.4	3.6
182.2	18.7	5.4	181.8	10.7	4.4	182.0	8.2	0.8	174.0	39.4	4.6	177.0	28.1	#DIV/0!	185.0	52.2		177.0	43.6	4.2
195.4	18.2	5.7	197.3	10.4	4.4	196.3	7.6	1.0	188.5	39.1	4.6	190.0	27.8	#DIV/0!	200.0	51.6		198.5	40.0	0.1
209.0	19.4	7.9	208.7	9.0	1.4	211.0	7.9	1.5	203.0	38.9	4.3	221.0	27.3	#DIV/0!	204.0	51.8		208.5	39.8	0.0
224.7	21.9	7.3	226.3	11.2	5.1	226.5	7.4	1.7	223.0	41.7	#DIV/0!							225.0	47.0	0.1
242.3	19.7	8.1	240.0	9.9	4.9	238.2	7.0	1.6												
256.3	19.5	8.3	260.0	11.3	7.5	254.8	5.9	0.2												
270.3	19.3	8.6	271.0	16.3	#DIV/0!	266.5	5.6	0.1												
285.0	19.0	8.9	284.0	9.1	5.9	282.5	5.5	0.2												
299.7	18.7	9.3	300.5	10.4	7.1	301.3	5.3	0.1												
314.7	18.4	9.5	313.0	10.1	6.9	314.3	5.2	0.1												
328.0	18.3	9.8	325.5	9.9	6.8	327.5	5.0	0.1												
345.0	19.3	8.7	343.3	11.2	5.4	342.5	4.9	0.1												
361.3	17.8	10.3	359.5	9.2	6.1	360.3	4.7	0.1												
375.5	21.4	11.8	375.3	7.5	4.8	373.0	4.6	0.1												



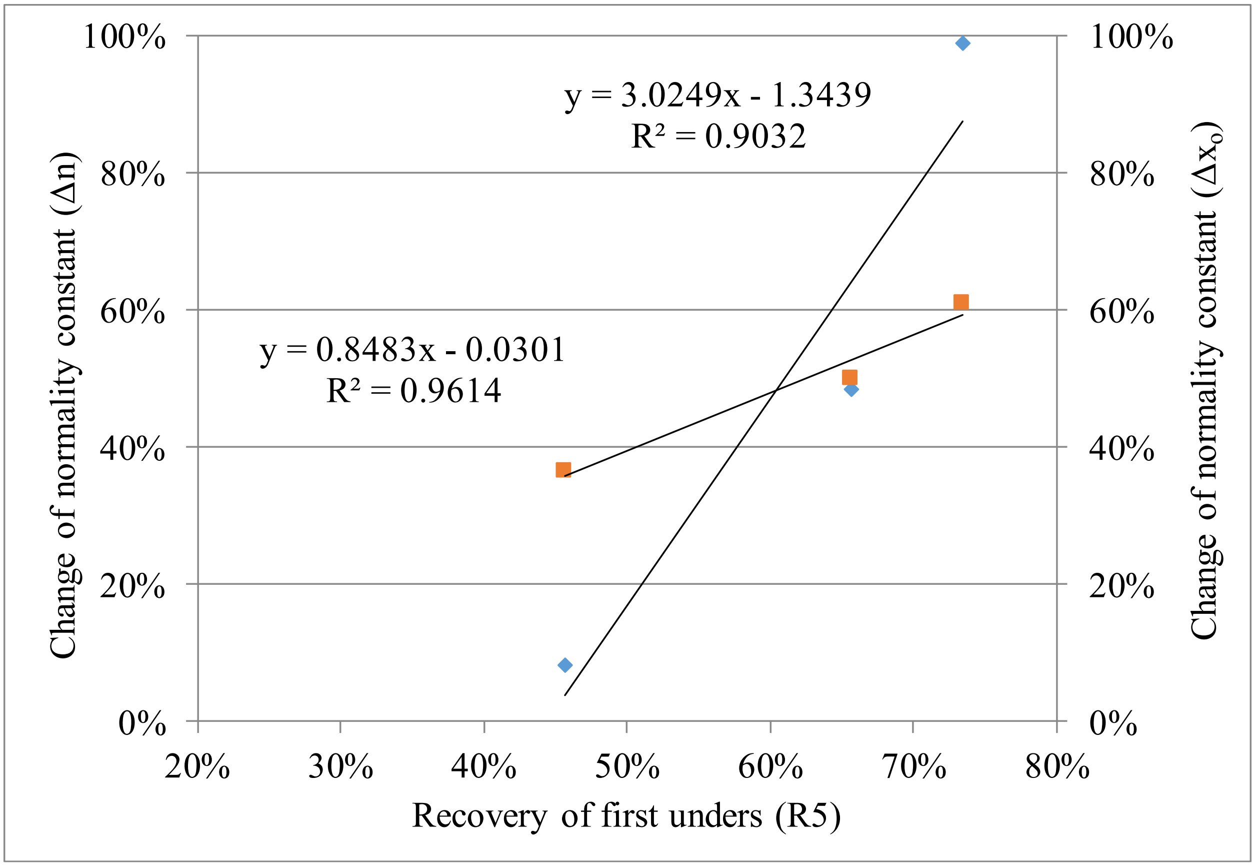
Separation of Trommel's Second Unders																				
Winter (40±7t/h)			Winter (55±6t/h)			Winter (64±5t/h)			Summer (46±2t/h)			Summer (79±1t/h)			Spring (46±0t/h)			Spring (57±1t/h)		
Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD
0.0	0.0	0.0	0.8	14.1	31.6	0.7	11.8	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
14.8	66.5	4.2	15.0	69.0	7.1	15.0	73.4	8.2	13.5	59.6	4.7	16.0	58.2	0.2	12.0	36.8		15.0	54.0	7.4
29.3	68.0	4.1	30.8	69.8	7.1	30.5	70.3	6.5	28.0	58.0	1.6	28.8	57.6	0.8	27.0	41.3		30.7	55.7	4.8
45.6	69.3	3.3	48.8	69.3	4.5	47.3	72.6	7.7	48.0	58.0	1.1	46.8	60.5	2.6	42.0	43.8		48.5	56.7	5.8
61.8	71.8	2.7	61.0	74.2	4.7	58.4	76.4	7.0	57.3	57.4	2.4	64.0	59.9	4.2	58.5	44.7		63.3	57.2	3.4
75.5	72.0	3.8	75.0	74.1	5.7	71.4	75.5	7.7	72.0	58.1	3.0	76.0	59.8	3.8	73.0	45.6		78.7	54.6	2.7
90.2	70.7	3.2	89.5	74.7	5.0	88.4	76.9	5.7	89.7	58.3	2.6	89.7	59.1	2.6	89.5	45.2		95.0	55.0	3.1
104.3	71.6	3.7	105.7	76.2	6.5	107.3	79.5	6.5	106.7	56.8	2.6	102.0	59.9	3.6	101.5	44.7		107.0	54.5	2.7
119.6	72.9	4.1	120.0	76.9	6.4	120.0	79.9	6.8	117.5	57.7	3.2	117.5	60.1	3.3	116.0	44.4		116.5	54.5	3.1
133.8	72.0	4.3	132.5	77.1	5.3	133.8	77.6	4.3	132.5	57.7	3.1	133.0	60.4	3.1	129.0	44.6		135.3	52.9	3.3
145.3	70.5	3.8	150.0	77.5	5.4	151.6	80.2	6.7	147.0	57.6	3.3	149.0	61.3	2.0	144.0	44.2		150.0	56.1	0.4
163.7	72.6	4.1	164.8	76.1	5.8	167.4	80.3	6.2	160.5	57.5	3.1	161.5	59.3	4.1	165.0	44.6		163.3	53.6	3.3
182.2	73.3	4.8	181.8	77.4	5.7	182.0	79.3	6.3	174.0	57.6	3.3	177.0	62.3	#DIV/0!	185.0	44.7		177.0	52.5	3.9
195.4	74.7	6.2	197.3	77.5	5.5	196.3	82.1	6.6	188.5	57.8	3.3	190.0	62.5	#DIV/0!	200.0	44.9		198.5	55.5	0.0
209.0	74.1	7.4	208.7	82.7	1.2	211.0	81.2	5.8	203.0	57.8	3.3	221.0	62.6	#DIV/0!	204.0	44.7		208.5	55.6	0.0
224.7	70.8	6.7	226.3	79.3	6.9	226.5	83.0	6.1	223.0	55.6	#DIV/0!							225.0	48.6	0.0
242.3	71.7	7.0	240.0	80.7	6.2	238.2	83.5	5.4												
256.3	71.7	7.1	260.0	78.1	9.5	254.8	81.7	7.4												
270.3	71.9	7.5	271.0	71.8	#DIV/0!	266.5	83.2	10.9												
285.0	72.2	7.9	284.0	80.8	7.3	282.5	84.1	6.5												
299.7	72.6	8.2	300.5	79.2	8.6	301.3	83.9	8.2												
314.7	72.7	8.5	313.0	79.3	8.6	314.3	84.0	8.2												
328.0	72.7	8.9	325.5	79.1	8.7	327.5	88.5	4.5												
345.0	70.1	5.6	343.3	77.4	6.9	342.5	88.6	4.6												
361.3	72.9	9.3	359.5	79.4	8.4	360.3	90.4	3.4												
375.5	68.4	7.3	375.3	81.5	6.9	373.0	87.7	3.9												



Separation of Trommel's Overs																				
Winter (40±7t/h)			Winter (55±6t/h)			Winter (64±5t/h)			Summer (46±2t/h)			Summer (79±1t/h)			Spring (46±0t/h)			Spring (57±1t/h)		
Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD	Time	Mean	SD
0.0	0.0	0.0	0.8	2.9	6.5	0.7	2.4	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
14.8	3.3	3.6	15.0	6.9	6.3	15.0	8.1	4.8	13.5	1.5	1.9	16.0	1.5	0.3	12.0	0.0		15.0	0.2	0.3
29.3	6.4	3.8	30.8	9.4	5.1	30.5	9.9	5.4	28.0	2.2	2.4	28.8	7.5	2.0	27.0	0.0		30.7	1.0	0.2
45.6	7.6	3.7	48.8	10.7	2.7	47.3	9.7	3.6	48.0	3.2	1.8	46.8	7.8	4.5	42.0	0.6		48.5	2.3	1.6
61.8	6.6	2.8	61.0	9.6	2.8	58.4	9.0	3.8	57.3	1.5	1.9	64.0	10.9	6.4	58.5	0.9		63.3	3.7	1.8
75.5	7.2	3.4	75.0	10.4	3.7	71.4	10.3	4.7	72.0	2.6	2.5	76.0	11.4	5.9	73.0	1.4		78.7	2.8	1.1
90.2	7.7	3.7	89.5	10.6	2.2	88.4	10.4	3.7	89.7	3.5	1.8	89.7	12.6	4.3	89.5	2.2		95.0	3.3	1.3
104.3	7.9	2.8	105.7	9.4	2.6	107.3	9.1	4.7	106.7	2.5	1.7	102.0	11.3	4.9	101.5	2.1		107.0	3.4	1.0
119.6	7.6	2.1	120.0	9.2	2.4	120.0	9.3	5.2	117.5	3.0	2.0	117.5	11.1	4.4	116.0	2.4		116.5	3.8	0.8
133.8	7.7	2.5	132.5	10.1	2.3	133.8	11.5	3.9	132.5	3.2	1.7	133.0	10.5	3.1	129.0	2.6		135.3	3.8	0.5
145.3	7.8	2.9	150.0	10.6	2.7	151.6	10.6	5.8	147.0	3.1	1.3	149.0	9.8	1.9	144.0	2.6		150.0	4.1	0.2
163.7	8.4	2.4	164.8	11.1	2.7	167.4	10.9	5.5	160.5	3.0	1.3	161.5	11.7	3.1	165.0	3.0		163.3	4.0	0.4
182.2	8.0	2.5	181.8	11.8	3.3	182.0	12.5	5.8	174.0	3.0	1.3	177.0	9.6	#DIV/0!	185.0	3.1		177.0	4.0	0.3
195.4	7.6	2.7	197.3	12.1	3.2	196.3	10.3	6.0	188.5	3.2	1.2	190.0	9.7	#DIV/0!	200.0	3.5		198.5	4.5	0.1
209.0	6.5	1.3	208.7	8.4	0.4	211.0	10.8	5.9	203.0	3.3	1.0	221.0	10.1	#DIV/0!	204.0	3.5		208.5	4.6	0.0
224.7	7.3	2.4	226.3	9.6	2.1	226.5	9.7	6.0	223.0	2.7	#DIV/0!							225.0	4.4	0.0
242.3	8.6	2.7	240.0	9.4	1.6	238.2	9.5	5.3												
256.3	8.8	2.9	260.0	10.6	2.1	254.8	12.4	7.3												
270.3	8.8	2.8	271.0	11.9	#DIV/0!	266.5	11.2	10.8												
285.0	8.8	2.6	284.0	10.1	1.4	282.5	10.4	6.5												
299.7	8.7	2.4	300.5	10.4	1.4	301.3	10.8	8.2												
314.7	8.8	2.6	313.0	10.6	1.7	314.3	10.8	8.2												
328.0	9.0	2.9	325.5	11.0	1.9	327.5	6.5	4.4												
345.0	10.6	3.1	343.3	11.5	1.5	342.5	6.5	4.5												
361.3	9.3	3.3	359.5	11.5	2.3	360.3	4.9	3.3												
375.5	10.2	4.5	375.3	11.1	2.0	373.0	7.7	3.8												



A-3: Correlation between (Δn and R_5) and (Δx_o and R_5) in the second unders



APPENDIX B: PARTICLE SIZE DISTRIBUTION RESULTS

The particle size distributions were developed for the total feed samples and its compostable and RDF sub-categories. Particle size distributions were developed for both wet basis and dry basis.

A detailed sample calculation is provided prior to presenting the PSD results.

The summary figure is all dry basis PSDs developed for the total feed, the trommel's second <9 inch unders and >9 inch overs, in support of Figures X in Chapter 3 of this thesis.

Rosin-Rammler Particle Size Distribution

The Rosin-Rammler model is given in $Y = \mathbf{1 - exp(-x/x_o)^n}$

Where:

- Y is the cumulative passing weight fraction of particles smaller than given sieve size x;
- n is "uniformity constant" (constant); and
- x_o is "characteristic particle size," defined as the size at which 63.2 % by weight of the particles are smaller.

Then:

$$ln\left(\frac{1}{1 - Y_x}\right) = (x/x_o)^n$$

$$ln\left[ln\left(\frac{1}{1-Y_x}\right)\right] = nln(x/x_o) = n[ln(x) - ln(x_o)] = nln(x) - n\ ln(x_o)$$

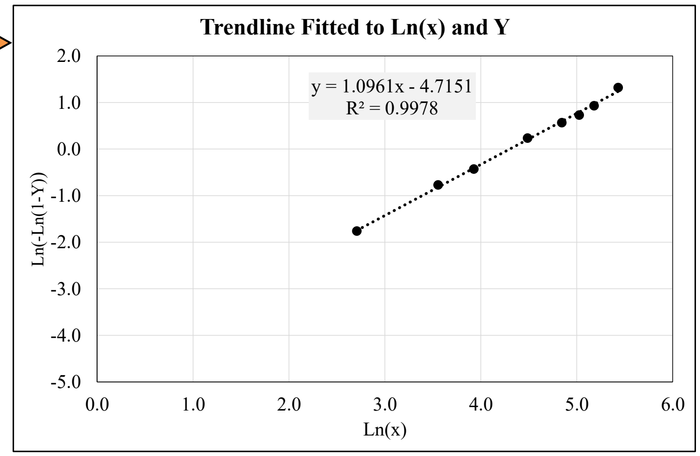
Then plot $ln\left[ln\left(\frac{1}{1-Y_x}\right)\right]$ versus $ln(x)$. The trendline has a general equation of $y = ax + b$, therefore: $y = ln\left[ln\left(\frac{1}{1-Y_x}\right)\right]$; $a = n$; $x = ln(\mathrm{x})$; and $b = -n\ ln(x_o)$

The Constant *n* is the slope of the trendline (i.e. *a*) and graphically, the interception of the resultant trendline (i.e., *b*) will be equal to -$nln(\mathrm{x_o})$, thus the value of x_o is $exp\left(\frac{b}{n}\right)$ or $exp\left(\frac{b}{a}\right)$.

Rosin-Rammler Particle Size Distribution Fitting Calculations										
Sieve Size (x)		Wet Sieve Analysis								
		Sieve Data			PSD Fitting Plot					
inch	mm	% Retained	Cumulative % Retained	Cumulative % Passed (Y)	Ln(x)	Ln(Ln(1/(1-Y))	Calculated Ln(Ln(1/(1-Y)))	Calculated Cumulative % Passed (Y)	Calculated Cumulative % Retained
C#1		C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9
75.0	1905	0.0%	0.0%	100.0%	7.55		3.56	100.0%	0.0%
9.0	229	2.4%	2.4%	97.6%	5.43	1.32	1.24	96.8%	3.2%
7.0	**178**	**5.6%**	**7.9%**	**92.1%**	**5.18**	**0.93**	**0.96**	**92.7%**	**7.3%**
6.0	152	4.6%	12.6%	87.4%	5.03	0.73	0.79	89.1%	10.9%
5.0	127	4.6%	17.2%	82.8%	4.84	0.57	0.59	83.7%	16.3%
3.5	89	11.1%	28.2%	71.8%	4.49	0.23	0.20	70.7%	29.3%
2.0	51	23.9%	52.2%	47.8%	3.93	-0.43	-0.41	48.5%	51.5%
1.4	35	10.8%	63.0%	37.0%	3.56	-0.77	-0.82	35.7%	64.3%
0.6	15	21.2%	84.2%	15.8%	2.71	-1.76	-1.75	16.0%	84.0%
0	0	15.8%	100.0%	0.0%			-4.72	0.9%	99.1%
					Plotted				

Note: the largest particle size was assumed to be 75 inch, the largest sieve size used was 9 inch (or 229 mm).

Summary of Results		
R^2 =	0.999	Coefficient of correlation between obtained and calculated value of cumulative % passed.
R^2 =	0.999	Coefficient of correlation between obtained and calculated value of cumulative % retained.
n =	1.096	uniformity constant
$n.ln(x_o)$ =	-4.715	
x_0 (mm)	73.819	characteristic particle size
x_0 (inch)	2.906	
R^2 =	0.998	Coefficient of Correlation for Trendline Fitted to Ln(x) and Y
D_{60} =	68.160	Sieve size which 60% by weight of sample passes through.
D_{10} =	9.474	Sieve size which 10% by weight of sample passes through.
UC = D_{60} /	7.194	Uniformity Coefficient = D60/D10



Column Description and Sample Calculation for Highlighted Row

C#1: Sieve size (inch and millimeter units)

C#2: Fraction of sample retaining on top of any respective sieve size, expressed as % by weight of total sample obtained from sieve analysis.

C#3: Cumulative fraction of sample retaining on top of the respective sieve size, expressed as % by weight of total sample (7.9%=2.4% (from previous row)+5.6%(from C#2)

C#4: Cumulative fraction of sample passing through the respective sieve size, expressed as % by weight of total sample (92.1%=100%-7.9% (from C#3)

C#5: Natural logarithm of size x (5.18=ln(178))

C#6: Ln(Ln(1/(1-Y)) using Y data provided in C#3, 0.93=Ln(Ln(1/(1-0.921))

C#7: Ln(Ln(1/(1-Y)) calculated based on calculated values of Ln (x) provided in C#5 and n and x_o provided in the summary table above. 0.96=5.18x1.096-4.715

C#8: Calculated value of cumulative % passed for any given sieve size, which equal to 1-1/EXP(EXP(value given in C#7)) (92.7%=1-1/EXP(EXP(0.96))

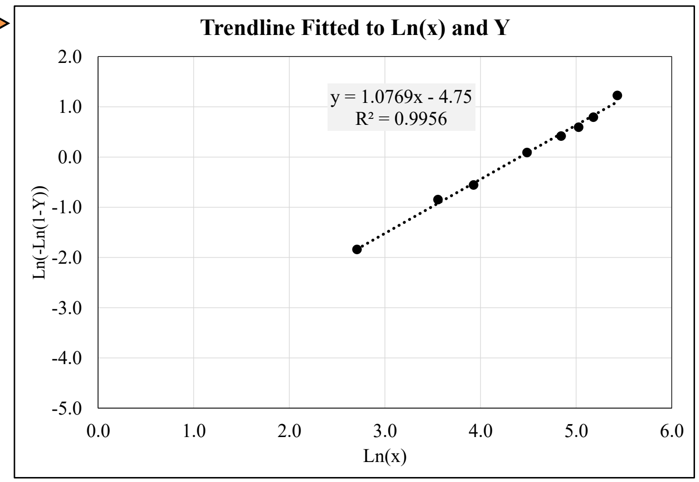
C#9: Calculated value of cumulative % retained on any given sieve size, which is equal to 100%-cumulative % passed provided in C#8 (7.3%-100%-92.7%)

Rosin-Rammler Particle Size Distribution Fitting Calculations

Sieve Size (x)		Dry Sieve Analysis								
		Sieve Data			PSD Fitting Plot					
inch	mm	% Retained	Cumulative % Retained	Cumulative % Passed (Y)	Ln(x)	Ln(Ln(1/(1-Y))	Calculated Ln(Ln(1/(1-Y)))	Calculated Cumulative % Passed (Y)	Calculated Cumulative % Retained
C#1		C#2	C#3	C#4	C#5	C#6	C#7	C#8	C#9
75(*)	1905	0.0%	0.0%	100.0%	7.55		3.38	100.0%	0.0%
9.0	229	3.3%	3.3%	96.7%	5.43	1.22	1.10	95.0%	5.0%
7.0	**178**	**7.6%**	**11.0%**	**89.0%**	**5.18**	**0.79**	**0.83**	**89.9%**	**10.1%**
6.0	152	5.4%	16.4%	83.6%	5.03	0.59	0.66	85.6%	14.4%
5.0	127	5.5%	21.9%	78.1%	4.84	0.42	0.47	79.7%	20.3%
3.5	89	11.6%	33.5%	66.5%	4.49	0.09	0.08	66.3%	33.7%
2.0	51	22.9%	56.4%	43.6%	3.93	-0.56	-0.52	44.8%	55.2%
1.4	35	8.8%	65.2%	34.8%	3.56	-0.85	-0.92	32.8%	67.2%
0.6	15	20.1%	85.3%	14.7%	2.71	-1.84	-1.83	14.8%	85.2%
0	0	14.7%	100.0%	0.0%			-4.75	0.9%	99.1%
					Plotted				

Note: the largest particle size was assumed to be 75 inch, the largest sieve size used was 9 inch (or 229 mm).

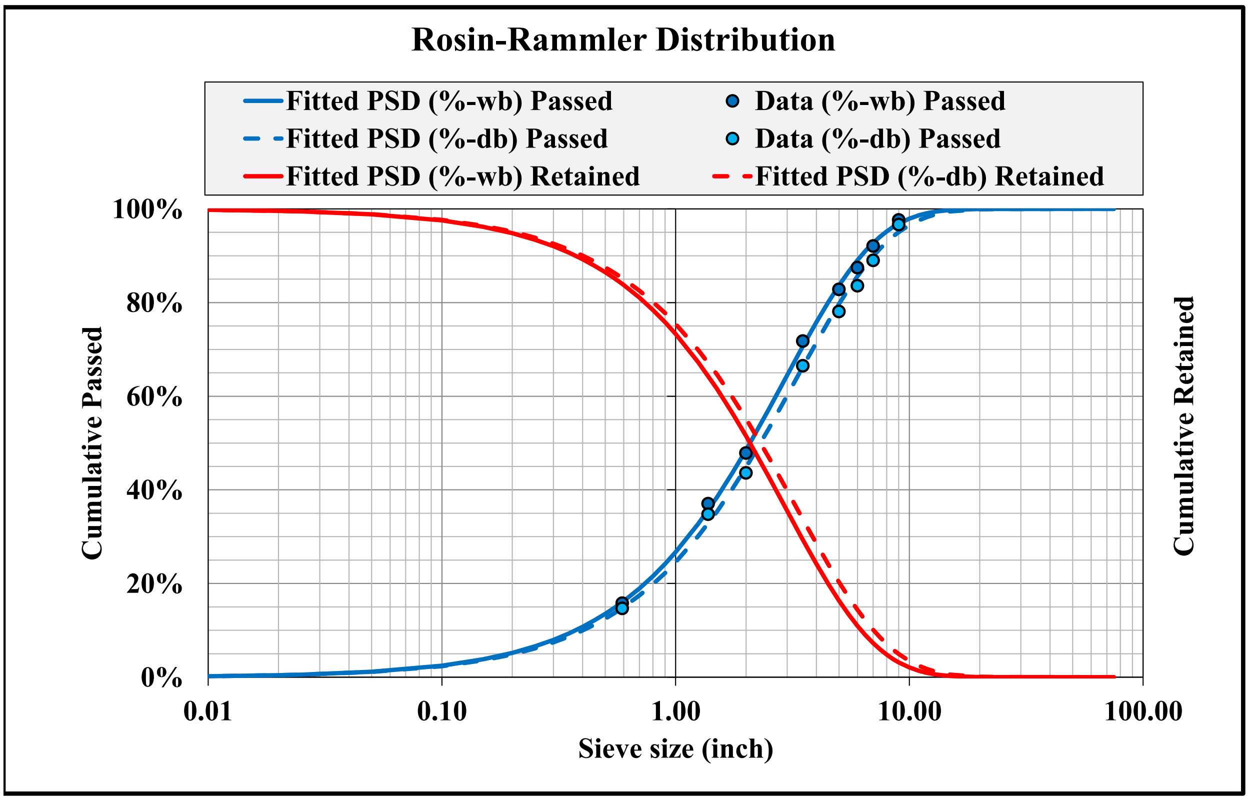
Summary of Results		
$R^2 =$	0.998	Coefficient of correlation between obtained and calculated value of cumulative % passed.
$R^2 =$	0.998	Coefficient of correlation between obtained and calculated value of cumulative % retained.
n =	1.077	uniformity constant
$n.\ln(x_o) =$	-4.750	
x_0 (mm)	82.328	characteristic particle size
x_0 (inch)	3.241	
$R^2 =$	0.996	Coefficient of Correlation for Trendline Fitted to Ln(x) and Y
$D_{60} =$	75.909	Sieve size which 60% by weight of sample passes through.
$D_{10} =$	10.187	Sieve size which 10% by weight of sample passes through.
$UC = D_{60} / D_{10}$	7.452	Uniformity Coefficient = D60/D10



Fitted PSD						
inch	Wet Sieve Analysis			Dry Sieve Analysis		
	Ln (-Ln(1-Y))	Cum. Passed %	Cum. Retained	Ln (-Ln(1-Y))	Cum. Passed %	Cum. Retained
75.00	3.56	100.0%	0.0%	3.38	100.0%	0.0%
60.00	3.32	100.0%	0.0%	3.14	100.0%	0.0%
50.00	3.12	100.0%	0.0%	2.95	100.0%	0.0%
45.00	3.00	100.0%	0.0%	2.83	100.0%	0.0%
40.00	2.87	100.0%	0.0%	2.71	100.0%	0.0%
35.00	2.73	100.0%	0.0%	2.56	100.0%	0.0%
30.00	2.56	100.0%	0.0%	2.40	100.0%	0.0%
25.00	2.36	100.0%	0.0%	2.20	100.0%	0.0%
20.00	2.11	100.0%	0.0%	1.96	99.9%	0.1%
15.00	1.80	99.8%	0.2%	1.65	99.5%	0.5%
14.00	1.72	99.6%	0.4%	1.58	99.2%	0.8%
13.00	1.64	99.4%	0.6%	1.50	98.8%	1.2%
12.00	1.55	99.1%	0.9%	1.41	98.3%	1.7%
11.00	1.46	98.6%	1.4%	1.32	97.6%	2.4%
10.00	1.35	97.9%	2.1%	1.21	96.5%	3.5%
9.00	1.24	96.8%	3.2%	1.10	95.0%	5.0%
8.50	1.18	96.1%	3.9%	1.04	94.1%	5.9%
8.00	1.11	95.2%	4.8%	0.97	92.9%	7.1%
7.50	1.04	94.1%	5.9%	0.90	91.5%	8.5%
7.00	0.96	92.7%	7.3%	0.83	89.9%	10.1%
6.50	0.88	91.1%	8.9%	0.75	87.9%	12.1%
6.00	0.79	89.1%	10.9%	0.66	85.6%	14.4%
5.50	0.70	86.6%	13.4%	0.57	82.9%	17.1%
5.00	0.59	83.7%	16.3%	0.47	79.7%	20.3%
4.50	0.48	80.1%	19.9%	0.35	75.9%	24.1%
4.00	0.35	75.8%	24.2%	0.23	71.5%	28.5%
3.50	0.20	70.7%	29.3%	0.08	66.3%	33.7%
3.00	0.03	64.5%	35.5%	-0.08	60.2%	39.8%
2.50	-0.17	57.2%	42.8%	-0.28	53.0%	47.0%
2.00	-0.41	48.5%	51.5%	-0.52	44.8%	55.2%
1.75	-0.56	43.6%	56.4%	-0.66	40.2%	59.8%
1.50	-0.72	38.4%	61.6%	-0.83	35.3%	64.7%
1.25	-0.92	32.7%	67.3%	-1.03	30.1%	69.9%
1.00	-1.17	26.7%	73.3%	-1.27	24.6%	75.4%
0.90	-1.28	24.2%	75.8%	-1.38	22.2%	77.8%
0.80	-1.41	21.6%	78.4%	-1.51	19.9%	80.1%
0.70	-1.56	18.9%	81.1%	-1.65	17.5%	82.5%
0.60	-1.73	16.3%	83.7%	-1.82	15.0%	85.0%
0.55	-1.82	14.9%	85.1%	-1.91	13.8%	86.2%

Fitted PSD						
inch	Wet Sieve Analysis			Dry Sieve Analysis		
	Ln (-Ln(1-Y))	Cum. Passed %	Cum. Retained	Ln (-Ln(1-Y))	Cum. Passed %	Cum. Retained
0.50	-1.93	13.5%	86.5%	-2.01	12.5%	87.5%
0.45	-2.04	12.1%	87.9%	-2.13	11.2%	88.8%
0.40	-2.17	10.8%	89.2%	-2.25	10.0%	90.0%
0.35	-2.32	9.4%	90.6%	-2.40	8.7%	91.3%
0.30	-2.49	8.0%	92.0%	-2.56	7.4%	92.6%
0.25	-2.69	6.6%	93.4%	-2.76	6.1%	93.9%
0.20	-2.93	5.2%	94.8%	-3.00	4.9%	95.1%
0.15	-3.25	3.8%	96.2%	-3.31	3.6%	96.4%
0.10	-3.69	2.5%	97.5%	-3.75	2.3%	97.7%
0.05	-4.45	1.2%	98.8%	-4.49	1.1%	98.9%
0.03	-5.21	0.5%	99.5%	-5.24	0.5%	99.5%
0.02	-5.46	0.4%	99.6%	-5.48	0.4%	99.6%
0.01	-6.22	0.2%	99.8%	-6.23	0.2%	99.8%

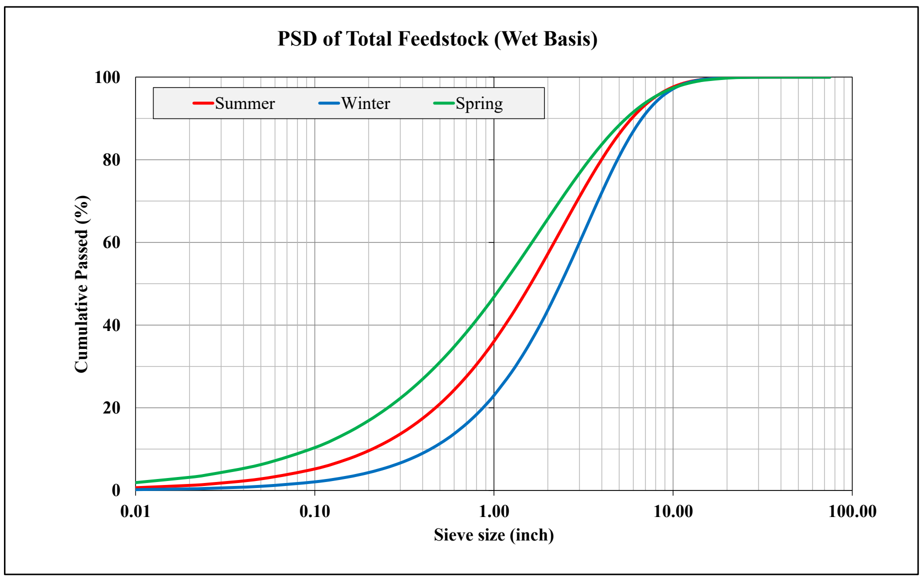
Note: Highlighted sieve size (i.e., 9 inch to 0.55 inch) represents the range sieve analysis data was, PSD outside this range was projections.



Fitting Rosin-Rammler Distribution to Total Feedstock

Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.98	1.00	1.00	1.00	0.97	1.00	0.98	0.98	0.98	0.99	0.99	1.00	0.98	0.99	0.97	1.00	1.00	1.00						
n =		0.94	1.19	0.95	1.09	0.79	0.81	0.71	0.77	1.02	0.94	0.89	0.87	1.51	1.29	1.36	1.09	1.20	1.01						
n x ln(D_N) =		-4.24	-5.28	-4.15	-4.82	-3.18	-3.18	-2.67	-2.77	-4.28	-3.72	-3.74	-3.55	-6.79	-5.86	-5.97	-4.69	-5.15	-4.38						
D_N (mm)		88.81	85.42	78.02	82.66	55.90	50.74	43.96	36.76	65.17	52.21	66.29	59.32	90.50	95.59	79.79	73.49	72.41	75.94						
D_N (in)		3.50	3.36	3.07	3.25	2.20	2.00	1.73	1.45	2.57	2.06	2.61	2.34	3.56	3.76	3.14	2.89	2.85	2.99						
R^2 =		0.97	0.99	0.99	0.99	0.98	0.99	0.93	0.95	0.98	0.97	0.98	0.99	0.98	0.97	0.96	1.00	1.00	0.99						
D_{60} =		80.95	79.36	71.18	76.31	50.04	45.55	38.83	32.80	59.84	47.58	60.10	53.64	85.40	89.30	74.83	67.83	67.33	69.65						
D_{10} =		8.19	12.83	7.35	10.54	3.23	3.16	1.81	1.96	7.23	4.78	5.32	4.45	20.34	16.61	15.29	9.35	11.16	8.20						
UC =		9.88	6.19	9.69	7.24	15.47	14.40	21.48	16.73	8.27	9.95	11.30	12.06	4.20	5.38	4.89	7.25	6.03	8.49						
Sieve Size		**Percent of of material passed at any given size (%-wet basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	99.8	100.0	99.9	100.0	99.9	100.0	99.9	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.1	99.9	0.1
20.00	508.0	99.4	100.0	99.7	99.9	99.7	99.8	99.6	99.9	100.0	100.0	99.8	99.8	100.0	100.0	100.0	100.0	100.0	99.9	99.9	0.1	99.9	0.2	99.8	0.1
15.00	381.0	98.1	99.7	98.9	99.5	98.9	99.4	99.0	99.8	99.8	99.8	99.1	99.3	100.0	99.7	100.0	99.8	99.9	99.4	99.5	0.3	99.5	0.6	99.3	0.4
14.00	355.6	97.5	99.6	98.6	99.3	98.7	99.2	98.7	99.7	99.7	99.8	98.9	99.1	100.0	99.6	100.0	99.6	99.9	99.1	99.4	0.4	99.3	0.8	99.1	0.5
13.00	330.2	96.8	99.3	98.1	98.9	98.3	99.0	98.4	99.5	99.5	99.7	98.5	98.8	99.9	99.3	99.9	99.4	99.8	98.8	99.1	0.6	99.0	1.0	98.8	0.6
12.00	304.8	95.9	98.9	97.4	98.4	97.8	98.6	98.0	99.4	99.2	99.5	98.0	98.4	99.8	98.8	99.8	99.1	99.6	98.3	98.8	0.7	98.6	1.2	98.5	0.7
11.00	279.4	94.8	98.3	96.6	97.7	97.2	98.1	97.5	99.1	98.8	99.2	97.3	97.9	99.6	98.1	99.6	98.6	99.4	97.6	98.3	0.9	98.0	1.5	98.0	0.9
10.00	254.0	93.3	97.4	95.4	96.7	96.3	97.5	96.8	98.8	98.2	98.8	96.4	97.1	99.1	97.0	99.2	97.9	98.9	96.6	97.6	1.1	97.2	1.8	97.4	1.1
9.00	228.6	91.3	96.0	93.8	95.2	95.2	96.6	95.9	98.3	97.3	98.2	95.1	96.0	98.2	95.4	98.5	96.8	98.1	95.3	96.7	1.4	95.9	2.2	96.5	1.3
8.50	215.9	90.1	95.0	92.8	94.2	94.5	96.1	95.4	98.0	96.7	97.8	94.3	95.4	97.6	94.2	97.9	96.1	97.6	94.4	96.0	1.5	95.0	2.4	96.0	1.5
8.00	203.2	88.8	93.9	91.7	93.1	93.7	95.4	94.7	97.6	95.9	97.3	93.4	94.6	96.6	92.8	97.2	95.2	96.9	93.3	95.3	1.7	93.9	2.6	95.4	1.6
7.50	190.5	87.2	92.5	90.4	91.7	92.8	94.6	94.0	97.1	95.0	96.6	92.3	93.6	95.4	91.2	96.2	94.1	95.9	92.1	94.4	1.8	92.7	2.8	94.6	1.8
7.00	177.8	85.4	90.8	88.8	90.1	91.7	93.7	93.1	96.5	93.9	95.8	91.0	92.5	93.7	89.2	94.9	92.7	94.8	90.6	93.3	2.0	91.1	3.0	93.8	2.0
6.50	165.1	83.4	88.8	87.0	88.1	90.5	92.6	92.1	95.8	92.5	94.8	89.5	91.2	91.6	86.7	93.2	91.1	93.3	88.8	92.0	2.2	89.2	3.1	92.8	2.2
6.00	152.4	81.1	86.3	84.9	85.8	89.0	91.3	91.0	94.9	90.8	93.6	87.8	89.7	88.9	83.8	91.1	89.1	91.4	86.8	90.4	2.4	86.9	3.2	91.5	2.5
5.50	139.7	78.4	83.4	82.5	83.0	87.3	89.7	89.6	93.8	88.7	92.0	85.7	87.8	85.4	80.4	88.3	86.7	89.0	84.3	88.6	2.6	84.1	3.3	90.1	2.7
5.00	127.0	75.4	79.8	79.6	79.8	85.2	87.8	87.9	92.5	86.2	90.1	83.2	85.6	81.1	76.3	84.8	83.8	86.0	81.4	86.3	2.8	80.8	3.4	88.4	3.0
4.50	114.3	71.9	75.7	76.3	75.9	82.8	85.5	85.9	90.8	83.1	87.6	80.3	82.9	75.9	71.6	80.4	80.2	82.3	78.0	83.5	3.0	76.8	3.5	86.3	3.4
4.00	101.6	67.9	70.7	72.4	71.4	79.9	82.7	83.6	88.7	79.3	84.6	76.9	79.7	69.6	66.1	75.1	75.9	77.8	73.9	80.1	3.2	72.1	3.7	83.7	3.7
3.50	88.9	63.2	65.0	67.8	66.1	76.4	79.3	80.7	86.1	74.7	80.8	72.7	75.9	62.2	59.8	68.6	70.8	72.2	69.0	76.0	3.4	66.5	3.9	80.6	4.1
3.00	76.2	57.9	58.2	62.4	59.9	72.1	75.1	77.1	82.6	69.1	76.0	67.8	71.1	53.8	52.6	60.9	64.7	65.5	63.3	71.0	3.6	59.9	4.3	76.7	4.4
2.50	63.5	51.7	50.5	56.0	52.7	66.9	69.9	72.6	78.2	62.2	70.0	61.8	65.4	44.4	44.6	51.9	57.4	57.4	56.6	64.8	3.8	52.3	4.8	71.9	4.8
2.00	50.8	44.6	41.7	48.5	44.4	60.4	63.2	67.0	72.2	53.9	62.3	54.6	58.3	34.2	35.8	41.8	48.7	47.9	48.6	57.3	3.9	43.6	5.3	65.7	5.1
1.75	44.5	40.6	36.9	44.3	39.8	56.6	59.3	63.5	68.6	49.1	57.7	50.4	54.1	29.0	31.2	36.3	43.9	42.6	44.1	52.8	3.9	38.9	5.4	62.0	5.2
1.50	38.1	36.2	31.9	39.7	34.9	52.2	54.7	59.5	64.2	43.9	52.4	45.7	49.4	23.8	26.4	30.6	38.6	37.0	39.2	47.8	3.8	33.8	5.5	57.7	5.3
1.25	31.8	31.5	26.6	34.6	29.6	47.3	49.5	54.8	59.1	38.1	46.5	40.5	44.1	18.6	21.5	24.8	33.0	31.0	33.9	42.3	3.8	28.5	5.4	52.7	5.3

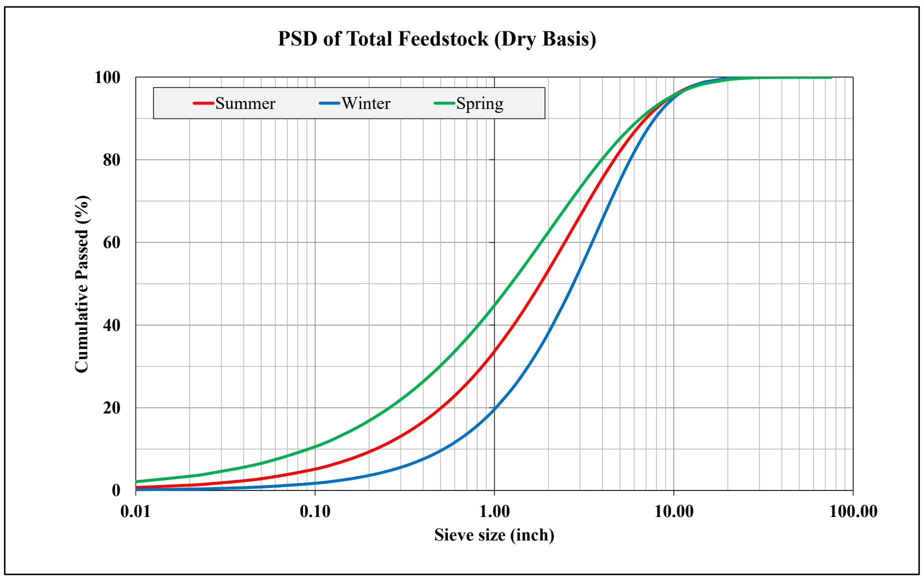
Sieve Size		Percent of of material passed at any given size (%-wet basis)																								
inch	mm																									
1.00	25.4	26.4	21.1	29.1	24.1	41.5	43.5	49.3	52.9	31.7	39.8	34.6	38.0	13.7	16.6	19.0	26.9	24.7	28.1		36.0	3.6	23.0	5.2	46.8	5.2
0.90	22.9	24.2	18.9	26.7	21.8	39.0	40.8	46.8	50.1	29.0	36.8	32.1	35.4	11.8	14.7	16.7	24.4	22.1	25.7		33.3	3.5	20.7	5.0	44.1	5.2
0.80	20.3	22.0	16.6	24.2	19.4	36.2	37.9	44.0	47.0	26.2	33.7	29.4	32.6	10.0	12.8	14.4	21.8	19.5	23.2		30.5	3.4	18.4	4.8	41.3	5.1
0.70	17.8	19.7	14.4	21.7	17.0	33.3	34.8	41.0	43.6	23.2	30.4	26.6	29.6	8.2	10.9	12.1	19.1	16.8	20.6		27.5	3.3	16.1	4.5	38.2	4.9
0.60	15.2	17.2	12.1	19.0	14.6	30.1	31.4	37.7	39.9	20.2	26.9	23.6	26.4	6.6	9.0	10.0	16.4	14.2	17.9		24.3	3.1	13.7	4.2	34.8	4.7
0.55	14.0	16.0	11.0	17.7	13.4	28.4	29.6	36.0	37.9	18.7	25.1	22.1	24.8	5.8	8.1	8.9	15.1	12.9	16.5		22.7	3.0	12.5	4.0	33.0	4.6
0.50	12.7	14.7	9.9	16.3	12.1	26.7	27.8	34.1	35.7	17.1	23.2	20.5	23.1	5.0	7.2	7.9	13.7	11.6	15.1		21.0	2.9	11.3	3.8	31.1	4.5
0.45	11.4	13.4	8.8	14.8	10.9	24.8	25.8	32.1	33.5	15.5	21.3	18.8	21.3	4.3	6.3	6.8	12.3	10.3	13.7		19.2	2.7	10.2	3.5	29.1	4.4
0.40	10.2	12.1	7.7	13.4	9.6	22.9	23.8	29.9	31.1	13.9	19.3	17.1	19.4	3.6	5.4	5.9	10.9	9.0	12.3		17.4	2.6	9.0	3.3	26.9	4.2
0.35	8.9	10.8	6.6	11.9	8.4	20.9	21.6	27.7	28.6	12.2	17.2	15.3	17.5	3.0	4.6	4.9	9.5	7.7	10.8		15.6	2.4	7.8	3.0	24.7	4.0
0.30	7.6	9.4	5.5	10.3	7.1	18.7	19.3	25.2	25.8	10.5	15.1	13.5	15.5	2.4	3.8	4.0	8.1	6.4	9.3		13.6	2.2	6.6	2.7	22.3	3.8
0.25	6.4	7.9	4.5	8.8	5.9	16.4	16.9	22.5	22.9	8.8	12.9	11.6	13.4	1.8	3.0	3.1	6.7	5.2	7.8		11.7	2.0	5.5	2.4	19.7	3.5
0.20	5.1	6.5	3.4	7.1	4.6	14.0	14.3	19.6	19.7	7.1	10.6	9.6	11.2	1.3	2.3	2.3	5.3	4.0	6.3		9.6	1.8	4.3	2.0	16.9	3.2
0.15	3.8	5.0	2.5	5.5	3.4	11.3	11.5	16.3	16.1	5.3	8.2	7.5	8.8	0.8	1.6	1.6	3.9	2.8	4.7		7.5	1.5	3.2	1.6	13.8	2.8
0.10	2.5	3.4	1.5	3.8	2.2	8.3	8.4	12.5	12.1	3.5	5.6	5.3	6.3	0.5	0.9	0.9	2.5	1.8	3.2		5.2	1.2	2.1	1.1	10.3	2.3
0.05	1.3	1.8	0.7	2.0	1.0	4.9	4.9	7.9	7.3	1.8	3.0	2.9	3.5	0.2	0.4	0.4	1.2	0.8	1.6		2.8	0.7	1.0	0.6	6.2	1.6
0.03	0.6	0.9	0.3	1.0	0.5	2.9	2.8	4.9	4.3	0.9	1.6	1.6	1.9	0.1	0.2	0.1	0.6	0.3	0.8		1.5	0.4	0.5	0.3	3.7	1.1
0.02	0.5	0.8	0.2	0.8	0.4	2.4	2.4	4.2	3.7	0.7	1.3	1.3	1.6	0.0	0.1	0.1	0.4	0.3	0.6		1.2	0.4	0.4	0.3	3.2	0.9
0.01	0.3	0.4	0.1	0.4	0.2	1.4	1.4	2.6	2.2	0.3	0.7	0.7	0.9	0.0	0.0	0.0	0.2	0.1	0.3		0.6	0.2	0.2	0.1	1.9	0.6



Fitting Rosin-Rammler Distribution to Total Feedstock

Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.97	1.00	0.99	0.99	0.99	0.99	0.97	0.97	0.98	0.99	0.98	0.99	0.99	0.99	0.98	0.99	1.00	0.99						
n =		0.93	1.22	0.98	1.14	0.74	0.79	0.68	0.72	0.95	0.94	0.83	0.85	1.51	1.32	1.32	1.07	1.20	0.99						
n x ln(D_N) =		-4.33	-5.64	-4.55	-5.25	-3.12	-3.23	-2.66	-2.60	-4.08	-3.85	-3.61	-3.59	-6.97	-6.23	-5.97	-4.65	-5.23	-4.46						
D_N (mm)		108.22	100.39	102.02	99.94	66.23	57.97	51.10	36.74	73.31	59.66	78.34	67.13	100.03	113.72	91.63	78.60	79.31	90.36						
D_N (in)		4.26	3.95	4.02	3.93	2.61	2.28	2.01	1.45	2.89	2.35	3.08	2.64	3.94	4.48	3.61	3.09	3.12	3.56						
R^2 =		0.96	1.00	0.99	0.98	0.99	0.98	0.90	0.93	0.98	0.96	0.96	0.98	0.98	0.98	0.97	0.99	1.00	0.98						
D_{60} =		52.36	58.00	51.51	55.45	26.86	24.90	18.92	14.48	36.13	29.24	34.77	30.56	64.19	68.26	55.12	41.86	45.21	45.87						
D_{10} =		9.51	15.98	10.34	13.89	3.22	3.42	1.83	1.62	6.85	5.47	5.15	4.81	22.63	20.57	16.70	9.53	12.07	9.32						
UC =		5.51	3.63	4.98	3.99	8.34	7.28	10.33	8.92	5.27	5.34	6.75	6.35	2.84	3.32	3.30	4.39	3.75	4.92						
Sieve Size		**Percent of of material passed at any given size (%-Dry basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	99.9	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	99.9	0.1
30.00	762.0	99.8	100.0	99.9	100.0	99.8	100.0	99.8	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.1	100.0	0.1	99.9	0.1
25.00	635.0	99.4	100.0	99.8	100.0	99.5	99.9	99.6	100.0	100.0	100.0	99.6	99.9	100.0	100.0	100.0	100.0	100.0	99.9	99.9	0.2	99.9	0.2	99.7	0.2
20.00	508.0	98.5	99.9	99.2	99.8	98.9	99.6	99.1	99.9	99.8	99.9	99.1	99.6	100.0	99.9	100.0	99.9	100.0	99.6	99.6	0.4	99.7	0.5	99.4	0.4
15.00	381.0	95.9	99.4	97.4	99.0	97.5	98.9	98.0	99.6	99.2	99.7	97.5	98.8	99.9	99.3	99.9	99.5	99.9	98.4	98.8	0.9	98.9	1.3	98.5	0.9
14.00	355.6	95.1	99.1	96.7	98.6	97.0	98.5	97.6	99.4	98.9	99.5	97.0	98.4	99.9	98.9	99.8	99.3	99.8	97.9	98.4	1.1	98.5	1.6	98.1	1.1
13.00	330.2	94.0	98.6	95.8	98.0	96.3	98.1	97.1	99.2	98.5	99.3	96.3	98.0	99.8	98.3	99.6	99.0	99.6	97.3	98.0	1.3	98.0	1.9	97.7	1.3
12.00	304.8	92.6	98.0	94.7	97.2	95.6	97.6	96.5	99.0	97.9	99.0	95.4	97.4	99.5	97.4	99.3	98.6	99.3	96.4	97.4	1.5	97.3	2.2	97.2	1.5
11.00	279.4	91.0	97.0	93.2	96.0	94.6	97.0	95.7	98.7	97.2	98.6	94.3	96.6	99.1	96.2	98.7	97.9	98.9	95.3	96.7	1.8	96.3	2.6	96.5	1.7
10.00	254.0	88.9	95.6	91.4	94.5	93.4	96.1	94.8	98.2	96.1	98.0	92.9	95.6	98.3	94.4	97.9	97.0	98.2	93.8	95.6	2.1	95.0	3.1	95.6	2.0
9.00	228.6	86.4	93.5	89.0	92.3	91.9	94.9	93.6	97.6	94.7	97.1	91.1	94.2	97.0	91.8	96.5	95.6	97.1	91.9	94.3	2.5	93.1	3.6	94.5	2.4
8.50	215.9	85.0	92.2	87.6	91.0	91.0	94.2	92.9	97.2	93.8	96.5	90.1	93.4	95.9	90.2	95.5	94.7	96.3	90.6	93.5	2.6	91.9	3.8	93.8	2.6
8.00	203.2	83.3	90.7	86.0	89.4	90.0	93.3	92.1	96.8	92.8	95.8	88.9	92.4	94.6	88.3	94.3	93.6	95.4	89.3	92.5	2.8	90.5	4.0	93.1	2.8
7.50	190.5	81.5	88.8	84.2	87.6	88.9	92.4	91.2	96.2	91.6	94.9	87.6	91.3	93.0	86.1	92.8	92.3	94.2	87.7	91.3	3.0	88.8	4.2	92.2	3.1
7.00	177.8	79.5	86.6	82.2	85.5	87.6	91.3	90.2	95.6	90.2	93.9	86.0	89.9	90.8	83.5	90.9	90.8	92.8	85.8	90.0	3.2	86.8	4.4	91.2	3.3
6.50	165.1	77.2	84.1	79.9	83.0	86.1	90.0	89.0	94.8	88.5	92.6	84.3	88.4	88.2	80.5	88.7	89.0	90.9	83.7	88.5	3.4	84.5	4.5	90.0	3.6
6.00	152.4	74.7	81.1	77.3	80.2	84.4	88.4	87.7	93.9	86.5	91.1	82.3	86.6	84.9	77.0	85.9	86.8	88.7	81.3	86.6	3.6	81.8	4.7	88.6	3.9
5.50	139.7	71.8	77.7	74.4	76.9	82.5	86.6	86.1	92.7	84.2	89.2	80.1	84.6	81.0	73.0	82.6	84.2	86.0	78.6	84.5	3.7	78.6	4.8	87.0	4.2
5.00	127.0	68.6	73.6	71.1	73.1	80.3	84.5	84.3	91.3	81.5	87.0	77.5	82.2	76.2	68.5	78.5	81.1	82.7	75.4	82.0	3.9	74.9	4.9	85.1	4.6
4.50	114.3	65.1	69.0	67.3	68.8	77.7	82.0	82.2	89.6	78.2	84.2	74.5	79.3	70.6	63.5	73.8	77.5	78.7	71.7	79.1	4.0	70.6	5.0	82.9	5.0
4.00	101.6	61.1	63.8	63.1	63.9	74.7	79.0	79.6	87.5	74.4	80.8	71.1	75.9	64.1	57.8	68.2	73.1	73.9	67.5	75.6	4.1	65.6	5.1	80.2	5.3
3.50	88.9	56.6	57.8	58.2	58.3	71.2	75.5	76.6	84.9	69.9	76.7	67.0	71.9	56.7	51.5	61.7	68.0	68.2	62.6	71.4	4.1	60.0	5.3	77.1	5.7
3.00	76.2	51.5	51.0	52.8	52.0	67.0	71.1	73.0	81.6	64.6	71.6	62.4	67.2	48.4	44.6	54.3	62.0	61.5	57.0	66.4	4.0	53.5	5.4	73.2	6.1
2.50	63.5	45.7	43.5	46.6	44.9	62.1	65.9	68.6	77.3	58.2	65.4	56.9	61.5	39.5	37.2	46.0	54.9	53.5	50.6	60.5	3.8	46.2	5.6	68.5	6.5
2.00	50.8	39.1	35.2	39.6	37.0	56.0	59.4	63.1	71.7	50.6	57.7	50.3	54.5	30.1	29.3	36.8	46.6	44.4	43.2	53.3	3.5	38.1	5.7	62.5	6.8
1.75	44.5	35.5	30.8	35.7	32.8	52.4	55.5	59.8	68.3	46.3	53.1	46.5	50.5	25.4	25.2	31.9	42.0	39.4	39.1	49.1	3.3	33.8	5.7	59.0	6.9
1.50	38.1	31.7	26.3	31.6	28.3	48.4	51.1	56.0	64.2	41.6	48.1	42.4	46.0	20.7	21.1	26.9	37.0	34.1	34.6	44.5	3.1	29.2	5.6	54.9	6.9
1.25	31.8	27.5	21.7	27.2	23.7	43.9	46.2	51.6	59.3	36.4	42.4	37.7	41.0	16.1	17.0	21.8	31.6	28.5	29.9	39.4	2.8	24.5	5.3	50.3	6.9

Sieve Size		Percent of of material passed at any given size (%-Dry basis)																								
inch	mm																									
1.00	25.4	23.0	17.0	22.5	18.9	38.7	40.5	46.4	53.5	30.6	36.1	32.6	35.3	11.8	13.0	16.8	25.9	22.6	24.8		33.7	2.5	19.6	4.9	44.8	6.7
0.90	22.9	21.1	15.1	20.5	17.0	36.4	38.0	44.0	50.8	28.2	33.3	30.3	32.9	10.1	11.4	14.8	23.5	20.2	22.6		31.2	2.4	17.6	4.7	42.3	6.6
0.80	20.3	19.2	13.2	18.5	15.0	34.0	35.2	41.5	47.9	25.6	30.4	27.9	30.3	8.6	9.8	12.8	21.0	17.8	20.4		28.6	2.3	15.6	4.4	39.7	6.4
0.70	17.8	17.1	11.3	16.4	13.0	31.3	32.3	38.7	44.7	22.9	27.4	25.4	27.5	7.1	8.3	10.8	18.5	15.4	18.1		25.8	2.1	13.6	4.1	36.8	6.2
0.60	15.2	15.0	9.5	14.3	11.1	28.5	29.2	35.7	41.1	20.2	24.2	22.8	24.6	5.6	6.9	8.9	16.0	13.0	15.8		22.9	2.0	11.6	3.8	33.6	6.0
0.55	14.0	14.0	8.6	13.2	10.1	26.9	27.6	34.0	39.2	18.7	22.5	21.4	23.0	4.9	6.1	8.0	14.7	11.8	14.6		21.4	1.9	10.6	3.6	31.9	5.8
0.50	12.7	12.9	7.6	12.1	9.1	25.4	25.9	32.3	37.2	17.2	20.8	19.9	21.4	4.3	5.4	7.1	13.3	10.6	13.3		19.8	1.8	9.6	3.4	30.2	5.6
0.45	11.4	11.7	6.8	11.0	8.1	23.7	24.0	30.5	35.0	15.7	19.0	18.4	19.8	3.7	4.7	6.2	12.0	9.4	12.1		18.2	1.8	8.6	3.1	28.3	5.4
0.40	10.2	10.6	5.9	9.8	7.1	21.9	22.2	28.5	32.7	14.2	17.2	16.9	18.1	3.1	4.1	5.3	10.7	8.2	10.8		16.6	1.7	7.6	2.9	26.3	5.2
0.35	8.9	9.4	5.0	8.7	6.1	20.1	20.2	26.4	30.2	12.6	15.3	15.2	16.3	2.5	3.4	4.5	9.3	7.0	9.6		14.9	1.6	6.6	2.6	24.2	5.0
0.30	7.6	8.2	4.2	7.5	5.2	18.1	18.1	24.1	27.5	11.0	13.4	13.6	14.4	2.0	2.8	3.7	8.0	5.9	8.3		13.1	1.5	5.6	2.4	22.0	4.7
0.25	6.4	7.0	3.3	6.3	4.2	16.0	15.8	21.7	24.6	9.3	11.4	11.8	12.5	1.5	2.2	2.9	6.6	4.8	7.0		11.3	1.4	4.6	2.1	19.5	4.3
0.20	5.1	5.7	2.6	5.1	3.3	13.7	13.4	18.9	21.3	7.6	9.4	9.9	10.5	1.1	1.7	2.2	5.2	3.7	5.6		9.3	1.2	3.6	1.7	16.9	3.9
0.15	3.8	4.4	1.8	3.9	2.4	11.3	10.8	15.9	17.7	5.9	7.2	7.9	8.3	0.7	1.1	1.5	3.9	2.6	4.3		7.3	1.1	2.7	1.4	13.9	3.4
0.10	2.5	3.1	1.1	2.6	1.5	8.4	8.0	12.3	13.5	4.0	5.0	5.7	5.9	0.4	0.7	0.9	2.5	1.6	2.9		5.2	0.9	1.7	1.0	10.6	2.8
0.05	1.3	1.6	0.5	1.3	0.7	5.1	4.7	7.9	8.4	2.1	2.6	3.3	3.3	0.1	0.3	0.3	1.2	0.7	1.5		2.8	0.6	0.8	0.5	6.5	1.9
0.03	0.6	0.9	0.2	0.7	0.3	3.1	2.7	5.0	5.2	1.1	1.4	1.8	1.9	0.0	0.1	0.1	0.6	0.3	0.7		1.5	0.4	0.4	0.3	4.0	1.3
0.02	0.5	0.7	0.2	0.5	0.2	2.6	2.3	4.3	4.5	0.9	1.1	1.5	1.5	0.0	0.1	0.1	0.5	0.2	0.6		1.3	0.3	0.3	0.2	3.4	1.1
0.01	0.3	0.4	0.1	0.3	0.1	1.6	1.3	2.7	2.7	0.5	0.6	0.9	0.9	0.0	0.0	0.0	0.2	0.1	0.3		0.7	0.2	0.2	0.1	2.1	0.7

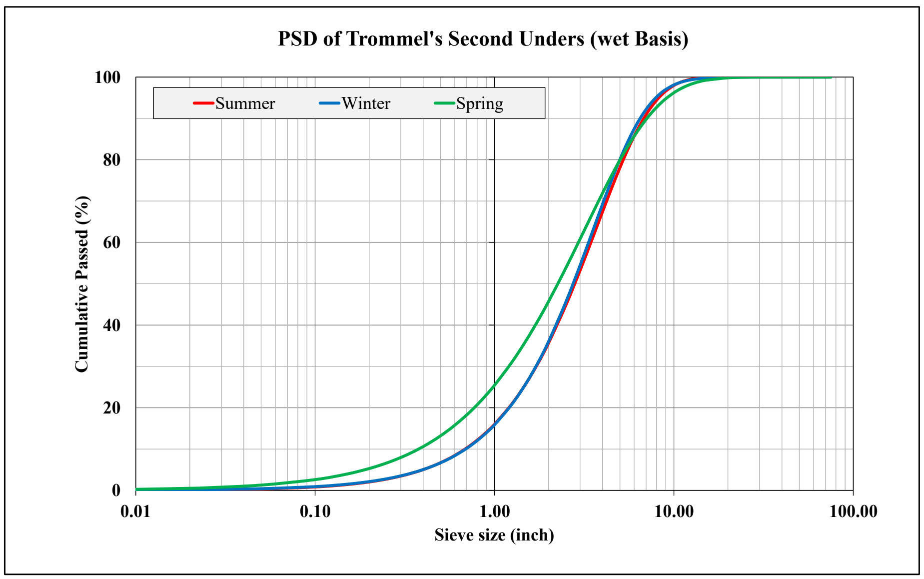


Fitting Rosin-Rammler Distribution to Trommel's <9 inch Second Unders

Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	0.98	1.00	0.99	1.00	0.99	1.00	0.99	0.98	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	1.00	1.00
n =	1.24	1.46	0.97	1.44	1.16	1.12	1.00	0.97	1.35	1.29	1.56	1.26	1.65	1.83	1.62	1.51	1.30	1.26
n x ln(D_N) =	-5.82	-6.63	-4.25	-6.63	-5.06	-4.91	-4.56	-4.15	-6.03	-5.85	-7.32	-5.60	-7.36	-8.50	-7.15	-6.72	-5.60	-5.66
D_N (mm)	110.88	94.85	78.85	99.38	79.16	78.67	96.75	71.85	86.67	93.34	108.49	84.08	87.37	103.11	82.01	85.09	74.28	89.73
D_N (in)	4.37	3.73	3.10	3.91	3.12	3.10	3.81	2.83	3.41	3.67	4.27	3.31	3.44	4.06	3.23	3.35	2.92	3.53
R^2 =	0.99	0.99	0.99	1.00	0.98	0.99	1.00	0.98	0.99	1.00	1.00	0.99	0.99	1.00	1.00	0.99	1.00	1.00
D_{60} =	103.31	89.33	72.08	93.53	73.40	72.78	88.62	65.65	81.25	87.23	102.58	78.46	82.85	98.31	77.71	80.32	69.45	83.71
D_{10} =	17.93	20.24	7.82	20.85	11.33	10.62	10.12	7.06	16.41	16.32	25.67	14.15	22.28	30.24	20.51	19.23	13.14	15.00
UC =	5.76	4.41	9.22	4.49	6.48	6.85	8.76	9.30	4.95	5.34	4.00	5.54	3.72	3.25	3.79	4.18	5.29	5.58

Sieve Size		Percent of of material passed at any given size (%-wet basis)																		Summer		Winter		Spring	
inch	mm																			Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.1
20.00	508.0	99.9	100.0	99.8	100.0	100.0	100.0	99.5	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.1	99.8	0.2
15.00	381.0	99.0	99.9	99.0	99.9	99.8	99.7	98.0	99.4	99.9	99.8	99.9	99.9	100.0	100.0	100.0	100.0	100.0	99.8	99.9	0.1	99.8	0.4	99.2	0.8
14.00	355.6	98.5	99.9	98.7	99.8	99.7	99.6	97.4	99.1	99.9	99.6	99.8	99.8	100.0	100.0	100.0	100.0	100.0	99.6	99.8	0.1	99.6	0.6	98.9	1.0
13.00	330.2	97.9	99.8	98.2	99.6	99.5	99.3	96.7	98.8	99.8	99.4	99.7	99.6	100.0	100.0	100.0	100.0	99.9	99.4	99.6	0.2	99.5	0.8	98.6	1.3
12.00	304.8	96.9	99.6	97.6	99.3	99.1	99.0	95.7	98.3	99.6	99.0	99.3	99.4	100.0	99.9	100.0	99.9	99.8	99.1	99.3	0.2	99.2	1.1	98.0	1.6
11.00	279.4	95.6	99.2	96.8	98.8	98.7	98.4	94.4	97.6	99.2	98.4	98.7	99.0	99.9	99.8	99.9	99.8	99.6	98.5	98.8	0.4	98.8	1.5	97.3	2.0
10.00	254.0	93.8	98.5	95.6	97.9	97.9	97.6	92.7	96.7	98.6	97.4	97.7	98.2	99.7	99.5	99.8	99.5	99.3	97.5	98.0	0.6	98.1	2.0	96.2	2.4
9.00	228.6	91.3	97.3	94.0	96.4	96.7	96.4	90.5	95.4	97.6	95.8	95.9	97.1	99.2	98.7	99.5	98.8	98.7	96.1	96.6	0.9	97.0	2.6	94.7	2.9
8.50	215.9	89.7	96.4	93.1	95.3	95.9	95.5	89.2	94.5	96.8	94.8	94.7	96.3	98.8	97.9	99.2	98.3	98.2	95.1	95.6	1.1	96.2	3.0	93.8	3.1
8.00	203.2	87.9	95.2	91.9	93.9	94.9	94.5	87.7	93.5	95.8	93.5	93.0	95.3	98.2	96.9	98.7	97.6	97.5	93.9	94.4	1.3	95.2	3.4	92.7	3.4
7.50	190.5	85.8	93.7	90.6	92.2	93.7	93.3	86.0	92.4	94.5	91.9	91.0	94.0	97.3	95.4	98.0	96.6	96.7	92.4	92.8	1.7	93.9	3.8	91.3	3.6
7.00	177.8	83.3	91.8	89.0	90.1	92.2	91.8	84.0	91.0	92.9	89.9	88.5	92.4	96.0	93.4	97.0	95.3	95.5	90.6	90.9	2.1	92.2	4.2	89.8	3.9
6.50	165.1	80.5	89.4	87.2	87.5	90.4	90.0	81.8	89.4	90.8	87.6	85.4	90.4	94.2	90.7	95.6	93.5	94.1	88.4	88.6	2.5	90.1	4.5	87.9	4.1
6.00	152.4	77.3	86.4	85.0	84.3	88.2	87.8	79.3	87.4	88.3	84.8	81.7	88.0	91.8	87.1	93.5	91.1	92.1	85.7	85.7	3.1	87.4	4.9	85.7	4.3
5.50	139.7	73.6	82.8	82.5	80.5	85.5	85.1	76.4	85.1	85.1	81.4	77.3	85.0	88.5	82.5	90.7	88.0	89.7	82.5	82.2	3.7	84.1	5.2	83.0	4.4
5.00	127.0	69.3	78.3	79.6	75.9	82.2	82.0	73.1	82.4	81.3	77.4	72.2	81.4	84.3	76.9	86.9	84.0	86.6	78.7	78.1	4.4	80.1	5.5	79.9	4.6
4.50	114.3	64.6	73.1	76.2	70.6	78.3	78.2	69.3	79.2	76.6	72.7	66.2	77.1	78.9	70.1	82.0	79.0	82.6	74.2	73.2	5.0	75.1	5.7	76.2	4.7
4.00	101.6	59.2	66.9	72.2	64.4	73.7	73.6	65.0	75.3	71.1	67.2	59.5	71.9	72.3	62.2	75.7	73.0	77.7	68.9	67.4	5.7	69.3	6.0	71.9	4.7
3.50	88.9	53.3	59.7	67.5	57.3	68.1	68.2	60.1	70.8	64.5	60.9	51.9	65.8	64.3	53.3	68.0	65.6	71.7	62.8	60.8	6.2	62.4	6.3	66.8	4.6
3.00	76.2	46.7	51.7	62.0	49.4	61.6	61.9	54.5	65.3	56.8	53.7	43.8	58.7	55.0	43.7	58.8	57.1	64.4	55.7	53.2	6.6	54.5	6.6	60.8	4.5
2.50	63.5	39.5	42.7	55.5	40.8	53.9	54.4	48.2	58.8	48.1	45.6	35.2	50.4	44.6	33.7	48.3	47.4	55.8	47.7	44.8	6.7	45.6	6.9	53.8	4.4
2.00	50.8	31.7	33.1	47.9	31.6	45.0	45.8	40.9	51.1	38.5	36.6	26.4	41.1	33.6	23.9	36.8	36.8	45.7	38.7	35.6	6.5	36.0	7.0	45.7	4.2
1.75	44.5	27.6	28.2	43.6	26.9	40.1	40.9	36.9	46.6	33.3	31.9	22.0	36.1	28.0	19.2	30.9	31.2	40.1	33.8	30.8	6.1	31.0	6.9	41.1	4.0
1.50	38.1	23.5	23.3	38.9	22.2	34.9	35.8	32.6	41.8	28.0	27.0	17.7	30.8	22.5	14.9	25.0	25.7	34.3	28.9	25.9	5.7	25.9	6.7	36.3	3.9

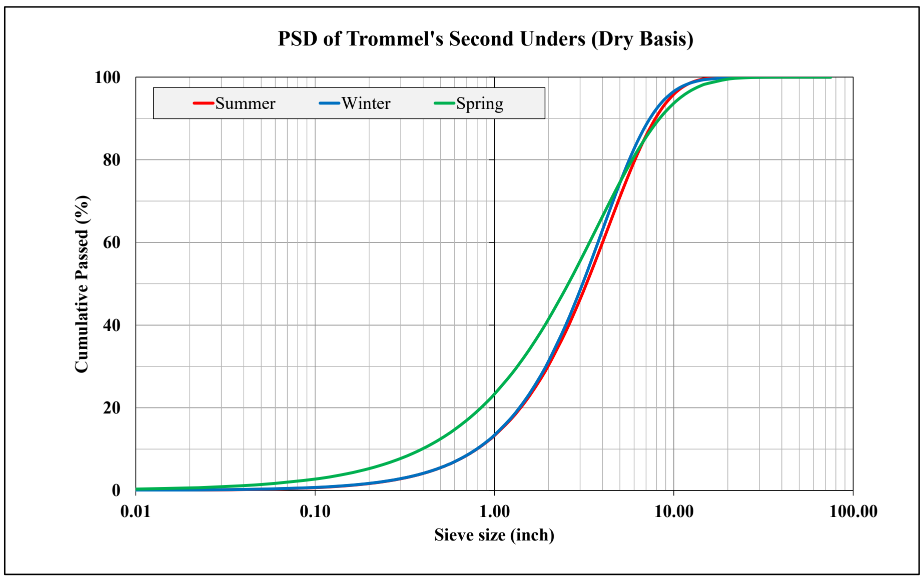
Sieve Size		Percent of of material passed at any given size (%-wet basis)																								
inch	mm																									
1.25	31.8	19.2	18.4	33.8	17.6	29.3	30.3	28.1	36.4	22.7	22.0	13.7	25.3	17.2	10.9	19.3	20.1	28.2	23.7		20.9	5.1	20.8	6.4	31.0	3.7
1.00	25.4	15.0	13.6	28.2	13.1	23.5	24.5	23.2	30.6	17.3	17.0	9.8	19.8	12.3	7.4	13.9	14.8	22.0	18.5		16.0	4.3	15.9	5.8	25.4	3.5
0.90	22.9	13.3	11.8	25.9	11.3	21.1	22.1	21.1	28.1	15.2	15.0	8.4	17.6	10.4	6.1	11.8	12.8	19.5	16.4		14.0	3.9	13.9	5.5	23.1	3.3
0.80	20.3	11.6	10.1	23.4	9.7	18.7	19.6	19.0	25.5	13.1	13.0	7.1	15.3	8.7	5.0	9.9	10.8	16.9	14.3		12.1	3.5	12.0	5.1	20.7	3.2
0.70	17.8	9.9	8.4	20.9	8.0	16.3	17.1	16.9	22.8	11.1	11.1	5.8	13.1	7.0	3.9	8.0	8.9	14.5	12.2		10.3	3.1	10.2	4.7	18.3	3.0
0.60	15.2	8.3	6.7	18.3	6.5	13.8	14.6	14.7	19.9	9.1	9.2	4.6	10.9	5.5	3.0	6.3	7.1	12.0	10.2		8.4	2.7	8.4	4.3	15.8	2.8
0.55	14.0	7.4	6.0	16.9	5.7	12.6	13.4	13.5	18.5	8.1	8.3	4.0	9.8	4.8	2.5	5.5	6.3	10.8	9.2		7.6	2.5	7.5	4.0	14.5	2.7
0.50	12.7	6.6	5.2	15.5	5.0	11.3	12.1	12.4	17.0	7.2	7.3	3.5	8.8	4.1	2.1	4.7	5.5	9.6	8.2		6.7	2.3	6.7	3.8	13.2	2.6
0.45	11.4	5.9	4.5	14.1	4.3	10.1	10.8	11.2	15.5	6.3	6.4	2.9	7.7	3.4	1.8	4.0	4.7	8.4	7.2		5.8	2.0	5.8	3.5	11.9	2.4
0.40	10.2	5.1	3.8	12.7	3.7	8.9	9.5	10.0	13.9	5.4	5.6	2.4	6.7	2.8	1.4	3.3	3.9	7.3	6.2		5.0	1.8	5.0	3.2	10.6	2.3
0.35	8.9	4.3	3.1	11.3	3.0	7.7	8.3	8.8	12.3	4.5	4.7	2.0	5.7	2.3	1.1	2.7	3.2	6.1	5.3		4.2	1.6	4.3	2.9	9.3	2.1
0.30	7.6	3.6	2.5	9.8	2.4	6.4	7.0	7.6	10.7	3.7	3.9	1.6	4.7	1.8	0.8	2.1	2.6	5.1	4.4		3.5	1.3	3.5	2.5	8.0	1.9
0.25	6.4	2.9	1.9	8.2	1.9	5.2	5.7	6.4	9.1	2.9	3.1	1.2	3.8	1.3	0.6	1.6	2.0	4.0	3.5		2.7	1.1	2.8	2.2	6.6	1.7
0.20	5.1	2.2	1.4	6.7	1.4	4.1	4.5	5.2	7.4	2.1	2.3	0.8	2.8	0.9	0.4	1.1	1.4	3.0	2.7		2.0	0.9	2.1	1.8	5.3	1.5
0.15	3.8	1.5	0.9	5.1	0.9	2.9	3.3	3.9	5.6	1.5	1.6	0.5	2.0	0.6	0.2	0.7	0.9	2.1	1.9		1.4	0.6	1.5	1.4	3.9	1.2
0.10	2.5	0.9	0.5	3.5	0.5	1.8	2.1	2.6	3.8	0.8	1.0	0.3	1.2	0.3	0.1	0.4	0.5	1.2	1.1		0.8	0.4	0.9	1.0	2.6	0.9
0.05	1.3	0.4	0.2	1.8	0.2	0.8	1.0	1.3	2.0	0.3	0.4	0.1	0.5	0.1	0.0	0.1	0.2	0.5	0.5		0.3	0.2	0.4	0.5	1.3	0.5
0.03	0.6	0.2	0.1	0.9	0.1	0.4	0.4	0.7	1.0	0.1	0.2	0.0	0.2	0.0	0.0	0.0	0.1	0.2	0.2		0.1	0.1	0.2	0.3	0.6	0.3
0.02	0.5	0.1	0.0	0.7	0.0	0.3	0.3	0.5	0.8	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.1		0.1	0.1	0.1	0.2	0.5	0.2
0.01	0.3	0.1	0.0	0.4	0.0	0.1	0.2	0.3	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1		0.0	0.0	0.1	0.1	0.2	0.1



Fitting Rosin-Rammler Distribution to Trommel's <9 inch Second Unders

Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.97	1.00	0.98	1.00	0.99	0.99	0.98	0.96	0.99	1.00	0.99	1.00	1.00	1.00	1.00	0.99	1.00	0.99						
n =		1.25	1.49	1.01	1.48	1.17	1.13	1.01	0.85	1.32	1.32	1.57	1.29	1.69	1.85	1.59	1.49	1.30	1.24						
n x ln(D_N) =		-6.13	-6.97	-4.65	-7.00	-5.36	-5.10	-4.80	-3.62	-6.08	-6.12	-7.66	-5.89	-7.69	-8.74	-7.16	-6.70	-5.69	-5.78						
D_N (mm)		132.60	108.17	100.98	114.59	96.42	91.38	117.78	70.84	100.72	104.59	132.01	96.18	95.86	113.50	91.00	88.57	80.10	105.11						
D_N (in)		5.22	4.26	3.98	4.51	3.80	3.60	4.64	2.79	3.97	4.12	5.20	3.79	3.77	4.47	3.58	3.49	3.15	4.14						
R^2 =		0.99	1.00	0.98	0.99	0.99	0.98	1.00	0.94	1.00	0.99	1.00	0.99	0.99	1.00	1.00	0.99	1.00	0.99						
D_{60} =		77.63	68.88	51.85	72.69	54.39	50.40	60.44	32.15	60.52	62.80	86.02	57.11	64.34	78.89	59.60	56.50	47.74	61.20						
D_{10} =		22.06	23.85	10.82	24.93	14.16	12.45	12.60	5.02	18.29	18.94	31.44	16.78	25.21	33.55	22.04	19.65	14.14	17.17						
UC =		3.52	2.89	4.79	2.92	3.84	4.05	4.80	6.40	3.31	3.32	2.74	3.40	2.55	2.35	2.70	2.88	3.37	3.56						
Sieve Size		**Percent of of material passed at any given size (%-Dry basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.1
25.00	635.0	99.9	100.0	99.8	100.0	100.0	100.0	99.6	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.1	99.8	0.2
20.00	508.0	99.5	100.0	99.4	100.0	99.9	99.9	98.7	99.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	0.0	99.9	0.2	99.5	0.6
15.00	381.0	97.7	99.9	97.8	99.7	99.3	99.3	96.2	98.5	99.7	99.6	99.5	99.7	100.0	100.0	100.0	100.0	99.9	99.3	99.6	0.1	99.4	0.9	98.3	1.5
14.00	355.6	96.8	99.7	97.1	99.5	99.0	99.0	95.2	98.1	99.5	99.3	99.1	99.5	100.0	100.0	100.0	100.0	99.9	98.9	99.4	0.2	99.2	1.2	97.8	1.8
13.00	330.2	95.7	99.5	96.3	99.1	98.6	98.6	94.1	97.5	99.2	98.9	98.5	99.3	100.0	99.9	100.0	99.9	99.8	98.4	99.0	0.3	98.9	1.6	97.2	2.1
12.00	304.8	94.2	99.1	95.2	98.6	97.9	98.0	92.6	96.9	98.7	98.3	97.6	98.8	99.9	99.8	99.9	99.8	99.7	97.7	98.3	0.6	98.4	2.1	96.3	2.5
11.00	279.4	92.2	98.4	93.8	97.6	96.9	97.1	90.8	96.0	97.9	97.4	96.1	98.1	99.8	99.5	99.7	99.6	99.4	96.6	97.4	0.9	97.6	2.7	95.2	3.0
10.00	254.0	89.6	97.2	92.1	96.1	95.6	95.8	88.6	94.8	96.6	96.0	93.9	97.0	99.4	98.8	99.4	99.2	98.9	95.0	95.9	1.4	96.6	3.4	93.7	3.4
9.00	228.6	86.2	95.2	89.8	93.7	93.6	94.0	85.8	93.3	94.8	93.9	90.6	95.3	98.7	97.4	98.7	98.4	98.0	92.8	93.6	2.1	94.9	4.3	91.7	4.0
8.50	215.9	84.2	93.9	88.4	92.2	92.4	92.9	84.1	92.4	93.5	92.6	88.5	94.1	98.0	96.2	98.1	97.7	97.3	91.3	92.2	2.5	93.7	4.7	90.4	4.2
8.00	203.2	81.9	92.2	86.8	90.3	90.9	91.5	82.3	91.4	92.0	90.9	86.0	92.7	97.1	94.7	97.2	96.9	96.5	89.6	90.4	3.0	92.3	5.2	89.0	4.5
7.50	190.5	79.3	90.2	85.0	88.0	89.2	89.9	80.3	90.2	90.2	89.0	83.1	91.0	95.8	92.6	96.0	95.7	95.4	87.7	88.3	3.6	90.6	5.6	87.4	4.8
7.00	177.8	76.4	87.7	82.9	85.2	87.1	88.0	78.0	88.8	88.0	86.6	79.7	89.0	94.1	89.9	94.5	94.1	94.0	85.4	85.8	4.2	88.4	6.0	85.5	5.0
6.50	165.1	73.2	84.7	80.6	82.0	84.7	85.8	75.5	87.2	85.3	83.9	75.8	86.6	91.8	86.4	92.4	92.1	92.2	82.7	82.9	4.8	85.8	6.4	83.3	5.3
6.00	152.4	69.6	81.1	78.0	78.2	81.9	83.2	72.6	85.3	82.2	80.6	71.4	83.6	88.7	82.1	89.6	89.5	90.0	79.5	79.5	5.5	82.6	6.8	80.8	5.6
5.50	139.7	65.6	76.9	75.0	73.8	78.7	80.1	69.5	83.2	78.6	76.9	66.5	80.2	84.8	76.9	86.1	86.1	87.2	75.9	75.5	6.2	78.8	7.0	77.9	5.9
5.00	127.0	61.2	71.9	71.6	68.8	74.9	76.5	66.0	80.7	74.3	72.5	61.0	76.1	79.9	70.8	81.7	82.0	83.8	71.8	71.0	6.8	74.3	7.2	74.5	6.2
4.50	114.3	56.4	66.2	67.8	63.1	70.5	72.4	62.1	77.7	69.3	67.5	55.0	71.3	73.9	63.7	76.2	76.9	79.5	67.0	65.8	7.4	69.1	7.3	70.7	6.5
4.00	101.6	51.1	59.8	63.4	56.7	65.5	67.6	57.8	74.3	63.6	61.8	48.5	65.8	66.8	55.7	69.6	70.7	74.4	61.7	59.9	7.8	63.0	7.4	66.3	6.8
3.50	88.9	45.4	52.6	58.5	49.7	59.7	62.1	52.9	70.3	57.2	55.4	41.6	59.5	58.6	47.1	61.8	63.4	68.2	55.6	53.4	8.1	56.1	7.4	61.2	7.2
3.00	76.2	39.3	44.8	52.9	42.2	53.2	55.7	47.5	65.5	50.0	48.3	34.4	52.3	49.3	38.1	53.0	55.0	60.8	48.9	46.2	8.0	48.4	7.3	55.5	7.5
2.50	63.5	32.8	36.4	46.6	34.2	45.8	48.5	41.5	59.8	42.0	40.4	27.2	44.3	39.3	29.0	43.2	45.6	52.3	41.4	38.5	7.7	40.1	7.1	48.9	7.8
2.00	50.8	25.9	27.7	39.4	26.0	37.6	40.3	34.9	52.9	33.3	32.0	20.0	35.5	29.0	20.3	32.7	35.3	42.5	33.3	30.2	7.0	31.2	6.7	41.4	8.0
1.75	44.5	22.4	23.4	35.4	21.9	33.2	35.8	31.3	49.0	28.8	27.7	16.6	30.9	24.0	16.2	27.4	30.0	37.2	29.1	26.0	6.4	26.7	6.4	37.3	8.0
1.50	38.1	18.9	19.1	31.2	17.9	28.6	31.1	27.5	44.6	24.2	23.2	13.3	26.2	19.0	12.5	22.2	24.7	31.7	24.7	21.7	5.8	22.2	6.0	32.9	7.9
1.25	31.8	15.3	14.9	26.8	14.0	23.8	26.2	23.4	39.7	19.6	18.8	10.1	21.3	14.4	9.1	17.1	19.4	26.0	20.2	17.5	5.0	17.7	5.5	28.3	7.7

Sieve Size		Percent of of material passed at any given size (%-Dry basis)																								
inch	mm																									
1.00	25.4	11.8	10.9	22.0	10.3	18.9	21.0	19.2	34.2	15.0	14.4	7.3	16.5	10.1	6.1	12.4	14.3	20.2	15.8		13.3	4.1	13.4	4.8	23.3	7.3
0.90	22.9	10.4	9.4	20.1	8.9	16.9	18.9	17.5	31.8	13.2	12.6	6.2	14.5	8.5	5.1	10.6	12.4	17.8	14.0		11.6	3.7	11.7	4.5	21.2	7.1
0.80	20.3	9.1	8.0	18.0	7.5	14.9	16.7	15.7	29.2	11.4	10.9	5.2	12.6	7.1	4.1	8.8	10.5	15.5	12.2		10.0	3.3	10.1	4.2	19.1	6.8
0.70	17.8	7.7	6.6	15.9	6.2	12.9	14.6	13.8	26.6	9.7	9.2	4.2	10.7	5.7	3.2	7.2	8.7	13.2	10.4		8.5	2.9	8.5	3.8	17.0	6.4
0.60	15.2	6.4	5.3	13.8	5.0	10.8	12.4	12.0	23.7	8.0	7.6	3.3	8.9	4.4	2.4	5.7	7.0	11.0	8.7		6.9	2.5	7.0	3.4	14.7	6.0
0.55	14.0	5.8	4.6	12.7	4.4	9.8	11.3	11.0	22.2	7.1	6.8	2.9	8.0	3.8	2.1	5.0	6.1	9.8	7.8		6.2	2.3	6.2	3.1	13.6	5.8
0.50	12.7	5.1	4.0	11.6	3.8	8.9	10.2	10.1	20.7	6.3	6.0	2.5	7.1	3.3	1.7	4.3	5.3	8.8	7.0		5.5	2.0	5.5	2.9	12.5	5.5
0.45	11.4	4.5	3.5	10.5	3.3	7.9	9.1	9.1	19.1	5.5	5.3	2.1	6.2	2.7	1.4	3.6	4.6	7.7	6.2		4.8	1.8	4.8	2.7	11.3	5.2
0.40	10.2	3.9	2.9	9.4	2.8	6.9	8.0	8.1	17.5	4.7	4.5	1.8	5.4	2.3	1.2	3.0	3.9	6.6	5.3		4.1	1.6	4.1	2.4	10.1	4.9
0.35	8.9	3.3	2.4	8.3	2.3	5.9	6.9	7.1	15.7	4.0	3.8	1.4	4.5	1.8	0.9	2.5	3.2	5.6	4.5		3.4	1.4	3.5	2.2	8.9	4.6
0.30	7.6	2.7	1.9	7.1	1.8	5.0	5.9	6.2	13.9	3.3	3.1	1.1	3.7	1.4	0.7	1.9	2.5	4.6	3.8		2.8	1.2	2.9	1.9	7.7	4.2
0.25	6.4	2.2	1.5	6.0	1.4	4.0	4.8	5.1	12.1	2.6	2.5	0.9	3.0	1.0	0.5	1.5	1.9	3.7	3.0		2.2	0.9	2.3	1.6	6.5	3.7
0.20	5.1	1.7	1.0	4.8	1.0	3.1	3.8	4.1	10.1	1.9	1.8	0.6	2.2	0.7	0.3	1.0	1.4	2.8	2.3		1.7	0.7	1.7	1.3	5.3	3.2
0.15	3.8	1.2	0.7	3.6	0.7	2.2	2.7	3.1	8.0	1.3	1.3	0.4	1.5	0.4	0.2	0.6	0.9	1.9	1.6		1.1	0.5	1.2	1.0	4.0	2.7
0.10	2.5	0.7	0.4	2.4	0.4	1.4	1.7	2.1	5.7	0.8	0.7	0.2	0.9	0.2	0.1	0.3	0.5	1.1	1.0		0.7	0.3	0.7	0.7	2.7	2.0
0.05	1.3	0.3	0.1	1.2	0.1	0.6	0.8	1.0	3.2	0.3	0.3	0.1	0.4	0.1	0.0	0.1	0.2	0.5	0.4		0.3	0.1	0.3	0.3	1.4	1.2
0.03	0.6	0.1	0.0	0.6	0.0	0.3	0.4	0.5	1.8	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.2	0.2		0.1	0.1	0.1	0.2	0.7	0.7
0.02	0.5	0.1	0.0	0.5	0.0	0.2	0.3	0.4	1.5	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1		0.1	0.0	0.1	0.1	0.6	0.6
0.01	0.3	0.0	0.0	0.2	0.0	0.1	0.1	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1		0.0	0.0	0.0	0.1	0.3	0.3

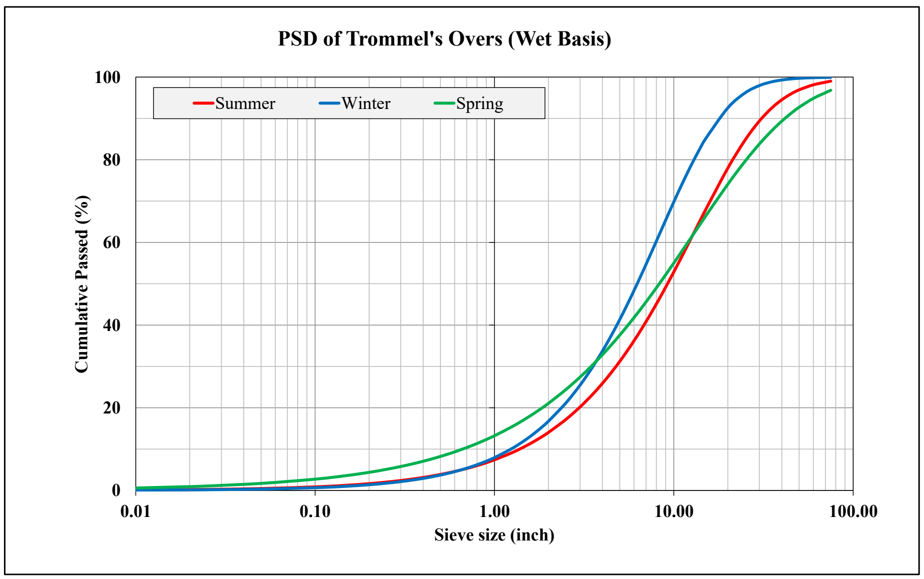


Fitting Rosin-Rammler Distribution to Trommel's >9 inch Overs

Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	0.99	0.99	0.98	0.99	0.92	0.99	0.99	0.93	0.93	0.96	0.96	0.96	0.99	0.96	0.91	1.00	1.00	0.99
n =	1.20	1.03	0.84	1.46	0.78	0.92	0.81	0.59	0.92	0.87	1.29	1.24	1.39	1.44	1.09	1.16	1.21	1.37
n x ln(D_N) =	-6.54	-5.48	-4.64	-8.08	-4.91	-5.14	-4.75	-3.31	-4.76	-5.41	-7.78	-7.11	-7.08	-8.14	-6.16	-5.85	-6.01	-7.56
D_N (mm)	229.11	203.55	251.16	258.73	531.87	270.87	350.39	263.61	179.54	488.01	426.91	315.66	165.89	279.70	285.90	155.83	142.35	253.43
D_N (in)	9.02	8.01	9.89	10.19	20.94	10.66	13.80	10.38	7.07	19.21	16.81	12.43	6.53	11.01	11.26	6.14	5.60	9.98
R^2 =	1.00	0.99	0.97	0.98	0.94	0.99	0.99	0.94	0.92	0.96	0.99	0.97	0.99	0.98	0.96	1.00	1.00	0.99
D_{60} =	213.07	186.99	226.35	243.64	475.67	246.25	314.60	227.51	163.22	441.54	398.84	294.11	155.75	263.27	263.85	144.51	132.45	237.70
D_{10} =	35.35	22.91	17.27	55.11	30.02	23.32	21.86	5.95	15.43	37.13	74.13	51.13	32.71	58.93	36.24	22.34	22.26	48.74
UC =	6.03	8.16	13.11	4.42	15.84	10.56	14.39	38.25	10.58	11.89	5.38	5.75	4.76	4.47	7.28	6.47	5.95	4.88

Sieve Size		**Percent of of material passed at any given size (%-wet basis)**																		Summer		Winter		Spring	
inch	**mm**																			Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	99.6	100.0	93.4	99.7	98.1	96.1	100.0	96.3	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.0	1.8	100.0	0.1	96.8	2.7
60.00	1524.0	100.0	100.0	98.9	100.0	89.8	99.2	96.3	94.1	99.9	93.3	99.4	99.9	100.0	100.0	99.8	100.0	100.0	100.0	98.1	3.2	99.9	0.3	94.9	4.0
50.00	1270.0	100.0	99.9	98.0	100.0	86.1	98.4	94.2	92.1	99.8	90.0	98.3	99.6	100.0	100.0	99.4	100.0	100.0	100.0	96.9	4.6	99.7	0.6	92.7	5.1
45.00	1143.0	99.9	99.7	97.2	100.0	83.8	97.6	92.6	90.8	99.6	87.8	97.1	99.3	100.0	100.0	98.9	100.0	100.0	100.0	95.9	5.5	99.6	0.9	91.2	5.7
40.00	1016.0	99.8	99.5	96.1	99.9	81.0	96.5	90.7	89.2	99.3	85.0	95.3	98.6	100.0	99.8	98.1	100.0	100.0	99.9	94.5	6.6	99.3	1.3	89.4	6.4
35.00	889.0	99.4	99.0	94.5	99.8	77.6	94.9	88.1	87.2	98.7	81.5	92.3	97.3	100.0	99.5	96.8	99.9	100.0	99.6	92.4	7.8	98.8	1.8	86.9	7.1
30.00	762.0	98.6	98.0	92.1	99.2	73.4	92.4	84.7	84.7	97.7	77.1	87.8	94.9	100.0	98.6	94.6	99.8	100.0	98.9	89.4	9.2	98.0	2.6	83.8	7.8
25.00	635.0	96.7	96.0	88.7	97.5	68.3	88.8	80.2	81.5	95.9	71.6	81.1	90.7	99.8	96.2	90.8	99.4	99.8	97.0	84.8	10.7	96.2	3.7	79.7	8.5
20.00	508.0	92.6	92.3	83.6	93.1	61.9	83.1	74.1	77.1	92.5	64.5	71.4	83.5	99.1	90.6	84.6	98.0	99.1	92.5	78.0	12.5	92.6	5.4	74.1	8.9
15.00	381.0	84.2	85.2	75.8	82.7	53.7	74.5	65.7	71.2	86.4	55.3	57.9	71.7	95.8	79.0	74.5	94.0	96.3	82.5	67.8	14.3	85.0	7.9	66.3	9.1
14.00	355.6	81.7	83.1	73.8	79.6	51.8	72.3	63.7	69.7	84.6	53.2	54.6	68.6	94.4	75.7	71.9	92.6	95.2	79.6	65.3	14.7	82.7	8.5	64.4	9.1
13.00	330.2	78.8	80.7	71.6	76.0	49.8	69.9	61.4	68.1	82.6	50.9	51.3	65.3	92.5	71.9	69.0	90.8	93.8	76.2	62.5	15.0	80.1	9.1	62.3	9.1
12.00	304.8	75.6	78.0	69.2	71.9	47.6	67.2	59.1	66.4	80.3	48.5	47.7	61.6	90.2	67.8	65.8	88.6	91.9	72.4	59.5	15.3	77.1	9.8	60.1	9.1
11.00	279.4	71.9	75.0	66.5	67.3	45.3	64.3	56.5	64.5	77.7	45.9	44.0	57.7	87.2	63.2	62.3	86.0	89.6	68.1	56.3	15.5	73.7	10.3	57.6	9.0
10.00	254.0	67.8	71.5	63.6	62.2	42.9	61.0	53.7	62.4	74.7	43.2	40.1	53.4	83.5	58.1	58.5	82.8	86.7	63.3	52.9	15.6	69.8	10.8	55.0	8.9
9.00	228.6	63.1	67.6	60.3	56.6	40.3	57.5	50.7	60.1	71.3	40.3	36.1	48.9	79.0	52.6	54.3	79.0	83.1	58.1	49.1	15.7	65.4	11.2	52.2	8.8
8.50	215.9	60.6	65.4	58.5	53.6	39.0	55.6	49.1	58.9	69.4	38.8	34.1	46.5	76.3	49.7	52.1	76.8	80.9	55.2	47.2	15.7	62.9	11.4	50.6	8.8
8.00	203.2	57.9	63.1	56.7	50.5	37.6	53.6	47.4	57.6	67.4	37.2	32.0	44.0	73.4	46.8	49.8	74.3	78.6	52.3	45.1	15.6	60.3	11.5	49.0	8.7
7.50	190.5	55.1	60.7	54.7	47.3	36.1	51.5	45.7	56.2	65.2	35.6	29.8	41.5	70.2	43.7	47.4	71.7	75.9	49.2	43.0	15.5	57.6	11.5	47.4	8.7
7.00	177.8	52.1	58.1	52.7	44.0	34.6	49.3	43.8	54.7	62.9	33.9	27.7	38.8	66.7	40.5	44.9	68.8	73.0	46.0	40.8	15.4	54.7	11.5	45.6	8.6
6.50	165.1	49.0	55.3	50.5	40.6	33.0	47.0	41.9	53.1	60.4	32.2	25.5	36.2	63.0	37.3	42.3	65.7	69.8	42.7	38.6	15.2	51.6	11.4	43.8	8.5
6.00	152.4	45.8	52.4	48.2	37.1	31.3	44.6	39.9	51.4	57.7	30.4	23.4	33.4	58.9	34.0	39.6	62.3	66.3	39.3	36.2	14.9	48.4	11.3	41.8	8.4
5.50	139.7	42.4	49.3	45.7	33.5	29.6	42.0	37.8	49.6	54.8	28.5	21.2	30.6	54.5	30.7	36.8	58.6	62.4	35.8	33.8	14.6	45.0	11.0	39.8	8.4
5.00	127.0	38.8	45.9	43.1	29.9	27.8	39.3	35.5	47.7	51.7	26.5	19.0	27.7	49.9	27.4	33.8	54.6	58.1	32.3	31.2	14.2	41.4	10.7	37.6	8.3
4.50	114.3	35.1	42.4	40.3	26.3	25.9	36.4	33.2	45.6	48.4	24.5	16.8	24.8	44.9	24.0	30.8	50.3	53.5	28.6	28.6	13.7	37.6	10.2	35.3	8.2
4.00	101.6	31.3	38.7	37.3	22.6	23.9	33.4	30.7	43.3	44.7	22.4	14.6	21.8	39.8	20.7	27.7	45.6	48.5	25.0	25.9	13.1	33.7	9.7	32.8	8.0
3.50	88.9	27.4	34.7	34.1	19.0	21.8	30.2	28.0	40.8	40.8	20.2	12.5	18.8	34.4	17.4	24.4	40.7	43.2	21.3	23.1	12.3	29.7	9.1	30.2	7.9
3.00	76.2	23.3	30.5	30.7	15.5	19.6	26.8	25.2	38.0	36.6	17.9	10.3	15.8	28.8	14.2	21.1	35.4	37.4	17.6	20.2	11.4	25.5	8.3	27.4	7.7
2.50	63.5	19.2	26.0	27.0	12.1	17.3	23.2	22.1	34.9	32.0	15.5	8.3	12.9	23.2	11.1	17.6	29.8	31.3	14.0	17.2	10.3	21.1	7.4	24.4	7.5
2.00	50.8	15.0	21.3	23.0	8.9	14.7	19.4	18.8	31.4	27.0	12.9	6.3	9.9	17.6	8.2	14.1	23.9	24.9	10.5	14.0	9.0	16.7	6.3	21.1	7.2
1.75	44.5	13.0	18.8	20.8	7.4	13.3	17.3	17.1	29.4	24.3	11.6	5.3	8.5	14.9	6.8	12.3	20.8	21.6	8.9	12.4	8.3	14.5	5.8	19.3	7.0
1.50	38.1	10.9	16.3	18.5	6.0	11.9	15.2	15.2	27.2	21.4	10.2	4.4	7.1	12.2	5.5	10.5	17.8	18.3	7.3	10.8	7.5	12.3	5.1	17.4	6.7
1.25	31.8	8.8	13.7	16.1	4.6	10.4	13.1	13.3	24.8	18.5	8.8	3.5	5.7	9.6	4.2	8.7	14.6	15.0	5.7	9.1	6.6	10.1	4.5	15.4	6.4

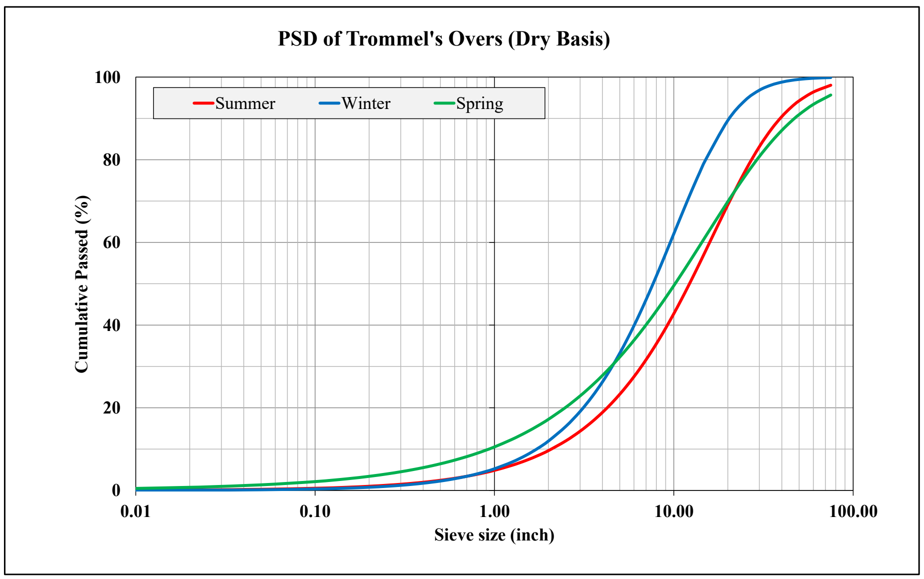
Sieve Size		Percent of of material passed at any given size (%-wet basis)																								
inch	mm																									
1.00	25.4	6.8	11.1	13.6	3.4	8.8	10.8	11.2	22.1	15.3	7.3	2.6	4.3	7.2	3.1	6.9	11.5	11.6	4.2		7.4	5.6	7.9	3.8	13.2	6.0
0.90	22.9	6.0	10.0	12.5	2.9	8.2	9.8	10.3	20.9	14.0	6.7	2.3	3.8	6.2	2.6	6.2	10.3	10.3	3.7		6.7	5.2	7.1	3.5	12.3	5.8
0.80	20.3	5.3	8.9	11.4	2.4	7.5	8.9	9.5	19.6	12.7	6.0	2.0	3.3	5.3	2.2	5.5	9.0	9.0	3.1		6.0	4.8	6.2	3.2	11.4	5.6
0.70	17.8	4.5	7.8	10.2	2.0	6.8	7.9	8.5	18.3	11.3	5.4	1.7	2.8	4.4	1.8	4.7	7.8	7.7	2.6		5.3	4.3	5.4	2.9	10.4	5.3
0.60	15.2	3.8	6.7	9.1	1.6	6.0	6.9	7.6	16.8	9.9	4.7	1.4	2.3	3.6	1.5	4.0	6.5	6.4	2.1		4.6	3.8	4.5	2.5	9.3	5.0
0.55	14.0	3.4	6.1	8.4	1.4	5.6	6.4	7.1	16.0	9.2	4.4	1.2	2.1	3.2	1.3	3.7	5.9	5.8	1.9		4.2	3.6	4.1	2.4	8.8	4.9
0.50	12.7	3.0	5.6	7.8	1.2	5.2	5.9	6.6	15.2	8.4	4.0	1.1	1.9	2.8	1.1	3.3	5.3	5.2	1.7		3.9	3.3	3.7	2.2	8.2	4.7
0.45	11.4	2.7	5.0	7.2	1.1	4.8	5.3	6.0	14.4	7.7	3.7	0.9	1.6	2.4	1.0	3.0	4.7	4.6	1.4		3.5	3.0	3.3	2.0	7.6	4.5
0.40	10.2	2.3	4.5	6.5	0.9	4.4	4.8	5.5	13.5	6.9	3.3	0.8	1.4	2.1	0.8	2.6	4.1	4.0	1.2		3.1	2.8	2.9	1.8	7.0	4.3
0.35	8.9	2.0	3.9	5.9	0.7	4.0	4.3	5.0	12.5	6.2	3.0	0.7	1.2	1.7	0.7	2.3	3.6	3.4	1.0		2.8	2.5	2.5	1.7	6.4	4.1
0.30	7.6	1.6	3.3	5.2	0.6	3.5	3.7	4.4	11.5	5.4	2.6	0.6	1.0	1.4	0.5	1.9	3.0	2.8	0.8		2.4	2.2	2.1	1.5	5.8	3.8
0.25	6.4	1.3	2.8	4.4	0.5	3.1	3.1	3.8	10.4	4.6	2.2	0.4	0.8	1.1	0.4	1.6	2.4	2.3	0.7		2.0	1.9	1.7	1.3	5.1	3.5
0.20	5.1	1.0	2.2	3.7	0.3	2.6	2.6	3.2	9.1	3.7	1.8	0.3	0.6	0.8	0.3	1.2	1.9	1.7	0.5		1.6	1.5	1.4	1.1	4.4	3.2
0.15	3.8	0.7	1.6	2.9	0.2	2.1	2.0	2.5	7.8	2.9	1.4	0.2	0.4	0.5	0.2	0.9	1.3	1.2	0.3		1.2	1.2	1.0	0.8	3.6	2.8
0.10	2.5	0.4	1.1	2.1	0.1	1.5	1.4	1.8	6.2	2.0	1.0	0.1	0.3	0.3	0.1	0.6	0.8	0.8	0.2		0.8	0.9	0.7	0.6	2.7	2.3
0.05	1.3	0.2	0.5	1.2	0.0	0.9	0.7	1.0	4.1	1.1	0.6	0.1	0.1	0.1	0.0	0.3	0.4	0.3	0.1		0.4	0.5	0.3	0.3	1.7	1.6
0.03	0.6	0.1	0.3	0.7	0.0	0.5	0.4	0.6	2.8	0.6	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0		0.2	0.3	0.2	0.2	1.1	1.1
0.02	0.5	0.1	0.2	0.5	0.0	0.4	0.3	0.5	2.4	0.5	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0		0.2	0.2	0.1	0.2	0.9	1.0
0.01	0.3	0.0	0.1	0.3	0.0	0.3	0.2	0.3	1.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0		0.1	0.1	0.1	0.1	0.6	0.7



Fitting Rosin-Rammler Distribution to Trommel's >9 inch Overs

Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.99	0.99	0.96	1.00	0.93	0.99	0.99	0.92	0.97	0.92	0.95	0.95	1.00	0.95	0.89	1.00	1.00	0.98						
n =		1.30	1.24	0.93	1.62	0.81	0.96	0.95	0.57	0.91	0.94	1.31	1.30	1.35	1.55	1.15	1.28	1.22	1.46						
n x ln(D_N) =		-7.26	-6.77	-5.46	-9.09	-5.16	-5.53	-5.68	-3.40	-5.24	-6.10	-8.18	-7.58	-7.16	-8.89	-6.79	-6.71	-6.35	-8.31						
D_N (mm)		272.34	239.42	353.51	272.92	561.45	316.84	390.88	409.19	314.57	667.91	505.49	348.97	199.20	314.10	367.32	192.82	179.91	292.62						
D_N (in)		10.72	9.43	13.92	10.74	22.10	12.47	15.39	16.11	12.38	26.30	19.90	13.74	7.84	12.37	14.46	7.59	7.08	11.52						
R^2 =		1.00	0.98	0.94	0.98	0.93	0.98	0.98	0.94	0.96	0.94	0.98	0.96	1.00	0.98	0.96	1.00	1.00	0.99						
D_{60} =		162.13	139.02	171.68	180.30	246.21	157.50	192.89	124.81	150.48	326.36	303.25	207.75	121.25	203.42	204.72	113.86	103.85	184.89						
D_{10} =		47.92	38.75	31.44	68.06	35.48	30.47	36.68	7.66	26.60	60.64	91.26	61.40	37.76	73.28	51.82	33.01	28.55	62.85						
UC =		3.38	3.59	5.46	2.65	6.94	5.17	5.26	16.29	5.66	5.38	3.32	3.38	3.21	2.78	3.95	3.45	3.64	2.94						
Sieve Size		**Percent of of material passed at any given size (%-Dry basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	99.2	100.0	93.3	99.6	98.9	90.8	99.4	93.1	99.7	100.0	100.0	100.0	99.9	100.0	100.0	100.0	98.0	3.3	99.9	0.3	95.7	4.3
60.00	1524.0	100.0	100.0	98.0	100.0	89.5	98.9	97.4	87.8	98.5	88.6	98.6	99.9	100.0	100.0	99.4	100.0	100.0	100.0	96.4	5.3	99.7	0.7	93.4	5.6
50.00	1270.0	99.9	100.0	96.3	100.0	85.7	97.8	95.3	85.0	97.2	83.9	96.5	99.5	100.0	100.0	98.4	100.0	100.0	100.0	94.3	7.0	99.5	1.2	91.0	6.5
45.00	1143.0	99.8	99.9	94.9	100.0	83.2	96.8	93.8	83.3	96.1	80.9	94.6	99.0	100.0	99.9	97.5	100.0	100.0	99.9	92.7	8.1	99.2	1.7	89.3	7.0
40.00	1016.0	99.6	99.7	93.1	100.0	80.2	95.3	91.6	81.2	94.6	77.3	91.8	98.2	100.0	99.8	96.0	100.0	100.0	99.8	90.5	9.2	98.8	2.4	87.1	7.5
35.00	889.0	99.0	99.4	90.5	99.9	76.6	93.2	88.7	78.8	92.4	73.0	87.8	96.5	99.9	99.3	93.7	99.9	99.9	99.4	87.4	10.3	98.1	3.3	84.4	7.9
30.00	762.0	97.7	98.5	87.0	99.5	72.3	90.2	84.8	75.9	89.3	67.7	82.0	93.6	99.8	98.0	90.1	99.7	99.7	98.3	83.2	11.3	96.8	4.5	80.8	8.2
25.00	635.0	95.0	96.4	82.2	98.0	66.9	85.8	79.5	72.3	85.0	61.5	74.1	88.6	99.2	94.9	84.7	99.0	99.1	95.5	77.3	12.2	94.4	6.0	76.1	8.3
20.00	508.0	89.4	92.1	75.4	93.5	60.2	79.3	72.3	67.7	78.7	53.9	63.5	80.3	97.1	87.8	76.6	96.8	97.1	89.4	69.1	12.7	89.5	7.9	69.9	8.0
15.00	381.0	78.7	83.1	65.8	82.0	51.8	69.7	62.3	61.7	69.6	44.6	49.8	67.4	91.0	74.0	64.8	90.8	91.8	77.0	57.9	12.5	79.9	9.8	61.4	7.4
14.00	355.6	75.7	80.4	63.4	78.5	49.8	67.3	59.9	60.3	67.3	42.5	46.7	64.1	88.8	70.2	61.8	88.7	90.0	73.6	55.2	12.4	77.1	10.2	59.3	7.2
13.00	330.2	72.3	77.4	60.9	74.4	47.7	64.7	57.3	58.8	64.8	40.3	43.5	60.6	86.2	66.1	58.7	86.3	87.8	69.7	52.3	12.2	74.0	10.5	57.1	7.0
12.00	304.8	68.6	74.0	58.2	69.8	45.5	61.8	54.6	57.1	62.2	38.1	40.2	56.8	83.1	61.5	55.4	83.4	85.1	65.4	49.3	12.0	70.4	10.8	54.8	6.8
11.00	279.4	64.4	70.2	55.2	64.6	43.2	58.8	51.6	55.3	59.2	35.7	36.8	52.8	79.4	56.6	51.8	79.9	82.0	60.7	46.1	11.7	66.5	11.0	52.2	6.7
10.00	254.0	59.9	65.9	52.1	58.9	40.8	55.5	48.5	53.4	56.1	33.2	33.3	48.5	75.1	51.3	48.0	75.9	78.2	55.6	42.8	11.4	62.1	11.1	49.5	6.5
9.00	228.6	54.9	61.1	48.7	52.8	38.2	51.8	45.1	51.3	52.7	30.6	29.7	43.9	70.0	45.8	44.0	71.1	73.8	50.2	39.2	11.1	57.2	11.1	46.6	6.4
8.50	215.9	52.3	58.5	46.9	49.5	36.8	49.9	43.4	50.2	50.8	29.3	27.9	41.5	67.2	42.9	41.9	68.5	71.3	47.3	37.4	10.9	54.6	11.0	45.1	6.3
8.00	203.2	49.6	55.8	45.0	46.2	35.4	47.9	41.5	49.0	48.9	27.9	26.0	39.1	64.2	39.9	39.7	65.7	68.7	44.4	35.5	10.6	51.9	10.9	43.5	6.3
7.50	190.5	46.7	52.9	43.0	42.8	33.9	45.8	39.6	47.7	46.9	26.5	24.2	36.7	61.0	37.0	37.5	62.6	65.8	41.4	33.6	10.4	49.1	10.8	41.8	6.3
7.00	177.8	43.8	50.0	41.0	39.3	32.4	43.7	37.7	46.4	44.8	25.1	22.4	34.1	57.6	34.0	35.2	59.4	62.7	38.3	31.6	10.1	46.1	10.6	40.0	6.3
6.50	165.1	40.7	46.8	38.9	35.8	30.8	41.4	35.6	45.0	42.6	23.6	20.5	31.6	54.0	30.9	32.9	56.0	59.4	35.1	29.6	9.9	43.0	10.3	38.2	6.3
6.00	152.4	37.6	43.6	36.7	32.2	29.2	39.0	33.5	43.6	40.4	22.1	18.7	29.0	50.1	27.9	30.5	52.3	55.8	32.0	27.5	9.6	39.9	10.0	36.3	6.3
5.50	139.7	34.4	40.2	34.4	28.7	27.5	36.6	31.3	42.0	38.0	20.6	16.8	26.3	46.1	24.9	28.1	48.5	52.0	28.8	25.4	9.2	36.6	9.6	34.4	6.3
5.00	127.0	31.1	36.7	32.0	25.1	25.8	34.0	29.1	40.3	35.4	19.0	15.0	23.7	42.0	21.9	25.6	44.4	48.0	25.5	23.3	8.8	33.2	9.1	32.3	6.3
4.50	114.3	27.7	33.0	29.5	21.7	23.9	31.3	26.7	38.5	32.8	17.4	13.2	21.0	37.6	18.9	23.0	40.2	43.7	22.3	21.1	8.4	29.8	8.6	30.1	6.4
4.00	101.6	24.3	29.3	26.9	18.3	22.0	28.5	24.2	36.5	30.0	15.7	11.4	18.3	33.1	16.0	20.4	35.7	39.2	19.2	18.9	8.0	26.2	8.0	27.8	6.4
3.50	88.9	20.9	25.5	24.2	15.0	20.0	25.5	21.7	34.4	27.1	14.0	9.7	15.6	28.5	13.2	17.8	31.1	34.5	16.1	16.6	7.4	22.7	7.2	25.4	6.4
3.00	76.2	17.5	21.6	21.3	11.9	17.8	22.4	19.0	32.1	24.0	12.2	8.0	13.0	23.9	10.6	15.1	26.4	29.5	13.0	14.3	6.8	19.1	6.5	22.8	6.4
2.50	63.5	14.1	17.6	18.3	9.0	15.6	19.2	16.3	29.4	20.8	10.4	6.3	10.4	19.2	8.1	12.5	21.5	24.4	10.1	12.0	6.2	15.5	5.6	20.1	6.4
2.00	50.8	10.7	13.7	15.2	6.3	13.2	15.8	13.4	26.5	17.3	8.5	4.8	7.9	14.6	5.8	9.8	16.7	19.2	7.4	9.6	5.4	11.9	4.6	17.2	6.3
1.75	44.5	9.1	11.7	13.5	5.1	11.9	14.1	11.9	24.8	15.5	7.6	4.0	6.7	12.3	4.7	8.5	14.3	16.6	6.1	8.4	4.9	10.2	4.1	15.7	6.2
1.50	38.1	7.5	9.8	11.8	4.0	10.6	12.2	10.3	23.0	13.6	6.6	3.3	5.5	10.1	3.8	7.1	11.9	13.9	4.9	7.2	4.5	8.5	3.6	14.0	6.0
1.25	31.8	6.0	7.9	10.1	3.0	9.2	10.4	8.8	21.0	11.6	5.6	2.6	4.4	8.0	2.8	5.8	9.5	11.3	3.8	6.1	3.9	6.8	3.0	12.3	5.8

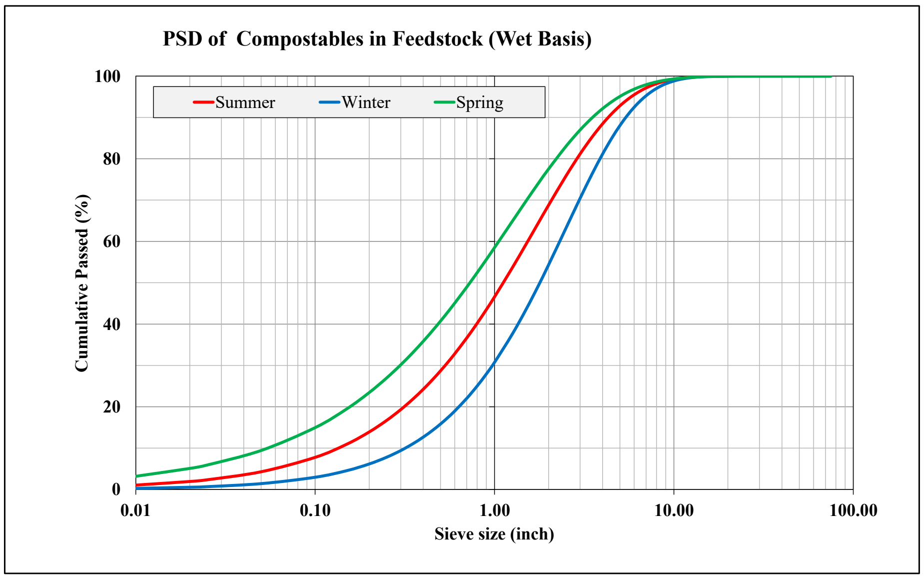
Sieve Size		Percent of of material passed at any given size (%-Dry basis)																								
inch	mm																									
1.00	25.4	4.5	6.1	8.3	2.1	7.7	8.5	7.2	18.7	9.6	4.6	1.9	3.3	6.0	2.0	4.5	7.3	8.7	2.8		4.9	3.3	5.2	2.4	10.5	5.5
0.90	22.9	4.0	5.3	7.5	1.8	7.1	7.7	6.5	17.8	8.8	4.1	1.7	2.9	5.2	1.7	4.0	6.4	7.7	2.4		4.4	3.1	4.6	2.2	9.8	5.4
0.80	20.3	3.4	4.6	6.8	1.5	6.5	6.9	5.8	16.7	7.9	3.7	1.5	2.5	4.5	1.4	3.5	5.5	6.7	2.0		3.9	2.8	4.0	2.0	9.0	5.2
0.70	17.8	2.9	3.9	6.0	1.2	5.8	6.1	5.2	15.6	7.0	3.3	1.2	2.1	3.7	1.2	3.0	4.7	5.7	1.6		3.4	2.6	3.4	1.8	8.2	5.0
0.60	15.2	2.4	3.3	5.2	0.9	5.2	5.3	4.5	14.4	6.1	2.8	1.0	1.7	3.0	0.9	2.5	3.9	4.8	1.3		2.9	2.3	2.8	1.5	7.3	4.7
0.55	14.0	2.1	2.9	4.8	0.8	4.8	4.9	4.1	13.8	5.7	2.6	0.9	1.5	2.7	0.8	2.3	3.5	4.3	1.2		2.7	2.1	2.5	1.4	6.9	4.6
0.50	12.7	1.9	2.6	4.4	0.7	4.5	4.4	3.8	13.1	5.2	2.4	0.8	1.4	2.4	0.7	2.1	3.1	3.8	1.0		2.4	2.0	2.3	1.3	6.4	4.4
0.45	11.4	1.6	2.3	4.0	0.6	4.1	4.0	3.4	12.4	4.8	2.2	0.7	1.2	2.1	0.6	1.8	2.7	3.4	0.9		2.2	1.8	2.0	1.2	6.0	4.3
0.40	10.2	1.4	2.0	3.6	0.5	3.7	3.6	3.1	11.6	4.3	2.0	0.6	1.0	1.8	0.5	1.6	2.3	2.9	0.7		2.0	1.7	1.7	1.0	5.5	4.1
0.35	8.9	1.2	1.7	3.2	0.4	3.4	3.2	2.7	10.8	3.8	1.7	0.5	0.9	1.5	0.4	1.4	2.0	2.5	0.6		1.7	1.5	1.5	0.9	5.0	3.9
0.30	7.6	1.0	1.4	2.8	0.3	3.0	2.7	2.3	10.0	3.3	1.5	0.4	0.7	1.2	0.3	1.2	1.6	2.1	0.5		1.5	1.3	1.2	0.8	4.5	3.7
0.25	6.4	0.8	1.1	2.4	0.2	2.6	2.3	2.0	9.0	2.8	1.3	0.3	0.6	0.9	0.2	0.9	1.3	1.7	0.4		1.2	1.1	1.0	0.7	4.0	3.4
0.20	5.1	0.6	0.9	1.9	0.2	2.1	1.9	1.6	8.0	2.3	1.0	0.2	0.4	0.7	0.2	0.7	1.0	1.3	0.3		1.0	0.9	0.8	0.5	3.4	3.1
0.15	3.8	0.4	0.6	1.5	0.1	1.7	1.4	1.2	6.9	1.8	0.8	0.2	0.3	0.5	0.1	0.5	0.7	0.9	0.2		0.8	0.7	0.5	0.4	2.8	2.7
0.10	2.5	0.2	0.4	1.0	0.1	1.2	1.0	0.8	5.5	1.2	0.5	0.1	0.2	0.3	0.1	0.3	0.4	0.5	0.1		0.5	0.5	0.3	0.3	2.1	2.2
0.05	1.3	0.1	0.2	0.5	0.0	0.7	0.5	0.4	3.7	0.7	0.3	0.0	0.1	0.1	0.0	0.1	0.2	0.2	0.0		0.3	0.3	0.2	0.2	1.3	1.6
0.03	0.6	0.0	0.1	0.3	0.0	0.4	0.3	0.2	2.5	0.4	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0		0.1	0.2	0.1	0.1	0.9	1.1
0.02	0.5	0.0	0.0	0.2	0.0	0.3	0.2	0.2	2.2	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0		0.1	0.1	0.1	0.1	0.7	1.0
0.01	0.3	0.0	0.0	0.1	0.0	0.2	0.1	0.1	1.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.1	0.1	0.0	0.0	0.5	0.7



Fitting Rosin-Rammler Distribution to Compostable Fraction of Total Feedstock

Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16								
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3						
R^2 =		0.98	0.99	0.99	1.00	0.97	0.99	0.95	0.97	0.99	0.97	0.99	0.99	1.00	1.00	1.00	1.00	1.00	0.99						
n =		1.15	1.12	0.99	1.12	0.60	0.76	0.80	0.91	0.85	0.92	0.91	0.91	1.14	1.04	1.10	1.05	1.16	1.13						
n x ln(D_N) =		-4.88	-4.71	-4.00	-4.71	-1.82	-2.60	-2.74	-3.27	-3.04	-3.45	-3.51	-3.46	-4.75	-4.52	-4.32	-4.30	-4.78	-4.63						
D_N (mm)		68.88	68.21	57.32	67.24	21.04	30.89	31.43	35.75	36.39	42.02	47.74	45.78	65.21	77.87	51.26	60.20	62.16	60.47						
D_N (in)		2.71	2.69	2.26	2.65	0.83	1.22	1.24	1.41	1.43	1.65	1.88	1.80	2.57	3.07	2.02	2.37	2.45	2.38						
R^2 =		0.96	0.99	0.99	0.99	0.90	0.96	0.93	0.92	0.98	0.85	0.96	0.99	1.00	1.00	1.00	0.99	1.00	0.99						
D_{60} =		63.85	63.07	52.46	62.19	18.18	27.52	28.16	32.49	32.81	38.22	43.35	41.57	60.39	71.57	47.33	55.39	57.64	55.96						
D_{10} =		9.77	9.09	5.87	9.02	0.49	1.58	1.86	3.05	2.54	3.66	3.99	3.82	9.02	8.89	6.60	7.05	8.90	8.23	Summer		Winter		Spring	
UC =		6.54	6.94	8.94	6.89	37.14	17.45	15.14	10.67	12.92	10.43	10.85	10.88	6.69	8.05	7.17	7.86	6.48	6.80	Mean	SD	Mean	SD	Mean	SD
Sieve Size		Percent of of material passed at any given size (%-wet basis)																							
inch	mm																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
20.00	508.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.1
15.00	381.0	99.9	99.9	99.8	99.9	99.7	99.9	99.9	100.0	99.9	100.0	99.9	99.9	99.9	99.4	100.0	99.9	100.0	100.0	99.9	0.0	99.9	0.2	99.9	0.1
14.00	355.6	99.9	99.8	99.8	99.8	99.6	99.8	99.9	100.0	99.9	99.9	99.8	99.8	99.9	99.2	100.0	99.8	99.9	99.9	99.9	0.1	99.8	0.2	99.8	0.2
13.00	330.2	99.8	99.7	99.6	99.7	99.4	99.8	99.9	100.0	99.8	99.9	99.7	99.7	99.8	98.9	100.0	99.7	99.9	99.9	99.8	0.1	99.7	0.3	99.7	0.2
12.00	304.8	99.6	99.5	99.5	99.6	99.3	99.6	99.8	99.9	99.8	99.8	99.5	99.6	99.7	98.4	99.9	99.6	99.8	99.8	99.7	0.1	99.5	0.4	99.7	0.3
11.00	279.4	99.3	99.2	99.2	99.3	99.1	99.5	99.7	99.9	99.6	99.7	99.3	99.4	99.5	97.7	99.8	99.3	99.7	99.6	99.5	0.2	99.3	0.6	99.5	0.3
10.00	254.0	98.9	98.7	98.7	98.8	98.8	99.3	99.5	99.8	99.4	99.5	98.9	99.1	99.1	96.7	99.7	98.9	99.4	99.4	99.2	0.3	98.8	0.8	99.3	0.4
9.00	228.6	98.1	97.9	98.0	98.1	98.5	98.9	99.2	99.6	99.1	99.2	98.4	98.6	98.4	95.3	99.4	98.3	98.9	98.9	98.8	0.4	98.1	1.1	99.0	0.5
8.50	215.9	97.6	97.3	97.5	97.5	98.2	98.7	99.0	99.4	98.9	98.9	98.0	98.3	98.0	94.4	99.2	97.8	98.5	98.5	98.5	0.4	97.6	1.3	98.8	0.5
8.00	203.2	96.9	96.6	96.9	96.8	97.9	98.4	98.8	99.3	98.6	98.6	97.6	97.9	97.4	93.3	98.9	97.2	98.1	98.0	98.2	0.5	97.0	1.5	98.6	0.6
7.50	190.5	96.0	95.7	96.2	96.0	97.6	98.1	98.5	99.0	98.3	98.2	97.0	97.4	96.6	92.0	98.5	96.5	97.4	97.4	97.7	0.6	96.2	1.7	98.3	0.6
7.00	177.8	94.9	94.6	95.3	94.9	97.2	97.7	98.1	98.7	97.8	97.7	96.3	96.7	95.6	90.5	98.0	95.6	96.6	96.6	97.1	0.7	95.3	2.0	97.9	0.6
6.50	165.1	93.5	93.2	94.2	93.5	96.8	97.1	97.6	98.3	97.2	97.1	95.4	95.9	94.4	88.7	97.3	94.4	95.5	95.5	96.4	0.9	94.0	2.2	97.4	0.6
6.00	152.4	91.8	91.4	92.8	91.8	96.2	96.5	97.0	97.7	96.5	96.2	94.3	94.9	92.8	86.6	96.3	92.9	94.1	94.1	95.5	1.1	92.5	2.5	96.8	0.7
5.50	139.7	89.5	89.2	91.0	89.7	95.5	95.6	96.2	96.9	95.6	95.2	92.9	93.6	90.7	84.0	95.1	91.1	92.2	92.4	94.3	1.3	90.5	2.9	96.1	0.6
5.00	127.0	86.8	86.5	88.8	87.0	94.7	94.6	95.2	95.9	94.4	93.8	91.2	92.0	88.2	81.0	93.3	88.8	89.8	90.1	92.8	1.5	88.0	3.2	95.1	0.6
4.50	114.3	83.3	83.1	86.1	83.7	93.6	93.2	93.9	94.5	92.8	91.9	89.0	89.9	84.9	77.4	91.0	85.9	86.8	87.1	90.9	1.8	85.0	3.5	93.8	0.5
4.00	101.6	79.1	79.0	82.8	79.6	92.3	91.5	92.2	92.6	90.8	89.5	86.2	87.2	80.9	73.2	88.0	82.3	82.9	83.4	88.4	2.1	81.1	3.8	92.1	0.5
3.50	88.9	73.9	73.9	78.6	74.5	90.6	89.2	89.9	90.0	88.1	86.4	82.8	83.9	75.9	68.3	84.0	77.8	78.0	78.7	85.3	2.4	76.3	4.1	89.9	0.6
3.00	76.2	67.5	67.7	73.4	68.4	88.5	86.2	86.8	86.4	84.6	82.3	78.3	79.5	69.7	62.4	78.7	72.2	71.8	72.7	81.2	2.8	70.4	4.4	87.0	1.0
2.50	63.5	59.8	60.3	66.9	60.9	85.6	82.2	82.6	81.6	79.8	76.9	72.6	73.9	62.1	55.5	71.8	65.3	64.1	65.2	75.8	3.2	63.2	4.5	83.0	1.8
2.00	50.8	50.5	51.3	58.8	51.8	81.6	76.7	76.9	74.8	73.4	69.6	65.3	66.7	52.9	47.4	62.9	56.7	54.7	56.0	68.8	3.6	54.3	4.5	77.5	2.9
1.75	44.5	45.3	46.2	54.1	46.7	79.1	73.2	73.2	70.5	69.4	65.1	60.8	62.2	47.6	42.8	57.5	51.7	49.2	50.7	64.4	3.8	49.2	4.4	74.0	3.6
1.50	38.1	39.7	40.7	48.7	41.1	76.0	69.0	68.8	65.4	64.6	59.9	55.7	57.1	41.9	37.9	51.4	46.1	43.3	44.8	59.3	3.9	43.6	4.2	69.8	4.5
1.25	31.8	33.6	34.7	42.8	35.0	72.2	64.0	63.5	59.2	59.0	53.8	49.9	51.2	35.7	32.6	44.6	40.0	36.8	38.3	53.5	4.0	37.4	4.0	64.7	5.4

Sieve Size		Percent of of material passed at any given size (%-wet basis)																								
inch	mm																									
1.00	25.4	27.2	28.2	36.1	28.5	67.3	57.8	57.0	51.9	52.2	46.7	43.1	44.4	29.0	26.9	37.0	33.3	29.9	31.3		46.6	4.0	30.7	3.6	58.5	6.4
0.90	22.9	24.5	25.6	33.2	25.8	65.0	54.9	54.0	48.6	49.1	43.5	40.1	41.3	26.2	24.5	33.8	30.4	27.0	28.4		43.5	4.0	27.9	3.4	55.6	6.9
0.80	20.3	21.7	22.8	30.2	23.0	62.4	51.7	50.7	44.9	45.7	40.0	36.9	38.1	23.3	22.0	30.4	27.4	24.0	25.3		40.2	3.9	25.0	3.2	52.4	7.3
0.70	17.8	19.0	20.0	27.0	20.2	59.5	48.2	47.0	41.0	42.1	36.4	33.5	34.6	20.4	19.4	26.9	24.3	20.9	22.2		36.6	3.8	22.0	3.0	49.0	7.7
0.60	15.2	16.1	17.1	23.7	17.3	56.2	44.3	43.0	36.8	38.1	32.5	29.9	30.9	17.4	16.8	23.2	21.1	17.8	19.0		32.8	3.7	19.0	2.7	45.1	8.1
0.55	14.0	14.7	15.7	22.0	15.8	54.3	42.2	40.8	34.5	35.9	30.4	28.0	28.9	15.9	15.5	21.3	19.4	16.3	17.4		30.8	3.6	17.4	2.6	43.0	8.2
0.50	12.7	13.3	14.2	20.2	14.3	52.3	40.0	38.5	32.2	33.7	28.2	26.0	26.9	14.4	14.1	19.4	17.7	14.7	15.8		28.7	3.5	15.8	2.4	40.7	8.4
0.45	11.4	11.9	12.7	18.4	12.8	50.0	37.6	36.0	29.7	31.3	26.0	23.9	24.8	12.9	12.8	17.5	16.0	13.1	14.2		26.5	3.3	14.2	2.3	38.4	8.5
0.40	10.2	10.4	11.2	16.6	11.3	47.6	35.0	33.4	27.2	28.8	23.7	21.8	22.6	11.4	11.4	15.6	14.3	11.6	12.5		24.2	3.2	12.6	2.1	35.8	8.6
0.35	8.9	9.0	9.8	14.7	9.8	45.0	32.3	30.6	24.5	26.2	21.2	19.6	20.3	9.8	10.0	13.6	12.6	10.0	10.9		21.8	3.0	11.0	1.9	33.1	8.6
0.30	7.6	7.6	8.3	12.7	8.4	42.0	29.3	27.7	21.6	23.4	18.7	17.2	17.9	8.3	8.6	11.6	10.8	8.4	9.2		19.3	2.8	9.4	1.7	30.1	8.6
0.25	6.4	6.2	6.8	10.8	6.9	38.6	26.1	24.4	18.6	20.4	16.1	14.8	15.4	6.8	7.2	9.6	9.0	6.9	7.6		16.7	2.6	7.8	1.5	26.9	8.4
0.20	5.1	4.8	5.4	8.7	5.4	34.8	22.5	20.9	15.5	17.3	13.3	12.3	12.8	5.3	5.7	7.6	7.2	5.4	5.9		13.9	2.3	6.1	1.3	23.4	8.1
0.15	3.8	3.5	3.9	6.6	3.9	30.2	18.6	17.0	12.1	13.8	10.3	9.6	10.0	3.9	4.3	5.6	5.4	3.9	4.3		10.9	1.9	4.5	1.0	19.5	7.7
0.10	2.5	2.2	2.5	4.5	2.5	24.6	14.0	12.6	8.5	10.0	7.2	6.7	7.0	2.5	2.8	3.6	3.5	2.4	2.8		7.8	1.5	2.9	0.7	14.9	6.8
0.05	1.3	1.0	1.2	2.3	1.2	17.0	8.6	7.5	4.6	5.7	3.9	3.7	3.8	1.1	1.4	1.7	1.7	1.1	1.3		4.3	1.0	1.4	0.4	9.4	5.3
0.03	0.6	0.5	0.5	1.2	0.5	11.6	5.2	4.4	2.5	3.2	2.1	2.0	2.1	0.5	0.7	0.8	0.8	0.5	0.6		2.3	0.6	0.7	0.2	5.9	4.0
0.02	0.5	0.3	0.4	0.9	0.4	10.2	4.4	3.7	2.0	2.7	1.7	1.6	1.7	0.4	0.5	0.6	0.7	0.4	0.5		1.9	0.5	0.5	0.2	5.1	3.6
0.01	0.3	0.2	0.2	0.5	0.2	6.9	2.6	2.1	1.1	1.5	0.9	0.9	0.9	0.2	0.3	0.3	0.3	0.2	0.2		1.0	0.3	0.2	0.1	3.2	2.5

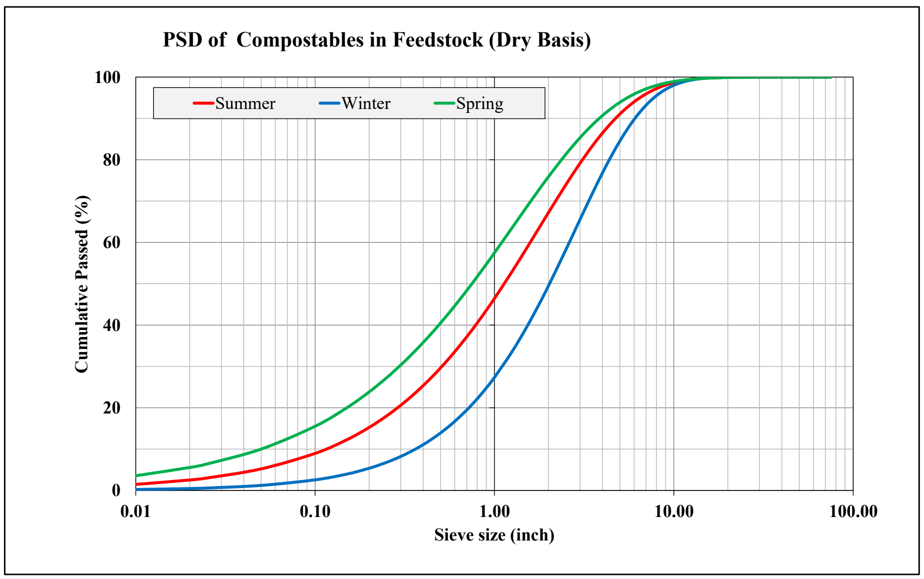


Fitting Rosin-Rammler Distribution to Compostable Fraction of Total Feedstock

Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	0.97	0.99	0.99	0.99	0.95	0.97	0.95	0.96	0.99	0.94	0.96	0.99	1.00	1.00	0.99	1.00	1.00	0.99
n =	1.27	1.20	1.07	1.11	0.57	0.73	0.75	0.91	0.73	0.92	0.83	0.91	1.14	1.06	1.03	1.05	1.12	1.05
n x ln(D_N) =	-5.52	-5.24	-4.52	-4.83	-1.76	-2.56	-2.56	-3.30	-2.52	-3.52	-3.26	-3.57	-4.90	-4.84	-4.11	-4.43	-4.70	-4.36
D_N (mm)	77.99	77.88	68.68	75.91	22.08	33.63	30.76	37.86	31.80	46.36	50.48	50.05	72.60	96.36	53.74	68.51	67.64	64.22
D_N (in)	3.07	3.07	2.70	2.99	0.87	1.32	1.21	1.49	1.25	1.83	1.99	1.97	2.86	3.79	2.12	2.70	2.66	2.53
R^2 =	0.96	0.99	0.99	0.99	0.88	0.93	0.92	0.93	0.97	0.83	0.91	0.99	1.00	1.00	0.99	1.00	1.00	0.98
D_{60} =	45.90	44.59	36.65	41.55	6.76	13.38	12.53	18.09	12.64	22.29	22.49	23.97	40.34	51.09	28.01	36.07	37.04	33.83
D_{10} =	13.21	12.02	8.38	10.08	0.42	1.53	1.52	3.19	1.44	3.99	3.36	4.25	10.14	11.50	6.06	7.98	8.99	7.50
UC =	3.48	3.71	4.37	4.12	16.12	8.72	8.25	5.68	8.75	5.59	6.68	5.64	3.98	4.44	4.63	4.52	4.12	4.51

Sieve Size		Percent of of material passed at any given size (%-Dry basis)																		Summer		Winter		Spring	
inch	**mm**	Jan-15 1	Jan-15 2	Jan-15 3	Jan-15 4	May-15 1	May-15 2	May-15 3	May-15 4	Jun-15 1	Jun-15 2	Jun-15 3	Jun-15 4	Nov-15 1	Nov-15 2	Nov-15 3	Feb-16 1	Feb-16 2	Feb-16 3	Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.1
20.00	508.0	100.0	100.0	100.0	100.0	99.7	99.9	100.0	100.0	99.9	100.0	99.9	100.0	100.0	99.7	100.0	100.0	100.0	100.0	99.9	0.0	100.0	0.1	99.9	0.1
15.00	381.0	99.9	99.9	99.8	99.8	99.4	99.7	99.9	100.0	99.8	99.9	99.5	99.8	99.9	98.6	99.9	99.8	99.9	99.8	99.8	0.2	99.7	0.4	99.7	0.3
14.00	355.6	99.9	99.8	99.7	99.6	99.2	99.6	99.8	100.0	99.7	99.8	99.4	99.7	99.8	98.1	99.9	99.6	99.8	99.8	99.7	0.2	99.6	0.5	99.6	0.3
13.00	330.2	99.8	99.7	99.5	99.4	99.0	99.5	99.7	99.9	99.6	99.8	99.1	99.6	99.6	97.5	99.8	99.4	99.7	99.6	99.5	0.3	99.4	0.7	99.5	0.4
12.00	304.8	99.6	99.4	99.3	99.1	98.8	99.3	99.6	99.9	99.4	99.6	98.8	99.4	99.4	96.6	99.7	99.2	99.5	99.4	99.3	0.3	99.1	0.9	99.4	0.5
11.00	279.4	99.4	99.1	98.9	98.6	98.5	99.1	99.5	99.8	99.2	99.4	98.4	99.2	99.1	95.4	99.6	98.7	99.2	99.1	99.1	0.4	98.7	1.2	99.2	0.5
10.00	254.0	98.8	98.4	98.3	97.9	98.2	98.7	99.2	99.6	98.9	99.1	97.8	98.8	98.5	93.9	99.3	98.1	98.7	98.5	98.7	0.6	98.0	1.5	98.9	0.6
9.00	228.6	98.0	97.4	97.3	96.7	97.7	98.2	98.9	99.4	98.5	98.7	97.0	98.2	97.6	91.8	98.8	97.1	98.0	97.7	98.1	0.8	97.0	1.9	98.6	0.7
8.50	215.9	97.4	96.7	96.7	95.9	97.4	97.9	98.6	99.2	98.2	98.3	96.5	97.8	96.9	90.5	98.5	96.4	97.4	97.2	97.7	0.9	96.4	2.2	98.3	0.8
8.00	203.2	96.5	95.8	95.9	95.0	97.1	97.6	98.4	99.0	97.9	97.9	95.8	97.2	96.1	89.0	98.1	95.6	96.7	96.5	97.2	1.0	95.5	2.4	98.0	0.9
7.50	190.5	95.5	94.7	94.9	93.9	96.7	97.1	98.0	98.7	97.5	97.4	95.1	96.6	95.1	87.2	97.5	94.6	95.8	95.6	96.6	1.1	94.5	2.7	97.6	0.9
7.00	177.8	94.2	93.3	93.7	92.4	96.2	96.5	97.6	98.3	97.0	96.8	94.2	95.8	93.8	85.2	96.8	93.4	94.7	94.5	95.9	1.3	93.2	3.0	97.2	1.0
6.50	165.1	92.5	91.6	92.2	90.7	95.6	95.9	97.0	97.8	96.4	95.9	93.1	94.9	92.3	82.9	95.8	91.9	93.3	93.2	95.1	1.4	91.6	3.3	96.6	1.0
6.00	152.4	90.3	89.4	90.4	88.6	95.0	95.1	96.4	97.1	95.6	94.9	91.8	93.7	90.3	80.3	94.7	90.1	91.6	91.6	94.0	1.7	89.7	3.7	95.9	1.0
5.50	139.7	87.7	86.7	88.2	86.1	94.2	94.1	95.5	96.2	94.7	93.6	90.3	92.2	87.9	77.3	93.1	87.9	89.4	89.5	92.7	1.9	87.4	4.0	95.0	1.0
5.00	127.0	84.4	83.5	85.5	83.0	93.3	92.8	94.4	95.0	93.5	92.0	88.4	90.4	85.0	73.8	91.2	85.2	86.7	87.0	91.1	2.2	84.5	4.4	93.9	1.0
4.50	114.3	80.3	79.6	82.2	79.4	92.1	91.3	93.1	93.5	92.1	89.8	86.1	88.0	81.4	69.8	88.7	81.9	83.4	84.0	89.0	2.6	81.0	4.8	92.5	1.0
4.00	101.6	75.3	74.8	78.1	74.9	90.7	89.3	91.3	91.4	90.3	87.2	83.3	85.2	77.0	65.3	85.5	77.9	79.3	80.2	86.5	3.0	76.8	5.1	90.7	1.0
3.50	88.9	69.3	69.0	73.2	69.7	89.0	86.9	89.1	88.6	87.9	83.7	79.8	81.5	71.7	60.1	81.4	73.1	74.2	75.5	83.3	3.5	71.7	5.5	88.4	1.0
3.00	76.2	62.1	62.2	67.3	63.4	86.7	83.7	86.1	84.9	84.9	79.3	75.5	76.9	65.2	54.2	76.1	67.3	68.1	69.8	79.2	4.1	65.6	5.8	85.4	1.3
2.50	63.5	53.7	54.3	60.1	55.9	83.8	79.6	82.1	79.8	80.9	73.7	70.2	71.1	57.6	47.4	69.5	60.3	60.6	62.8	74.0	4.8	58.2	6.0	81.3	2.0
2.00	50.8	44.1	45.0	51.5	47.2	79.9	74.1	76.7	72.9	75.5	66.3	63.4	63.7	48.6	39.8	61.1	51.9	51.6	54.3	67.2	5.7	49.5	6.0	75.9	3.1
1.75	44.5	38.8	39.9	46.6	42.3	77.4	70.6	73.2	68.6	72.1	61.8	59.3	59.2	43.5	35.6	56.1	47.0	46.5	49.3	63.1	6.1	44.6	5.9	72.5	3.8
1.50	38.1	33.2	34.5	41.3	37.1	74.4	66.6	69.1	63.4	68.0	56.6	54.7	54.1	38.0	31.2	50.4	41.8	41.0	43.9	58.4	6.5	39.2	5.7	68.4	4.6
1.25	31.8	27.4	28.8	35.5	31.5	70.7	61.7	64.1	57.3	63.2	50.7	49.3	48.3	32.2	26.6	44.1	36.0	35.0	38.0	52.9	6.9	33.5	5.4	63.5	5.6

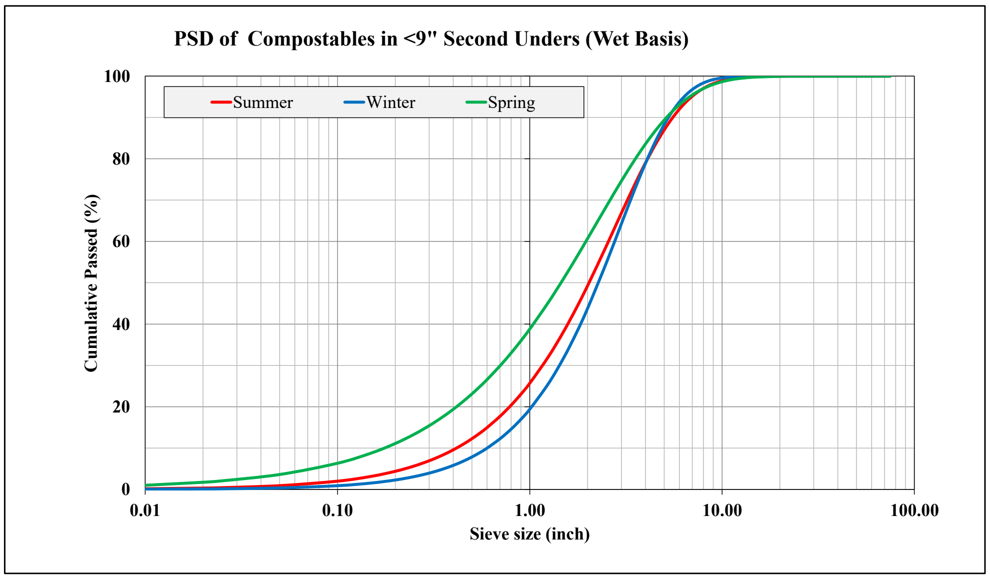
Sieve Size		Percent of of material passed at any given size (%-Dry basis)																							
inch	mm																								
1.00	25.4	21.4	22.9	29.2	25.6	66.1	55.7	58.0	50.1	57.2	43.8	43.2	41.6	26.0	21.6	37.0	29.8	28.5	31.5	46.5	7.2	27.3	4.9	57.5	6.6
0.90	22.9	19.0	20.4	26.5	23.1	63.9	53.0	55.1	46.8	54.5	40.7	40.4	38.7	23.4	19.6	33.9	27.2	25.8	28.7	43.6	7.3	24.8	4.6	54.7	7.1
0.80	20.3	16.6	18.0	23.8	20.6	61.5	50.0	52.0	43.3	51.4	37.5	37.5	35.6	20.8	17.5	30.7	24.4	23.0	25.9	40.5	7.3	22.1	4.3	51.7	7.5
0.70	17.8	14.2	15.5	21.0	18.0	58.7	46.7	48.5	39.5	48.1	34.0	34.3	32.2	18.2	15.4	27.4	21.6	20.2	22.9	37.1	7.3	19.4	4.0	48.3	7.9
0.60	15.2	11.9	13.1	18.1	15.4	55.5	43.0	44.6	35.4	44.3	30.3	30.9	28.7	15.5	13.2	23.9	18.7	17.3	19.9	33.5	7.2	16.7	3.6	44.6	8.3
0.55	14.0	10.7	11.9	16.6	14.1	53.7	41.0	42.5	33.2	42.3	28.3	29.1	26.8	14.1	12.1	22.1	17.2	15.8	18.3	31.6	7.2	15.3	3.4	42.6	8.5
0.50	12.7	9.5	10.6	15.2	12.7	51.8	38.8	40.3	31.0	40.1	26.3	27.2	24.9	12.7	11.0	20.2	15.7	14.3	16.7	29.6	7.1	13.9	3.2	40.5	8.6
0.45	11.4	8.4	9.4	13.7	11.4	49.7	36.6	37.9	28.6	37.8	24.2	25.3	22.9	11.4	9.9	18.4	14.2	12.9	15.1	27.5	6.9	12.5	3.0	38.2	8.7
0.40	10.2	7.3	8.2	12.1	10.1	47.5	34.2	35.4	26.1	35.3	22.0	23.2	20.8	10.0	8.8	16.4	12.7	11.4	13.5	25.3	6.7	11.1	2.7	35.8	8.8
0.35	8.9	6.2	7.1	10.6	8.8	44.9	31.6	32.6	23.5	32.7	19.7	21.0	18.7	8.7	7.7	14.5	11.1	9.9	11.8	23.0	6.5	9.6	2.5	33.2	8.8
0.30	7.6	5.1	5.9	9.1	7.4	42.1	28.7	29.7	20.8	29.8	17.4	18.8	16.4	7.3	6.6	12.5	9.5	8.4	10.2	20.6	6.2	8.2	2.2	30.3	8.8
0.25	6.4	4.1	4.8	7.5	6.1	38.9	25.7	26.4	17.9	26.6	14.9	16.4	14.1	6.0	5.5	10.5	8.0	6.9	8.5	18.0	5.8	6.8	1.9	27.2	8.7
0.20	5.1	3.1	3.7	6.0	4.8	35.2	22.3	22.9	14.9	23.1	12.3	13.8	11.7	4.7	4.3	8.4	6.4	5.4	6.8	15.2	5.3	5.3	1.6	23.8	8.4
0.15	3.8	2.2	2.6	4.4	3.5	30.8	18.5	18.9	11.7	19.2	9.6	11.0	9.1	3.4	3.2	6.3	4.7	4.0	5.1	12.2	4.7	3.9	1.2	20.0	8.0
0.10	2.5	1.3	1.6	2.9	2.2	25.4	14.1	14.3	8.2	14.7	6.7	8.0	6.4	2.1	2.1	4.2	3.1	2.5	3.3	9.0	3.9	2.6	0.9	15.5	7.2
0.05	1.3	0.5	0.7	1.4	1.0	17.9	8.8	8.8	4.5	9.1	3.6	4.6	3.4	1.0	1.0	2.1	1.5	1.2	1.6	5.2	2.7	1.2	0.5	10.0	5.7
0.03	0.6	0.2	0.3	0.7	0.5	12.5	5.4	5.3	2.4	5.6	1.9	2.6	1.8	0.4	0.5	1.0	0.7	0.5	0.8	3.0	1.8	0.6	0.2	6.4	4.3
0.02	0.5	0.2	0.2	0.5	0.4	11.1	4.6	4.5	2.0	4.8	1.6	2.2	1.5	0.3	0.4	0.8	0.6	0.4	0.6	2.5	1.6	0.4	0.2	5.5	3.9
0.01	0.3	0.1	0.1	0.3	0.2	7.6	2.8	2.7	1.1	2.9	0.8	1.2	0.8	0.2	0.2	0.4	0.3	0.2	0.3	1.4	1.0	0.2	0.1	3.5	2.8



Fitting Rosin-Rammler Distribution to Compostable Fraction of Trommel's <9 inch Second Unders

Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3						
R^2 =		0.97	0.99	0.99	1.00	0.99	1.00	0.98	0.99	1.00	0.98	0.98	0.99	1.00	1.00	0.99	1.00	1.00	0.99						
n =		1.16	1.56	1.30	1.34	0.71	0.97	1.04	1.11	1.15	1.03	1.32	1.37	1.53	1.80	1.65	1.42	1.40	1.35						
n x ln(D_N) =		-5.02	-6.80	-5.44	-5.87	-2.57	-3.86	-4.26	-4.59	-4.66	-4.41	-5.80	-5.80	-6.63	-8.17	-6.95	-6.05	-5.97	-5.76						
D_N (mm)		76.04	78.07	65.82	79.25	37.59	54.60	61.03	62.24	57.75	72.41	81.77	69.31	75.22	92.47	66.79	70.67	70.59	71.00						
D_N (in)		2.99	3.07	2.59	3.12	1.48	2.15	2.40	2.45	2.27	2.85	3.22	2.73	2.96	3.64	2.63	2.78	2.78	2.80						
R^2 =		0.97	0.99	0.99	1.00	0.99	1.00	0.98	0.99	0.99	0.98	0.98	0.98	1.00	1.00	0.99	0.98	1.00	0.99						
D_{60} =		70.52	73.82	61.54	74.25	33.22	49.87	56.10	57.52	53.52	66.52	76.52	65.02	71.05	88.10	63.36	66.46	66.32	66.56						
D_{10} =		10.91	18.46	11.66	14.82	1.56	5.32	6.96	8.20	8.13	8.16	14.79	13.38	17.35	26.56	17.14	14.52	14.18	13.45						
UC =		6.46	4.00	5.28	5.01	21.26	9.38	8.06	7.02	6.58	8.15	5.17	4.86	4.10	3.32	3.70	4.58	4.68	4.95	Mean	SD	Mean	SD	Mean	SD
Sieve Size		Percent of of material passed at any given size (%-wet basis)																							
inch	mm																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
20.00	508.0	100.0	100.0	100.0	100.0	99.8	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	99.9	0.1
15.00	381.0	99.8	100.0	100.0	100.0	99.4	99.9	99.9	99.9	100.0	99.6	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	0.2	100.0	0.0	99.8	0.2
14.00	355.6	99.7	100.0	100.0	99.9	99.3	99.8	99.8	99.9	100.0	99.4	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	0.3	100.0	0.1	99.7	0.3
13.00	330.2	99.6	100.0	100.0	99.9	99.0	99.7	99.7	99.8	99.9	99.2	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.7	0.4	99.9	0.1	99.6	0.3
12.00	304.8	99.3	100.0	99.9	99.8	98.8	99.5	99.5	99.7	99.9	98.8	99.6	99.9	100.0	100.0	100.0	100.0	100.0	99.9	99.6	0.5	99.9	0.2	99.4	0.4
11.00	279.4	98.9	99.9	99.9	99.6	98.4	99.2	99.2	99.5	99.8	98.2	99.4	99.9	99.9	99.9	100.0	99.9	99.9	99.8	99.3	0.8	99.8	0.3	99.1	0.5
10.00	254.0	98.3	99.8	99.7	99.2	97.9	98.8	98.7	99.1	99.6	97.4	98.8	99.7	99.8	99.8	100.0	99.8	99.8	99.6	98.9	1.1	99.6	0.5	98.6	0.5
9.00	228.6	97.2	99.5	99.4	98.4	97.2	98.1	98.0	98.6	99.2	96.2	97.9	99.4	99.6	99.4	100.0	99.5	99.4	99.2	98.2	1.5	99.2	0.8	98.0	0.6
8.50	215.9	96.5	99.2	99.1	97.8	96.8	97.7	97.5	98.1	98.9	95.4	97.2	99.1	99.4	99.0	99.9	99.3	99.2	98.9	97.7	1.7	98.8	1.0	97.5	0.6
8.00	203.2	95.6	98.8	98.7	97.1	96.3	97.2	96.9	97.6	98.6	94.5	96.4	98.7	99.0	98.4	99.8	98.9	98.8	98.4	97.0	2.0	98.3	1.2	97.0	0.5
7.50	190.5	94.5	98.2	98.1	96.1	95.7	96.5	96.1	96.9	98.0	93.3	95.2	98.1	98.4	97.5	99.7	98.3	98.2	97.8	96.2	2.3	97.7	1.4	96.3	0.5
7.00	177.8	93.1	97.3	97.4	94.8	95.0	95.6	95.2	96.0	97.4	92.0	93.8	97.3	97.6	96.1	99.4	97.6	97.4	96.9	95.1	2.7	96.8	1.7	95.4	0.4
6.50	165.1	91.4	96.0	96.3	93.1	94.2	94.6	93.9	94.8	96.5	90.4	92.0	96.2	96.5	94.2	98.9	96.5	96.3	95.6	93.8	3.1	95.5	2.1	94.4	0.4
6.00	152.4	89.3	94.2	94.9	91.0	93.2	93.3	92.4	93.3	95.2	88.4	89.7	94.7	94.8	91.5	98.0	94.9	94.7	94.0	92.0	3.5	93.7	2.5	93.1	0.4
5.50	139.7	86.8	91.6	93.0	88.2	92.0	91.6	90.5	91.4	93.7	86.0	86.8	92.6	92.5	87.8	96.6	92.8	92.6	91.8	89.8	3.9	91.4	3.0	91.4	0.6
5.00	127.0	83.7	88.2	90.5	84.8	90.6	89.6	88.2	89.0	91.6	83.2	83.2	89.9	89.3	83.0	94.5	90.0	89.8	88.9	87.0	4.4	88.2	3.5	89.3	1.0
4.50	114.3	79.9	83.7	87.1	80.5	88.9	87.0	85.3	86.0	88.8	79.8	78.9	86.2	85.0	76.9	91.2	86.2	86.0	85.1	83.4	4.9	84.2	4.1	86.8	1.6
4.00	101.6	75.3	77.9	82.8	75.2	86.7	83.8	81.7	82.2	85.2	75.8	73.6	81.5	79.5	69.4	86.5	81.3	81.1	80.3	79.0	5.3	78.9	4.7	83.6	2.3
3.50	88.9	69.8	70.6	77.2	68.9	84.1	79.8	77.2	77.4	80.6	70.9	67.3	75.5	72.5	60.6	79.9	75.0	74.9	74.2	73.6	5.8	72.4	5.3	79.6	3.2
3.00	76.2	63.3	61.8	70.2	61.3	80.8	74.8	71.6	71.4	74.7	65.1	59.8	68.0	63.9	50.6	71.2	67.1	67.1	66.7	66.9	6.2	64.3	5.8	74.7	4.4
2.50	63.5	55.6	51.5	61.5	52.4	76.5	68.6	64.7	64.0	67.2	58.2	51.2	58.8	53.8	39.8	60.1	57.6	57.8	57.7	58.9	6.6	54.8	6.2	68.5	5.7
2.00	50.8	46.6	40.0	51.0	42.3	71.0	60.7	56.3	55.0	57.8	50.0	41.4	48.0	42.2	28.8	47.1	46.5	46.8	47.1	49.3	6.8	43.8	6.2	60.7	7.3
1.75	44.5	41.5	34.0	45.1	36.9	67.6	55.9	51.3	49.8	52.3	45.4	36.1	42.0	36.0	23.4	39.9	40.4	40.7	41.2	44.0	6.8	37.9	6.0	56.1	8.1
1.50	38.1	36.2	27.8	38.8	31.2	63.6	50.7	45.9	44.0	46.2	40.3	30.6	35.7	29.7	18.3	32.6	34.0	34.4	35.0	38.2	6.6	31.8	5.7	51.0	8.8
1.25	31.8	30.5	21.8	32.1	25.4	58.8	44.7	39.8	37.7	39.5	34.8	25.0	29.1	23.4	13.5	25.3	27.4	27.8	28.6	32.1	6.4	25.6	5.3	45.3	9.5

Sieve Size		Percent of of material passed at any given size (%-wet basis)																								
inch	mm																									
1.00	25.4	24.5	15.9	25.2	19.5	53.1	38.0	33.2	30.9	32.3	28.8	19.3	22.4	17.2	9.3	18.3	20.8	21.2	22.0		25.7	5.9	19.4	4.6	38.8	10.0
0.90	22.9	22.0	13.7	22.3	17.2	50.5	35.0	30.3	28.0	29.2	26.3	17.0	19.7	14.9	7.7	15.6	18.2	18.6	19.4		23.0	5.6	17.0	4.3	36.0	10.1
0.80	20.3	19.5	11.5	19.5	14.9	47.6	31.9	27.4	25.1	26.0	23.7	14.8	17.0	12.6	6.3	13.0	15.6	16.0	16.8		20.4	5.3	14.6	4.0	33.0	10.2
0.70	17.8	16.9	9.5	16.7	12.6	44.5	28.7	24.3	22.0	22.8	21.0	12.6	14.4	10.4	5.0	10.6	13.1	13.5	14.3		17.7	5.0	12.2	3.6	29.9	10.1
0.60	15.2	14.4	7.5	13.9	10.4	41.0	25.3	21.1	18.9	19.5	18.2	10.4	11.8	8.3	3.8	8.3	10.7	11.0	11.7		15.0	4.5	10.0	3.1	26.6	10.0
0.55	14.0	13.1	6.6	12.5	9.3	39.1	23.5	19.5	17.3	17.8	16.8	9.3	10.6	7.3	3.3	7.2	9.5	9.8	10.5		13.6	4.3	8.9	2.9	24.9	9.8
0.50	12.7	11.8	5.7	11.1	8.2	37.1	21.7	17.8	15.7	16.1	15.3	8.3	9.3	6.3	2.7	6.2	8.3	8.6	9.3		12.3	4.0	7.8	2.7	23.1	9.7
0.45	11.4	10.5	4.9	9.8	7.2	35.0	19.8	16.2	14.1	14.4	13.9	7.2	8.1	5.4	2.3	5.2	7.2	7.5	8.1		10.9	3.8	6.8	2.4	21.3	9.4
0.40	10.2	9.2	4.1	8.4	6.2	32.7	17.9	14.4	12.5	12.7	12.4	6.2	7.0	4.5	1.8	4.3	6.1	6.4	7.0		9.6	3.5	5.8	2.2	19.4	9.2
0.35	8.9	8.0	3.3	7.1	5.2	30.3	15.9	12.7	10.9	11.0	10.9	5.2	5.8	3.7	1.5	3.5	5.1	5.3	5.8		8.2	3.1	4.9	1.9	17.4	8.8
0.30	7.6	6.7	2.6	5.9	4.2	27.6	13.9	10.9	9.3	9.3	9.4	4.3	4.8	2.9	1.1	2.7	4.1	4.3	4.8		6.9	2.8	3.9	1.7	15.4	8.4
0.25	6.4	5.5	2.0	4.7	3.3	24.7	11.8	9.1	7.6	7.6	7.8	3.4	3.7	2.2	0.8	2.0	3.2	3.4	3.7		5.6	2.4	3.1	1.4	13.3	7.8
0.20	5.1	4.2	1.4	3.5	2.5	21.5	9.6	7.3	6.0	6.0	6.3	2.5	2.8	1.6	0.5	1.4	2.3	2.5	2.8		4.4	2.0	2.3	1.1	11.1	7.1
0.15	3.8	3.1	0.9	2.4	1.7	18.0	7.4	5.5	4.4	4.3	4.7	1.8	1.9	1.0	0.3	0.9	1.6	1.7	1.9		3.2	1.6	1.5	0.8	8.8	6.2
0.10	2.5	1.9	0.5	1.4	1.0	13.8	5.0	3.6	2.8	2.7	3.1	1.0	1.1	0.6	0.2	0.4	0.9	0.9	1.1		2.0	1.1	0.9	0.5	6.3	5.1
0.05	1.3	0.9	0.2	0.6	0.4	8.7	2.6	1.8	1.3	1.2	1.5	0.4	0.4	0.2	0.0	0.1	0.3	0.4	0.4		0.9	0.6	0.4	0.2	3.6	3.4
0.03	0.6	0.4	0.1	0.2	0.2	5.4	1.3	0.9	0.6	0.6	0.8	0.2	0.2	0.1	0.0	0.0	0.1	0.1	0.2		0.4	0.3	0.1	0.1	2.1	2.3
0.02	0.5	0.3	0.0	0.2	0.1	4.6	1.1	0.7	0.5	0.4	0.6	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1		0.3	0.2	0.1	0.1	1.7	2.0
0.01	0.3	0.1	0.0	0.1	0.0	2.9	0.6	0.3	0.2	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.1	0.1	0.0	0.0	1.0	1.3

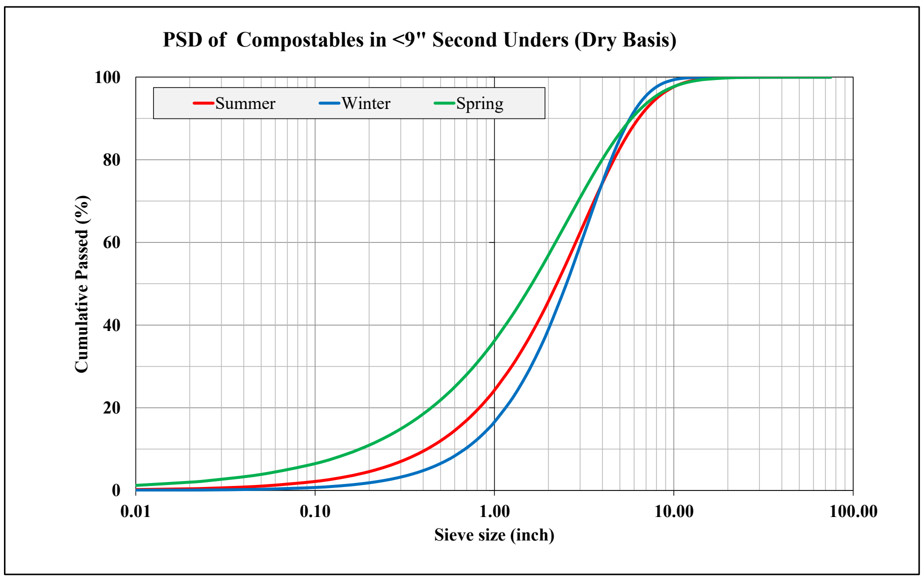


Fitting Rosin-Rammler Distribution to Compostable Fraction of Trommel's <9 inch Second Unders

Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	0.94	0.98	0.99	1.00	1.00	0.99	0.99	0.99	1.00	0.98	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99
n =	1.31	1.63	1.42	1.42	0.64	0.94	1.02	1.18	1.02	1.04	1.22	1.44	1.66	1.91	1.64	1.48	1.34	1.19
n x ln(D_N) =	-5.79	-7.18	-6.14	-6.47	-2.37	-3.90	-4.28	-4.99	-4.11	-4.61	-5.59	-6.24	-7.44	-8.86	-6.96	-6.40	-5.79	-5.12
D_N (mm)	84.39	82.70	74.49	94.27	39.80	63.46	66.09	69.69	56.97	83.52	97.02	75.96	87.19	102.46	70.46	76.27	74.84	73.04
D_N (in)	3.32	3.26	2.93	3.71	1.57	2.50	2.60	2.74	2.24	3.29	3.82	2.99	3.43	4.03	2.77	3.00	2.95	2.88
R^2 =	0.95	0.98	0.99	1.00	0.99	0.99	0.98	0.99	1.00	0.98	0.99	0.98	1.00	0.99	0.99	0.99	0.99	0.99
D_{60} =	50.46	54.71	46.48	58.82	14.01	31.07	34.24	39.37	29.42	43.85	56.00	47.67	58.24	72.13	46.74	48.38	45.38	41.61
D_{10} =	15.07	20.73	15.34	19.41	1.20	5.80	7.30	10.29	6.22	9.64	15.39	15.94	22.56	31.61	17.82	16.60	14.00	11.09
UC =	3.35	2.64	3.03	3.03	11.64	5.36	4.69	3.83	4.73	4.55	3.64	2.99	2.58	2.28	2.62	2.91	3.24	3.75

Sieve Size		Percent of of material passed at any given size (%-dry basis)																		Summer		Winter		Spring	
inch	mm	Jan-15 1	Jan-15 2	Jan-15 3	Jan-15 4	May-15 1	May-15 2	May-15 3	May-15 4	Jun-15 1	Jun-15 2	Jun-15 3	Jun-15 4	Nov-15 1	Nov-15 2	Nov-15 3	Feb-16 1	Feb-16 2	Feb-16 3	Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.1
25.00	635.0	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	99.9	0.1
20.00	508.0	100.0	100.0	100.0	100.0	99.4	99.9	100.0	100.0	100.0	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	0.1	100.0	0.0	99.8	0.3
15.00	381.0	99.9	100.0	100.0	99.9	98.6	99.5	99.7	99.9	99.9	99.2	99.5	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.7	0.4	100.0	0.0	99.5	0.6
14.00	355.6	99.9	100.0	100.0	99.9	98.3	99.4	99.6	99.9	99.8	98.9	99.2	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.5	0.5	100.0	0.1	99.3	0.7
13.00	330.2	99.7	100.0	100.0	99.7	98.0	99.1	99.4	99.8	99.7	98.5	98.9	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.3	0.7	99.9	0.1	99.1	0.8
12.00	304.8	99.5	100.0	99.9	99.5	97.5	98.7	99.1	99.7	99.6	97.9	98.3	99.9	100.0	100.0	100.0	100.0	99.9	99.6	98.9	1.0	99.8	0.2	98.8	0.9
11.00	279.4	99.2	99.9	99.9	99.1	97.0	98.2	98.7	99.4	99.3	97.0	97.4	99.9	99.9	99.9	100.0	99.9	99.7	99.3	98.4	1.4	99.7	0.3	98.3	1.0
10.00	254.0	98.5	99.8	99.7	98.3	96.3	97.5	98.1	99.0	99.0	95.9	96.1	99.7	99.7	99.7	100.0	99.7	99.4	98.8	97.6	1.9	99.4	0.6	97.7	1.1
9.00	228.6	97.5	99.5	99.3	97.1	95.4	96.5	97.1	98.2	98.4	94.3	94.2	99.3	99.3	99.0	99.9	99.4	98.9	98.0	96.5	2.7	98.8	0.9	96.8	1.2
8.50	215.9	96.7	99.1	98.9	96.1	94.9	95.8	96.5	97.7	97.9	93.2	93.0	98.9	98.9	98.4	99.8	99.0	98.4	97.4	95.8	3.1	98.3	1.2	96.2	1.2
8.00	203.2	95.7	98.7	98.5	94.9	94.2	95.0	95.7	97.0	97.4	92.0	91.5	98.4	98.3	97.5	99.7	98.6	97.8	96.6	94.8	3.6	97.6	1.5	95.5	1.2
7.50	190.5	94.5	97.9	97.8	93.4	93.5	94.0	94.8	96.2	96.7	90.6	89.8	97.7	97.5	96.2	99.4	97.9	97.0	95.7	93.7	4.1	96.7	1.8	94.6	1.2
7.00	177.8	92.9	96.9	96.8	91.5	92.7	92.8	93.6	95.1	95.8	88.9	87.7	96.7	96.2	94.3	98.9	96.9	95.9	94.5	92.3	4.6	95.5	2.2	93.6	1.1
6.50	165.1	91.0	95.4	95.5	89.1	91.8	91.4	92.2	93.7	94.8	86.9	85.3	95.3	94.5	91.7	98.2	95.6	94.5	92.9	90.6	5.2	93.8	2.7	92.3	1.0
6.00	152.4	88.5	93.3	93.7	86.2	90.7	89.8	90.4	91.9	93.4	84.6	82.4	93.5	92.1	88.2	97.1	93.8	92.6	91.0	88.5	5.8	91.6	3.2	90.7	0.9
5.50	139.7	85.5	90.4	91.4	82.6	89.4	87.8	88.3	89.6	91.7	81.9	79.0	91.0	88.8	83.6	95.3	91.3	90.1	88.6	85.9	6.4	88.8	3.9	88.8	0.9
5.00	127.0	81.8	86.6	88.2	78.3	87.9	85.3	85.8	86.8	89.6	78.7	75.1	87.7	84.6	77.9	92.7	88.0	86.9	85.6	82.8	7.0	85.1	4.6	86.4	1.1
4.50	114.3	77.4	81.6	84.1	73.2	86.1	82.4	82.6	83.3	86.9	75.0	70.5	83.5	79.2	70.9	89.0	83.7	82.9	81.9	79.0	7.5	80.4	5.4	83.6	1.7
4.00	101.6	72.0	75.3	78.9	67.1	83.9	78.9	78.8	78.9	83.5	70.7	65.3	78.1	72.5	62.6	83.8	78.3	77.9	77.3	74.4	8.0	74.6	6.2	80.1	2.5
3.50	88.9	65.7	67.5	72.4	60.1	81.3	74.7	74.2	73.6	79.2	65.6	59.3	71.5	64.4	53.3	76.8	71.5	71.6	71.8	68.9	8.5	67.5	6.9	75.9	3.6
3.00	76.2	58.3	58.3	64.4	52.2	78.1	69.5	68.5	67.1	73.9	59.7	52.5	63.4	55.0	43.3	67.9	63.2	64.1	65.1	62.4	8.9	59.2	7.4	70.8	5.0
2.50	63.5	49.8	47.8	54.9	43.4	74.1	63.2	61.7	59.2	67.3	52.8	44.9	53.8	44.6	33.0	57.0	53.4	55.2	57.1	54.7	9.3	49.6	7.6	64.6	6.6
2.00	50.8	40.3	36.4	44.0	33.9	69.0	55.6	53.4	49.8	58.9	44.9	36.5	42.9	33.4	23.0	44.3	42.2	44.8	47.7	45.8	9.5	39.0	7.4	56.9	8.4
1.75	44.5	35.1	30.5	38.1	29.0	65.8	51.1	48.7	44.5	54.0	40.4	32.0	37.0	27.8	18.3	37.5	36.3	39.2	42.5	40.9	9.4	33.4	7.1	52.5	9.3
1.50	38.1	29.8	24.7	31.9	24.1	62.2	46.1	43.4	38.8	48.5	35.7	27.3	30.9	22.3	14.0	30.6	30.2	33.2	36.9	35.6	9.3	27.8	6.6	47.6	10.1
1.25	31.8	24.3	19.0	25.7	19.1	57.9	40.6	37.7	32.7	42.4	30.6	22.5	24.8	17.0	10.1	23.8	24.0	27.1	30.9	30.1	8.9	22.1	5.9	42.2	10.9

Sieve Size		Percent of of material passed at any given size (%-dry basis)																					
inch	mm																						
1.00	25.4	18.8	13.6	19.4	14.3	52.7	34.5	31.4	26.3	35.6	25.1	17.7	18.6	12.0	6.7	17.2	17.9	20.9	24.7	24.2	8.3	16.6	5.1	36.2	11.5
0.90	22.9	16.6	11.6	17.0	12.5	50.3	31.8	28.7	23.6	32.7	22.8	15.7	16.2	10.2	5.5	14.7	15.5	18.4	22.1	21.9	7.9	14.4	4.7	33.6	11.7
0.80	20.3	14.4	9.7	14.5	10.6	47.7	29.0	25.9	20.9	29.6	20.5	13.8	13.9	8.5	4.4	12.2	13.2	15.9	19.5	19.4	7.5	12.3	4.2	30.9	11.7
0.70	17.8	12.3	7.9	12.2	8.9	44.9	26.1	23.0	18.2	26.4	18.1	11.8	11.6	6.8	3.4	10.0	11.0	13.5	16.9	17.0	7.0	10.3	3.8	28.0	11.7
0.60	15.2	10.1	6.2	9.9	7.2	41.7	23.0	20.0	15.4	23.0	15.6	9.9	9.4	5.3	2.6	7.8	8.9	11.1	14.3	14.5	6.4	8.3	3.3	25.0	11.5
0.55	14.0	9.1	5.4	8.8	6.4	40.0	21.4	18.5	14.0	21.3	14.4	8.9	8.3	4.6	2.2	6.8	7.8	10.0	13.0	13.2	6.0	7.4	3.0	23.5	11.4
0.50	12.7	8.1	4.6	7.7	5.6	38.1	19.8	16.9	12.6	19.5	13.1	8.0	7.3	4.0	1.8	5.9	6.9	8.8	11.7	12.0	5.7	6.5	2.8	21.9	11.2
0.45	11.4	7.1	3.9	6.7	4.8	36.1	18.1	15.3	11.2	17.8	11.8	7.1	6.3	3.3	1.5	5.0	5.9	7.7	10.4	10.7	5.3	5.6	2.5	20.2	11.0
0.40	10.2	6.1	3.3	5.7	4.1	34.0	16.3	13.7	9.9	15.9	10.5	6.1	5.4	2.8	1.2	4.1	5.0	6.6	9.1	9.5	4.9	4.8	2.2	18.5	10.7
0.35	8.9	5.2	2.6	4.7	3.4	31.7	14.6	12.1	8.5	14.0	9.2	5.2	4.4	2.2	0.9	3.3	4.1	5.6	7.8	8.2	4.4	4.0	1.9	16.7	10.3
0.30	7.6	4.2	2.0	3.8	2.7	29.2	12.7	10.4	7.1	12.1	7.9	4.4	3.6	1.7	0.7	2.6	3.3	4.5	6.5	7.0	3.9	3.2	1.7	14.9	9.8
0.25	6.4	3.4	1.5	3.0	2.1	26.4	10.8	8.7	5.8	10.2	6.6	3.5	2.8	1.3	0.5	1.9	2.5	3.6	5.3	5.8	3.4	2.5	1.4	13.0	9.2
0.20	5.1	2.5	1.1	2.2	1.5	23.4	8.9	7.0	4.5	8.2	5.3	2.7	2.0	0.9	0.3	1.3	1.8	2.7	4.1	4.5	2.8	1.8	1.1	10.9	8.5
0.15	3.8	1.7	0.7	1.4	1.0	19.8	6.8	5.3	3.2	6.2	3.9	1.9	1.3	0.5	0.2	0.8	1.2	1.8	2.9	3.3	2.2	1.2	0.8	8.8	7.5
0.10	2.5	1.0	0.3	0.8	0.6	15.7	4.7	3.5	2.0	4.1	2.6	1.2	0.7	0.3	0.1	0.4	0.7	1.1	1.8	2.2	1.5	0.7	0.5	6.5	6.2
0.05	1.3	0.4	0.1	0.3	0.2	10.3	2.5	1.7	0.9	2.1	1.3	0.5	0.3	0.1	0.0	0.1	0.2	0.4	0.8	1.0	0.8	0.3	0.2	3.9	4.4
0.03	0.6	0.2	0.0	0.1	0.1	6.7	1.3	0.9	0.4	1.0	0.6	0.2	0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.5	0.4	0.1	0.1	2.3	3.0
0.02	0.5	0.1	0.0	0.1	0.1	5.9	1.1	0.7	0.3	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.3	0.1	0.1	2.0	2.6
0.01	0.3	0.1	0.0	0.0	0.0	3.8	0.6	0.3	0.1	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	1.2	1.7



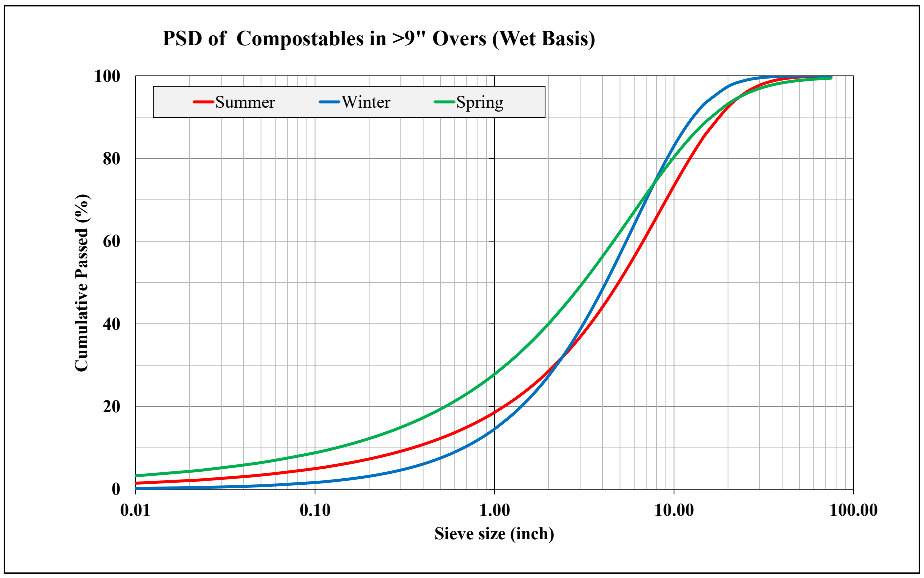
Fitting Rosin-Rammler Distribution to Compostable Fraction of Trommel's >9 inch Overs

Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	0.98	1.00	0.98	0.98	0.92	0.99	0.99	0.88	0.91	0.93	0.95	0.96	0.97	0.95	0.78	0.99	0.99	0.99
n =	1.07	1.01	0.94	1.53	0.98	0.79	0.81	0.39	0.53	0.98	1.12	1.30	1.28	1.36	0.84	0.85	1.09	1.49
n x ln(D_N) =	-4.93	-5.05	-4.53	-8.10	-4.96	-3.83	-4.14	-1.58	-2.14	-5.07	-6.35	-7.01	-6.20	-7.57	-4.19	-4.04	-5.09	-7.74
D_N (mm)	101.46	146.95	120.94	199.34	156.01	128.06	161.80	58.35	56.50	172.91	288.68	221.29	127.25	261.81	145.85	114.23	107.08	181.54
D_N (in)	3.99	5.79	4.76	7.85	6.14	5.04	6.37	2.30	2.22	6.81	11.37	8.71	5.01	10.31	5.74	4.50	4.22	7.15
R^2 =	0.98	1.00	0.98	0.98	0.92	0.99	0.99	0.87	0.89	0.93	0.96	0.97	0.97	0.95	0.78	0.98	0.99	0.98
D_{60} =	93.48	134.80	110.24	188.26	142.73	114.62	145.31	46.57	47.92	158.22	267.01	206.87	118.84	245.50	131.46	103.10	98.82	171.18
D_{10} =	12.31	15.92	11.16	45.74	15.79	7.38	10.17	0.18	0.81	17.57	38.75	39.07	21.89	50.00	10.06	8.16	13.56	40.01
UC =	7.59	8.47	9.88	4.12	9.04	15.54	14.28	264.84	58.81	9.00	6.89	5.29	5.43	4.91	13.06	12.63	7.29	4.28

Percent of of material passed at any given size (%-wet basis)

Sieve Size		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
inch	**mm**	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	97.9	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.1	100.0	0.0	99.5	1.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	99.9	99.8	97.1	99.7	100.0	99.8	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.9	0.1	100.0	0.0	99.2	1.4
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	99.8	99.5	96.3	99.5	99.9	99.5	100.0	100.0	100.0	99.8	100.0	100.0	100.0	99.7	0.3	100.0	0.1	98.9	1.7
45.00	1143.0	100.0	100.0	100.0	100.0	99.9	99.6	99.3	95.8	99.3	99.8	99.1	100.0	100.0	99.9	99.7	99.9	100.0	100.0	99.5	0.4	99.9	0.1	98.7	1.9
40.00	1016.0	100.0	99.9	99.9	100.0	99.8	99.4	98.8	95.2	99.0	99.7	98.3	99.9	100.0	99.8	99.4	99.8	100.0	100.0	99.2	0.7	99.9	0.2	98.3	2.1
35.00	889.0	100.0	99.8	99.9	100.0	99.6	99.0	98.2	94.4	98.7	99.3	97.1	99.8	100.0	99.5	99.0	99.7	100.0	100.0	98.7	1.2	99.8	0.3	97.8	2.4
30.00	762.0	100.0	99.5	99.7	100.0	99.1	98.3	97.1	93.3	98.1	98.7	94.9	99.3	100.0	98.6	98.2	99.4	100.0	100.0	97.7	2.0	99.5	0.6	97.0	2.6
25.00	635.0	99.9	98.8	99.2	99.7	98.1	97.1	95.2	92.0	97.3	97.3	91.1	98.0	100.0	96.4	96.8	98.7	99.9	99.8	95.9	3.2	98.9	1.3	95.6	2.7
20.00	508.0	99.6	97.0	97.9	98.5	95.9	94.8	92.1	90.1	96.0	94.4	84.8	94.7	99.7	91.5	94.3	97.2	99.6	99.0	92.5	5.2	97.4	2.7	93.2	2.6
15.00	381.0	98.3	92.7	94.8	93.2	91.0	90.6	86.6	87.4	93.6	88.7	74.5	86.8	98.3	81.1	89.4	93.9	98.1	95.1	85.9	8.1	93.5	5.2	88.9	2.2
14.00	355.6	97.8	91.3	93.7	91.1	89.4	89.3	85.0	86.7	93.0	86.9	71.7	84.3	97.6	78.0	88.0	92.8	97.5	93.4	84.0	8.9	92.1	5.9	87.6	2.2
13.00	330.2	97.0	89.7	92.4	88.5	87.6	87.9	83.2	85.9	92.2	84.9	68.7	81.4	96.6	74.6	86.3	91.6	96.7	91.2	81.8	9.8	90.5	6.7	86.2	2.1
12.00	304.8	96.1	87.7	90.9	85.3	85.5	86.2	81.2	85.0	91.3	82.6	65.5	78.0	95.3	70.8	84.4	90.1	95.6	88.5	79.3	10.8	88.4	7.5	84.5	2.2
11.00	279.4	94.7	85.3	89.0	81.3	83.0	84.3	79.0	84.0	90.3	79.9	61.9	74.2	93.5	66.5	82.2	88.3	94.2	85.0	76.6	11.9	86.0	8.4	82.6	2.5
10.00	254.0	93.0	82.5	86.7	76.5	80.1	82.0	76.4	82.9	89.1	76.8	58.0	69.8	91.1	61.7	79.7	86.1	92.3	80.8	73.4	13.1	83.0	9.4	80.4	2.9
9.00	228.6	90.7	79.1	83.9	70.9	76.7	79.4	73.4	81.7	87.8	73.2	53.7	64.8	87.9	56.5	76.8	83.6	89.8	75.6	69.9	14.4	79.5	10.4	77.8	3.6
8.50	215.9	89.3	77.2	82.2	67.7	74.7	77.9	71.8	81.0	87.0	71.2	51.4	62.0	86.0	53.7	75.1	82.1	88.3	72.6	67.9	15.1	77.4	10.9	76.3	4.0
8.00	203.2	87.7	75.1	80.5	64.3	72.6	76.3	70.0	80.3	86.1	69.0	49.1	59.1	83.8	50.8	73.3	80.5	86.6	69.4	65.8	15.8	75.2	11.4	74.8	4.5
7.50	190.5	85.9	72.8	78.5	60.7	70.4	74.5	68.1	79.4	85.1	66.7	46.6	56.1	81.3	47.7	71.4	78.7	84.6	65.8	63.6	16.5	72.7	11.9	73.1	5.0
7.00	177.8	83.8	70.3	76.3	56.8	67.9	72.6	66.0	78.6	84.1	64.2	44.1	52.9	78.4	44.6	69.3	76.7	82.4	62.1	61.3	17.3	70.1	12.4	71.3	5.6
6.50	165.1	81.4	67.5	73.9	52.7	65.3	70.5	63.8	77.6	82.9	61.5	41.4	49.5	75.2	41.4	67.0	74.6	79.9	58.0	58.8	18.0	67.2	12.8	69.3	6.2
6.00	152.4	78.6	64.6	71.2	48.5	62.4	68.2	61.4	76.6	81.6	58.7	38.7	46.0	71.6	38.1	64.6	72.2	77.0	53.7	56.2	18.8	64.0	13.2	67.1	7.0
5.50	139.7	75.5	61.3	68.2	44.0	59.2	65.7	58.8	75.4	80.2	55.5	35.8	42.3	67.6	34.7	61.9	69.5	73.7	49.2	53.5	19.6	60.6	13.6	64.8	7.7
5.00	127.0	71.9	57.8	64.9	39.5	55.8	63.0	56.0	74.1	78.5	52.2	32.9	38.5	63.1	31.2	58.9	66.5	70.0	44.4	50.5	20.3	56.8	13.8	62.2	8.6
4.50	114.3	67.9	53.9	61.3	34.8	52.1	59.9	52.9	72.7	76.6	48.6	29.8	34.6	58.2	27.7	55.7	63.2	65.8	39.5	47.4	21.0	52.8	13.9	59.4	9.5
4.00	101.6	63.3	49.8	57.2	30.0	48.1	56.5	49.6	71.1	74.5	44.7	26.7	30.5	52.8	24.1	52.2	59.5	61.1	34.4	44.1	21.7	48.4	13.9	56.3	10.5
3.50	88.9	58.0	45.2	52.7	25.2	43.8	52.8	45.9	69.2	72.0	40.5	23.4	26.4	46.9	20.6	48.3	55.4	55.8	29.2	40.6	22.2	43.7	13.7	52.9	11.5
3.00	76.2	52.1	40.2	47.6	20.5	39.0	48.5	41.8	67.0	69.0	36.0	20.1	22.2	40.5	17.0	44.0	50.7	49.9	24.0	36.8	22.6	38.7	13.2	49.1	12.6
2.50	63.5	45.5	34.8	42.0	16.0	33.9	43.7	37.3	64.4	65.5	31.1	16.7	18.0	33.7	13.6	39.1	45.5	43.2	18.9	32.8	22.7	33.2	12.5	44.8	13.7
2.00	50.8	38.0	28.9	35.7	11.6	28.3	38.3	32.3	61.2	61.1	25.9	13.3	13.8	26.6	10.2	33.7	39.4	35.9	14.0	28.5	22.5	27.4	11.4	40.0	14.7
1.75	44.5	33.9	25.8	32.2	9.6	25.3	35.2	29.5	59.3	58.5	23.1	11.6	11.7	22.9	8.6	30.8	36.1	31.9	11.6	26.2	22.2	24.3	10.7	37.3	15.2
1.50	38.1	29.6	22.5	28.5	7.7	22.1	31.9	26.5	57.2	55.6	20.2	9.8	9.7	19.3	7.0	27.6	32.4	27.7	9.3	23.8	21.7	21.2	9.8	34.4	15.7
1.25	31.8	25.1	19.1	24.6	5.9	18.9	28.3	23.3	54.6	52.1	17.2	8.1	7.7	15.6	5.5	24.2	28.5	23.4	7.2	21.3	21.0	17.9	8.8	31.3	16.0

Sieve Size		Percent of of material passed at any given size (%-wet basis)																								
inch	mm																									
1.00	25.4	20.4	15.6	20.5	4.2	15.5	24.4	19.9	51.5	48.0	14.0	6.4	5.8	12.0	4.1	20.5	24.2	18.8	5.2		18.6	20.0	14.6	7.7	27.8	16.2
0.90	22.9	18.4	14.1	18.7	3.6	14.1	22.7	18.4	50.1	46.1	12.8	5.7	5.1	10.5	3.6	19.0	22.4	17.0	4.5		17.4	19.5	13.2	7.1	26.3	16.2
0.80	20.3	16.5	12.6	16.9	3.0	12.6	20.9	16.9	48.5	44.1	11.4	5.0	4.4	9.1	3.1	17.3	20.5	15.1	3.8		16.2	18.8	11.8	6.6	24.7	16.2
0.70	17.8	14.4	11.1	15.1	2.5	11.2	19.0	15.3	46.8	41.8	10.1	4.3	3.7	7.8	2.6	15.6	18.5	13.2	3.1		15.0	18.1	10.4	6.0	23.1	16.1
0.60	15.2	12.4	9.6	13.2	1.9	9.7	17.0	13.6	44.8	39.3	8.8	3.6	3.1	6.4	2.1	13.9	16.4	11.3	2.5		13.7	17.3	9.0	5.4	21.3	16.0
0.55	14.0	11.4	8.8	12.2	1.7	8.9	16.0	12.7	43.7	37.9	8.1	3.3	2.7	5.8	1.8	13.0	15.3	10.3	2.2		13.0	16.8	8.3	5.1	20.3	15.8
0.50	12.7	10.3	8.0	11.2	1.5	8.2	14.9	11.9	42.5	36.4	7.4	3.0	2.4	5.1	1.6	12.0	14.2	9.3	1.9		12.3	16.2	7.5	4.7	19.4	15.7
0.45	11.4	9.3	7.3	10.2	1.3	7.4	13.8	10.9	41.2	34.8	6.7	2.6	2.1	4.5	1.4	11.1	13.1	8.4	1.6		11.6	15.6	6.8	4.4	18.3	15.5
0.40	10.2	8.2	6.5	9.2	1.1	6.6	12.7	10.0	39.8	33.1	6.0	2.3	1.8	3.9	1.2	10.1	11.9	7.4	1.4		10.8	15.0	6.1	4.0	17.3	15.2
0.35	8.9	7.2	5.7	8.2	0.9	5.8	11.5	9.0	38.3	31.2	5.2	2.0	1.5	3.3	1.0	9.1	10.7	6.4	1.1		10.0	14.3	5.3	3.6	16.1	14.9
0.30	7.6	6.1	4.9	7.1	0.7	5.0	10.2	8.0	36.5	29.2	4.5	1.7	1.3	2.7	0.8	8.0	9.5	5.5	0.9		9.2	13.4	4.6	3.2	14.9	14.5
0.25	6.4	5.1	4.1	6.0	0.5	4.2	8.9	6.9	34.5	26.9	3.8	1.4	1.0	2.1	0.6	6.9	8.2	4.5	0.7		8.3	12.5	3.9	2.8	13.6	14.0
0.20	5.1	4.0	3.3	4.9	0.4	3.4	7.6	5.8	32.2	24.3	3.1	1.1	0.7	1.6	0.5	5.8	6.8	3.6	0.5		7.3	11.4	3.1	2.3	12.2	13.4
0.15	3.8	3.0	2.4	3.7	0.2	2.6	6.1	4.6	29.3	21.3	2.3	0.8	0.5	1.1	0.3	4.5	5.4	2.6	0.3		6.2	10.1	2.4	1.8	10.7	12.5
0.10	2.5	1.9	1.6	2.6	0.1	1.7	4.4	3.4	25.7	17.5	1.6	0.5	0.3	0.7	0.2	3.3	3.8	1.7	0.2		5.0	8.4	1.6	1.3	8.8	11.3
0.05	1.3	0.9	0.8	1.3	0.0	0.9	2.6	1.9	20.3	12.5	0.8	0.2	0.1	0.3	0.1	1.8	2.1	0.8	0.1		3.4	6.1	0.8	0.7	6.4	9.3
0.03	0.6	0.4	0.4	0.7	0.0	0.4	1.5	1.1	15.9	8.8	0.4	0.1	0.1	0.1	0.0	1.0	1.2	0.4	0.0		2.3	4.3	0.4	0.4	4.7	7.5
0.02	0.5	0.4	0.3	0.6	0.0	0.4	1.3	0.9	14.7	7.9	0.3	0.1	0.0	0.1	0.0	0.8	1.0	0.3	0.0		2.1	3.9	0.3	0.4	4.3	6.9
0.01	0.3	0.2	0.2	0.3	0.0	0.2	0.7	0.5	11.4	5.5	0.2	0.0	0.0	0.0	0.0	0.5	0.5	0.1	0.0		1.4	2.7	0.2	0.2	3.2	5.5

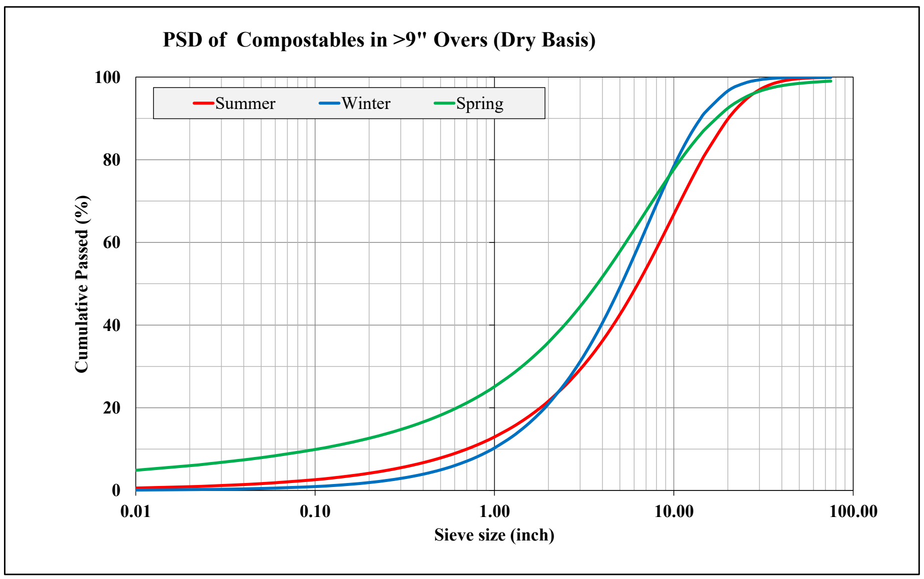


Fitting Rosin-Rammler Distribution to Compostable Fraction of Trommel's >9 inch Overs

Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	0.98	0.99	0.99	0.95	0.95	0.99	0.99	0.88	0.95	0.94	0.94	0.96	0.98	0.96	0.74	0.99	1.00	0.98
n =	1.27	1.17	0.98	1.54	1.03	0.93	0.97	0.31	0.63	1.03	1.28	1.33	1.28	1.60	0.87	0.97	1.15	1.76
n x ln(D_N) =	-6.04	-5.98	-4.86	-8.25	-5.23	-4.75	-5.13	-1.14	-2.96	-5.58	-7.38	-7.27	-6.42	-9.05	-4.54	-4.94	-5.72	-9.34
D_N (mm)	117.77	165.11	145.21	213.86	160.10	167.79	202.71	40.67	107.64	230.15	318.39	242.24	151.12	285.94	187.55	161.03	146.15	203.06
D_N (in)	4.64	6.50	5.72	8.42	6.30	6.61	7.98	1.60	4.24	9.06	12.54	9.54	5.95	11.26	7.38	6.34	5.75	7.99
R^2 =	0.97	1.00	0.99	0.97	0.95	0.99	0.99	0.88	0.95	0.94	0.95	0.96	0.97	0.95	0.73	0.99	1.00	0.97
D_{60} =	69.28	93.06	72.95	138.20	83.39	81.30	101.08	4.57	37.19	119.56	188.37	145.91	89.41	187.94	86.44	80.68	81.36	138.57
D_{10} =	19.91	24.18	14.46	49.53	18.01	14.81	19.70	0.03	3.06	25.65	54.87	44.33	26.05	70.10	14.00	15.90	20.54	56.45
UC =	3.48	3.85	5.04	2.79	4.63	5.49	5.13	170.26	12.15	4.66	3.43	3.29	3.43	2.68	6.17	5.07	3.96	2.45

Sieve Size		Percent of of material passed at any given size (%-dry basis)																		Summer		Winter		Spring	
inch	**mm**	Jan-15 1	Jan-15 2	Jan-15 3	Jan-15 4	May-15 1	May-15 2	May-15 3	May-15 4	Jun-15 1	Jun-15 2	Jun-15 3	Jun-15 4	Nov-15 1	Nov-15 2	Nov-15 3	Feb-16 1	Feb-16 2	Feb-16 3	Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.2	99.8	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.9	0.1	100.0	0.0	99.0	1.9
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	95.2	99.5	99.9	99.9	100.0	100.0	100.0	99.8	100.0	100.0	100.0	99.8	0.2	100.0	0.1	98.8	2.4
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	99.9	99.7	94.4	99.1	99.7	99.7	100.0	100.0	100.0	99.5	99.9	100.0	100.0	99.6	0.4	99.9	0.2	98.5	2.7
45.00	1143.0	100.0	100.0	99.9	100.0	99.9	99.7	99.5	93.8	98.8	99.4	99.4	100.0	100.0	100.0	99.2	99.9	100.0	100.0	99.4	0.5	99.9	0.3	98.3	2.9
40.00	1016.0	100.0	100.0	99.9	100.0	99.9	99.5	99.1	93.2	98.4	99.0	98.8	99.9	100.0	100.0	98.7	99.7	100.0	100.0	99.0	0.6	99.8	0.4	97.9	3.2
35.00	889.0	100.0	99.9	99.7	100.0	99.7	99.1	98.4	92.4	97.8	98.2	97.6	99.6	100.0	99.8	97.9	99.5	100.0	100.0	98.3	0.9	99.7	0.7	97.4	3.4
30.00	762.0	100.0	99.8	99.4	99.9	99.3	98.3	97.2	91.5	96.8	96.7	95.3	99.0	100.0	99.2	96.6	98.9	99.9	100.0	96.9	1.5	99.4	1.0	96.6	3.5
25.00	635.0	100.0	99.2	98.5	99.5	98.4	96.8	95.1	90.2	95.4	94.1	91.1	97.2	99.8	97.2	94.4	97.7	99.5	99.9	94.5	2.6	98.6	1.8	95.1	3.5
20.00	508.0	99.8	97.6	96.6	97.7	96.3	93.9	91.2	88.6	93.0	89.5	83.8	93.1	99.1	91.9	90.7	95.3	98.5	99.3	89.8	4.4	96.7	3.1	92.5	3.3
15.00	381.0	98.8	93.0	92.3	91.2	91.3	88.2	84.1	86.3	89.2	81.3	71.6	83.8	96.2	79.5	84.3	90.1	95.0	95.1	81.5	7.4	91.5	5.8	87.5	3.1
14.00	355.6	98.3	91.4	90.9	88.8	89.7	86.6	82.1	85.7	88.1	79.0	68.4	81.0	95.0	75.8	82.5	88.5	93.7	93.1	79.1	8.1	89.8	6.5	86.0	3.1
13.00	330.2	97.5	89.5	89.2	85.8	87.8	84.6	79.8	85.1	86.9	76.5	64.9	77.9	93.4	71.6	80.5	86.6	92.2	90.5	76.5	9.0	87.7	7.3	84.4	3.3
12.00	304.8	96.4	87.1	87.3	82.2	85.6	82.4	77.3	84.4	85.5	73.7	61.2	74.2	91.4	67.0	78.2	84.4	90.2	87.0	73.6	9.9	85.1	8.1	82.4	3.7
11.00	279.4	94.9	84.3	84.9	77.9	83.0	79.9	74.4	83.6	83.9	70.5	57.1	70.1	88.9	61.9	75.7	81.9	87.8	82.7	70.4	11.0	82.1	9.0	80.2	4.2
10.00	254.0	92.9	80.9	82.2	72.8	80.0	77.0	71.2	82.7	82.1	66.9	52.7	65.5	85.7	56.3	72.8	78.9	84.8	77.3	66.8	12.0	78.5	9.9	77.7	5.0
9.00	228.6	90.1	76.9	78.9	67.0	76.4	73.6	67.5	81.7	80.0	63.0	48.0	60.4	81.7	50.3	69.5	75.5	81.2	70.8	62.8	13.2	74.2	10.8	74.8	5.9
8.50	215.9	88.4	74.6	77.1	63.7	74.4	71.7	65.4	81.2	78.8	60.8	45.6	57.6	79.4	47.2	67.7	73.5	79.1	67.2	60.7	13.7	71.8	11.2	73.2	6.5
8.00	203.2	86.4	72.1	75.0	60.3	72.1	69.7	63.3	80.6	77.6	58.5	43.0	54.7	76.8	43.9	65.8	71.5	76.8	63.3	58.5	14.3	69.2	11.7	71.4	7.2
7.50	190.5	84.1	69.3	72.8	56.7	69.8	67.5	61.0	80.0	76.2	56.1	40.4	51.7	73.9	40.7	63.7	69.2	74.2	59.1	56.1	14.9	66.4	12.0	69.6	7.9
7.00	177.8	81.4	66.4	70.4	52.9	67.2	65.2	58.6	79.3	74.7	53.6	37.8	48.5	70.8	37.3	61.5	66.7	71.4	54.7	53.6	15.5	63.4	12.4	67.6	8.6
6.50	165.1	78.4	63.2	67.8	48.9	64.4	62.7	56.0	78.5	73.0	50.9	35.0	45.2	67.4	34.0	59.2	64.1	68.3	50.1	51.0	16.1	60.1	12.7	65.4	9.5
6.00	152.4	75.0	59.8	64.9	44.8	61.3	59.9	53.2	77.7	71.2	48.1	32.3	41.8	63.6	30.6	56.6	61.2	65.0	45.3	48.3	16.6	56.7	12.9	63.0	10.4
5.50	139.7	71.1	56.1	61.8	40.5	58.1	57.0	50.2	76.8	69.2	45.1	29.4	38.3	59.5	27.2	53.9	58.1	61.3	40.4	45.5	17.1	53.0	13.0	60.5	11.4
5.00	127.0	66.7	52.1	58.4	36.1	54.5	53.8	47.1	75.8	67.0	41.9	26.5	34.6	55.1	23.9	51.0	54.8	57.3	35.5	42.5	17.5	49.1	13.1	57.8	12.5
4.50	114.3	61.8	47.8	54.7	31.7	50.7	50.4	43.7	74.7	64.6	38.6	23.6	30.9	50.3	20.6	47.8	51.2	53.0	30.5	39.4	17.9	44.9	12.9	54.9	13.6
4.00	101.6	56.4	43.2	50.6	27.3	46.5	46.6	40.2	73.4	61.9	35.1	20.7	27.1	45.2	17.4	44.4	47.2	48.3	25.6	36.2	18.1	40.6	12.6	51.7	14.8
3.50	88.9	50.4	38.4	46.2	22.8	42.1	42.6	36.3	72.0	58.8	31.4	17.7	23.3	39.8	14.3	40.8	43.0	43.2	20.9	32.8	18.2	36.0	12.1	48.2	16.1
3.00	76.2	43.8	33.2	41.3	18.5	37.2	38.2	32.2	70.3	55.2	27.5	14.8	19.4	34.1	11.3	36.7	38.3	37.7	16.4	29.3	18.1	31.1	11.4	44.5	17.4
2.50	63.5	36.7	27.9	36.0	14.3	32.0	33.4	27.8	68.2	51.1	23.4	11.9	15.6	28.1	8.6	32.4	33.3	31.9	12.2	25.5	17.7	26.1	10.4	40.4	18.7
2.00	50.8	29.2	22.2	30.2	10.4	26.4	28.1	23.1	65.7	46.3	19.1	9.1	11.9	21.9	6.1	27.5	27.8	25.7	8.4	21.6	17.0	20.9	9.2	35.8	20.0
1.75	44.5	25.3	19.3	27.0	8.5	23.4	25.3	20.6	64.2	43.5	16.9	7.7	10.0	18.8	5.0	24.9	24.9	22.5	6.7	19.6	16.5	18.3	8.4	33.4	20.6
1.50	38.1	21.3	16.4	23.7	6.8	20.4	22.4	18.1	62.5	40.5	14.6	6.4	8.3	15.8	3.9	22.2	21.8	19.3	5.1	17.4	15.8	15.6	7.6	30.8	21.2
1.25	31.8	17.3	13.5	20.3	5.2	17.2	19.2	15.4	60.4	37.0	12.3	5.1	6.5	12.7	2.9	19.3	18.6	15.9	3.8	15.2	14.8	13.0	6.7	28.1	21.6

Sieve Size		Percent of of material passed at any given size (%-dry basis)																								
inch	mm																									
1.00	25.4	13.4	10.6	16.7	3.7	13.9	15.9	12.6	57.9	33.1	9.9	3.9	4.9	9.7	2.1	16.2	15.3	12.6	2.6		12.9	13.7	10.3	5.6	25.1	21.9
0.90	22.9	11.8	9.4	15.2	3.2	12.6	14.6	11.5	56.7	31.3	8.9	3.4	4.3	8.5	1.7	14.9	13.9	11.2	2.1		12.0	13.1	9.2	5.2	23.8	22.0
0.80	20.3	10.2	8.2	13.7	2.6	11.2	13.2	10.3	55.4	29.4	8.0	2.9	3.7	7.4	1.4	13.5	12.5	9.9	1.7		11.0	12.5	8.1	4.7	22.5	22.0
0.70	17.8	8.7	7.1	12.1	2.2	9.9	11.7	9.1	54.0	27.4	7.0	2.5	3.1	6.3	1.2	12.2	11.1	8.5	1.4		10.0	11.8	7.1	4.3	21.2	21.9
0.60	15.2	7.2	5.9	10.5	1.7	8.5	10.3	7.9	52.3	25.2	6.0	2.0	2.5	5.2	0.9	10.7	9.6	7.2	1.0		8.9	11.0	6.0	3.8	19.7	21.7
0.55	14.0	6.5	5.4	9.7	1.5	7.8	9.5	7.3	51.3	24.1	5.5	1.8	2.3	4.6	0.8	10.0	8.9	6.5	0.9		8.4	10.6	5.5	3.5	19.0	21.6
0.50	12.7	5.8	4.8	8.9	1.3	7.1	8.7	6.7	50.3	22.8	5.0	1.6	2.0	4.1	0.7	9.2	8.1	5.9	0.8		7.9	10.1	5.0	3.3	18.2	21.4
0.45	11.4	5.1	4.3	8.0	1.1	6.4	8.0	6.0	49.2	21.5	4.5	1.4	1.7	3.6	0.6	8.5	7.4	5.2	0.6		7.3	9.6	4.4	3.0	17.4	21.2
0.40	10.2	4.4	3.7	7.2	0.9	5.7	7.2	5.4	48.0	20.1	4.0	1.2	1.5	3.1	0.5	7.7	6.6	4.6	0.5		6.7	9.0	3.9	2.7	16.5	20.9
0.35	8.9	3.7	3.2	6.3	0.7	5.0	6.4	4.8	46.6	18.7	3.5	1.0	1.2	2.6	0.4	6.9	5.8	4.0	0.4		6.1	8.5	3.4	2.4	15.7	20.6
0.30	7.6	3.1	2.7	5.5	0.6	4.3	5.5	4.1	45.0	17.1	3.0	0.8	1.0	2.2	0.3	6.0	5.0	3.3	0.3		5.5	7.8	2.9	2.1	14.7	20.2
0.25	6.4	2.4	2.2	4.6	0.4	3.5	4.7	3.5	43.2	15.4	2.5	0.7	0.8	1.7	0.2	5.2	4.2	2.7	0.2		4.8	7.1	2.4	1.8	13.7	19.6
0.20	5.1	1.9	1.7	3.7	0.3	2.8	3.8	2.8	41.0	13.5	2.0	0.5	0.6	1.3	0.2	4.3	3.4	2.1	0.2		4.1	6.3	1.9	1.5	12.6	18.9
0.15	3.8	1.3	1.2	2.8	0.2	2.1	2.9	2.1	38.3	11.4	1.5	0.3	0.4	0.9	0.1	3.4	2.6	1.5	0.1		3.4	5.4	1.4	1.2	11.4	18.0
0.10	2.5	0.8	0.7	1.9	0.1	1.4	2.0	1.4	34.7	8.9	1.0	0.2	0.2	0.5	0.1	2.4	1.8	1.0	0.0		2.6	4.2	0.9	0.8	9.9	16.5
0.05	1.3	0.3	0.3	1.0	0.0	0.7	1.1	0.7	29.2	5.9	0.5	0.1	0.1	0.2	0.0	1.3	0.9	0.4	0.0		1.6	2.8	0.5	0.5	7.9	14.2
0.03	0.6	0.1	0.1	0.5	0.0	0.3	0.6	0.4	24.3	3.8	0.2	0.0	0.0	0.1	0.0	0.7	0.5	0.2	0.0		1.0	1.9	0.2	0.2	6.4	11.9
0.02	0.5	0.1	0.1	0.4	0.0	0.3	0.5	0.3	22.9	3.3	0.2	0.0	0.0	0.1	0.0	0.6	0.4	0.2	0.0		0.9	1.6	0.2	0.2	6.0	11.3
0.01	0.3	0.0	0.1	0.2	0.0	0.1	0.2	0.2	19.0	2.2	0.1	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.0		0.6	1.1	0.1	0.1	4.9	9.4



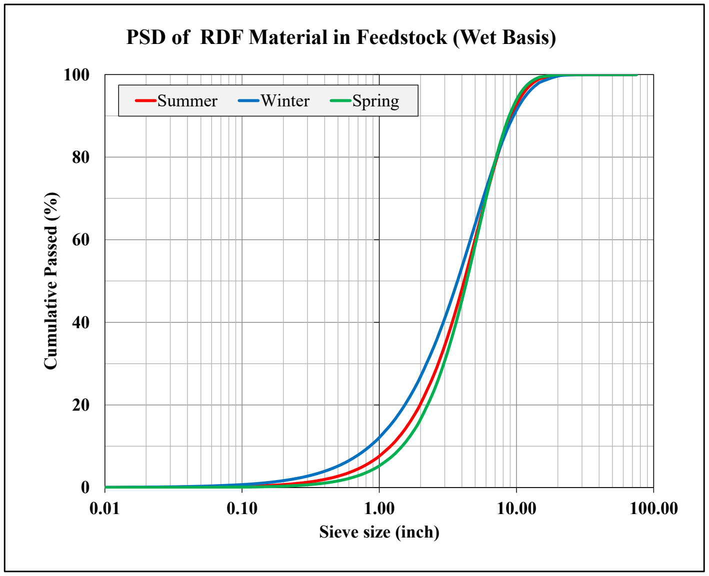
Fitting Rosin-Rammler Distribution to RDF Fraction of Total Feedstock

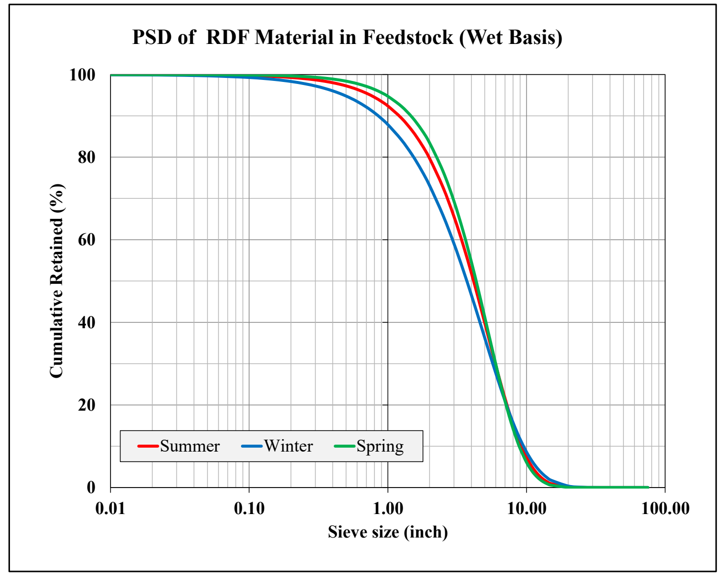
Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.92	0.98	0.98	0.99	0.98	0.99	0.99	0.99	0.98	0.98	0.98	0.99	0.99	0.98	1.00	0.99	1.00	0.98						
n =		1.26	1.22	1.09	1.39	1.69	1.71	1.81	1.79	1.36	1.60	1.75	1.49	1.38	1.34	1.25	1.44	1.24	1.34						
n x ln(D_N) =		-6.29	-5.85	-5.28	-6.66	-8.64	-8.33	-8.89	-8.49	-6.72	-7.57	-8.76	-7.32	-6.69	-6.76	-5.97	-6.99	-5.71	-6.44						
D_N (mm)		145.22	122.31	128.00	119.80	168.47	131.61	135.93	116.19	141.74	112.48	150.46	134.52	126.11	155.11	117.02	126.59	98.32	123.46						
D_N (in)		5.72	4.82	5.04	4.72	6.63	5.18	5.35	4.57	5.58	4.43	5.92	5.30	4.96	6.11	4.61	4.98	3.87	4.86						
R^2 =		0.90	0.97	0.98	0.98	0.99	0.99	0.98	0.97	0.98	0.95	0.97	0.98	0.99	0.98	1.00	0.99	0.99	0.96						
D_{60} =		135.52	113.83	118.12	112.50	159.95	125.04	129.52	110.64	132.89	106.51	143.12	126.87	118.39	145.32	109.14	119.15	91.65	115.65						
D_{10} =		24.50	19.25	16.21	23.76	44.34	35.19	39.23	32.95	26.96	27.64	41.48	29.81	24.81	28.95	19.44	26.65	16.12	22.96						
UC =		5.53	5.91	7.29	4.73	3.61	3.55	3.30	3.36	4.93	3.85	3.45	4.26	4.77	5.02	5.62	4.47	5.69	5.04						
Sieve Size		**Percent of of material passed at any given size (%-wet basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	99.8	99.9	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	0.0	99.9	0.1	100.0	0.0
20.00	508.0	99.2	99.7	98.9	99.9	99.8	100.0	100.0	100.0	99.6	100.0	100.0	99.9	99.9	99.3	99.8	99.9	100.0	99.9	99.9	0.2	99.6	0.4	100.0	0.1
15.00	381.0	96.6	98.1	96.2	99.3	98.1	99.8	99.8	100.0	97.8	99.9	99.4	99.1	99.0	96.4	98.8	99.3	99.5	98.9	99.1	0.9	98.2	1.3	99.4	0.9
14.00	355.6	95.5	97.4	95.2	98.9	97.1	99.6	99.7	99.9	96.9	99.8	98.9	98.6	98.5	95.2	98.2	98.8	99.3	98.4	98.6	1.2	97.6	1.6	99.1	1.3
13.00	330.2	94.1	96.5	94.0	98.3	95.5	99.2	99.3	99.8	95.7	99.6	98.1	97.8	97.7	93.6	97.5	98.2	98.9	97.6	97.8	1.6	96.6	2.0	98.5	2.0
12.00	304.8	92.2	95.2	92.4	97.4	93.4	98.5	98.7	99.6	94.1	99.3	96.8	96.6	96.6	91.6	96.4	97.1	98.3	96.5	96.7	2.1	95.4	2.4	97.5	2.8
11.00	279.4	89.8	93.5	90.4	96.1	90.4	97.3	97.5	99.2	91.9	98.6	94.8	94.9	95.1	88.9	94.9	95.7	97.4	94.9	95.0	2.8	93.7	2.9	96.1	3.9
10.00	254.0	86.8	91.2	87.9	94.2	86.4	95.4	95.5	98.2	89.0	97.5	91.8	92.4	92.8	85.6	92.9	93.5	96.2	92.8	92.7	3.6	91.4	3.5	93.9	5.1
9.00	228.6	83.0	88.2	84.8	91.4	81.2	92.3	92.3	96.5	85.2	95.6	87.5	89.0	89.7	81.4	90.1	90.4	94.3	89.8	89.3	4.5	88.3	4.0	90.6	6.5
8.50	215.9	80.8	86.4	82.9	89.7	78.1	90.2	90.1	95.1	83.0	94.2	84.7	86.8	87.8	78.9	88.4	88.5	93.0	87.9	87.2	4.9	86.4	4.3	88.4	7.2
8.00	203.2	78.3	84.4	80.9	87.6	74.6	87.7	87.4	93.4	80.4	92.4	81.5	84.3	85.6	76.2	86.4	86.2	91.5	85.7	84.7	5.4	84.3	4.6	85.8	7.9
7.50	190.5	75.6	82.0	78.6	85.1	70.8	84.7	84.2	91.1	77.5	90.2	77.9	81.4	83.0	73.2	84.2	83.5	89.7	83.2	81.8	5.9	81.8	4.8	82.7	8.5
7.00	177.8	72.5	79.3	76.1	82.3	66.6	81.2	80.3	88.2	74.3	87.6	73.8	78.1	80.0	69.9	81.5	80.5	87.6	80.4	78.4	6.4	79.0	5.1	79.1	9.1
6.50	165.1	69.2	76.3	73.3	79.0	62.0	77.1	75.9	84.6	70.8	84.3	69.1	74.3	76.6	66.3	78.6	77.0	85.1	77.1	74.6	6.8	75.8	5.3	74.9	9.4
6.00	152.4	65.5	72.9	70.2	75.3	57.0	72.3	70.8	80.3	66.8	80.4	64.0	70.0	72.7	62.3	75.2	72.9	82.2	73.4	70.3	7.1	72.3	5.5	70.1	9.7
5.50	139.7	61.4	69.1	66.7	71.0	51.8	66.9	65.0	75.1	62.5	75.7	58.5	65.3	68.4	58.1	71.3	68.4	78.7	69.3	65.5	7.4	68.2	5.6	64.7	9.7
5.00	127.0	57.0	64.9	62.9	66.2	46.3	61.0	58.7	69.0	57.8	70.3	52.5	60.1	63.6	53.5	67.0	63.4	74.7	64.6	60.1	7.5	63.8	5.7	58.7	9.4
4.50	114.3	52.2	60.2	58.7	60.8	40.5	54.4	51.8	62.1	52.6	64.2	46.1	54.3	58.2	48.5	62.1	57.8	70.1	59.4	54.3	7.5	58.8	5.7	52.2	8.9
4.00	101.6	47.1	55.0	54.0	54.8	34.7	47.4	44.6	54.5	47.1	57.2	39.6	48.2	52.4	43.3	56.7	51.7	64.7	53.7	48.0	7.2	53.3	5.7	45.3	8.2
3.50	88.9	41.6	49.2	49.0	48.3	28.8	40.1	37.1	46.2	41.2	49.6	32.9	41.7	46.0	37.8	50.8	45.1	58.6	47.5	41.3	6.8	47.4	5.6	38.1	7.2
3.00	76.2	35.8	43.0	43.4	41.3	23.1	32.5	29.6	37.5	35.0	41.5	26.3	34.8	39.2	32.0	44.2	38.2	51.7	40.8	34.4	6.2	41.0	5.3	30.7	6.0
2.50	63.5	29.6	36.3	37.3	33.9	17.6	25.1	22.3	28.8	28.6	33.0	19.9	27.8	32.1	26.1	37.2	30.9	44.0	33.7	27.3	5.4	34.1	5.0	23.4	4.7
2.00	50.8	23.3	29.1	30.6	26.2	12.4	17.9	15.5	20.4	22.0	24.4	13.9	20.8	24.7	20.1	29.6	23.5	35.6	26.3	20.3	4.5	26.9	4.5	16.5	3.4
1.75	44.5	20.1	25.3	27.1	22.3	10.0	14.5	12.4	16.5	18.7	20.2	11.2	17.4	21.0	17.1	25.7	19.8	31.1	22.5	16.9	4.0	23.2	4.1	13.3	2.8
1.50	38.1	16.8	21.5	23.4	18.4	7.8	11.4	9.5	12.8	15.5	16.2	8.7	14.1	17.4	14.1	21.7	16.2	26.5	18.7	13.6	3.4	19.5	3.7	10.4	2.2
1.25	31.8	13.6	17.6	19.7	14.6	5.8	8.5	6.9	9.4	12.3	12.3	6.4	10.9	13.8	11.2	17.7	12.7	21.7	15.0	10.5	2.8	15.8	3.3	7.7	1.6

1.00	25.4	10.4	13.7	15.8	10.9	4.0	5.9	4.7	6.4	9.3	8.8	4.4	8.0	10.3	8.5	13.7	9.4	16.9	11.4	7.6	2.2	12.1	2.8	5.2	1.1
0.90	22.9	9.2	12.2	14.2	9.5	3.4	4.9	3.9	5.3	8.1	7.5	3.7	6.8	9.0	7.4	12.1	8.1	15.0	9.9	6.5	2.0	10.7	2.6	4.4	0.9
0.80	20.3	8.0	10.6	12.6	8.1	2.8	4.0	3.2	4.3	6.9	6.2	3.0	5.8	7.7	6.3	10.5	6.9	13.1	8.6	5.5	1.7	9.2	2.4	3.6	0.7
0.70	17.8	6.8	9.1	11.0	6.8	2.2	3.2	2.5	3.4	5.8	5.1	2.4	4.8	6.4	5.3	9.0	5.7	11.2	7.2	4.5	1.5	7.9	2.1	2.8	0.6
0.60	15.2	5.6	7.6	9.4	5.5	1.7	2.5	1.9	2.6	4.7	4.0	1.8	3.8	5.2	4.4	7.5	4.6	9.4	5.9	3.6	1.2	6.5	1.8	2.2	0.4
0.55	14.0	5.0	6.9	8.6	4.9	1.5	2.2	1.6	2.3	4.2	3.5	1.6	3.3	4.6	3.9	6.7	4.1	8.4	5.3	3.1	1.1	5.8	1.7	1.9	0.4
0.50	12.7	4.5	6.2	7.8	4.3	1.3	1.8	1.4	1.9	3.7	3.0	1.3	2.9	4.1	3.4	6.0	3.5	7.5	4.7	2.7	1.0	5.2	1.6	1.6	0.3
0.45	11.4	3.9	5.4	6.9	3.7	1.1	1.5	1.1	1.6	3.2	2.5	1.1	2.5	3.5	3.0	5.3	3.1	6.6	4.1	2.3	0.9	4.6	1.4	1.3	0.3
0.40	10.2	3.4	4.7	6.1	3.2	0.9	1.3	0.9	1.3	2.8	2.1	0.9	2.1	3.0	2.6	4.6	2.6	5.8	3.5	2.0	0.8	3.9	1.3	1.1	0.2
0.35	8.9	2.9	4.0	5.3	2.6	0.7	1.0	0.7	1.0	2.3	1.7	0.7	1.7	2.5	2.1	3.9	2.1	4.9	2.9	1.6	0.7	3.3	1.1	0.9	0.2
0.30	7.6	2.4	3.4	4.5	2.1	0.5	0.8	0.5	0.8	1.9	1.3	0.5	1.4	2.0	1.7	3.2	1.7	4.1	2.4	1.3	0.6	2.8	1.0	0.7	0.1
0.25	6.4	1.9	2.7	3.7	1.7	0.4	0.6	0.4	0.6	1.5	1.0	0.4	1.0	1.6	1.4	2.6	1.3	3.3	1.9	1.0	0.4	2.2	0.8	0.5	0.1
0.20	5.1	1.4	2.1	2.9	1.2	0.3	0.4	0.3	0.4	1.1	0.7	0.3	0.7	1.2	1.0	1.9	1.0	2.5	1.4	0.7	0.3	1.7	0.7	0.3	0.1
0.15	3.8	1.0	1.5	2.2	0.8	0.2	0.2	0.2	0.2	0.7	0.4	0.2	0.5	0.8	0.7	1.4	0.6	1.7	0.9	0.5	0.2	1.2	0.5	0.2	0.0
0.10	2.5	0.6	0.9	1.4	0.5	0.1	0.1	0.1	0.1	0.4	0.2	0.1	0.3	0.4	0.4	0.8	0.4	1.1	0.6	0.3	0.1	0.7	0.3	0.1	0.0
0.05	1.3	0.2	0.4	0.7	0.2	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.1	0.2	0.2	0.3	0.1	0.4	0.2	0.1	0.1	0.3	0.2	0.0	0.0
0.03	0.6	0.1	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0
0.02	0.5	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0
0.01	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
Sieve Size		**Percent of of material retained at any given size (%-wet basis)**																							
inch	**mm**																								
75.00	1905.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60.00	1524.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	1270.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45.00	1143.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40.00	1016.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	889.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
30.00	762.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.00	635.0	0.2	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
20.00	508.0	0.8	0.3	1.1	0.1	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.1	0.1	0.7	0.2	0.1	0.0	0.1	0.1	0.2	0.4	0.4	0.0	0.1
15.00	381.0	3.4	1.9	3.8	0.7	1.9	0.2	0.2	0.0	2.2	0.1	0.6	0.9	1.0	3.6	1.2	0.7	0.5	1.1	0.9	0.9	1.8	1.3	0.6	0.9
14.00	355.6	4.5	2.6	4.8	1.1	2.9	0.4	0.3	0.1	3.1	0.2	1.1	1.4	1.5	4.8	1.8	1.2	0.7	1.6	1.4	1.2	2.4	1.6	0.9	1.3
13.00	330.2	5.9	3.5	6.0	1.7	4.5	0.8	0.7	0.2	4.3	0.4	1.9	2.2	2.3	6.4	2.5	1.8	1.1	2.4	2.2	1.6	3.4	2.0	1.5	2.0
12.00	304.8	7.8	4.8	7.6	2.6	6.6	1.5	1.3	0.4	5.9	0.7	3.2	3.4	3.4	8.4	3.6	2.9	1.7	3.5	3.3	2.1	4.6	2.4	2.5	2.8
11.00	279.4	10.2	6.5	9.6	3.9	9.6	2.7	2.5	0.8	8.1	1.4	5.2	5.1	4.9	11.1	5.1	4.3	2.6	5.1	5.0	2.8	6.3	2.9	3.9	3.9
10.00	254.0	13.2	8.8	12.1	5.8	13.6	4.6	4.5	1.8	11.0	2.5	8.2	7.6	7.2	14.4	7.1	6.5	3.8	7.2	7.3	3.6	8.6	3.5	6.1	5.1
9.00	228.6	17.0	11.8	15.2	8.6	18.8	7.7	7.7	3.5	14.8	4.4	12.5	11.0	10.3	18.6	9.9	9.6	5.7	10.2	10.7	4.5	11.7	4.0	9.4	6.5
8.50	215.9	19.2	13.6	17.1	10.3	21.9	9.8	9.9	4.9	17.0	5.8	15.3	13.2	12.2	21.1	11.6	11.5	7.0	12.1	12.8	4.9	13.6	4.3	11.6	7.2
8.00	203.2	21.7	15.6	19.1	12.4	25.4	12.3	12.6	6.6	19.6	7.6	18.5	15.7	14.4	23.8	13.6	13.8	8.5	14.3	15.3	5.4	15.7	4.6	14.2	7.9
7.50	190.5	24.4	18.0	21.4	14.9	29.2	15.3	15.8	8.9	22.5	9.8	22.1	18.6	17.0	26.8	15.8	16.5	10.3	16.8	18.2	5.9	18.2	4.8	17.3	8.5
7.00	177.8	27.5	20.7	23.9	17.7	33.4	18.8	19.7	11.8	25.7	12.4	26.2	21.9	20.0	30.1	18.5	19.5	12.4	19.6	21.6	6.4	21.0	5.1	20.9	9.1
6.50	165.1	30.8	23.7	26.7	21.0	38.0	22.9	24.1	15.4	29.2	15.7	30.9	25.7	23.4	33.7	21.4	23.0	14.9	22.9	25.4	6.8	24.2	5.3	25.1	9.4
6.00	152.4	34.5	27.1	29.8	24.7	43.0	27.7	29.2	19.7	33.2	19.6	36.0	30.0	27.3	37.7	24.8	27.1	17.8	26.6	29.7	7.1	27.7	5.5	29.9	9.7
5.50	139.7	38.6	30.9	33.3	29.0	48.2	33.1	35.0	24.9	37.5	24.3	41.5	34.7	31.6	41.9	28.7	31.6	21.3	30.7	34.5	7.4	31.8	5.6	35.3	9.7
5.00	127.0	43.0	35.1	37.1	33.8	53.7	39.0	41.3	31.0	42.2	29.7	47.5	39.9	36.4	46.5	33.0	36.6	25.3	35.4	39.9	7.5	36.2	5.7	41.3	9.4
4.50	114.3	47.8	39.8	41.3	39.2	59.5	45.6	48.2	37.9	47.4	35.8	53.9	45.7	41.8	51.5	37.9	42.2	29.9	40.6	45.7	7.5	41.2	5.7	47.8	8.9

4.00	101.6	52.9	45.0	46.0	45.2	65.3	52.6	55.4	45.5	52.9	42.8	60.4	51.8	47.6	56.7	43.3	48.3	35.3	46.3	52.0	7.2	46.7	5.7	54.7	8.2
3.50	88.9	58.4	50.8	51.0	51.7	71.2	59.9	62.9	53.8	58.8	50.4	67.1	58.3	54.0	62.2	49.2	54.9	41.4	52.5	58.7	6.8	52.6	5.6	61.9	7.2
3.00	76.2	64.2	57.0	56.6	58.7	76.9	67.5	70.4	62.5	65.0	58.5	73.7	65.2	60.8	68.0	55.8	61.8	48.3	59.2	65.6	6.2	59.0	5.3	69.3	6.0
2.50	63.5	70.4	63.7	62.7	66.1	82.4	74.9	77.7	71.2	71.4	67.0	80.1	72.2	67.9	73.9	62.8	69.1	56.0	66.3	72.7	5.4	65.9	5.0	76.6	4.7
2.00	50.8	76.7	70.9	69.4	73.8	87.6	82.1	84.5	79.6	78.0	75.6	86.1	79.2	75.3	79.9	70.4	76.5	64.4	73.7	79.7	4.5	73.1	4.5	83.5	3.4
1.75	44.5	79.9	74.7	72.9	77.7	90.0	85.5	87.6	83.5	81.3	79.8	88.8	82.6	79.0	82.9	74.3	80.2	68.9	77.5	83.1	4.0	76.8	4.1	86.7	2.8
1.50	38.1	83.2	78.5	76.6	81.6	92.2	88.6	90.5	87.2	84.5	83.8	91.3	85.9	82.6	85.9	78.3	83.8	73.5	81.3	86.4	3.4	80.5	3.7	89.6	2.2
1.25	31.8	86.4	82.4	80.3	85.4	94.2	91.5	93.1	90.6	87.7	87.7	93.6	89.1	86.2	88.8	82.3	87.3	78.3	85.0	89.5	2.8	84.2	3.3	92.3	1.6
1.00	25.4	89.6	86.3	84.2	89.1	96.0	94.1	95.3	93.6	90.7	91.2	95.6	92.0	89.7	91.5	86.3	90.6	83.1	88.6	92.4	2.2	87.9	2.8	94.8	1.1
0.90	22.9	90.8	87.8	85.8	90.5	96.6	95.1	96.1	94.7	91.9	92.5	96.3	93.2	91.0	92.6	87.9	91.9	85.0	90.1	93.5	2.0	89.3	2.6	95.6	0.9
0.80	20.3	92.0	89.4	87.4	91.9	97.2	96.0	96.8	95.7	93.1	93.8	97.0	94.2	92.3	93.7	89.5	93.1	86.9	91.4	94.5	1.7	90.8	2.4	96.4	0.7
0.70	17.8	93.2	90.9	89.0	93.2	97.8	96.8	97.5	96.6	94.2	94.9	97.6	95.2	93.6	94.7	91.0	94.3	88.8	92.8	95.5	1.5	92.1	2.1	97.2	0.6
0.60	15.2	94.4	92.4	90.6	94.5	98.3	97.5	98.1	97.4	95.3	96.0	98.2	96.2	94.8	95.6	92.5	95.4	90.6	94.1	96.4	1.2	93.5	1.8	97.8	0.4
0.55	14.0	95.0	93.1	91.4	95.1	98.5	97.8	98.4	97.7	95.8	96.5	98.4	96.7	95.4	96.1	93.3	95.9	91.6	94.7	96.9	1.1	94.2	1.7	98.1	0.4
0.50	12.7	95.5	93.8	92.2	95.7	98.7	98.2	98.6	98.1	96.3	97.0	98.7	97.1	95.9	96.6	94.0	96.5	92.5	95.3	97.3	1.0	94.8	1.6	98.4	0.3
0.45	11.4	96.1	94.6	93.1	96.3	98.9	98.5	98.9	98.4	96.8	97.5	98.9	97.5	96.5	97.0	94.7	96.9	93.4	95.9	97.7	0.9	95.4	1.4	98.7	0.3
0.40	10.2	96.6	95.3	93.9	96.8	99.1	98.7	99.1	98.7	97.2	97.9	99.1	97.9	97.0	97.4	95.4	97.4	94.2	96.5	98.0	0.8	96.1	1.3	98.9	0.2
0.35	8.9	97.1	96.0	94.7	97.4	99.3	99.0	99.3	99.0	97.7	98.3	99.3	98.3	97.5	97.9	96.1	97.9	95.1	97.1	98.4	0.7	96.7	1.1	99.1	0.2
0.30	7.6	97.6	96.6	95.5	97.9	99.5	99.2	99.5	99.2	98.1	98.7	99.5	98.6	98.0	98.3	96.8	98.3	95.9	97.6	98.7	0.6	97.2	1.0	99.3	0.1
0.25	6.4	98.1	97.3	96.3	98.3	99.6	99.4	99.6	99.4	98.5	99.0	99.6	99.0	98.4	98.6	97.4	98.7	96.7	98.1	99.0	0.4	97.8	0.8	99.5	0.1
0.20	5.1	98.6	97.9	97.1	98.8	99.7	99.6	99.7	99.6	98.9	99.3	99.7	99.3	98.8	99.0	98.1	99.0	97.5	98.6	99.3	0.3	98.3	0.7	99.7	0.1
0.15	3.8	99.0	98.5	97.8	99.2	99.8	99.8	99.8	99.8	99.3	99.6	99.8	99.5	99.2	99.3	98.6	99.4	98.3	99.1	99.5	0.2	98.8	0.5	99.8	0.0
0.10	2.5	99.4	99.1	98.6	99.5	99.9	99.9	99.9	99.9	99.6	99.8	99.9	99.7	99.6	99.6	99.2	99.6	98.9	99.4	99.7	0.1	99.3	0.3	99.9	0.0
0.05	1.3	99.8	99.6	99.3	99.8	100.0	100.0	100.0	100.0	99.8	99.9	100.0	99.9	99.8	99.8	99.7	99.9	99.6	99.8	99.9	0.1	99.7	0.2	100.0	0.0
0.03	0.6	99.9	99.8	99.7	99.9	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.9	99.9	99.9	100.0	99.8	99.9	100.0	0.0	99.9	0.1	100.0	0.0
0.02	0.5	99.9	99.9	99.8	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	99.9	99.9	100.0	0.0	99.9	0.1	100.0	0.0
0.01	0.3	100.0	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	0.0	100.0	0.0	100.0	0.0


PSD of RDF Material in Feedstock (Wet Basis)
Summer
Winter
Spring
Cumulative Passed (%)
Sieve size (inch)
0
20
40
60
80
100
0.01
0.10
1.00
10.00
100.00


PSD of RDF Material in Feedstock (Wet Basis)
Summer
Winter
Spring
Cumulative Retained (%)
Sieve size (inch)
0
20
40
60
80
100
0.01
0.10
1.00
10.00
100.00

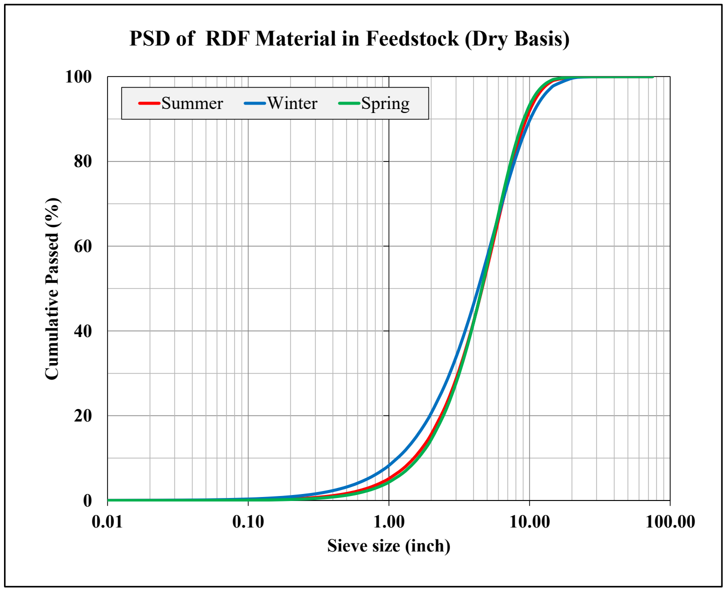
Fitting Rosin-Rammler Distribution to RDF Fraction of Total Feedstock

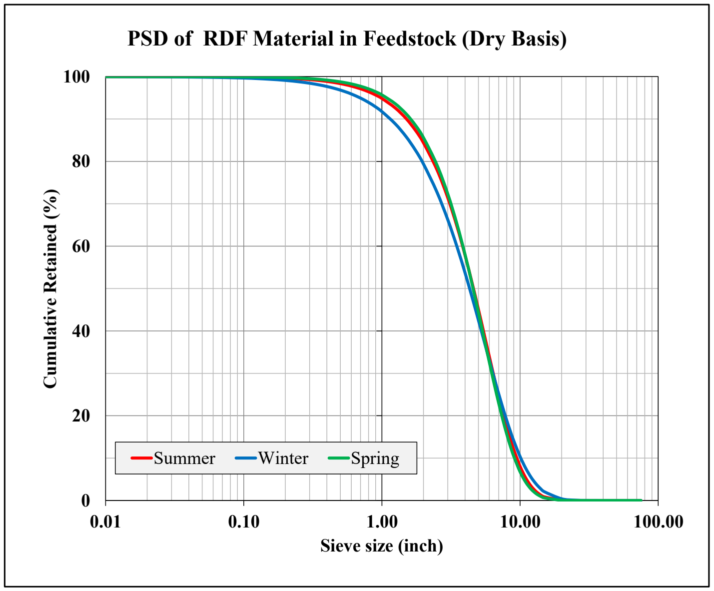
Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	#REF!	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.92	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.97	0.99	0.99	0.98	1.00	0.99	1.00	0.99						
n =		1.42	1.35	1.23	1.62	1.77	1.85	1.85	1.81	1.51	1.76	1.90	1.66	1.57	1.42	1.34	1.55	1.40	1.51						
n x $\ln(D_N)$ =		-7.27	-6.64	-6.19	-7.89	-9.14	-9.15	-9.17	-8.68	-7.63	-8.49	-9.64	-8.27	-7.79	-7.33	-6.55	-7.66	-6.63	-7.42						
D_N (mm)		167.09	138.57	154.80	132.63	177.27	138.93	141.44	120.21	155.08	122.62	161.05	145.59	140.67	173.04	133.89	137.89	114.29	136.63						
D_N (in)		6.58	5.46	6.09	5.22	6.98	5.47	5.57	4.73	6.11	4.83	6.34	5.73	5.54	6.81	5.27	5.43	4.50	5.38						
R^2 =		0.91	0.97	0.98	0.99	0.99	0.99	0.98	0.97	0.98	0.96	0.97	0.98	0.99	0.98	1.00	0.99	0.99	0.98						
D60 =		104.09	84.12	89.53	87.50	121.17	96.71	98.42	82.98	99.47	83.81	113.01	97.16	91.82	107.87	81.04	89.51	70.70	87.56						
D10 =		34.23	26.03	24.72	32.92	49.56	41.28	41.97	34.73	35.03	34.26	49.15	37.55	33.69	35.53	24.91	32.43	22.87	30.77						
UC =		3.04	3.23	3.62	2.66	2.45	2.34	2.34	2.39	2.84	2.45	2.30	2.59	2.73	3.04	3.25	2.76	3.09	2.85						
Sieve Size		Percent of of material passed at any given size (%-dry basis)																							
inch	mm																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	99.9	100.0	99.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	100.0	100.0	100.0	100.0	100.0	0.0	99.9	0.1	100.0	0.0
20.00	508.0	99.2	99.7	98.6	100.0	99.8	100.0	100.0	100.0	99.8	100.0	100.0	100.0	99.9	99.0	99.7	99.9	100.0	99.9	99.9	0.1	99.6	0.5	100.0	0.1
15.00	381.0	96.0	98.0	95.1	99.6	97.9	99.8	99.8	100.0	98.0	99.9	99.4	99.3	99.2	95.4	98.3	99.2	99.5	99.1	99.1	0.8	97.9	1.8	99.4	1.0
14.00	355.6	94.6	97.1	93.8	99.3	96.7	99.7	99.6	99.9	97.0	99.9	98.9	98.8	98.7	93.8	97.5	98.7	99.2	98.6	98.6	1.2	97.1	2.2	99.0	1.5
13.00	330.2	92.8	96.0	92.1	98.7	95.0	99.3	99.2	99.8	95.7	99.7	98.0	98.0	97.8	91.8	96.5	97.9	98.8	97.7	97.8	1.7	96.0	2.8	98.3	2.2
12.00	304.8	90.4	94.4	89.9	97.8	92.6	98.6	98.4	99.5	93.8	99.3	96.5	96.7	96.6	89.3	95.1	96.8	98.1	96.5	96.6	2.3	94.5	3.4	97.3	3.2
11.00	279.4	87.4	92.3	87.3	96.4	89.3	97.4	97.1	99.0	91.3	98.6	94.2	94.8	94.7	86.1	93.1	95.0	97.0	94.7	94.7	3.0	92.4	4.0	95.7	4.4
10.00	254.0	83.7	89.6	84.1	94.2	84.8	95.3	94.8	97.9	87.9	97.3	90.7	92.0	92.1	82.2	90.5	92.5	95.3	92.2	92.0	4.0	89.6	4.7	93.2	5.8
9.00	228.6	79.0	85.9	80.1	91.0	79.1	91.9	91.2	95.9	83.4	95.0	85.7	87.9	88.3	77.4	87.1	88.9	92.8	88.6	88.0	5.0	85.9	5.3	89.6	7.3
8.50	215.9	76.3	83.7	77.8	88.9	75.7	89.6	88.8	94.4	80.8	93.4	82.5	85.4	86.0	74.6	85.0	86.6	91.2	86.4	85.5	5.6	83.6	5.6	87.1	8.0
8.00	203.2	73.3	81.3	75.2	86.4	72.0	86.8	85.9	92.5	77.8	91.3	78.9	82.4	83.2	71.5	82.6	83.9	89.3	83.8	82.6	6.1	81.1	5.8	84.3	8.7
7.50	190.5	70.0	78.5	72.5	83.4	67.9	83.4	82.4	90.0	74.5	88.7	74.7	79.0	80.1	68.2	79.9	80.9	87.0	80.8	79.2	6.6	78.1	6.0	80.9	9.3
7.00	177.8	66.5	75.3	69.4	79.9	63.4	79.4	78.3	86.9	70.8	85.4	70.1	75.2	76.4	64.6	76.8	77.3	84.4	77.4	75.4	7.1	74.8	6.1	77.0	9.8
6.50	165.1	62.6	71.8	66.1	75.9	58.6	74.8	73.6	83.1	66.7	81.6	64.9	70.8	72.4	60.8	73.4	73.4	81.2	73.6	71.0	7.5	71.1	6.2	72.5	10.2
6.00	152.4	58.4	67.9	62.5	71.4	53.5	69.5	68.3	78.5	62.2	77.0	59.4	66.0	67.8	56.6	69.6	68.9	77.6	69.3	66.1	7.7	67.0	6.2	67.4	10.4
5.50	139.7	54.0	63.6	58.6	66.3	48.1	63.6	62.4	73.1	57.4	71.6	53.4	60.7	62.8	52.2	65.3	64.0	73.4	64.4	60.8	7.8	62.5	6.2	61.8	10.3
5.00	127.0	49.2	58.9	54.4	60.6	42.6	57.1	55.9	66.9	52.3	65.5	47.1	54.9	57.3	47.5	60.6	58.5	68.6	59.2	55.0	7.7	57.5	6.0	55.6	10.0
4.50	114.3	44.2	53.8	49.8	54.5	36.9	50.2	49.0	59.9	46.8	58.7	40.7	48.8	51.4	42.6	55.5	52.6	63.2	53.4	48.7	7.5	52.1	5.8	49.0	9.4
4.00	101.6	39.0	48.2	44.9	47.8	31.2	42.9	41.8	52.2	41.0	51.2	34.1	42.3	45.1	37.4	49.9	46.3	57.2	47.2	42.2	7.0	46.3	5.5	42.0	8.6
3.50	88.9	33.5	42.3	39.7	40.8	25.6	35.4	34.5	43.9	35.0	43.3	27.7	35.6	38.5	32.2	43.9	39.7	50.5	40.7	35.4	6.4	40.2	5.1	34.9	7.5
3.00	76.2	28.0	36.1	34.2	33.5	20.2	28.0	27.2	35.4	28.9	35.1	21.5	28.9	31.7	26.8	37.5	32.8	43.3	33.9	28.6	5.6	33.8	4.7	27.7	6.2
2.50	63.5	22.4	29.5	28.5	26.2	15.1	20.9	20.3	27.0	22.8	26.9	15.7	22.3	24.9	21.4	30.8	25.9	35.6	27.0	21.9	4.6	27.2	4.2	20.8	4.9
2.00	50.8	16.8	22.8	22.5	19.1	10.4	14.3	13.9	18.9	16.9	19.0	10.6	16.0	18.2	16.1	23.9	19.1	27.5	20.1	15.6	3.6	20.6	3.5	14.4	3.5
1.75	44.5	14.2	19.5	19.5	15.7	8.3	11.4	11.1	15.2	14.0	15.4	8.3	13.0	15.0	13.5	20.4	15.8	23.4	16.8	12.7	3.1	17.4	3.2	11.5	2.8
1.50	38.1	11.5	16.1	16.4	12.5	6.4	8.7	8.4	11.7	11.3	11.9	6.3	10.2	12.0	11.0	17.0	12.7	19.4	13.5	9.9	2.5	14.2	2.8	8.8	2.2

1.25	31.8	9.0	12.9	13.3	9.5	4.7	6.3	6.1	8.6	8.7	8.8	4.5	7.7	9.1	8.6	13.6	9.7	15.4	10.5	7.4	2.0	11.2	2.4	6.4	1.6
1.00	25.4	6.7	9.7	10.3	6.7	3.2	4.2	4.1	5.8	6.3	6.0	3.0	5.4	6.5	6.3	10.3	7.0	11.5	7.6	5.2	1.5	8.3	2.0	4.3	1.1
0.90	22.9	5.8	8.5	9.1	5.7	2.7	3.5	3.4	4.8	5.4	5.0	2.4	4.5	5.6	5.5	9.0	5.9	10.0	6.5	4.3	1.3	7.1	1.8	3.6	0.9
0.80	20.3	4.9	7.3	8.0	4.7	2.2	2.8	2.7	3.9	4.5	4.1	2.0	3.7	4.6	4.6	7.7	5.0	8.5	5.5	3.6	1.1	6.1	1.6	2.9	0.7
0.70	17.8	4.1	6.1	6.8	3.8	1.7	2.2	2.1	3.1	3.7	3.3	1.5	3.0	3.8	3.9	6.5	4.1	7.1	4.5	2.9	0.9	5.1	1.4	2.3	0.6
0.60	15.2	3.3	5.0	5.7	3.0	1.3	1.6	1.6	2.3	2.9	2.5	1.1	2.3	3.0	3.1	5.3	3.2	5.8	3.6	2.2	0.8	4.1	1.2	1.7	0.4
0.55	14.0	2.9	4.5	5.1	2.6	1.1	1.4	1.4	2.0	2.6	2.1	1.0	2.0	2.6	2.8	4.7	2.8	5.1	3.1	1.9	0.7	3.6	1.1	1.5	0.4
0.50	12.7	2.5	3.9	4.5	2.2	0.9	1.2	1.1	1.7	2.2	1.8	0.8	1.7	2.2	2.4	4.2	2.4	4.5	2.7	1.6	0.6	3.2	1.0	1.2	0.3
0.45	11.4	2.2	3.4	4.0	1.9	0.8	1.0	0.9	1.4	1.9	1.5	0.7	1.5	1.9	2.1	3.6	2.1	3.9	2.3	1.4	0.5	2.7	0.9	1.0	0.3
0.40	10.2	1.9	2.9	3.5	1.6	0.6	0.8	0.8	1.1	1.6	1.2	0.5	1.2	1.6	1.8	3.1	1.7	3.3	2.0	1.1	0.4	2.3	0.8	0.8	0.2
0.35	8.9	1.5	2.5	3.0	1.3	0.5	0.6	0.6	0.9	1.3	1.0	0.4	1.0	1.3	1.5	2.6	1.4	2.8	1.6	0.9	0.4	1.9	0.7	0.6	0.2
0.30	7.6	1.2	2.0	2.5	1.0	0.4	0.5	0.4	0.7	1.0	0.7	0.3	0.7	1.0	1.2	2.1	1.1	2.2	1.3	0.7	0.3	1.6	0.6	0.5	0.1
0.25	6.4	1.0	1.6	2.0	0.7	0.3	0.3	0.3	0.5	0.8	0.5	0.2	0.5	0.8	0.9	1.7	0.8	1.7	1.0	0.5	0.2	1.2	0.5	0.4	0.1
0.20	5.1	0.7	1.2	1.5	0.5	0.2	0.2	0.2	0.3	0.6	0.4	0.1	0.4	0.5	0.7	1.2	0.6	1.3	0.7	0.4	0.2	0.9	0.4	0.2	0.1
0.15	3.8	0.5	0.8	1.1	0.3	0.1	0.1	0.1	0.2	0.4	0.2	0.1	0.2	0.3	0.4	0.9	0.4	0.9	0.4	0.2	0.1	0.6	0.3	0.1	0.0
0.10	2.5	0.3	0.5	0.6	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.1	0.2	0.2	0.5	0.2	0.5	0.2	0.1	0.1	0.3	0.2	0.1	0.0
0.05	1.3	0.1	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0
0.03	0.6	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.5	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.01	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
Sieve Size		Percent of of material retained at any given size (%-dry basis)																							
inch	mm																								
75.00	1905.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60.00	1524.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	1270.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45.00	1143.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40.00	1016.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	889.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
30.00	762.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.00	635.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
20.00	508.0	0.8	0.3	1.4	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	1.0	0.3	0.1	0.0	0.1	0.1	0.1	0.4	0.5	0.0	0.1
15.00	381.0	4.0	2.0	4.9	0.4	2.1	0.2	0.2	0.0	2.0	0.1	0.6	0.7	0.8	4.6	1.7	0.8	0.5	0.9	0.9	0.8	2.1	1.8	0.6	1.0
14.00	355.6	5.4	2.9	6.2	0.7	3.3	0.3	0.4	0.1	3.0	0.1	1.1	1.2	1.3	6.2	2.5	1.3	0.8	1.4	1.4	1.2	2.9	2.2	1.0	1.5
13.00	330.2	7.2	4.0	7.9	1.3	5.0	0.7	0.8	0.2	4.3	0.3	2.0	2.0	2.2	8.2	3.5	2.1	1.2	2.3	2.2	1.7	4.0	2.8	1.7	2.2
12.00	304.8	9.6	5.6	10.1	2.2	7.4	1.4	1.6	0.5	6.2	0.7	3.5	3.3	3.4	10.7	4.9	3.2	1.9	3.5	3.4	2.3	5.5	3.4	2.7	3.2
11.00	279.4	12.6	7.7	12.7	3.6	10.7	2.6	2.9	1.0	8.7	1.4	5.8	5.2	5.3	13.9	6.9	5.0	3.0	5.3	5.3	3.0	7.6	4.0	4.3	4.4
10.00	254.0	16.3	10.4	15.9	5.8	15.2	4.7	5.2	2.1	12.1	2.7	9.3	8.0	7.9	17.8	9.5	7.5	4.7	7.8	8.0	4.0	10.4	4.7	6.8	5.8
9.00	228.6	21.0	14.1	19.9	9.0	20.9	8.1	8.8	4.1	16.6	5.0	14.3	12.1	11.7	22.6	12.9	11.1	7.2	11.4	12.0	5.0	14.1	5.3	10.4	7.3
8.50	215.9	23.7	16.3	22.2	11.1	24.3	10.4	11.2	5.6	19.2	6.6	17.5	14.6	14.0	25.4	15.0	13.4	8.8	13.6	14.5	5.6	16.4	5.6	12.9	8.0
8.00	203.2	26.7	18.7	24.8	13.6	28.0	13.2	14.1	7.5	22.2	8.7	21.1	17.6	16.8	28.5	17.4	16.1	10.7	16.2	17.4	6.1	18.9	5.8	15.7	8.7
7.50	190.5	30.0	21.5	27.5	16.6	32.1	16.6	17.6	10.0	25.5	11.3	25.3	21.0	19.9	31.8	20.1	19.1	13.0	19.2	20.8	6.6	21.9	6.0	19.1	9.3
7.00	177.8	33.5	24.7	30.6	20.1	36.6	20.6	21.7	13.1	29.2	14.6	29.9	24.8	23.6	35.4	23.2	22.7	15.6	22.6	24.6	7.1	25.2	6.1	23.0	9.8
6.50	165.1	37.4	28.2	33.9	24.1	41.4	25.2	26.4	16.9	33.3	18.4	35.1	29.2	27.6	39.2	26.6	26.6	18.8	26.4	29.0	7.5	28.9	6.2	27.5	10.2
6.00	152.4	41.6	32.1	37.5	28.6	46.5	30.5	31.7	21.5	37.8	23.0	40.6	34.0	32.2	43.4	30.4	31.1	22.4	30.7	33.9	7.7	33.0	6.2	32.6	10.4
5.50	139.7	46.0	36.4	41.4	33.7	51.9	36.4	37.6	26.9	42.6	28.4	46.6	39.3	37.2	47.8	34.7	36.0	26.6	35.6	39.2	7.8	37.5	6.2	38.2	10.3

5.00	127.0	50.8	41.1	45.6	39.4	57.4	42.9	44.1	33.1	47.7	34.5	52.9	45.1	42.7	52.5	39.4	41.5	31.4	40.8	45.0	7.7	42.5	6.0	44.4	10.0
4.50	114.3	55.8	46.2	50.2	45.5	63.1	49.8	51.0	40.1	53.2	41.3	59.3	51.2	48.6	57.4	44.5	47.4	36.8	46.6	51.3	7.5	47.9	5.8	51.0	9.4
4.00	101.6	61.0	51.8	55.1	52.2	68.8	57.1	58.2	47.8	59.0	48.8	65.9	57.7	54.9	62.6	50.1	53.7	42.8	52.8	57.8	7.0	53.7	5.5	58.0	8.6
3.50	88.9	66.5	57.7	60.3	59.2	74.4	64.6	65.5	56.1	65.0	56.7	72.3	64.4	61.5	67.8	56.1	60.3	49.5	59.3	64.6	6.4	59.8	5.1	65.1	7.5
3.00	76.2	72.0	63.9	65.8	66.5	79.8	72.0	72.8	64.6	71.1	64.9	78.5	71.1	68.3	73.2	62.5	67.2	56.7	66.1	71.4	5.6	66.2	4.7	72.3	6.2
2.50	63.5	77.6	70.5	71.5	73.8	84.9	79.1	79.7	73.0	77.2	73.1	84.3	77.7	75.1	78.6	69.2	74.1	64.4	73.0	78.1	4.6	72.8	4.2	79.2	4.9
2.00	50.8	83.2	77.2	77.5	80.9	89.6	85.7	86.1	81.1	83.1	81.0	89.4	84.0	81.8	83.9	76.1	80.9	72.5	79.9	84.4	3.6	79.4	3.5	85.6	3.5
1.75	44.5	85.8	80.5	80.5	84.3	91.7	88.6	88.9	84.8	86.0	84.6	91.7	87.0	85.0	86.5	79.6	84.2	76.6	83.2	87.3	3.1	82.6	3.2	88.5	2.8
1.50	38.1	88.5	83.9	83.6	87.5	93.6	91.3	91.6	88.3	88.7	88.1	93.7	89.8	88.0	89.0	83.0	87.3	80.6	86.5	90.1	2.5	85.8	2.8	91.2	2.2
1.25	31.8	91.0	87.1	86.7	90.5	95.3	93.7	93.9	91.4	91.3	91.2	95.5	92.3	90.9	91.4	86.4	90.3	84.6	89.5	92.6	2.0	88.8	2.4	93.6	1.6
1.00	25.4	93.3	90.3	89.7	93.3	96.8	95.8	95.9	94.2	93.7	94.0	97.0	94.6	93.5	93.7	89.7	93.0	88.5	92.4	94.8	1.5	91.7	2.0	95.7	1.1
0.90	22.9	94.2	91.5	90.9	94.3	97.3	96.5	96.6	95.2	94.6	95.0	97.6	95.5	94.4	94.5	91.0	94.1	90.0	93.5	95.7	1.3	92.9	1.8	96.4	0.9
0.80	20.3	95.1	92.7	92.0	95.3	97.8	97.2	97.3	96.1	95.5	95.9	98.0	96.3	95.4	95.4	92.3	95.0	91.5	94.5	96.4	1.1	93.9	1.6	97.1	0.7
0.70	17.8	95.9	93.9	93.2	96.2	98.3	97.8	97.9	96.9	96.3	96.7	98.5	97.0	96.2	96.1	93.5	95.9	92.9	95.5	97.1	0.9	94.9	1.4	97.7	0.6
0.60	15.2	96.7	95.0	94.3	97.0	98.7	98.4	98.4	97.7	97.1	97.5	98.9	97.7	97.0	96.9	94.7	96.8	94.2	96.4	97.8	0.8	95.9	1.2	98.3	0.4
0.55	14.0	97.1	95.5	94.9	97.4	98.9	98.6	98.6	98.0	97.4	97.9	99.0	98.0	97.4	97.2	95.3	97.2	94.9	96.9	98.1	0.7	96.4	1.1	98.5	0.4
0.50	12.7	97.5	96.1	95.5	97.8	99.1	98.8	98.9	98.3	97.8	98.2	99.2	98.3	97.8	97.6	95.8	97.6	95.5	97.3	98.4	0.6	96.8	1.0	98.8	0.3
0.45	11.4	97.8	96.6	96.0	98.1	99.2	99.0	99.1	98.6	98.1	98.5	99.3	98.5	98.1	97.9	96.4	97.9	96.1	97.7	98.6	0.5	97.3	0.9	99.0	0.3
0.40	10.2	98.1	97.1	96.5	98.4	99.4	99.2	99.2	98.9	98.4	98.8	99.5	98.8	98.4	98.2	96.9	98.3	96.7	98.0	98.9	0.4	97.7	0.8	99.2	0.2
0.35	8.9	98.5	97.5	97.0	98.7	99.5	99.4	99.4	99.1	98.7	99.0	99.6	99.0	98.7	98.5	97.4	98.6	97.2	98.4	99.1	0.4	98.1	0.7	99.4	0.2
0.30	7.6	98.8	98.0	97.5	99.0	99.6	99.5	99.6	99.3	99.0	99.3	99.7	99.3	99.0	98.8	97.9	98.9	97.8	98.7	99.3	0.3	98.4	0.6	99.5	0.1
0.25	6.4	99.0	98.4	98.0	99.3	99.7	99.7	99.7	99.5	99.2	99.5	99.8	99.5	99.2	99.1	98.3	99.2	98.3	99.0	99.5	0.2	98.8	0.5	99.6	0.1
0.20	5.1	99.3	98.8	98.5	99.5	99.8	99.8	99.8	99.7	99.4	99.6	99.9	99.6	99.5	99.3	98.8	99.4	98.7	99.3	99.6	0.2	99.1	0.4	99.8	0.1
0.15	3.8	99.5	99.2	98.9	99.7	99.9	99.9	99.9	99.8	99.6	99.8	99.9	99.8	99.7	99.6	99.1	99.6	99.1	99.6	99.8	0.1	99.4	0.3	99.9	0.0
0.10	2.5	99.7	99.5	99.4	99.8	99.9	99.9	99.9	99.9	99.8	99.9	100.0	99.9	99.8	99.8	99.5	99.8	99.5	99.8	99.9	0.1	99.7	0.2	99.9	0.0
0.05	1.3	99.9	99.8	99.7	99.9	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.9	99.9	99.8	99.9	99.8	99.9	100.0	0.0	99.9	0.1	100.0	0.0
0.03	0.6	100.0	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.02	0.5	100.0	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.01	0.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0


PSD of RDF Material in Feedstock (Dry Basis)
Summer
Winter
Spring
Cumulative Passed (%)
Sieve size (inch)
0
20
40
60
80
100
0.01
0.10
1.00
10.00
100.00


PSD of RDF Material in Feedstock (Dry Basis)
Summer
Winter
Spring
Cumulative Retained (%)
Sieve size (inch)
0
20
40
60
80
100
0.01
0.10
1.00
10.00
100.00

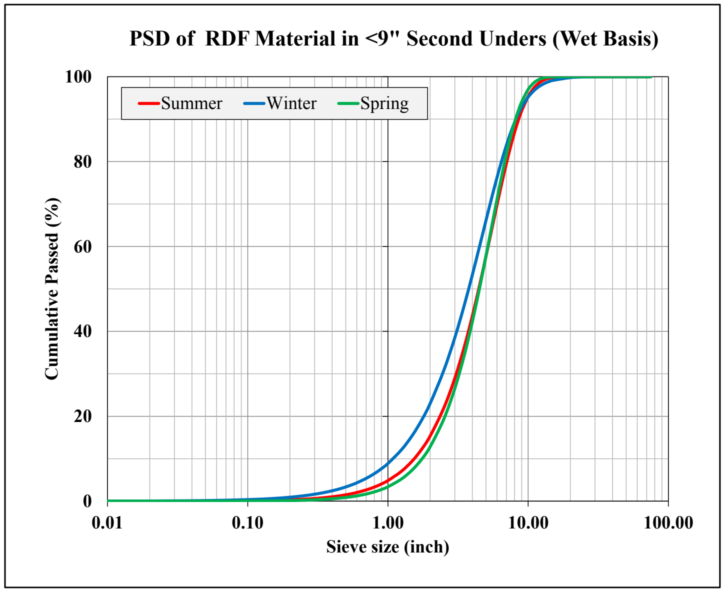
Fitting Rosin-Rammler Distribution to RDF Fraction of Trommel's <9 inch Second Unders

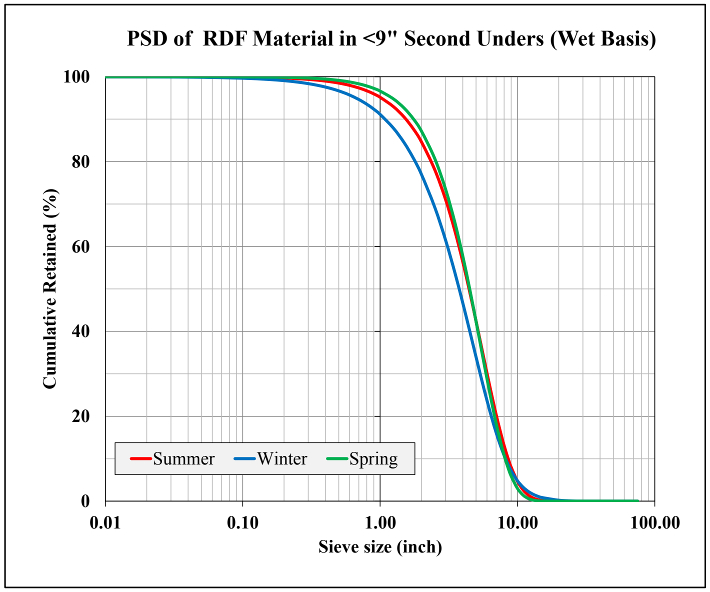
Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	#REF!	1	2	3	4	1	2	3	1	2	3						
R^2 =		0.98	1.00	1.00	1.00	0.98	0.99	1.00	1.00	0.98	1.00	0.99	0.99	0.98	1.00	1.00	0.99	1.00	1.00						
n =		1.21	1.33	1.24	1.85	2.18	1.91	2.13	1.91	1.70	1.97	2.17	1.56	1.58	2.22	1.73	1.83	1.38	1.62						
n x ln(D_N) =		-6.14	-6.34	-5.88	-8.97	-10.88	-9.28	-10.57	-9.26	-8.33	-9.62	-10.93	-7.53	-7.45	-10.83	-8.05	-8.82	-6.29	-7.89						
D_N (mm)		162.15	118.72	113.31	128.10	146.19	128.47	144.45	127.26	135.47	133.30	154.98	125.52	111.89	132.28	104.95	122.80	94.66	129.45						
D_N (in)		6.38	4.67	4.46	5.04	5.76	5.06	5.69	5.01	5.33	5.25	6.10	4.94	4.41	5.21	4.13	4.83	3.73	5.10						
R^2 =		0.99	1.00	1.00	1.00	0.98	0.99	1.00	1.00	0.98	1.00	0.99	0.99	0.98	1.00	1.00	0.99	1.00	1.00						
D60 =		150.81	111.16	105.62	122.19	140.45	122.72	138.63	121.57	128.66	127.50	148.85	118.67	105.87	127.17	99.78	117.08	88.86	122.66						
D10 =		25.09	21.81	18.55	37.92	52.15	39.55	50.10	39.21	35.95	42.44	54.85	29.63	26.93	47.95	28.60	35.99	18.60	32.35						
UC =		6.01	5.10	5.69	3.22	2.69	3.10	2.77	3.10	3.58	3.00	2.71	4.00	3.93	2.65	3.49	3.25	4.78	3.79	Mean	SD	Mean	SD	Mean	SD
Sieve Size		**Percent of of material passed at any given size (%-wet basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	99.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	99.9	0.2	100.0	0.0
20.00	508.0	98.1	99.9	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	99.8	0.6	100.0	0.0
15.00	381.0	93.9	99.1	98.9	99.9	100.0	100.0	100.0	100.0	99.7	100.0	99.9	99.6	99.9	100.0	100.0	100.0	99.9	99.7	99.8	0.2	99.1	1.9	100.0	0.0
14.00	355.6	92.4	98.6	98.4	99.9	99.9	99.9	99.9	99.9	99.4	99.9	99.8	99.4	99.8	100.0	100.0	99.9	99.8	99.4	99.6	0.3	98.8	2.3	99.9	0.0
13.00	330.2	90.5	98.0	97.7	99.7	99.7	99.8	99.7	99.8	98.9	99.7	99.4	98.9	99.6	100.0	99.9	99.8	99.6	99.0	99.2	0.4	98.4	2.9	99.7	0.0
12.00	304.8	88.2	97.0	96.7	99.3	99.3	99.5	99.2	99.5	98.1	99.4	98.7	98.1	99.2	99.8	99.8	99.5	99.4	98.2	98.6	0.6	97.7	3.5	99.4	0.1
11.00	279.4	85.4	95.6	95.4	98.5	98.4	98.8	98.3	98.9	96.7	98.6	97.2	96.9	98.6	99.5	99.6	98.9	98.9	96.9	97.4	0.9	96.7	4.2	98.6	0.3
10.00	254.0	82.1	93.6	93.5	97.1	96.5	97.5	96.4	97.6	94.5	97.1	94.6	95.0	97.4	98.6	99.0	97.7	98.0	94.9	95.3	1.2	95.2	5.0	97.0	0.7
9.00	228.6	78.0	90.8	90.9	94.6	93.0	95.1	93.0	95.3	91.2	94.4	90.2	92.2	95.5	96.5	97.9	95.6	96.6	91.9	92.0	1.8	92.8	5.8	94.1	1.3
8.50	215.9	75.6	89.1	89.2	92.8	90.4	93.2	90.5	93.6	89.0	92.4	87.1	90.3	94.1	94.8	96.9	94.0	95.6	89.9	89.7	2.2	91.2	6.1	91.9	1.7
8.00	203.2	73.1	87.0	87.3	90.4	87.2	90.9	87.3	91.3	86.3	89.9	83.4	88.0	92.3	92.5	95.7	91.9	94.4	87.5	86.9	2.7	89.2	6.4	89.2	2.3
7.50	190.5	70.3	84.6	85.2	87.5	83.2	88.0	83.5	88.5	83.2	86.7	79.1	85.3	90.2	89.4	94.0	89.3	92.8	84.6	83.6	3.3	86.8	6.6	85.8	2.9
7.00	177.8	67.3	81.9	82.6	84.0	78.4	84.4	78.9	85.0	79.5	82.8	74.0	82.1	87.5	85.4	91.7	86.1	90.8	81.2	79.6	4.0	83.9	6.8	81.7	3.5
6.50	165.1	64.0	78.8	79.7	79.8	72.9	80.1	73.5	80.7	75.3	78.2	68.2	78.4	84.3	80.5	88.8	82.1	88.4	77.3	75.0	4.8	80.4	7.0	76.8	4.2
6.00	152.4	60.5	75.2	76.4	74.8	66.6	75.0	67.4	75.6	70.5	72.8	61.9	74.2	80.4	74.6	85.2	77.4	85.5	72.8	69.8	5.5	76.3	7.1	71.1	4.8
5.50	139.7	56.6	71.1	72.7	69.1	59.6	69.1	60.6	69.7	65.1	66.6	55.0	69.3	75.8	67.7	80.6	71.8	82.0	67.7	64.0	6.3	71.5	7.2	64.7	5.4
5.00	127.0	52.5	66.5	68.4	62.6	52.1	62.4	53.3	63.1	59.2	59.7	47.8	63.9	70.5	59.9	75.1	65.5	77.7	62.1	57.6	6.9	66.1	7.4	57.7	5.8
4.50	114.3	48.1	61.4	63.6	55.5	44.3	55.1	45.6	55.7	52.7	52.2	40.4	57.9	64.4	51.5	68.6	58.4	72.7	55.8	50.8	7.4	60.0	7.6	50.1	6.1
4.00	101.6	43.4	55.7	58.2	47.9	36.4	47.2	37.7	47.8	45.9	44.4	33.0	51.3	57.6	42.7	61.1	50.7	66.8	49.1	43.6	7.7	53.3	7.9	42.3	6.1
3.50	88.9	38.4	49.4	52.3	39.9	28.7	39.0	30.0	39.6	38.7	36.3	25.9	44.2	50.1	33.9	52.8	42.5	60.0	41.9	36.3	7.7	46.1	8.0	34.3	5.8
3.00	76.2	33.1	42.6	45.7	31.8	21.4	30.8	22.7	31.3	31.4	28.3	19.3	36.8	42.0	25.5	43.7	34.1	52.3	34.5	29.0	7.3	38.5	8.0	26.6	5.2
2.50	63.5	27.6	35.3	38.5	23.9	15.0	22.9	16.0	23.3	24.2	20.8	13.5	29.2	33.5	17.8	34.2	25.8	43.8	27.0	21.9	6.6	30.8	7.7	19.3	4.4
2.00	50.8	21.9	27.7	30.8	16.5	9.5	15.6	10.3	15.9	17.3	13.9	8.5	21.7	25.0	11.3	24.8	18.0	34.5	19.7	15.3	5.5	23.0	7.0	12.8	3.4
1.75	44.5	18.9	23.8	26.8	13.2	7.2	12.3	7.8	12.5	14.0	10.9	6.5	18.0	20.7	8.5	20.2	14.4	29.6	16.2	12.3	4.9	19.2	6.4	10.0	2.9

1.50	38.1	16.0	19.8	22.7	10.1	5.2	9.3	5.7	9.5	11.0	8.2	4.7	14.4	16.7	6.1	15.9	11.0	24.7	12.8	9.6	4.1	15.6	5.8	7.4	2.3
1.25	31.8	13.1	15.9	18.6	7.3	3.5	6.7	3.9	6.8	8.2	5.8	3.2	11.1	12.8	4.1	11.9	8.0	19.8	9.7	7.1	3.4	12.1	5.0	5.2	1.8
1.00	25.4	10.1	12.1	14.4	4.9	2.2	4.4	2.5	4.5	5.7	3.8	2.0	8.0	9.2	2.5	8.2	5.4	15.0	6.9	4.8	2.6	8.9	4.1	3.4	1.2
0.90	22.9	9.0	10.6	12.8	4.1	1.7	3.6	2.0	3.7	4.8	3.1	1.6	6.8	7.8	2.0	6.9	4.5	13.1	5.8	4.1	2.2	7.7	3.7	2.8	1.1
0.80	20.3	7.8	9.1	11.1	3.3	1.3	2.9	1.5	3.0	3.9	2.4	1.2	5.7	6.5	1.6	5.7	3.6	11.2	4.8	3.3	1.9	6.5	3.3	2.2	0.9
0.70	17.8	6.7	7.7	9.5	2.6	1.0	2.3	1.2	2.3	3.1	1.9	0.9	4.6	5.3	1.2	4.5	2.8	9.4	3.9	2.6	1.6	5.4	2.9	1.7	0.7
0.60	15.2	5.6	6.3	7.9	1.9	0.7	1.7	0.8	1.7	2.4	1.4	0.7	3.7	4.2	0.8	3.5	2.2	7.7	3.1	2.0	1.3	4.3	2.5	1.2	0.5
0.55	14.0	5.1	5.7	7.1	1.6	0.6	1.4	0.7	1.5	2.1	1.2	0.5	3.2	3.7	0.7	3.0	1.8	6.8	2.7	1.8	1.2	3.8	2.3	1.0	0.5
0.50	12.7	4.5	5.0	6.4	1.4	0.5	1.2	0.6	1.2	1.8	1.0	0.4	2.8	3.2	0.6	2.6	1.5	6.0	2.3	1.5	1.0	3.3	2.0	0.9	0.4
0.45	11.4	4.0	4.4	5.6	1.1	0.4	1.0	0.5	1.0	1.5	0.8	0.4	2.4	2.7	0.4	2.1	1.3	5.2	1.9	1.3	0.9	2.9	1.8	0.7	0.3
0.40	10.2	3.5	3.7	4.9	0.9	0.3	0.8	0.4	0.8	1.2	0.6	0.3	2.0	2.2	0.3	1.7	1.0	4.5	1.6	1.0	0.7	2.4	1.6	0.6	0.3
0.35	8.9	3.0	3.1	4.1	0.7	0.2	0.6	0.3	0.6	1.0	0.5	0.2	1.6	1.8	0.3	1.4	0.8	3.7	1.3	0.8	0.6	2.0	1.4	0.4	0.2
0.30	7.6	2.5	2.6	3.4	0.5	0.2	0.5	0.2	0.5	0.8	0.4	0.1	1.3	1.4	0.2	1.1	0.6	3.0	1.0	0.6	0.5	1.6	1.1	0.3	0.2
0.25	6.4	2.0	2.0	2.7	0.4	0.1	0.3	0.1	0.3	0.6	0.3	0.1	0.9	1.1	0.1	0.8	0.4	2.4	0.7	0.5	0.4	1.3	0.9	0.2	0.1
0.20	5.1	1.5	1.5	2.1	0.3	0.1	0.2	0.1	0.2	0.4	0.2	0.1	0.7	0.8	0.1	0.5	0.3	1.7	0.5	0.3	0.3	0.9	0.7	0.1	0.1
0.15	3.8	1.1	1.0	1.5	0.2	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.4	0.5	0.0	0.3	0.2	1.2	0.3	0.2	0.2	0.6	0.5	0.1	0.0
0.10	2.5	0.7	0.6	0.9	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.3	0.0	0.2	0.1	0.7	0.2	0.1	0.1	0.4	0.3	0.0	0.0
0.05	1.3	0.3	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.1	0.1	0.0	0.0
0.03	0.6	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0
0.02	0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.01	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
Sieve Size		**Percent of of material retained at any given size (%-wet basis)**																							
inch	**mm**																								
75.00	1905.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60.00	1524.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	1270.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45.00	1143.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40.00	1016.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	889.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
30.00	762.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.00	635.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0
20.00	508.0	1.9	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.0
15.00	381.0	6.1	0.9	1.1	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.4	0.1	0.0	0.0	0.0	0.1	0.3	0.2	0.2	0.9	1.9	0.0	0.0
14.00	355.6	7.6	1.4	1.6	0.1	0.1	0.1	0.1	0.1	0.6	0.1	0.2	0.6	0.2	0.0	0.0	0.1	0.2	0.6	0.4	0.3	1.2	2.3	0.1	0.0
13.00	330.2	9.5	2.0	2.3	0.3	0.3	0.2	0.3	0.2	1.1	0.3	0.6	1.1	0.4	0.0	0.1	0.2	0.4	1.0	0.8	0.4	1.6	2.9	0.3	0.0
12.00	304.8	11.8	3.0	3.3	0.7	0.7	0.5	0.8	0.5	1.9	0.6	1.3	1.9	0.8	0.2	0.2	0.5	0.6	1.8	1.4	0.6	2.3	3.5	0.6	0.1
11.00	279.4	14.6	4.4	4.6	1.5	1.6	1.2	1.7	1.1	3.3	1.4	2.8	3.1	1.4	0.5	0.4	1.1	1.1	3.1	2.6	0.9	3.3	4.2	1.4	0.3
10.00	254.0	17.9	6.4	6.5	2.9	3.5	2.5	3.6	2.4	5.5	2.9	5.4	5.0	2.6	1.4	1.0	2.3	2.0	5.1	4.7	1.2	4.8	5.0	3.0	0.7
9.00	228.6	22.0	9.2	9.1	5.4	7.0	4.9	7.0	4.7	8.8	5.6	9.8	7.8	4.5	3.5	2.1	4.4	3.4	8.1	8.0	1.8	7.2	5.8	5.9	1.3
8.50	215.9	24.4	10.9	10.8	7.2	9.6	6.8	9.5	6.4	11.0	7.6	12.9	9.7	5.9	5.2	3.1	6.0	4.4	10.1	10.3	2.2	8.8	6.1	8.1	1.7
8.00	203.2	26.9	13.0	12.7	9.6	12.8	9.1	12.7	8.7	13.7	10.1	16.6	12.0	7.7	7.5	4.3	8.1	5.6	12.5	13.1	2.7	10.8	6.4	10.8	2.3
7.50	190.5	29.7	15.4	14.8	12.5	16.8	12.0	16.5	11.5	16.8	13.3	20.9	14.7	9.8	10.6	6.0	10.7	7.2	15.4	16.4	3.3	13.2	6.6	14.2	2.9
7.00	177.8	32.7	18.1	17.4	16.0	21.6	15.6	21.1	15.0	20.5	17.2	26.0	17.9	12.5	14.6	8.3	13.9	9.2	18.8	20.4	4.0	16.1	6.8	18.3	3.5
6.50	165.1	36.0	21.2	20.3	20.2	27.1	19.9	26.5	19.3	24.7	21.8	31.8	21.6	15.7	19.5	11.2	17.9	11.6	22.7	25.0	4.8	19.6	7.0	23.2	4.2
6.00	152.4	39.5	24.8	23.6	25.2	33.4	25.0	32.6	24.4	29.5	27.2	38.1	25.8	19.6	25.4	14.8	22.6	14.5	27.2	30.2	5.5	23.7	7.1	28.9	4.8

5.50	139.7	43.4	28.9	27.3	30.9	40.4	30.9	39.4	30.3	34.9	33.4	45.0	30.7	24.2	32.3	19.4	28.2	18.0	32.3	36.0	6.3	28.5	7.2	35.3	5.4
5.00	127.0	47.5	33.5	31.6	37.4	47.9	37.6	46.7	36.9	40.8	40.3	52.2	36.1	29.5	40.1	24.9	34.5	22.3	37.9	42.4	6.9	33.9	7.4	42.3	5.8
4.50	114.3	51.9	38.6	36.4	44.5	55.7	44.9	54.4	44.3	47.3	47.8	59.6	42.1	35.6	48.5	31.4	41.6	27.3	44.2	49.2	7.4	40.0	7.6	49.9	6.1
4.00	101.6	56.6	44.3	41.8	52.1	63.6	52.8	62.3	52.2	54.1	55.6	67.0	48.7	42.4	57.3	38.9	49.3	33.2	50.9	56.4	7.7	46.7	7.9	57.7	6.1
3.50	88.9	61.6	50.6	47.7	60.1	71.3	61.0	70.0	60.4	61.3	63.7	74.1	55.8	49.9	66.1	47.2	57.5	40.0	58.1	63.7	7.7	53.9	8.0	65.7	5.8
3.00	76.2	66.9	57.4	54.3	68.2	78.6	69.2	77.3	68.7	68.6	71.7	80.7	63.2	58.0	74.5	56.3	65.9	47.7	65.5	71.0	7.3	61.5	8.0	73.4	5.2
2.50	63.5	72.4	64.7	61.5	76.1	85.0	77.1	84.0	76.7	75.8	79.2	86.5	70.8	66.5	82.2	65.8	74.2	56.2	73.0	78.1	6.6	69.2	7.7	80.7	4.4
2.00	50.8	78.1	72.3	69.2	83.5	90.5	84.4	89.7	84.1	82.7	86.1	91.5	78.3	75.0	88.7	75.2	82.0	65.5	80.3	84.7	5.5	77.0	7.0	87.2	3.4
1.75	44.5	81.1	76.2	73.2	86.8	92.8	87.7	92.2	87.5	86.0	89.1	93.5	82.0	79.3	91.5	79.8	85.6	70.4	83.8	87.7	4.9	80.8	6.4	90.0	2.9
1.50	38.1	84.0	80.2	77.3	89.9	94.8	90.7	94.3	90.5	89.0	91.8	95.3	85.6	83.3	93.9	84.1	89.0	75.3	87.2	90.4	4.1	84.4	5.8	92.6	2.3
1.25	31.8	86.9	84.1	81.4	92.7	96.5	93.3	96.1	93.2	91.8	94.2	96.8	88.9	87.2	95.9	88.1	92.0	80.2	90.3	92.9	3.4	87.9	5.0	94.8	1.8
1.00	25.4	89.9	87.9	85.6	95.1	97.8	95.6	97.5	95.5	94.3	96.2	98.0	92.0	90.8	97.5	91.8	94.6	85.0	93.1	95.2	2.6	91.1	4.1	96.6	1.2
0.90	22.9	91.0	89.4	87.2	95.9	98.3	96.4	98.0	96.3	95.2	96.9	98.4	93.2	92.2	98.0	93.1	95.5	86.9	94.2	95.9	2.2	92.3	3.7	97.2	1.1
0.80	20.3	92.2	90.9	88.9	96.7	98.7	97.1	98.5	97.0	96.1	97.6	98.8	94.3	93.5	98.4	94.3	96.4	88.8	95.2	96.7	1.9	93.5	3.3	97.8	0.9
0.70	17.8	93.3	92.3	90.5	97.4	99.0	97.7	98.8	97.7	96.9	98.1	99.1	95.4	94.7	98.8	95.5	97.2	90.6	96.1	97.4	1.6	94.6	2.9	98.3	0.7
0.60	15.2	94.4	93.7	92.1	98.1	99.3	98.3	99.2	98.3	97.6	98.6	99.3	96.3	95.8	99.2	96.5	97.8	92.3	96.9	98.0	1.3	95.7	2.5	98.8	0.5
0.55	14.0	94.9	94.3	92.9	98.4	99.4	98.6	99.3	98.5	97.9	98.8	99.5	96.8	96.3	99.3	97.0	98.2	93.2	97.3	98.2	1.2	96.2	2.3	99.0	0.5
0.50	12.7	95.5	95.0	93.6	98.6	99.5	98.8	99.4	98.8	98.2	99.0	99.6	97.2	96.8	99.4	97.4	98.5	94.0	97.7	98.5	1.0	96.7	2.0	99.1	0.4
0.45	11.4	96.0	95.6	94.4	98.9	99.6	99.0	99.5	99.0	98.5	99.2	99.6	97.6	97.3	99.6	97.9	98.7	94.8	98.1	98.7	0.9	97.1	1.8	99.3	0.3
0.40	10.2	96.5	96.3	95.1	99.1	99.7	99.2	99.6	99.2	98.8	99.4	99.7	98.0	97.8	99.7	98.3	99.0	95.5	98.4	99.0	0.7	97.6	1.6	99.4	0.3
0.35	8.9	97.0	96.9	95.9	99.3	99.8	99.4	99.7	99.4	99.0	99.5	99.8	98.4	98.2	99.7	98.6	99.2	96.3	98.7	99.2	0.6	98.0	1.4	99.6	0.2
0.30	7.6	97.5	97.4	96.6	99.5	99.8	99.5	99.8	99.5	99.2	99.6	99.9	98.7	98.6	99.8	98.9	99.4	97.0	99.0	99.4	0.5	98.4	1.1	99.7	0.2
0.25	6.4	98.0	98.0	97.3	99.6	99.9	99.7	99.9	99.7	99.4	99.7	99.9	99.1	98.9	99.9	99.2	99.6	97.6	99.3	99.5	0.4	98.7	0.9	99.8	0.1
0.20	5.1	98.5	98.5	97.9	99.7	99.9	99.8	99.9	99.8	99.6	99.8	99.9	99.3	99.2	99.9	99.5	99.7	98.3	99.5	99.7	0.3	99.1	0.7	99.9	0.1
0.15	3.8	98.9	99.0	98.5	99.8	100.0	99.9	100.0	99.9	99.8	99.9	100.0	99.6	99.5	100.0	99.7	99.8	98.8	99.7	99.8	0.2	99.4	0.5	99.9	0.0
0.10	2.5	99.3	99.4	99.1	99.9	100.0	99.9	100.0	99.9	99.9	100.0	100.0	99.8	99.7	100.0	99.8	99.9	99.3	99.8	99.9	0.1	99.6	0.3	100.0	0.0
0.05	1.3	99.7	99.8	99.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.9	100.0	100.0	100.0	99.7	99.9	100.0	0.0	99.9	0.1	100.0	0.0
0.03	0.6	99.9	99.9	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	0.0	99.9	0.1	100.0	0.0
0.02	0.5	99.9	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.01	0.3	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0


PSD of RDF Material in <9" Second Unders (Wet Basis)
Summer
Winter
Spring
Cumulative Passed (%)
100
80
60
40
20
0
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)


PSD of RDF Material in <9" Second Unders (Wet Basis)
Summer
Winter
Spring
Cumulative Retained (%)
100
80
60
40
20
0
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)

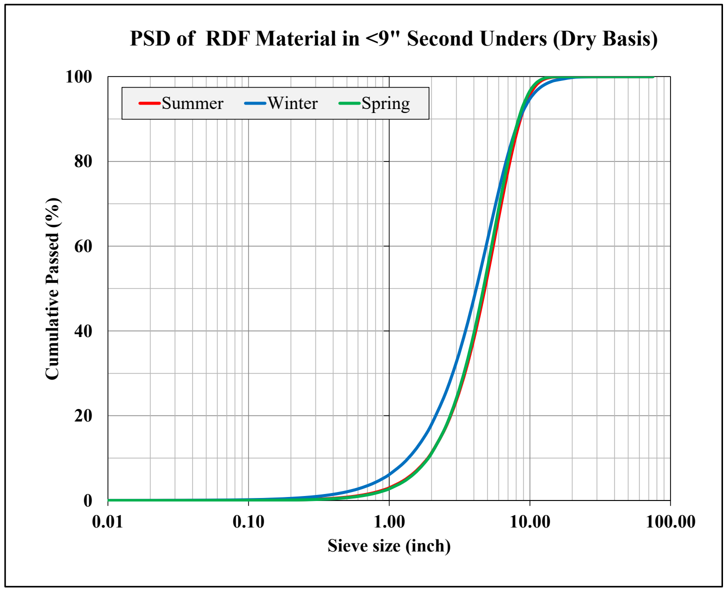
Fitting Rosin-Rammler Distribution to RDF Fraction of Trommel's <9 inch Second Unders

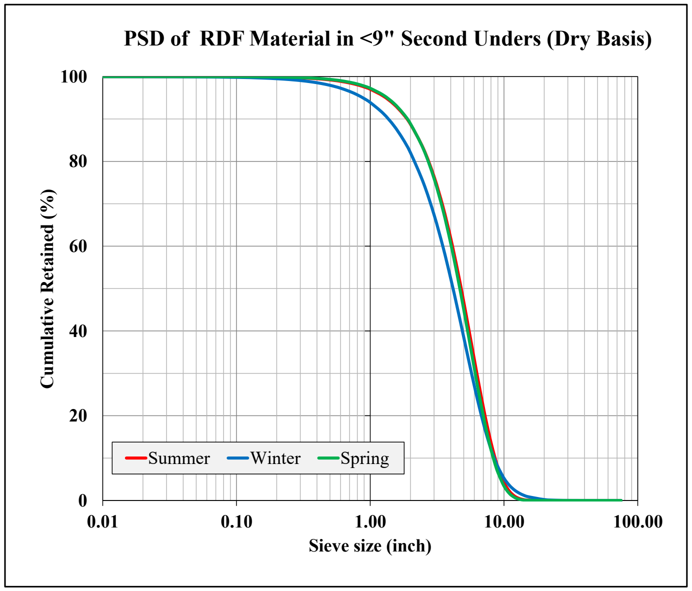
Parameter		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
R^2 =		0.98	1.00	1.00	0.99	0.98	0.98	1.00	1.00	0.97	1.00	0.99	0.99	0.99	0.99	1.00	0.99	1.00	1.00						
n =		1.33	1.47	1.40	1.99	2.17	2.10	2.16	1.97	2.05	2.13	2.39	1.75	1.85	2.41	1.87	2.00	1.49	1.81						
n x ln(D_N) =		-6.93	-7.16	-6.85	-9.72	-10.89	-10.28	-10.80	-9.64	-10.14	-10.51	-12.16	-8.60	-8.91	-11.86	-8.83	-9.71	-6.99	-8.88						
D_N (mm)		181.68	130.85	131.46	133.01	151.93	134.00	148.16	132.21	141.73	138.56	163.42	135.76	123.87	137.61	113.00	129.15	107.63	134.62						
D_N (in)		7.15	5.15	5.18	5.24	5.98	5.28	5.83	5.20	5.58	5.46	6.43	5.34	4.88	5.42	4.45	5.08	4.24	5.30						
R^2 =		0.99	1.00	1.00	0.99	0.99	0.99	1.00	1.00	0.97	1.00	0.99	0.99	0.99	1.00	1.00	0.99	1.00	1.00						
D60 =		109.73	82.85	81.45	94.86	111.46	97.32	108.58	94.07	102.07	101.09	123.33	92.49	86.13	104.12	78.86	92.26	68.64	92.90						
D10 =		33.55	28.31	26.44	42.87	53.82	45.89	52.31	42.28	47.19	48.19	63.65	37.53	36.67	54.06	33.87	41.85	23.85	38.85						
UC =		3.27	2.93	3.08	2.21	2.07	2.12	2.08	2.23	2.16	2.10	1.94	2.46	2.35	1.93	2.33	2.20	2.88	2.39						
Sieve Size		**Percent of of material passed at any given size (%-dry basis)**																							
inch	**mm**																								
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
35.00	889.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
30.00	762.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
25.00	635.0	99.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	99.9	0.2	100.0	0.0
20.00	508.0	98.0	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	99.8	0.6	100.0	0.0
15.00	381.0	93.2	99.2	98.8	100.0	99.9	100.0	100.0	100.0	99.9	100.0	99.9	99.8	100.0	100.0	100.0	100.0	99.9	99.9	99.9	0.1	99.1	2.1	100.0	0.0
14.00	355.6	91.3	98.7	98.2	99.9	99.8	100.0	99.9	99.9	99.9	99.9	99.8	99.5	99.9	100.0	100.0	99.9	99.7	99.7	99.8	0.2	98.7	2.7	99.9	0.1
13.00	330.2	89.1	98.0	97.4	99.8	99.5	99.9	99.6	99.8	99.6	99.8	99.5	99.1	99.8	100.0	99.9	99.9	99.5	99.4	99.5	0.3	98.3	3.3	99.7	0.1
12.00	304.8	86.4	96.9	96.1	99.4	98.9	99.6	99.1	99.4	99.2	99.5	98.8	98.4	99.5	99.9	99.8	99.6	99.1	98.8	99.0	0.5	97.6	4.1	99.3	0.3
11.00	279.4	83.0	95.3	94.4	98.7	97.6	99.1	98.1	98.7	98.2	98.8	97.3	97.1	98.9	99.6	99.6	99.1	98.4	97.7	97.8	0.8	96.5	5.0	98.4	0.6
10.00	254.0	79.0	92.9	92.0	97.3	95.3	97.8	95.9	97.3	96.3	97.4	94.3	95.0	97.7	98.7	98.9	97.9	97.3	95.7	95.7	1.4	94.8	6.0	96.6	1.2
9.00	228.6	74.3	89.7	88.6	94.7	91.2	95.4	92.2	94.8	93.0	94.5	89.2	91.7	95.5	96.6	97.6	95.6	95.4	92.6	92.1	2.2	92.1	6.9	93.4	2.0
8.50	215.9	71.6	87.6	86.5	92.7	88.3	93.4	89.5	92.8	90.6	92.4	85.7	89.5	93.9	94.8	96.5	93.9	94.1	90.5	89.5	2.8	90.2	7.3	91.0	2.5
8.00	203.2	68.7	85.2	84.2	90.2	84.7	90.9	86.2	90.3	87.6	89.6	81.4	86.8	91.8	92.2	95.0	91.6	92.4	87.8	86.4	3.5	87.9	7.6	88.0	3.1
7.50	190.5	65.5	82.4	81.4	87.0	80.5	87.7	82.1	87.2	84.0	86.1	76.4	83.6	89.1	88.8	92.9	88.6	90.4	84.7	82.5	4.2	85.1	7.7	84.4	3.6
7.00	177.8	62.2	79.2	78.3	83.1	75.5	83.6	77.3	83.4	79.6	81.8	70.6	79.9	85.8	84.3	90.3	84.9	88.0	80.9	78.0	5.0	81.7	7.8	80.0	4.2
6.50	165.1	58.5	75.5	74.8	78.5	69.8	78.8	71.7	78.8	74.5	76.6	64.1	75.5	81.7	78.8	86.9	80.5	85.0	76.5	72.7	5.8	77.7	7.8	74.8	4.7
6.00	152.4	54.7	71.4	70.8	73.0	63.5	73.0	65.5	73.4	68.7	70.6	57.1	70.6	76.9	72.2	82.6	75.1	81.4	71.4	66.7	6.5	72.9	7.7	68.8	5.1
5.50	139.7	50.6	66.7	66.3	66.8	56.6	66.4	58.5	67.2	62.1	63.9	49.7	65.1	71.3	64.5	77.4	69.0	77.1	65.7	60.2	7.1	67.5	7.5	62.2	5.4
5.00	127.0	46.2	61.6	61.4	59.8	49.2	59.1	51.2	60.3	55.0	56.4	42.2	58.9	64.9	56.1	71.2	62.0	72.2	59.3	53.1	7.5	61.5	7.4	54.9	5.6
4.50	114.3	41.7	55.9	56.0	52.3	41.7	51.1	43.5	52.8	47.5	48.5	34.7	52.3	57.8	47.2	64.0	54.3	66.5	52.5	45.7	7.7	54.8	7.3	47.3	5.5
4.00	101.6	36.9	49.8	50.2	44.3	34.2	42.8	35.8	44.8	39.7	40.3	27.5	45.2	50.0	38.2	55.9	46.2	60.0	45.2	38.2	7.5	47.7	7.2	39.4	5.2
3.50	88.9	32.0	43.3	43.9	36.2	26.9	34.5	28.2	36.7	32.0	32.2	20.9	37.9	41.8	29.5	47.2	37.8	52.8	37.6	30.7	7.1	40.2	7.0	31.6	4.8
3.00	76.2	27.0	36.3	37.2	28.1	20.1	26.3	21.1	28.6	24.5	24.4	14.9	30.5	33.5	21.4	38.1	29.4	45.0	30.0	23.6	6.4	32.6	6.8	24.0	4.1
2.50	63.5	21.8	29.2	30.2	20.6	14.0	18.8	14.8	21.0	17.6	17.3	9.9	23.2	25.2	14.4	28.9	21.5	36.5	22.6	17.0	5.5	25.1	6.3	17.1	3.3
2.00	50.8	16.7	22.0	23.2	13.7	8.9	12.2	9.4	14.0	11.5	11.1	6.0	16.4	17.5	8.7	20.1	14.4	27.8	15.7	11.3	4.3	18.0	5.5	11.1	2.4
1.75	44.5	14.2	18.5	19.6	10.7	6.7	9.4	7.1	11.0	8.9	8.5	4.4	13.2	14.0	6.4	16.1	11.2	23.4	12.6	8.7	3.6	14.7	4.9	8.6	2.0
1.50	38.1	11.7	15.0	16.1	8.0	4.9	6.9	5.2	8.2	6.6	6.2	3.0	10.3	10.7	4.4	12.3	8.4	19.1	9.7	6.5	2.9	11.5	4.3	6.3	1.6

1.25	31.8	9.3	11.7	12.7	5.6	3.3	4.7	3.5	5.8	4.6	4.2	2.0	7.6	7.8	2.9	8.9	5.9	14.9	7.0	4.6	2.3	8.7	3.6	4.3	1.2
1.00	25.4	7.0	8.6	9.5	3.7	2.0	3.0	2.2	3.8	2.9	2.7	1.2	5.2	5.2	1.7	6.0	3.8	10.9	4.8	3.0	1.7	6.1	2.9	2.8	0.8
0.90	22.9	6.1	7.4	8.2	3.0	1.6	2.4	1.7	3.1	2.4	2.1	0.9	4.3	4.3	1.3	4.9	3.1	9.4	4.0	2.4	1.4	5.2	2.6	2.2	0.7
0.80	20.3	5.3	6.3	7.0	2.4	1.3	1.9	1.4	2.5	1.9	1.7	0.7	3.5	3.5	1.0	4.0	2.5	8.0	3.2	1.9	1.2	4.3	2.3	1.7	0.5
0.70	17.8	4.4	5.2	5.9	1.8	0.9	1.4	1.0	1.9	1.4	1.3	0.5	2.8	2.7	0.7	3.1	1.9	6.6	2.5	1.5	1.0	3.5	1.9	1.3	0.4
0.60	15.2	3.6	4.2	4.7	1.3	0.7	1.0	0.7	1.4	1.0	0.9	0.3	2.2	2.1	0.5	2.3	1.4	5.3	1.9	1.1	0.8	2.7	1.6	1.0	0.3
0.55	14.0	3.2	3.7	4.2	1.1	0.6	0.9	0.6	1.2	0.9	0.8	0.3	1.9	1.8	0.4	2.0	1.2	4.6	1.6	0.9	0.7	2.4	1.4	0.8	0.3
0.50	12.7	2.8	3.2	3.7	0.9	0.5	0.7	0.5	1.0	0.7	0.6	0.2	1.6	1.5	0.3	1.7	1.0	4.0	1.4	0.8	0.6	2.1	1.3	0.7	0.2
0.45	11.4	2.5	2.7	3.2	0.8	0.4	0.6	0.4	0.8	0.6	0.5	0.2	1.3	1.2	0.2	1.4	0.8	3.5	1.1	0.6	0.5	1.7	1.1	0.5	0.2
0.40	10.2	2.1	2.3	2.7	0.6	0.3	0.4	0.3	0.6	0.5	0.4	0.1	1.1	1.0	0.2	1.1	0.6	2.9	0.9	0.5	0.4	1.4	1.0	0.4	0.2
0.35	8.9	1.8	1.9	2.3	0.5	0.2	0.3	0.2	0.5	0.3	0.3	0.1	0.8	0.8	0.1	0.9	0.5	2.4	0.7	0.4	0.3	1.2	0.8	0.3	0.1
0.30	7.6	1.5	1.5	1.8	0.3	0.2	0.2	0.2	0.4	0.3	0.2	0.1	0.6	0.6	0.1	0.6	0.4	1.9	0.6	0.3	0.2	0.9	0.7	0.2	0.1
0.25	6.4	1.1	1.2	1.4	0.2	0.1	0.2	0.1	0.2	0.2	0.1	0.0	0.5	0.4	0.1	0.5	0.2	1.4	0.4	0.2	0.2	0.7	0.5	0.2	0.1
0.20	5.1	0.8	0.8	1.0	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.3	0.3	0.0	0.3	0.2	1.0	0.3	0.1	0.1	0.5	0.4	0.1	0.0
0.15	3.8	0.6	0.6	0.7	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.2	0.0	0.2	0.1	0.7	0.2	0.1	0.1	0.3	0.3	0.1	0.0
0.10	2.5	0.3	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.4	0.1	0.0	0.0	0.2	0.2	0.0	0.0
0.05	1.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0
0.03	0.6	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.01	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
Sieve Size		**Percent of of material retained at any given size (%-dry basis)**																							
inch	**mm**																								
75.00	1905.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.00	1524.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	1270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45.00	1143.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.00	1016.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35.00	889.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.00	762.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.00	635.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0
20.00	508.0	2.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.0
15.00	381.0	6.8	0.8	1.2	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.9	2.1	0.0	0.0
14.00	355.6	8.7	1.3	1.8	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.2	0.5	0.1	0.0	0.0	0.1	0.3	0.3	0.2	0.2	1.3	2.7	0.1	0.1
13.00	330.2	10.9	2.0	2.6	0.2	0.5	0.1	0.4	0.2	0.4	0.2	0.5	0.9	0.2	0.0	0.1	0.1	0.5	0.6	0.5	0.3	1.7	3.3	0.3	0.1
12.00	304.8	13.6	3.1	3.9	0.6	1.1	0.4	0.9	0.6	0.8	0.5	1.2	1.6	0.5	0.1	0.2	0.4	0.9	1.2	1.0	0.5	2.4	4.1	0.7	0.3
11.00	279.4	17.0	4.7	5.6	1.3	2.4	0.9	1.9	1.3	1.8	1.2	2.7	2.9	1.1	0.4	0.4	0.9	1.6	2.3	2.2	0.8	3.5	5.0	1.6	0.6
10.00	254.0	21.0	7.1	8.0	2.7	4.7	2.2	4.1	2.7	3.7	2.6	5.7	5.0	2.3	1.3	1.1	2.1	2.7	4.3	4.3	1.4	5.2	6.0	3.4	1.2
9.00	228.6	25.7	10.3	11.4	5.3	8.8	4.6	7.8	5.2	7.0	5.5	10.8	8.3	4.5	3.4	2.4	4.4	4.6	7.4	7.9	2.2	7.9	6.9	6.6	2.0
8.50	215.9	28.4	12.4	13.5	7.3	11.7	6.6	10.5	7.2	9.4	7.6	14.3	10.5	6.1	5.2	3.5	6.1	5.9	9.5	10.5	2.8	9.8	7.3	9.0	2.5
8.00	203.2	31.3	14.8	15.8	9.8	15.3	9.1	13.8	9.7	12.4	10.4	18.6	13.2	8.2	7.8	5.0	8.4	7.6	12.2	13.6	3.5	12.1	7.6	12.0	3.1
7.50	190.5	34.5	17.6	18.6	13.0	19.5	12.3	17.9	12.8	16.0	13.9	23.6	16.4	10.9	11.2	7.1	11.4	9.6	15.3	17.5	4.2	14.9	7.7	15.6	3.6
7.00	177.8	37.8	20.8	21.7	16.9	24.5	16.4	22.7	16.6	20.4	18.2	29.4	20.1	14.2	15.7	9.7	15.1	12.0	19.1	22.0	5.0	18.3	7.8	20.0	4.2

6.50	165.1	41.5	24.5	25.2	21.5	30.2	21.2	28.3	21.2	25.5	23.4	35.9	24.5	18.3	21.2	13.1	19.5	15.0	23.5	27.3	5.8	22.3	7.8	25.2	4.7
6.00	152.4	45.3	28.6	29.2	27.0	36.5	27.0	34.5	26.6	31.3	29.4	42.9	29.4	23.1	27.8	17.4	24.9	18.6	28.6	33.3	6.5	27.1	7.7	31.2	5.1
5.50	139.7	49.4	33.3	33.7	33.2	43.4	33.6	41.5	32.8	37.9	36.1	50.3	34.9	28.7	35.5	22.6	31.0	22.9	34.3	39.8	7.1	32.5	7.5	37.8	5.4
5.00	127.0	53.8	38.4	38.6	40.2	50.8	40.9	48.8	39.7	45.0	43.6	57.8	41.1	35.1	43.9	28.8	38.0	27.8	40.7	46.9	7.5	38.5	7.4	45.1	5.6
4.50	114.3	58.3	44.1	44.0	47.7	58.3	48.9	56.5	47.2	52.5	51.5	65.3	47.7	42.2	52.8	36.0	45.7	33.5	47.5	54.3	7.7	45.2	7.3	52.7	5.5
4.00	101.6	63.1	50.2	49.8	55.7	65.8	57.2	64.2	55.2	60.3	59.7	72.5	54.8	50.0	61.8	44.1	53.8	40.0	54.8	61.8	7.5	52.3	7.2	60.6	5.2
3.50	88.9	68.0	56.7	56.1	63.8	73.1	65.5	71.8	63.3	68.0	67.8	79.1	62.1	58.2	70.5	52.8	62.2	47.2	62.4	69.3	7.1	59.8	7.0	68.4	4.8
3.00	76.2	73.0	63.7	62.8	71.9	79.9	73.7	78.9	71.4	75.5	75.6	85.1	69.5	66.5	78.6	61.9	70.6	55.0	70.0	76.4	6.4	67.4	6.8	76.0	4.1
2.50	63.5	78.2	70.8	69.8	79.4	86.0	81.2	85.2	79.0	82.4	82.7	90.1	76.8	74.8	85.6	71.1	78.5	63.5	77.4	83.0	5.5	74.9	6.3	82.9	3.3
2.00	50.8	83.3	78.0	76.8	86.3	91.1	87.8	90.6	86.0	88.5	88.9	94.0	83.6	82.5	91.3	79.9	85.6	72.2	84.3	88.7	4.3	82.0	5.5	88.9	2.4
1.75	44.5	85.8	81.5	80.4	89.3	93.3	90.6	92.9	89.0	91.1	91.5	95.6	86.8	86.0	93.6	83.9	88.8	76.6	87.4	91.3	3.6	85.3	4.9	91.4	2.0
1.50	38.1	88.3	85.0	83.9	92.0	95.1	93.1	94.8	91.8	93.4	93.8	97.0	89.7	89.3	95.6	87.7	91.6	80.9	90.3	93.5	2.9	88.5	4.3	93.7	1.6
1.25	31.8	90.7	88.3	87.3	94.4	96.7	95.3	96.5	94.2	95.4	95.8	98.0	92.4	92.2	97.1	91.1	94.1	85.1	93.0	95.4	2.3	91.3	3.6	95.7	1.2
1.00	25.4	93.0	91.4	90.5	96.3	98.0	97.0	97.8	96.2	97.1	97.3	98.8	94.8	94.8	98.3	94.0	96.2	89.1	95.2	97.0	1.7	93.9	2.9	97.2	0.8
0.90	22.9	93.9	92.6	91.8	97.0	98.4	97.6	98.3	96.9	97.6	97.9	99.1	95.7	95.7	98.7	95.1	96.9	90.6	96.0	97.6	1.4	94.8	2.6	97.8	0.7
0.80	20.3	94.7	93.7	93.0	97.6	98.7	98.1	98.6	97.5	98.1	98.3	99.3	96.5	96.5	99.0	96.0	97.5	92.0	96.8	98.1	1.2	95.7	2.3	98.3	0.5
0.70	17.8	95.6	94.8	94.1	98.2	99.1	98.6	99.0	98.1	98.6	98.7	99.5	97.2	97.3	99.3	96.9	98.1	93.4	97.5	98.5	1.0	96.5	1.9	98.7	0.4
0.60	15.2	96.4	95.8	95.3	98.7	99.3	99.0	99.3	98.6	99.0	99.1	99.7	97.8	97.9	99.5	97.7	98.6	94.7	98.1	98.9	0.8	97.3	1.6	99.0	0.3
0.55	14.0	96.8	96.3	95.8	98.9	99.4	99.1	99.4	98.8	99.1	99.2	99.7	98.1	98.2	99.6	98.0	98.8	95.4	98.4	99.1	0.7	97.6	1.4	99.2	0.3
0.50	12.7	97.2	96.8	96.3	99.1	99.5	99.3	99.5	99.0	99.3	99.4	99.8	98.4	98.5	99.7	98.3	99.0	96.0	98.6	99.2	0.6	97.9	1.3	99.3	0.2
0.45	11.4	97.5	97.3	96.8	99.2	99.6	99.4	99.6	99.2	99.4	99.5	99.8	98.7	98.8	99.8	98.6	99.2	96.5	98.9	99.4	0.5	98.3	1.1	99.5	0.2
0.40	10.2	97.9	97.7	97.3	99.4	99.7	99.6	99.7	99.4	99.5	99.6	99.9	98.9	99.0	99.8	98.9	99.4	97.1	99.1	99.5	0.4	98.6	1.0	99.6	0.2
0.35	8.9	98.2	98.1	97.7	99.5	99.8	99.7	99.8	99.5	99.7	99.7	99.9	99.2	99.2	99.9	99.1	99.5	97.6	99.3	99.6	0.3	98.8	0.8	99.7	0.1
0.30	7.6	98.5	98.5	98.2	99.7	99.8	99.8	99.8	99.6	99.7	99.8	99.9	99.4	99.4	99.9	99.4	99.6	98.1	99.4	99.7	0.2	99.1	0.7	99.8	0.1
0.25	6.4	98.9	98.8	98.6	99.8	99.9	99.8	99.9	99.8	99.8	99.9	100.0	99.5	99.6	99.9	99.5	99.8	98.6	99.6	99.8	0.2	99.3	0.5	99.8	0.1
0.20	5.1	99.2	99.2	99.0	99.8	99.9	99.9	99.9	99.8	99.9	99.9	100.0	99.7	99.7	100.0	99.7	99.8	99.0	99.7	99.9	0.1	99.5	0.4	99.9	0.0
0.15	3.8	99.4	99.4	99.3	99.9	100.0	99.9	100.0	99.9	99.9	100.0	100.0	99.8	99.8	100.0	99.8	99.9	99.3	99.8	99.9	0.1	99.7	0.3	99.9	0.0
0.10	2.5	99.7	99.7	99.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.9	100.0	99.9	100.0	99.6	99.9	100.0	0.0	99.8	0.2	100.0	0.0
0.05	1.3	99.9	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	0.0	99.9	0.1	100.0	0.0
0.03	0.6	99.9	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.02	0.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.01	0.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0


PSD of RDF Material in <9" Second Unders (Dry Basis)
Summer
Winter
Spring
Cumulative Passed (%)
100
80
60
40
20
0
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)


PSD of RDF Material in <9" Second Unders (Dry Basis)
Cumulative Retained (%)
100
80
60
40
20
0
Summer
Winter
Spring
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)

Fitting Rosin-Rammler Distribution to RDF Fraction of Trommel's >9 inch Overs

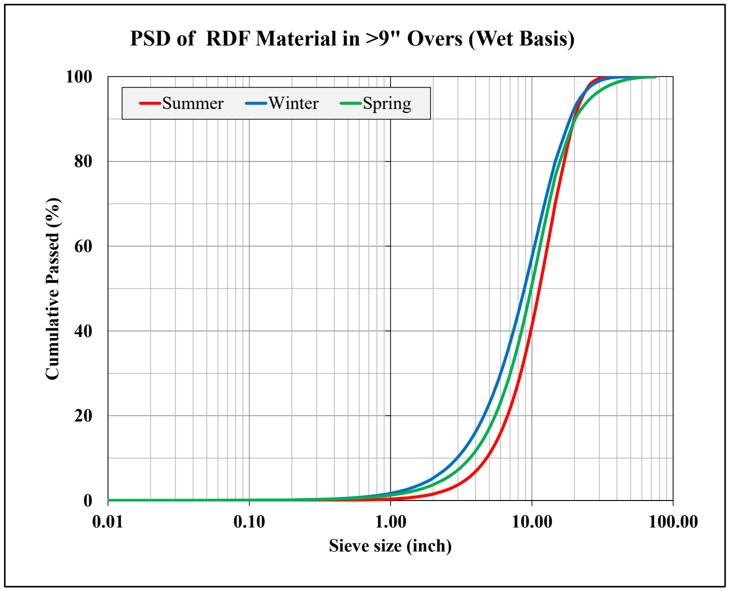
Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	1.00	1.00	1.00	0.97	0.99	0.99	0.99	0.88	0.99	0.94	0.98	0.99	0.99	0.93	0.86	0.99	0.99	0.91
n =	1.81	1.72	2.00	1.87	2.63	1.73	2.15	1.24	2.07	2.50	2.24	2.24	1.60	1.79	1.69	2.11	1.52	1.42
n x ln(D_N) =	-10.39	-9.51	-11.20	-10.52	-14.79	-9.92	-12.10	-7.53	-12.00	-15.02	-13.14	-12.60	-8.94	-10.36	-10.00	-11.35	-8.13	-8.31
D_N (mm)	311.05	252.68	271.10	275.53	276.11	309.24	277.26	428.33	328.00	409.05	357.40	275.09	264.69	329.82	365.04	219.40	211.57	347.76
D_N (in)	12.25	9.95	10.67	10.85	10.87	12.17	10.92	16.86	12.91	16.10	14.07	10.83	10.42	12.99	14.37	8.64	8.33	13.69
R^2 =	1.00	0.99	0.99	0.98	0.97	0.99	0.99	0.86	0.99	0.98	0.99	0.98	0.99	0.93	0.90	0.99	1.00	0.90
D60 =	296.39	240.16	259.50	262.96	267.08	294.00	266.22	399.25	314.45	394.98	343.69	264.57	250.64	314.07	346.69	210.48	199.73	327.00
D10 =	89.71	68.26	87.99	82.80	117.40	84.22	97.40	70.11	110.72	166.13	130.61	100.89	65.03	93.58	96.73	75.35	48.04	71.30
UC =	3.30	3.52	2.95	3.18	2.27	3.49	2.73	5.69	2.84	2.38	2.63	2.62	3.85	3.36	3.58	2.79	4.16	4.59

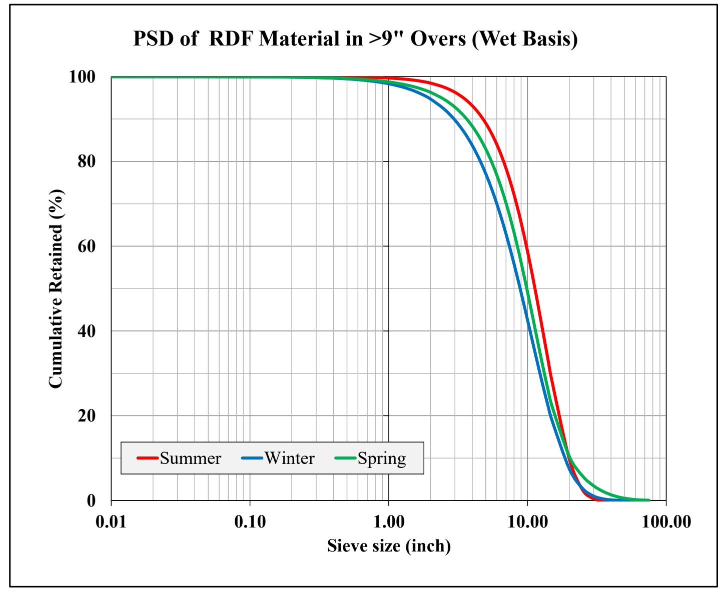
Sieve Size		Percent of of material passed at any given size (%-wet basis)																							
		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
inch	**mm**	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.1
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	99.8	0.4
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	100.0	0.0	100.0	0.1	99.5	1.1
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.6	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	99.6	100.0	0.0	99.9	0.1	99.2	1.7
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	94.6	100.0	100.0	100.0	100.0	100.0	99.9	99.7	100.0	100.0	99.0	100.0	0.0	99.9	0.3	98.7	2.7
35.00	889.0	99.9	100.0	100.0	100.0	100.0	99.8	100.0	91.6	100.0	99.9	100.0	100.0	99.9	99.7	98.9	100.0	100.0	97.7	100.0	0.0	99.6	0.7	97.9	4.2
30.00	762.0	99.4	99.9	100.0	99.9	100.0	99.1	100.0	87.1	99.7	99.1	99.6	100.0	99.6	98.8	96.9	100.0	99.9	95.2	99.6	0.4	99.0	1.6	96.6	6.3
25.00	635.0	97.4	99.2	99.6	99.2	100.0	96.9	99.7	80.4	98.0	95.0	97.3	99.9	98.3	96.0	92.2	100.0	99.5	90.5	97.6	2.0	97.2	3.3	94.3	9.3
20.00	508.0	91.2	96.4	97.0	95.7	99.3	90.6	97.5	71.0	91.6	82.1	88.9	98.1	94.2	88.5	82.6	99.7	97.7	82.0	90.1	6.6	92.5	6.3	89.6	13.0
15.00	381.0	76.4	86.8	86.1	84.0	90.3	76.2	86.2	57.9	74.4	56.7	68.5	87.5	83.4	72.6	65.9	95.9	91.3	68.0	71.8	12.8	81.0	10.0	77.6	14.5
14.00	355.6	72.0	83.5	82.1	80.1	85.7	72.0	81.9	54.8	69.3	50.6	62.8	83.1	79.9	68.1	61.6	93.7	88.9	64.4	66.5	13.6	77.4	10.6	73.6	13.8
13.00	330.2	67.2	79.5	77.3	75.4	79.8	67.4	76.7	51.5	63.7	44.3	56.7	77.8	76.0	63.3	57.0	90.6	86.0	60.5	60.7	14.0	73.3	11.0	68.9	12.7
12.00	304.8	61.9	74.9	71.8	70.1	72.7	62.3	70.7	48.1	57.6	38.1	50.4	71.6	71.5	58.0	52.1	86.4	82.5	56.4	54.4	14.0	68.5	11.3	63.4	11.2
11.00	279.4	56.1	69.5	65.4	64.2	64.4	56.8	63.8	44.4	51.2	32.0	43.8	64.5	66.4	52.5	47.0	81.1	78.2	51.9	47.9	13.6	63.2	11.3	57.4	9.3
10.00	254.0	50.0	63.5	58.4	57.6	55.2	50.9	56.3	40.7	44.5	26.2	37.3	56.7	60.8	46.6	41.8	74.4	73.3	47.3	41.2	12.8	57.4	11.1	50.8	7.1
9.00	228.6	43.6	56.9	50.9	50.6	45.6	44.7	48.3	36.7	37.7	20.9	30.8	48.3	54.6	40.5	36.4	66.4	67.5	42.4	34.4	11.6	51.0	10.6	43.8	5.0
8.50	215.9	40.3	53.4	47.0	46.9	40.8	41.6	44.2	34.7	34.3	18.3	27.7	44.0	51.4	37.4	33.7	62.0	64.3	39.8	31.1	10.8	47.6	10.2	40.3	4.0
8.00	203.2	37.0	49.7	43.0	43.2	36.0	38.3	40.1	32.7	31.0	16.0	24.6	39.8	48.0	34.4	31.0	57.3	61.0	37.3	27.8	10.0	44.2	9.8	36.8	3.2
7.50	190.5	33.7	46.0	39.0	39.4	31.4	35.1	36.0	30.6	27.7	13.8	21.7	35.5	44.6	31.3	28.3	52.4	57.4	34.6	24.7	9.2	40.7	9.4	33.3	2.7
7.00	177.8	30.5	42.1	35.0	35.6	27.0	31.9	31.9	28.5	24.5	11.7	18.9	31.3	41.0	28.2	25.6	47.4	53.6	32.0	21.6	8.3	37.1	8.9	29.8	2.5
6.50	165.1	27.2	38.2	31.0	31.8	22.8	28.7	28.0	26.3	21.4	9.9	16.3	27.2	37.5	25.2	22.9	42.3	49.7	29.3	18.7	7.4	33.5	8.3	26.4	2.6
6.00	152.4	24.0	34.2	27.1	28.1	18.9	25.5	24.1	24.2	18.5	8.1	13.8	23.3	33.8	22.3	20.4	37.1	45.5	26.6	15.9	6.5	29.9	7.7	23.2	2.9
5.50	139.7	20.9	30.3	23.3	24.5	15.3	22.3	20.5	22.0	15.7	6.6	11.5	19.6	30.2	19.4	17.8	32.1	41.3	24.0	13.4	5.6	26.4	7.1	20.0	3.2
5.00	127.0	17.9	26.4	19.7	20.9	12.2	19.3	17.0	19.8	13.1	5.2	9.4	16.2	26.5	16.6	15.4	27.1	36.9	21.3	11.0	4.7	22.9	6.5	17.1	3.5
4.50	114.3	15.1	22.6	16.3	17.5	9.4	16.4	13.8	17.6	10.6	4.1	7.5	13.0	22.9	14.0	13.0	22.4	32.5	18.6	8.8	3.9	19.5	5.8	14.3	3.6
4.00	101.6	12.4	18.8	13.1	14.3	6.9	13.6	10.9	15.4	8.4	3.0	5.8	10.2	19.4	11.5	10.8	17.9	28.0	16.0	6.9	3.1	16.2	5.1	11.7	3.7
3.50	88.9	9.8	15.3	10.2	11.3	4.9	10.9	8.3	13.2	6.5	2.2	4.4	7.6	16.0	9.2	8.7	13.9	23.5	13.4	5.2	2.4	13.1	4.5	9.3	3.6
3.00	76.2	7.5	12.0	7.6	8.6	3.3	8.5	6.0	11.0	4.7	1.5	3.1	5.5	12.7	7.0	6.8	10.2	19.1	10.9	3.7	1.8	10.3	3.8	7.2	3.3
2.50	63.5	5.5	8.9	5.3	6.2	2.1	6.3	4.1	8.9	3.3	0.9	2.1	3.7	9.6	5.1	5.0	7.1	14.9	8.6	2.5	1.2	7.6	3.1	5.3	2.9
2.00	50.8	3.7	6.1	3.5	4.1	1.2	4.3	2.6	6.8	2.1	0.5	1.3	2.2	6.8	3.5	3.5	4.5	10.8	6.3	1.5	0.8	5.3	2.3	3.7	2.4
1.75	44.5	2.9	4.9	2.7	3.2	0.8	3.4	1.9	5.8	1.6	0.4	0.9	1.7	5.6	2.7	2.8	3.4	8.9	5.2	1.1	0.6	4.2	2.0	3.0	2.2
1.50	38.1	2.2	3.8	2.0	2.4	0.5	2.6	1.4	4.8	1.1	0.3	0.7	1.2	4.4	2.1	2.1	2.5	7.1	4.2	0.8	0.4	3.3	1.6	2.3	1.9

1.25	31.8	1.6	2.8	1.4	1.7	0.3	1.9	0.9	3.9	0.8	0.2	0.4	0.8	3.3	1.5	1.6	1.7	5.5	3.3	0.5	0.3	2.4	1.3	1.8	1.5
1.00	25.4	1.1	1.9	0.9	1.1	0.2	1.3	0.6	2.9	0.5	0.1	0.3	0.5	2.3	1.0	1.1	1.1	3.9	2.4	0.3	0.2	1.7	1.0	1.3	1.2
0.90	22.9	0.9	1.6	0.7	0.9	0.1	1.1	0.5	2.6	0.4	0.1	0.2	0.4	2.0	0.8	0.9	0.9	3.4	2.1	0.3	0.2	1.4	0.8	1.1	1.1
0.80	20.3	0.7	1.3	0.6	0.8	0.1	0.9	0.4	2.2	0.3	0.1	0.2	0.3	1.6	0.7	0.7	0.7	2.8	1.8	0.2	0.1	1.2	0.7	0.9	0.9
0.70	17.8	0.6	1.0	0.4	0.6	0.1	0.7	0.3	1.9	0.2	0.0	0.1	0.2	1.3	0.5	0.6	0.5	2.3	1.5	0.2	0.1	0.9	0.6	0.7	0.8
0.60	15.2	0.4	0.8	0.3	0.4	0.0	0.5	0.2	1.6	0.2	0.0	0.1	0.2	1.0	0.4	0.5	0.4	1.8	1.2	0.1	0.1	0.7	0.5	0.6	0.7
0.55	14.0	0.4	0.7	0.3	0.4	0.0	0.5	0.2	1.4	0.1	0.0	0.1	0.1	0.9	0.4	0.4	0.3	1.6	1.0	0.1	0.1	0.6	0.4	0.5	0.6
0.50	12.7	0.3	0.6	0.2	0.3	0.0	0.4	0.1	1.3	0.1	0.0	0.1	0.1	0.8	0.3	0.3	0.2	1.4	0.9	0.1	0.0	0.5	0.4	0.5	0.6
0.45	11.4	0.3	0.5	0.2	0.3	0.0	0.3	0.1	1.1	0.1	0.0	0.0	0.1	0.6	0.2	0.3	0.2	1.2	0.8	0.1	0.0	0.5	0.3	0.4	0.5
0.40	10.2	0.2	0.4	0.1	0.2	0.0	0.3	0.1	0.9	0.1	0.0	0.0	0.1	0.5	0.2	0.2	0.2	1.0	0.7	0.0	0.0	0.4	0.3	0.3	0.4
0.35	8.9	0.2	0.3	0.1	0.2	0.0	0.2	0.1	0.8	0.1	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.8	0.5	0.0	0.0	0.3	0.2	0.3	0.4
0.30	7.6	0.1	0.2	0.1	0.1	0.0	0.2	0.0	0.7	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.6	0.4	0.0	0.0	0.2	0.2	0.2	0.3
0.25	6.4	0.1	0.2	0.1	0.1	0.0	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.5	0.3	0.0	0.0	0.2	0.1	0.2	0.2
0.20	5.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.3	0.2	0.0	0.0	0.1	0.1	0.1	0.2
0.15	3.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.1	0.1	0.1	0.1
0.10	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
0.05	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.03	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.01	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
Sieve Size		**Percent of of material retained at any given size (%-wet basis)**																							
inch	**mm**																								
75.00	1905.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
60.00	1524.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4
50.00	1270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.5	1.1
45.00	1143.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.0	0.1	0.1	0.8	1.7
40.00	1016.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	1.0	0.0	0.0	0.1	0.3	1.3	2.7
35.00	889.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	8.4	0.0	0.1	0.0	0.0	0.1	0.3	1.1	0.0	0.0	2.3	0.0	0.0	0.4	0.7	2.1	4.2
30.00	762.0	0.6	0.1	0.0	0.1	0.0	0.9	0.0	12.9	0.3	0.9	0.4	0.0	0.4	1.2	3.1	0.0	0.1	4.8	0.4	0.4	1.0	1.6	3.4	6.3
25.00	635.0	2.6	0.8	0.4	0.8	0.0	3.1	0.3	19.6	2.0	5.0	2.7	0.1	1.7	4.0	7.8	0.0	0.5	9.5	2.4	2.0	2.8	3.3	5.7	9.3
20.00	508.0	8.8	3.6	3.0	4.3	0.7	9.4	2.5	29.0	8.4	17.9	11.1	1.9	5.8	11.5	17.4	0.3	2.3	18.0	9.9	6.6	7.5	6.3	10.4	13.0
15.00	381.0	23.6	13.2	13.9	16.0	9.7	23.8	13.8	42.1	25.6	43.3	31.5	12.5	16.6	27.4	34.1	4.1	8.7	32.0	28.2	12.8	19.0	10.0	22.4	14.5
14.00	355.6	28.0	16.5	17.9	19.9	14.3	28.0	18.1	45.2	30.7	49.4	37.2	16.9	20.1	31.9	38.4	6.3	11.1	35.6	33.5	13.6	22.6	10.6	26.4	13.8
13.00	330.2	32.8	20.5	22.7	24.6	20.2	32.6	23.3	48.5	36.3	55.7	43.3	22.2	24.0	36.7	43.0	9.4	14.0	39.5	39.3	14.0	26.7	11.0	31.1	12.7
12.00	304.8	38.1	25.1	28.2	29.9	27.3	37.7	29.3	51.9	42.4	61.9	49.6	28.4	28.5	42.0	47.9	13.6	17.5	43.6	45.6	14.0	31.5	11.3	36.6	11.2
11.00	279.4	43.9	30.5	34.6	35.8	35.6	43.2	36.2	55.6	48.8	68.0	56.2	35.5	33.6	47.5	53.0	18.9	21.8	48.1	52.1	13.6	36.8	11.3	42.6	9.3
10.00	254.0	50.0	36.5	41.6	42.4	44.8	49.1	43.7	59.3	55.5	73.8	62.7	43.3	39.2	53.4	58.2	25.6	26.7	52.7	58.8	12.8	42.6	11.1	49.2	7.1
9.00	228.6	56.4	43.1	49.1	49.4	54.4	55.3	51.7	63.3	62.3	79.1	69.2	51.7	45.4	59.5	63.6	33.6	32.5	57.6	65.6	11.6	49.0	10.6	56.2	5.0
8.50	215.9	59.7	46.6	53.0	53.1	59.2	58.4	55.8	65.3	65.7	81.7	72.3	56.0	48.6	62.6	66.3	38.0	35.7	60.2	68.9	10.8	52.4	10.2	59.7	4.0
8.00	203.2	63.0	50.3	57.0	56.8	64.0	61.7	59.9	67.3	69.0	84.0	75.4	60.2	52.0	65.6	69.0	42.7	39.0	62.7	72.2	10.0	55.8	9.8	63.2	3.2
7.50	190.5	66.3	54.0	61.0	60.6	68.6	64.9	64.0	69.4	72.3	86.2	78.3	64.5	55.4	68.7	71.7	47.6	42.6	65.4	75.3	9.2	59.3	9.4	66.7	2.7
7.00	177.8	69.5	57.9	65.0	64.4	73.0	68.1	68.1	71.5	75.5	88.3	81.1	68.7	59.0	71.8	74.4	52.6	46.4	68.0	78.4	8.3	62.9	8.9	70.2	2.5
6.50	165.1	72.8	61.8	69.0	68.2	77.2	71.3	72.0	73.7	78.6	90.1	83.7	72.8	62.5	74.8	77.1	57.7	50.3	70.7	81.3	7.4	66.5	8.3	73.6	2.6
6.00	152.4	76.0	65.8	72.9	71.9	81.1	74.5	75.9	75.8	81.5	91.9	86.2	76.7	66.2	77.7	79.6	62.9	54.5	73.4	84.1	6.5	70.1	7.7	76.8	2.9
5.50	139.7	79.1	69.7	76.7	75.5	84.7	77.7	79.5	78.0	84.3	93.4	88.5	80.4	69.8	80.6	82.2	67.9	58.7	76.0	86.6	5.6	73.6	7.1	80.0	3.2

5.00	127.0	82.1	73.6	80.3	79.1	87.8	80.7	83.0	80.2	86.9	94.8	90.6	83.8	73.5	83.4	84.6	72.9	63.1	78.7	89.0	4.7	77.1	6.5	82.9	3.5
4.50	114.3	84.9	77.4	83.7	82.5	90.6	83.6	86.2	82.4	89.4	95.9	92.5	87.0	77.1	86.0	87.0	77.6	67.5	81.4	91.2	3.9	80.5	5.8	85.7	3.6
4.00	101.6	87.6	81.2	86.9	85.7	93.1	86.4	89.1	84.6	91.6	97.0	94.2	89.8	80.6	88.5	89.2	82.1	72.0	84.0	93.1	3.1	83.8	5.1	88.3	3.7
3.50	88.9	90.2	84.7	89.8	88.7	95.1	89.1	91.7	86.8	93.5	97.8	95.6	92.4	84.0	90.8	91.3	86.1	76.5	86.6	94.8	2.4	86.9	4.5	90.7	3.6
3.00	76.2	92.5	88.0	92.4	91.4	96.7	91.5	94.0	89.0	95.3	98.5	96.9	94.5	87.3	93.0	93.2	89.8	80.9	89.1	96.3	1.8	89.7	3.8	92.8	3.3
2.50	63.5	94.5	91.1	94.7	93.8	97.9	93.7	95.9	91.1	96.7	99.1	97.9	96.3	90.4	94.9	95.0	92.9	85.1	91.4	97.5	1.2	92.4	3.1	94.7	2.9
2.00	50.8	96.3	93.9	96.5	95.9	98.8	95.7	97.4	93.2	97.9	99.5	98.7	97.8	93.2	96.5	96.5	95.5	89.2	93.7	98.5	0.8	94.7	2.3	96.3	2.4
1.75	44.5	97.1	95.1	97.3	96.8	99.2	96.6	98.1	94.2	98.4	99.6	99.1	98.3	94.4	97.3	97.2	96.6	91.1	94.8	98.9	0.6	95.8	2.0	97.0	2.2
1.50	38.1	97.8	96.2	98.0	97.6	99.5	97.4	98.6	95.2	98.9	99.7	99.3	98.8	95.6	97.9	97.9	97.5	92.9	95.8	99.2	0.4	96.7	1.6	97.7	1.9
1.25	31.8	98.4	97.2	98.6	98.3	99.7	98.1	99.1	96.1	99.2	99.8	99.6	99.2	96.7	98.5	98.4	98.3	94.5	96.7	99.5	0.3	97.6	1.3	98.2	1.5
1.00	25.4	98.9	98.1	99.1	98.9	99.8	98.7	99.4	97.1	99.5	99.9	99.7	99.5	97.7	99.0	98.9	98.9	96.1	97.6	99.7	0.2	98.3	1.0	98.7	1.2
0.90	22.9	99.1	98.4	99.3	99.1	99.9	98.9	99.5	97.4	99.6	99.9	99.8	99.6	98.0	99.2	99.1	99.1	96.6	97.9	99.7	0.2	98.6	0.8	98.9	1.1
0.80	20.3	99.3	98.7	99.4	99.2	99.9	99.1	99.6	97.8	99.7	99.9	99.8	99.7	98.4	99.3	99.3	99.3	97.2	98.2	99.8	0.1	98.8	0.7	99.1	0.9
0.70	17.8	99.4	99.0	99.6	99.4	99.9	99.3	99.7	98.1	99.8	100.0	99.9	99.8	98.7	99.5	99.4	99.5	97.7	98.5	99.8	0.1	99.1	0.6	99.3	0.8
0.60	15.2	99.6	99.2	99.7	99.6	100.0	99.5	99.8	98.4	99.8	100.0	99.9	99.8	99.0	99.6	99.5	99.6	98.2	98.8	99.9	0.1	99.3	0.5	99.4	0.7
0.55	14.0	99.6	99.3	99.7	99.6	100.0	99.5	99.8	98.6	99.9	100.0	99.9	99.9	99.1	99.6	99.6	99.7	98.4	99.0	99.9	0.1	99.4	0.4	99.5	0.6
0.50	12.7	99.7	99.4	99.8	99.7	100.0	99.6	99.9	98.7	99.9	100.0	99.9	99.9	99.2	99.7	99.7	99.8	98.6	99.1	99.9	0.0	99.5	0.4	99.5	0.6
0.45	11.4	99.7	99.5	99.8	99.7	100.0	99.7	99.9	98.9	99.9	100.0	100.0	99.9	99.4	99.8	99.7	99.8	98.8	99.2	99.9	0.0	99.5	0.3	99.6	0.5
0.40	10.2	99.8	99.6	99.9	99.8	100.0	99.7	99.9	99.1	99.9	100.0	100.0	99.9	99.5	99.8	99.8	99.8	99.0	99.3	100.0	0.0	99.6	0.3	99.7	0.4
0.35	8.9	99.8	99.7	99.9	99.8	100.0	99.8	99.9	99.2	99.9	100.0	100.0	100.0	99.6	99.8	99.8	99.9	99.2	99.5	100.0	0.0	99.7	0.2	99.7	0.4
0.30	7.6	99.9	99.8	99.9	99.9	100.0	99.8	100.0	99.3	100.0	100.0	100.0	100.0	99.7	99.9	99.9	99.9	99.4	99.6	100.0	0.0	99.8	0.2	99.8	0.3
0.25	6.4	99.9	99.8	99.9	99.9	100.0	99.9	100.0	99.5	100.0	100.0	100.0	100.0	99.7	99.9	99.9	99.9	99.5	99.7	100.0	0.0	99.8	0.1	99.8	0.2
0.20	5.1	99.9	99.9	100.0	99.9	100.0	99.9	100.0	99.6	100.0	100.0	100.0	100.0	99.8	99.9	99.9	100.0	99.7	99.8	100.0	0.0	99.9	0.1	99.9	0.2
0.15	3.8	100.0	99.9	100.0	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.8	99.8	100.0	0.0	99.9	0.1	99.9	0.1
0.10	2.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	99.9	99.9	100.0	0.0	100.0	0.0	100.0	0.1
0.05	1.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.03	0.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.02	0.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.01	0.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0


PSD of RDF Material in >9" Overs (Wet Basis)
Summer
Winter
Spring
Cumulative Passed (%)
100
80
60
40
20
0
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)


PSD of RDF Material in >9" Overs (Wet Basis)
Cumulative Retained (%)
100
80
60
40
20
0
Summer
Winter
Spring
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)

Fitting Rosin-Rammler Distribution to RDF Fraction of Trommel's >9 inch Overs

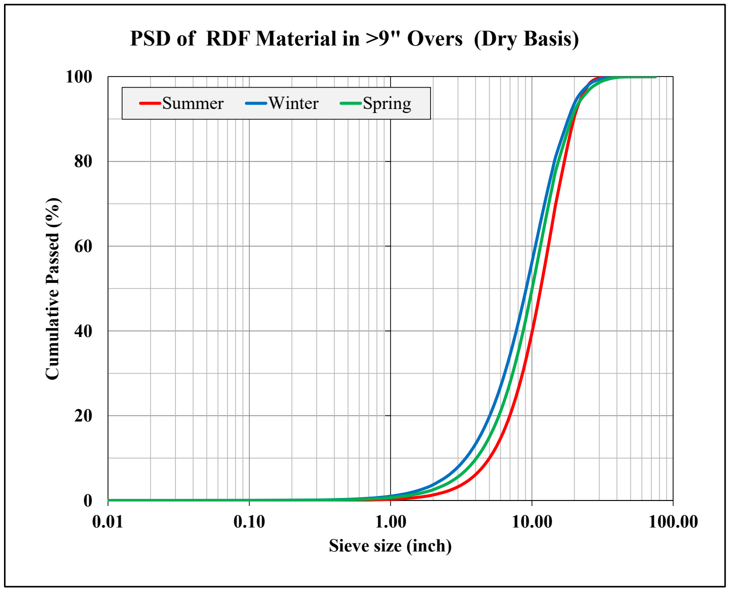
Parameter	Jan-15				May-15				Jun-15				Nov-15			Feb-16		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3
R^2 =	1.00	0.99	1.00	1.00	0.99	0.99	0.98	0.94	0.99	0.94	0.98	0.99	0.99	0.96	0.87	0.99	0.99	0.93
n =	1.95	1.82	2.13	1.97	2.62	1.85	2.24	1.66	2.14	2.65	2.32	2.27	1.84	2.07	1.75	2.17	2.04	1.60
n x ln(D_N) =	-11.26	-10.15	-12.00	-11.07	-14.72	-10.56	-12.62	-9.92	-12.44	-15.91	-13.65	-12.82	-10.28	-11.97	-10.32	-11.75	-10.96	-9.35
D_N (mm)	321.23	261.34	281.86	277.60	278.31	305.79	279.68	395.85	336.39	401.86	361.86	282.02	264.88	322.01	364.88	226.20	213.99	345.63
D_N (in)	12.65	10.29	11.10	10.93	10.96	12.04	11.01	15.58	13.24	15.82	14.25	11.10	10.43	12.68	14.37	8.91	8.42	13.61
R^2 =	1.00	0.99	0.99	1.00	0.97	0.99	0.99	0.91	1.00	0.98	0.99	0.99	1.00	0.95	0.91	0.99	0.99	0.92
D60 =	227.68	180.79	205.51	197.33	215.28	212.50	207.21	264.05	245.70	312.00	270.78	209.85	183.99	232.88	248.56	165.93	154.04	227.08
D10 =	101.39	76.05	97.81	88.48	117.74	90.34	102.40	101.96	117.43	172.11	136.98	104.77	78.14	108.75	100.83	80.11	71.13	84.61
UC =	2.25	2.38	2.10	2.23	1.83	2.35	2.02	2.59	2.09	1.81	1.98	2.00	2.35	2.14	2.47	2.07	2.17	2.68

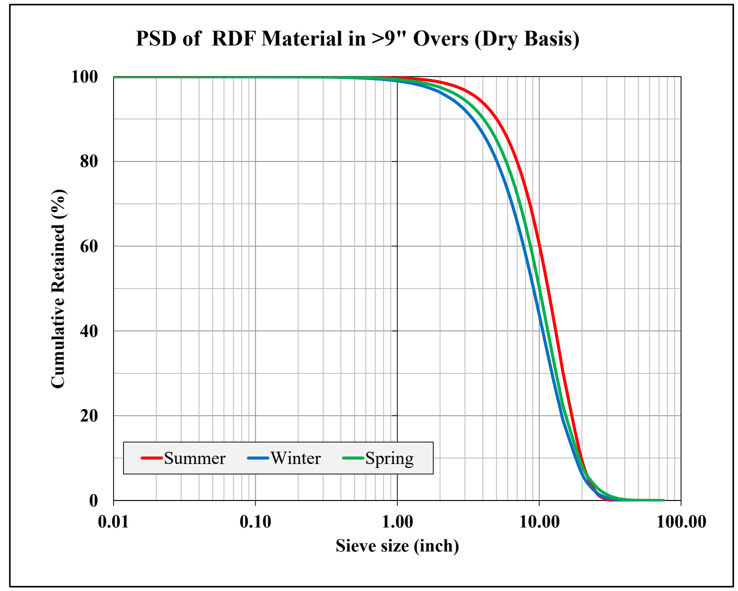
Sieve Size		Percent of of material passed at any given size (%-dry basis)																		Summer		Winter		Spring	
		Jan-15				May-15				Jun-15				Nov-15			Feb-16								
inch	**mm**	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
75.00	1905.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
60.00	1524.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
50.00	1270.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
45.00	1143.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	99.9	100.0	0.0	100.0	0.0	99.9	0.2
40.00	1016.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.2	100.0	100.0	100.0	100.0	100.0	100.0	99.8	100.0	100.0	99.6	100.0	0.0	99.9	0.1	99.8	0.4
35.00	889.0	99.9	100.0	100.0	100.0	100.0	99.9	100.0	97.8	100.0	100.0	100.0	100.0	100.0	100.0	99.1	100.0	100.0	98.9	100.0	0.0	99.8	0.4	99.4	1.1
30.00	762.0	99.5	99.9	100.0	99.9	100.0	99.5	100.0	94.8	99.7	99.6	99.6	100.0	99.9	99.7	97.3	100.0	100.0	97.1	99.7	0.2	99.3	1.1	98.6	2.5
25.00	635.0	97.7	99.4	99.6	99.4	100.0	97.9	99.8	88.8	98.0	96.6	97.5	99.8	99.3	98.3	92.8	100.0	100.0	92.9	98.0	1.4	97.9	2.8	96.6	5.3
20.00	508.0	91.3	96.5	97.0	96.3	99.2	92.2	97.8	78.0	91.1	84.5	88.9	97.8	96.4	92.4	83.2	99.7	99.7	84.3	90.5	5.5	93.7	5.9	91.8	9.7
15.00	381.0	75.2	86.3	85.0	84.5	89.7	77.7	86.4	60.9	72.9	58.0	67.6	86.2	85.8	75.8	66.0	95.5	96.1	68.9	71.2	11.8	81.9	10.2	78.7	12.9
14.00	355.6	70.5	82.7	80.6	80.4	85.0	73.3	82.0	56.7	67.6	51.5	61.7	81.6	82.1	70.7	61.6	93.0	94.1	64.9	65.6	12.6	78.0	11.0	74.2	12.7
13.00	330.2	65.2	78.4	75.3	75.5	79.1	68.4	76.6	52.3	61.8	44.8	55.5	76.1	77.7	65.1	56.8	89.7	91.2	60.5	59.5	13.1	73.5	11.6	69.1	12.1
12.00	304.8	59.4	73.4	69.3	69.9	71.9	63.0	70.3	47.7	55.5	38.1	48.9	69.7	72.6	59.0	51.8	85.2	87.3	55.9	53.1	13.2	68.4	11.9	63.2	11.0
11.00	279.4	53.3	67.7	62.5	63.7	63.6	57.1	63.1	42.9	49.0	31.7	42.3	62.4	66.8	52.5	46.6	79.4	82.2	50.9	46.3	12.9	62.6	12.0	56.7	9.6
10.00	254.0	46.9	61.3	55.1	56.8	54.5	50.8	55.3	38.1	42.2	25.6	35.6	54.5	60.4	45.7	41.2	72.4	75.8	45.7	39.5	12.1	56.1	11.7	49.7	8.0
9.00	228.6	40.2	54.3	47.3	49.5	45.0	44.3	47.1	33.1	35.5	20.1	29.2	46.2	53.3	38.8	35.7	64.1	68.2	40.3	32.7	11.0	49.2	10.9	42.4	6.3
8.50	215.9	36.9	50.6	43.3	45.7	40.2	40.9	42.9	30.6	32.1	17.5	26.1	42.0	49.6	35.4	32.9	59.5	63.9	37.6	29.4	10.3	45.5	10.4	38.7	5.5
8.00	203.2	33.6	46.9	39.3	41.8	35.5	37.5	38.7	28.2	28.8	15.1	23.1	37.8	45.9	32.0	30.2	54.7	59.3	34.8	26.2	9.6	41.8	9.8	35.0	4.7
7.50	190.5	30.3	43.0	35.3	37.9	31.0	34.1	34.5	25.7	25.7	12.9	20.2	33.6	42.0	28.6	27.4	49.8	54.5	32.0	23.1	8.8	38.1	9.2	31.3	4.1
7.00	177.8	27.0	39.1	31.3	34.0	26.6	30.8	30.4	23.3	22.6	10.9	17.5	29.6	38.1	25.3	24.7	44.8	49.6	29.2	20.1	7.9	34.3	8.4	27.8	3.5
6.50	165.1	23.9	35.1	27.4	30.2	22.5	27.4	26.4	20.9	19.6	9.0	15.0	25.6	34.2	22.1	22.1	39.7	44.5	26.4	17.3	7.0	30.6	7.6	24.3	3.1
6.00	152.4	20.8	31.2	23.7	26.5	18.7	24.2	22.6	18.6	16.8	7.3	12.6	21.9	30.3	19.1	19.5	34.6	39.3	23.7	14.7	6.2	26.9	6.8	21.0	2.8
5.50	139.7	17.9	27.3	20.1	22.8	15.2	21.0	19.0	16.3	14.2	5.9	10.4	18.3	26.5	16.2	17.0	29.7	34.2	20.9	12.2	5.3	23.3	6.0	17.9	2.6
5.00	127.0	15.1	23.5	16.8	19.3	12.1	17.9	15.7	14.1	11.7	4.6	8.5	15.1	22.7	13.5	14.6	24.9	29.1	18.3	10.0	4.5	19.8	5.1	14.9	2.5
4.50	114.3	12.5	19.9	13.6	16.0	9.3	15.0	12.6	12.0	9.5	3.5	6.7	12.1	19.1	11.0	12.3	20.4	24.2	15.7	7.9	3.7	16.5	4.3	12.2	2.4
4.00	101.6	10.0	16.4	10.8	12.9	6.9	12.3	9.8	9.9	7.4	2.6	5.1	9.4	15.7	8.7	10.1	16.2	19.6	13.2	6.1	2.9	13.4	3.5	9.7	2.2
3.50	88.9	7.8	13.1	8.2	10.1	4.9	9.7	7.4	8.1	5.6	1.8	3.8	7.0	12.5	6.7	8.1	12.4	15.3	10.8	4.6	2.3	10.5	2.8	7.5	2.0
3.00	76.2	5.9	10.0	6.0	7.6	3.3	7.4	5.3	6.3	4.1	1.2	2.7	5.0	9.6	4.9	6.3	9.0	11.4	8.5	3.2	1.7	7.9	2.1	5.6	1.7
2.50	63.5	4.1	7.3	4.1	5.3	2.1	5.3	3.5	4.7	2.8	0.7	1.8	3.3	6.9	3.4	4.6	6.2	8.0	6.4	2.2	1.1	5.6	1.6	3.9	1.4
2.00	50.8	2.7	4.9	2.6	3.5	1.2	3.6	2.2	3.3	1.7	0.4	1.1	2.0	4.7	2.2	3.1	3.8	5.2	4.6	1.3	0.7	3.7	1.1	2.5	1.1
1.75	44.5	2.1	3.9	2.0	2.7	0.8	2.8	1.6	2.6	1.3	0.3	0.8	1.5	3.7	1.6	2.5	2.9	4.0	3.7	1.0	0.5	2.9	0.9	2.0	0.9
1.50	38.1	1.5	2.9	1.4	2.0	0.5	2.1	1.1	2.0	0.9	0.2	0.5	1.1	2.8	1.2	1.9	2.1	2.9	2.9	0.7	0.4	2.2	0.7	1.5	0.8

1.25	31.8	1.1	2.1	1.0	1.4	0.3	1.5	0.8	1.5	0.6	0.1	0.4	0.7	2.0	0.8	1.4	1.4	2.0	2.2	0.5	0.3	1.5	0.5	1.0	0.6
1.00	25.4	0.7	1.4	0.6	0.9	0.2	1.0	0.5	1.0	0.4	0.1	0.2	0.4	1.3	0.5	0.9	0.9	1.3	1.5	0.3	0.2	1.0	0.4	0.7	0.4
0.90	22.9	0.6	1.2	0.5	0.7	0.1	0.8	0.4	0.9	0.3	0.0	0.2	0.3	1.1	0.4	0.8	0.7	1.0	1.3	0.2	0.1	0.8	0.3	0.6	0.4
0.80	20.3	0.5	0.9	0.4	0.6	0.1	0.7	0.3	0.7	0.2	0.0	0.1	0.3	0.9	0.3	0.6	0.5	0.8	1.1	0.2	0.1	0.7	0.3	0.4	0.3
0.70	17.8	0.4	0.7	0.3	0.4	0.1	0.5	0.2	0.6	0.2	0.0	0.1	0.2	0.7	0.2	0.5	0.4	0.6	0.9	0.1	0.1	0.5	0.2	0.3	0.2
0.60	15.2	0.3	0.6	0.2	0.3	0.1	0.4	0.1	0.4	0.1	0.0	0.1	0.1	0.5	0.2	0.4	0.3	0.5	0.7	0.1	0.1	0.4	0.2	0.3	0.2
0.55	14.0	0.2	0.5	0.2	0.3	0.0	0.3	0.1	0.4	0.1	0.0	0.1	0.1	0.4	0.1	0.3	0.2	0.4	0.6	0.1	0.0	0.3	0.1	0.2	0.2
0.50	12.7	0.2	0.4	0.1	0.2	0.0	0.3	0.1	0.3	0.1	0.0	0.0	0.1	0.4	0.1	0.3	0.2	0.3	0.5	0.1	0.0	0.3	0.1	0.2	0.1
0.45	11.4	0.1	0.3	0.1	0.2	0.0	0.2	0.1	0.3	0.1	0.0	0.0	0.1	0.3	0.1	0.2	0.2	0.3	0.4	0.0	0.0	0.2	0.1	0.2	0.1
0.40	10.2	0.1	0.3	0.1	0.1	0.0	0.2	0.1	0.2	0.1	0.0	0.0	0.1	0.2	0.1	0.2	0.1	0.2	0.4	0.0	0.0	0.2	0.1	0.1	0.1
0.35	8.9	0.1	0.2	0.1	0.1	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.1	0.2	0.3	0.0	0.0	0.1	0.1	0.1	0.1
0.30	7.6	0.1	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.1	0.1
0.25	6.4	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.0
0.20	5.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
0.15	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
0.10	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.03	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.01	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

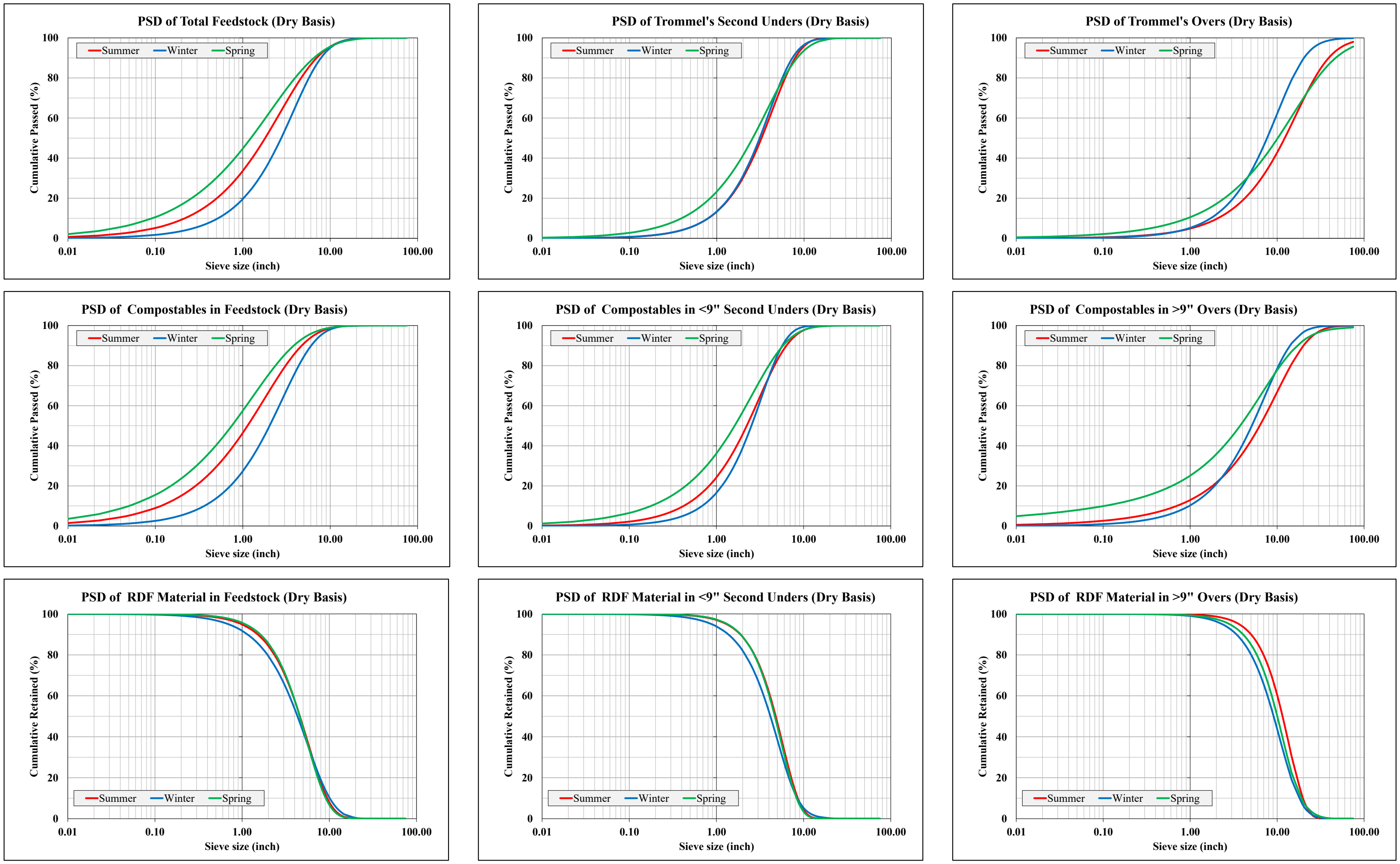
		Jan-15				May-15				Jun-15				Nov-15			Feb-16			Summer		Winter		Spring	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	Mean	SD	Mean	SD	Mean	SD
Sieve Size		**Percent of of material retained at any given size (%-dry basis)**																							
inch	**mm**																								
75.00	1905.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.00	1524.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.00	1270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45.00	1143.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2
40.00	1016.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.1	0.1	0.2	0.4
35.00	889.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	1.1	0.0	0.0	0.2	0.4	0.6	1.1
30.00	762.0	0.5	0.1	0.0	0.1	0.0	0.5	0.0	5.2	0.3	0.4	0.4	0.0	0.1	0.3	2.7	0.0	0.0	2.9	0.3	0.2	0.7	1.1	1.4	2.5
25.00	635.0	2.3	0.6	0.4	0.6	0.0	2.1	0.2	11.2	2.0	3.4	2.5	0.2	0.7	1.7	7.2	0.0	0.0	7.1	2.0	1.4	2.1	2.8	3.4	5.3
20.00	508.0	8.7	3.5	3.0	3.7	0.8	7.8	2.2	22.0	8.9	15.5	11.1	2.2	3.6	7.6	16.8	0.3	0.3	15.7	9.5	5.5	6.3	5.9	8.2	9.7
15.00	381.0	24.8	13.7	15.0	15.5	10.3	22.3	13.6	39.1	27.1	42.0	32.4	13.8	14.2	24.2	34.0	4.5	3.9	31.1	28.8	11.8	18.1	10.2	21.3	12.9
14.00	355.6	29.5	17.3	19.4	19.6	15.0	26.7	18.0	43.3	32.4	48.5	38.3	18.4	17.9	29.3	38.4	7.0	5.9	35.1	34.4	12.6	22.0	11.0	25.8	12.7
13.00	330.2	34.8	21.6	24.7	24.5	20.9	31.6	23.4	47.7	38.2	55.2	44.5	23.9	22.3	34.9	43.2	10.3	8.8	39.5	40.5	13.1	26.5	11.6	30.9	12.1
12.00	304.8	40.6	26.6	30.7	30.1	28.1	37.0	29.7	52.3	44.5	61.9	51.1	30.3	27.4	41.0	48.2	14.8	12.7	44.1	46.9	13.2	31.6	11.9	36.8	11.0
11.00	279.4	46.7	32.3	37.5	36.3	36.4	42.9	36.9	57.1	51.0	68.3	57.7	37.6	33.2	47.5	53.4	20.6	17.8	49.1	53.7	12.9	37.4	12.0	43.3	9.6
10.00	254.0	53.1	38.7	44.9	43.2	45.5	49.2	44.7	61.9	57.8	74.4	64.4	45.5	39.6	54.3	58.8	27.6	24.2	54.3	60.5	12.1	43.9	11.7	50.3	8.0
9.00	228.6	59.8	45.7	52.7	50.5	55.0	55.7	52.9	66.9	64.5	79.9	70.8	53.8	46.7	61.2	64.3	35.9	31.8	59.7	67.3	11.0	50.8	10.9	57.6	6.3
8.50	215.9	63.1	49.4	56.7	54.3	59.8	59.1	57.1	69.4	67.9	82.5	73.9	58.0	50.4	64.6	67.1	40.5	36.1	62.4	70.6	10.3	54.5	10.4	61.3	5.5
8.00	203.2	66.4	53.1	60.7	58.2	64.5	62.5	61.3	71.8	71.2	84.9	76.9	62.2	54.1	68.0	69.8	45.3	40.7	65.2	73.8	9.6	58.2	9.8	65.0	4.7
7.50	190.5	69.7	57.0	64.7	62.1	69.0	65.9	65.5	74.3	74.3	87.1	79.8	66.4	58.0	71.4	72.6	50.2	45.5	68.0	76.9	8.8	61.9	9.2	68.7	4.1
7.00	177.8	73.0	60.9	68.7	66.0	73.4	69.2	69.6	76.7	77.4	89.1	82.5	70.4	61.9	74.7	75.3	55.2	50.4	70.8	79.9	7.9	65.7	8.4	72.2	3.5
6.50	165.1	76.1	64.9	72.6	69.8	77.5	72.6	73.6	79.1	80.4	91.0	85.0	74.4	65.8	77.9	77.9	60.3	55.5	73.6	82.7	7.0	69.4	7.6	75.7	3.1
6.00	152.4	79.2	68.8	76.3	73.5	81.3	75.8	77.4	81.4	83.2	92.7	87.4	78.1	69.7	80.9	80.5	65.4	60.7	76.3	85.3	6.2	73.1	6.8	79.0	2.8
5.50	139.7	82.1	72.7	79.9	77.2	84.8	79.0	81.0	83.7	85.8	94.1	89.6	81.7	73.5	83.8	83.0	70.3	65.8	79.1	87.8	5.3	76.7	6.0	82.1	2.6

5.00	127.0	84.9	76.5	83.2	80.7	87.9	82.1	84.3	85.9	88.3	95.4	91.5	84.9	77.3	86.5	85.4	75.1	70.9	81.7	90.0	4.5	80.2	5.1	85.1	2.5
4.50	114.3	87.5	80.1	86.4	84.0	90.7	85.0	87.4	88.0	90.5	96.5	93.3	87.9	80.9	89.0	87.7	79.6	75.8	84.3	92.1	3.7	83.5	4.3	87.8	2.4
4.00	101.6	90.0	83.6	89.2	87.1	93.1	87.7	90.2	90.1	92.6	97.4	94.9	90.6	84.3	91.3	89.9	83.8	80.4	86.8	93.9	2.9	86.6	3.5	90.3	2.2
3.50	88.9	92.2	86.9	91.8	89.9	95.1	90.3	92.6	91.9	94.4	98.2	96.2	93.0	87.5	93.3	91.9	87.6	84.7	89.2	95.4	2.3	89.5	2.8	92.5	2.0
3.00	76.2	94.1	90.0	94.0	92.4	96.7	92.6	94.7	93.7	95.9	98.8	97.3	95.0	90.4	95.1	93.7	91.0	88.6	91.5	96.8	1.7	92.1	2.1	94.4	1.7
2.50	63.5	95.9	92.7	95.9	94.7	97.9	94.7	96.5	95.3	97.2	99.3	98.2	96.7	93.1	96.6	95.4	93.8	92.0	93.6	97.8	1.1	94.4	1.6	96.1	1.4
2.00	50.8	97.3	95.1	97.4	96.5	98.8	96.4	97.8	96.7	98.3	99.6	98.9	98.0	95.3	97.8	96.9	96.2	94.8	95.4	98.7	0.7	96.3	1.1	97.5	1.1
1.75	44.5	97.9	96.1	98.0	97.3	99.2	97.2	98.4	97.4	98.7	99.7	99.2	98.5	96.3	98.4	97.5	97.1	96.0	96.3	99.0	0.5	97.1	0.9	98.0	0.9
1.50	38.1	98.5	97.1	98.6	98.0	99.5	97.9	98.9	98.0	99.1	99.8	99.5	98.9	97.2	98.8	98.1	97.9	97.1	97.1	99.3	0.4	97.8	0.7	98.5	0.8
1.25	31.8	98.9	97.9	99.0	98.6	99.7	98.5	99.2	98.5	99.4	99.9	99.6	99.3	98.0	99.2	98.6	98.6	98.0	97.8	99.5	0.3	98.5	0.5	99.0	0.6
1.00	25.4	99.3	98.6	99.4	99.1	99.8	99.0	99.5	99.0	99.6	99.9	99.8	99.6	98.7	99.5	99.1	99.1	98.7	98.5	99.7	0.2	99.0	0.4	99.3	0.4
0.90	22.9	99.4	98.8	99.5	99.3	99.9	99.2	99.6	99.1	99.7	100.0	99.8	99.7	98.9	99.6	99.2	99.3	99.0	98.7	99.8	0.1	99.2	0.3	99.4	0.4
0.80	20.3	99.5	99.1	99.6	99.4	99.9	99.3	99.7	99.3	99.8	100.0	99.9	99.7	99.1	99.7	99.4	99.5	99.2	98.9	99.8	0.1	99.3	0.3	99.6	0.3
0.70	17.8	99.6	99.3	99.7	99.6	99.9	99.5	99.8	99.4	99.8	100.0	99.9	99.8	99.3	99.8	99.5	99.6	99.4	99.1	99.9	0.1	99.5	0.2	99.7	0.2
0.60	15.2	99.7	99.4	99.8	99.7	99.9	99.6	99.9	99.6	99.9	100.0	99.9	99.9	99.5	99.8	99.6	99.7	99.5	99.3	99.9	0.1	99.6	0.2	99.7	0.2
0.55	14.0	99.8	99.5	99.8	99.7	100.0	99.7	99.9	99.6	99.9	100.0	99.9	99.9	99.6	99.9	99.7	99.8	99.6	99.4	99.9	0.0	99.7	0.1	99.8	0.2
0.50	12.7	99.8	99.6	99.9	99.8	100.0	99.7	99.9	99.7	99.9	100.0	100.0	99.9	99.6	99.9	99.7	99.8	99.7	99.5	99.9	0.0	99.7	0.1	99.8	0.1
0.45	11.4	99.9	99.7	99.9	99.8	100.0	99.8	99.9	99.7	99.9	100.0	100.0	99.9	99.7	99.9	99.8	99.8	99.7	99.6	100.0	0.0	99.8	0.1	99.8	0.1
0.40	10.2	99.9	99.7	99.9	99.9	100.0	99.8	99.9	99.8	99.9	100.0	100.0	99.9	99.8	99.9	99.8	99.9	99.8	99.6	100.0	0.0	99.8	0.1	99.9	0.1
0.35	8.9	99.9	99.8	99.9	99.9	100.0	99.9	100.0	99.8	100.0	100.0	100.0	100.0	99.8	99.9	99.8	99.9	99.8	99.7	100.0	0.0	99.9	0.1	99.9	0.1
0.30	7.6	99.9	99.8	100.0	99.9	100.0	99.9	100.0	99.9	100.0	100.0	100.0	100.0	99.9	100.0	99.9	99.9	99.9	99.8	100.0	0.0	99.9	0.1	99.9	0.1
0.25	6.4	100.0	99.9	100.0	99.9	100.0	99.9	100.0	99.9	100.0	100.0	100.0	100.0	99.9	100.0	99.9	100.0	99.9	99.8	100.0	0.0	99.9	0.0	99.9	0.0
0.20	5.1	100.0	99.9	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0	99.9	100.0	0.0	100.0	0.0	100.0	0.0
0.15	3.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	0.0	100.0	0.0	100.0	0.0
0.10	2.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.05	1.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.03	0.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.02	0.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0
0.01	0.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0


PSD of RDF Material in >9" Overs (Dry Basis)
Summer
Winter
Spring
Cumulative Passed (%)
100
80
60
40
20
0
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)


PSD of RDF Material in >9" Overs (Dry Basis)
Summer
Winter
Spring
Cumulative Retained (%)
100
80
60
40
20
0
0.01
0.10
1.00
10.00
100.00
Sieve size (inch)

Summary of PSD Fitted to Total Feed, <9 inch Second Unders and >9 inch Overs



APPENDIX C: SYSTEM ENGINEERING DATA

Table C-1: System Availability Results

Trial No.	Month/Year	Trial No. Corresponding to Appendix A	Observed Wet Feed Rate (t/h)	Corrected Wet Feed Rate (t/h)	Observed Dry Feed Rate (t/h)	Corrected Dry Feed Rate (t/h)	Total Net Operation Duration (min)	Total Down Time, including sampling time (min)	Total Sampling Time (min)	Total Real Down Time (min)	Real Trial Duration (min)	Observed System Availability (%)	Real System Availability (%)
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
1	Mar-14	1	37.6 ± 2	41.6 ± 1.4	24.4 ± 1.3	27 ± 0.9	554.0	63.0	37.0	26.0	580.0	89.8%	95.5%
2		2	56.3 ± 2.3	59.9 ± 1.9	31 ± 1.3	33 ± 1	553.0	87.0	27.0	60.0	613.0	86.4%	90.2%
3		3	64.3 ± 4.9	72.4 ± 5.7	36.4 ± 2.8	40.9 ± 3.2	440.0	78.9	56.0	22.9	462.9	84.8%	95.0%
4	Jan-15	1	40.3 ± 4.2	49.3 ± 1.4	25.6 ± 2.7	31.3 ± 0.9	191.1	49.7	23.6	26.1	217.2	79.4%	88.0%
5		2	39.6 ± 4.8	46.8 ± 5.2	24 ± 2.9	28.3 ± 3.1	463.3	69.5	24.3	45.2	508.5	87.0%	91.1%
6		3	51.3 ± 5.1	64.8 ± 9.6	29.8 ± 3	37.6 ± 5.6	255.4	97.7	34.2	63.4	318.9	72.3%	80.1%
7		4	24.4 ± 3.5	28.6 ± 4.8	13.6 ± 2	16 ± 2.7	322.9	62.6	30.6	32.1	354.9	83.8%	91.0%
8	**Jun-15**	1	50.2 ± 8	80.2 ± 14.2	26.9 ± 4.3	43.1 ± 7.7	183.2	85.3	11.4	74.0	257.1	68.2%	71.2%
9		2	41 ± 4.3	48.1 ± 4.3	22.7 ± 2.4	26.6 ± 2.4	198.1	37.1	25.7	11.3	209.4	84.2%	94.6%
10		3	36.8 ± 3.6	43.7 ± 5.9	21.8 ± 2.2	25.9 ± 3.5	196.1	39.4	18.7	20.8	216.8	83.3%	90.4%
11		4	55.5 ± 7	77.5 ± 4.9	34.1 ± 4.3	47.7 ± 3	193.5	128.6	21.0	107.6	301.1	60.1%	64.3%
12	**Jul-15**	1-Additional (*)	58.3 ± 4.3	74.3 ± 7.9	31.6 ± 2.4	40.3 ± 4.3	195.4	62.0	23.8	38.2	233.6	75.9%	83.6%
13		2-Additional (*)	47.3 ± 4.2	59.4 ± 4.5	26.9 ± 2.4	33.8 ± 2.6	185.0	47.6	30.8	16.8	201.8	79.5%	91.7%
14		3-Additional (*)	63.8 ± 14	90.9 ± 6.1	34.8 ± 7.7	49.6 ± 3.3	139.7	103.2	22.1	81.1	220.8	57.5%	63.3%
15		4-Additional (*)	34.6 ± 5.2	41 ± 6.1	18.6 ± 2.8	22.1 ± 3.3	184.3	42.4	19.9	22.6	206.9	81.3%	89.1%
16	**Nov-15**	1-Additional (*)	51 ± 10.8	58.5 ± 13.9	28.8 ± 6.1	33 ± 7.9	245.7	41.6	26.3	15.2	260.9	85.5%	94.2%
17		2-Additional (*)	47 ± 8.7	56.8 ± 4.6	28.8 ± 5.4	34.8 ± 2.8	196.3	58.3	37.7	20.6	216.9	77.1%	90.5%
18		3-Additional (*)	42 ± 7.8	61.8 ± 8.5	25.9 ± 4.8	38.1 ± 5.3	275.4	95.6	47.1	48.6	324.0	74.2%	85.0%
19		4	57.8 ± 7.8	70.9 ± 5.3	32.7 ± 4.4	40.1 ± 3	195.0	59.0	35.0	24.1	219.0	76.8%	89.0%
20		5	31.8 ± 2.7	36.5 ± 3.6	18.5 ± 1.6	21.2 ± 2.1	236.7	44.8	30.2	14.6	251.3	84.1%	94.2%
21		6	42.7 ± 5.3	54.5 ± 2.3	23 ± 2.9	29.3 ± 1.2	307.4	77.0	18.2	58.8	366.3	80.0%	83.9%
22	Feb-16	1-Additional (*)	38.3 ± 4.1	46.4 ± 2.4	22.4 ± 2.4	27.1 ± 1.4	206.9	55.8	21.5	34.3	241.3	78.8%	85.8%
23		2-Additional (*)	52.7 ± 6.3	60.2 ± 4.2	31.1 ± 3.7	35.5 ± 2.5	155.1	34.5	12.0	22.5	177.6	81.8%	87.3%
24		3-Additional (*)	42.6 ± 11.3	47.8 ± 8.2	25.1 ± 6.7	28.1 ± 4.9	237.8	37.4	15.6	21.8	259.5	86.4%	91.6%
25		4	41.4 ± 8.3	57.7 ± 20.1	25.2 ± 5.1	35.1 ± 12.2	182.5	72.9	23.0	49.9	232.4	71.5%	78.5%
26		5	51 ± 6.9	58.8 ± 2.3	29.6 ± 4	34.2 ± 1.4	170.3	45.4	30.0	15.4	185.7	78.9%	91.7%
27		6	35.4 ± 9.1	44.7 ± 4.3	20.8 ± 5.4	26.2 ± 2.5	176.5	90.0	42.5	47.5	224.0	66.2%	78.8%
28	May-16	1	47.1 ± 6.4	58.7 ± 8	30.2 ± 4.1	37.6 ± 5.1	183.2	85.3	11.4	74.0	257.1	68.2%	71.2%
29		2	48.1 ± 5.1	56.1 ± 7.9	30.3 ± 3.2	35.3 ± 5	210.8	40.1	12.0	28.0	238.9	84.0%	88.3%
30		3	38.5 ± 3.8	46.2 ± 2.3	25 ± 2.5	30 ± 1.5	203.8	45.3	16.5	28.8	232.5	81.8%	87.6%
31		4	51.6 ± 5.6	61.6 ± 6	32 ± 3.5	38.2 ± 3.7	197.0	48.3	11.3	37.0	234.0	80.3%	84.2%
32		5-Additional (*)	34.2 ± 3	42 ± 4.9	20.7 ± 1.8	25.4 ± 3	184.0	45.6	14.3	31.2	215.2	80.2%	85.5%
33		6-Additional (*)	33.2 ± 2.4	42.9 ± 5.8	23.5 ± 1.7	30.4 ± 4.1	205.4	34.5	4.8	29.7	235.1	85.6%	87.4%

* Means additional trials were completed.

Sample Calculations for Highlighted trial 30 (May -16)

C11=C9-C10; 28.8 min = 45.3 min - 16.5 min

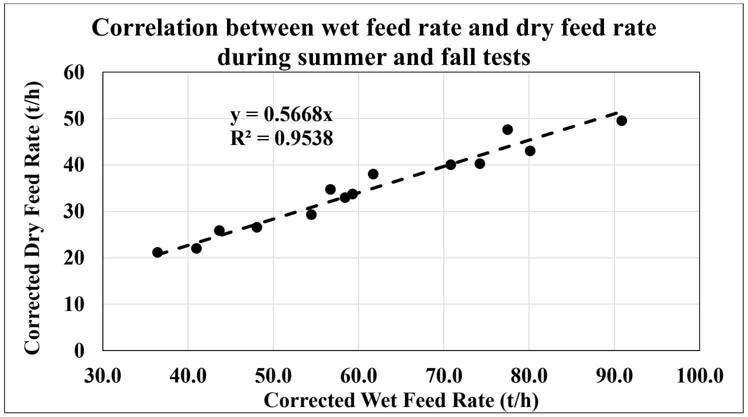
C12=C8+C11; 232.5 min = 203.8 min + 28.8 min

C13=C8/(C8+C9)x100; 81.8% = 203.8/(203.8+45.3)x100

C14=C8/C12x100; 87.6% = 203.8/232.5x100

Note: system availability results (C13) in June, July and November trials (rows 8 to 21) are plotted versus corresponding corrected (real) wet and fry feed rates for correlation analysis (see next pages). Also a correlation is drawn between dry and wet feed rates during summer and fall seasons (see the figure below).

Corrected Wet Feed Rate (t/h)	Corrected Dry Feed Rate (t/h)	Real System Availability (%)
80.1	43.0	71.2
48.1	26.6	94.6
43.7	25.9	90.4
77.5	47.6	64.3
74.2	40.3	83.6
59.3	33.7	91.7
90.9	49.5	63.3
41.0	22.0	89.1
58.4	33.0	94.2
56.7	34.7	90.5
61.7	38.0	85.0
70.8	40.0	89.0
36.4	21.2	94.2
54.5	29.3	83.9



Non-linear curve fit to system availability plotted versus wet feed rate

Nonlinear Curve Fit (ExpDec1) (10/28/2016 18:07:18)

Parameters

		Value	Standard Error	t-Value	Prob>|t|	Dependency
System Availability	y0	99.90322	10.4907	9.52302	2.48319E-6	0.97922
	A1	-1.54659	3.36014	-0.46028	0.65516	0.99855
	t1	-28.04496	17.21749	-1.62886	0.1344	0.99768
	k	-0.03566	0.02189			
	tau	-19.43928	11.93426			

Reduced Chi-sqr = 29.7297475915
COD(R^2) = 0.79771708322568
Iterations Performed = 22
Total Iterations in Session = 22
Fit converged. Chi-Sqr tolerance value of 1E-9 was reached.
Standard Error was scaled with square root of reduced Chi-Sqr.
k, tau are derived parameter(s).
Some input data points are missing.

Statistics

	System Availability
Number of Points	13
Degrees of Freedom	10
Reduced Chi-Sqr	29.72975
Residual Sum of Squares	297.29748
R-Square(COD)	0.79772
Adj. R-Square	0.75726
Fit Status	Succeeded(100)

Fit Status Code :
100 : Fit converged. Chi-Sqr tolerance value of 1E-9 was reached

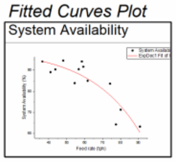
Summary

	y0		A1		t1		k	tau	Statistics	
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value		Reduced Chi-Sqr	Adj. R-Square
System Availability	99.90322	10.4907	-1.54659	3.36014	-28.04496	17.21749	-0.03566	-19.43928	29.72975	0.75726

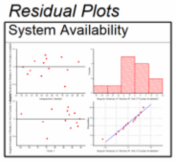
ANOVA

		DF	Sum of Squares	Mean Square	F Value	Prob>F
System Availability	Regression	3	93579.98209	31193.32736	1049.22947	2.39975E-12
	Residual	10	297.29748	29.72975		
	Uncorrected Total	13	93877.27957			
	Corrected Total	12	1469.71124			

Fitted Curves Plot



Residual Plots



Non-linear curve fit to system availability plotted versus dry feed rate

Nonlinear Curve Fit (ExpDec1) (6/1/2016 15:02:06)

Parameters

		Value	Standard Error	t-Value	Prob>|t|	Dependency
System Availability	y0	93.80322	3.23003	29.04095	9.49196E-12	0.86519
	A1	-0.07644	0.15591	-0.49031	0.63354	0.99807
	t1	-8.13743	2.68766	-3.0277	0.0115	0.99777
	k	-0.12289	0.04059			
	tau	-5.64043	1.86295			

Reduced Chi-sqr = 19.6914716682
COD(R^2) = 0.85465505489157
Iterations Performed = 51
Total Iterations in Session = 51
Fit converged. Chi-Sqr tolerance value of 1E-9 was reached.
Standard Error was scaled with square root of reduced Chi-Sqr.
k, tau are derived parameter(s).

Statistics

	System Availability
Number of Points	14
Degrees of Freedom	11
Reduced Chi-Sqr	19.69147
Residual Sum of Squares	216.60619
R-Square(COD)	0.85466
Adj. R-Square	0.82823
Fit Status	Succeeded(100)

Fit Status Code :
100 : Fit converged. Chi-Sqr tolerance value of 1E-9 was reached

Summary

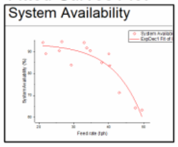
	y0		A1		t1		k	tau	Statistics	
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value		Reduced Chi-Sqr	Adj. R-Square
System Availability	93.80322	3.23003	-0.07644	0.15591	-8.13743	2.68766	-0.12289	-5.64043	19.69147	0.82823

ANOVA

		DF	Sum of Squares	Mean Square	F Value	Prob>F
System Availability	Regression	3	101584.92485	33861.64162	1719.60949	1.86517E-14
	Residual	11	216.60619	19.69147		
	Uncorrected Total	14	101801.53104			
	Corrected Total	13	1490.29048			

Fitted Curves Plot

System Availability



Residual Plots

System Availability

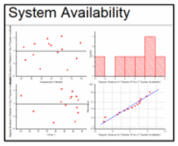


Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
January-1	January	1	pull cord	1.08
January-1	January	1	pull cord	0.25
January-1	January	1	pull cord	1.20
January-1	January	1	pull cord	0.63
January-1	January	1	pull cord	1.37
January-1	January	1	pull cord	0.85
January-1	January	1	pull cord	3.30
January-1	January	1	pull cord	1.40
January-1	January	1	pull cord	1.58
January-1	January	1	pull cord	1.83
January-1	January	1	pull cord	3.67
January-1	January	1	pull cord	1.50
January-1	January	1	pull cord	1.15
January-1	January	1	pull cord	1.00
January-1	January	1	pull cord	1.92
January-1	January	1	pull cord	1.33
January-1	January	1	pull cord	0.58
January-1	January	1	pull cord	0.68
January-2	January	2	magnet	2.20
January-2	January	2	pull cord	1.05
January-2	January	2	pull cord	0.50
January-2	January	2	pull cord	0.92
January-2	January	2	pull cord	2.55
January-2	January	2	pull cord	0.83
January-2	January	2	pull cord	1.75
January-2	January	2	pull cord	0.63
January-2	January	2	pull cord	1.12
January-2	January	2	pull cord	0.50
January-2	January	2	pull cord	1.42
January-2	January	2	pull cord	0.68
January-2	January	2	pull cord	0.82
January-2	January	2	pull cord	0.83
January-2	January	2	pull cord	2.25
January-2	January	2	pull cord	0.82
January-2	January	2	pull cord	0.75
January-2	January	2	pull cord	4.03
January-2	January	2	pull cord	1.07
January-2	January	2	pull cord	6.17
January-2	January	2	pull cord	0.78
January-2	January	2	pull cord	0.72
January-3	January	3	pull cord	1.07

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
January-3	January	3	pull cord	1.53
January-3	January	3	pull cord	1.32
January-3	January	3	pull cord	1.10
January-3	January	3	pull cord	0.67
January-3	January	3	pull cord	1.47
January-3	January	3	pull cord	5.22
January-3	January	3	pull cord	5.65
January-3	January	3	pull cord	1.42
January-3	January	3	pull cord	1.18
January-3	January	3	pull cord	2.65
January-3	January	3	pull cord	0.83
January-3	January	3	pull cord	1.75
January-3	January	3	pull cord	11.90
January-3	January	3	e-stop	3.15
January-3	January	3	pull cord	10.50
January-3	January	3	pull cord	0.60
January-4	January	4	pull cord	1.02
January-4	January	4	pull cord	1.95
January-4	January	4	magnet	1.17
January-4	January	4	pull cord	0.90
January-4	January	4	pull cord	3.00
January-4	January	4	pull cord	0.65
January-4	January	4	pull cord	1.17
January-4	January	4	pull cord	2.92
January-4	January	4	pull cord	1.17
May-1	May	1	C-102 pull cord	0.72
May-1	May	1	C-102 pull cord	1.12
May-1	May	1	C-102 pull cord	0.57
May-1	May	1	C-102 pull cord	0.62
May-1	May	1	C-102 pull cord	1.02
May-1	May	1	C-102 pull cord	1.13
May-1	May	1	C-102 pull cord	0.77
May-1	May	1	C-102 pull cord	1.30
May-1	May	1	C-102 pull cord	2.17
May-1	May	1	C-104 pull cord	1.13
May-1	May	1	C-102 pull cord	0.92
May-1	May	1	C-102 pull cord	1.63
May-1	May	1	C-104 pull cord	1.27
May-1	May	1	C-109 over load	50.63
May-1	May	1	C-104 pull cord	0.17
May-2	May	2	C-102 pull cord	2.03

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
May-2	May	2	C-102 pull cord	1.98
May-2	May	2	C-102 pull cord	1.33
May-2	May	2	C-102 pull cord	2.42
May-2	May	2	C-102 pull cord	1.12
May-2	May	2	C-104 pull cord	1.13
May-2	May	2	C-102 pull cord	1.50
May-2	May	2	C-104 pull cord	0.97
May-2	May	2	C-102 pull cord	0.77
May-2	May	2	C-104 pull cord	1.45
May-2	May	2	C-104 pull cord	2.22
May-2	May	2	C-104 pull cord	1.12
May-2	May	2	C-102 pull cord	0.78
May-2	May	2	C-104 pull cord	0.72
May-3	May	3	C-102 pull cord	0.87
May-3	May	3	C-102 pull cord	0.90
May-3	May	3	M 1201 motion failure	18.67
May-3	May	3	C-102 pull cord	1.38
May-3	May	3	C-102 pull cord	1.50
May-3	May	3	C-102 pull cord	1.58
May-3	May	3	C-102 pull cord	0.55
May-3	May	3	C-102 pull cord	0.68
May-4	May	4	C-202 pull cord	2.10
May-4	May	4	C-202 pull cord	1.70
May-4	May	4	C-202 pull cord	0.72
May-4	May	4	C-202 pull cord	1.52
May-4	May	4	C-204 pull cord	1.37
May-4	May	4	C-204 pull cord	1.03
May-4	May	4	C-204 pull cord	1.07
May-4	May	4	C-202 pull cord	1.25
May-4	May	4	C-204 pull cord	2.35
May-4	May	4	C-202 pull cord	1.07
May-4	May	4	C-202 pull cord	5.42
May-4	May	4	C-202 pull cord	0.60
May-4	May	4	C-202 pull cord	0.97
May-4	May	4	C-202 pull cord	1.97
May-4	May	4	C-202 pull cord	1.75
May-4	May	4	C-204 pull cord	1.23
May-4	May	4	C-202 pull cord	1.25
May-4	May	4	C-204 pull cord	1.25
May-4	May	4	C-204 pull cord	0.83
May-5	May	5	C-202 pull cord	0.88

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
May-5	May	5	C-202 pull cord	1.37
May-5	May	5	C-202 pull cord	0.90
May-5	May	5	C-202 pull cord	1.25
May-5	May	5	C-202 pull cord	0.17
May-5	May	5	C-204 pull cord	0.50
May-5	May	5	C-204 pull cord	2.58
May-5	May	5	C-202 pull cord	0.98
May-5	May	5	C-202 pull cord	0.70
May-5	May	5	C-204 pull cord	0.88
May-5	May	5	C-204 pull cord	1.13
May-5	May	5	C-1200 pull cord	7.00
May-5	May	5	C-202 pull cord	0.85
May-5	May	5	C-202 pull cord	1.67
May-5	May	5	C-202 pull cord	0.47
May-5	May	5	C-204 pull cord	0.83
May-5	May	5	C-202 pull cord	1.08
May-5	May	5	C-202 pull cord	1.30
May-6	May	6	C-201 motion failure	6.18
May-6	May	6	C-201 motion failure	2.78
May-6	May	6	C-201 motion failure	0.43
May-6	May	6	C-201 motion failure	0.77
May-6	May	6	C-204 pull cord	4.30
May-6	May	6	C-201 motion failure	5.87
May-6	May	6	C-202 pull cord	1.00
May-6	May	6	C-202 pull cord	0.90
May-6	May	6	C-201 motion failure	1.07
May-6	May	6	C-201 motion failure	1.58
May-6	May	6	C-202 pull cord	1.30
May-6	May	6	C-202 pull cord	0.70
June-1	June	1	C-202 pull cord	0.50
June-1	June	1	C-204 pull cord	1.85
June-1	June	1	C-202 pull cord	1.17
June-1	June	1	C-202 pull cord	0.32
June-1	June	1	C-202 pull cord	1.68
June-1	June	1	C-202 pull cord	1.17
June-1	June	1	C-202 pull cord	1.22
June-1	June	1	C-202 pull cord	0.67
June-1	June	1	C-202 pull cord	1.00
June-1	June	1	C-202 pull cord	1.00
June-1	June	1	C-204 pull cord	0.57
June-1	June	1	C-204 pull cord	4.00

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
June-1	June	1	C-202 pull cord	0.58
June-1	June	1	C-204 pull cord	0.70
June-1	June	1	C-202 pull cord	1.07
June-1	June	1	C-204 pull cord	0.00
June-2	June	2	C-202 pull cord	1.00
June-2	June	2	C-202 pull cord	0.82
June-2	June	2	C-202 pull cord	0.92
June-2	June	2	C-202 pull cord	0.78
June-2	June	2	C-204 pull cord	0.78
June-2	June	2	C-204 pull cord	1.52
June-2	June	2	C-202 pull cord	0.95
June-2	June	2	C-204 pull cord	2.68
June-2	June	2	C-204 pull cord	0.87
June-3	June	3	C-202 pull cord	1.63
June-3	June	3	C-202 pull cord	0.42
June-3	June	3	C-202 pull cord	1.28
June-3	June	3	C-202 pull cord	0.68
June-3	June	3	C-204 pull cord	1.58
June-3	June	3	C-202 pull cord	0.60
June-4	June	4	C-202 pull cord	1.18
June-4	June	4	C-204 pull cord	2.53
June-4	June	4	C-204 pull cord	2.63
June-4	June	4	C-202 pull cord	1.00
June-4	June	4	C-204 pull cord	1.13
June-4	June	4	C-202 pull cord	3.00
June-4	June	4	C-204 pull cord	1.80
June-4	June	4	C-202 pull cord	1.20
June-4	June	4	C-202 pull cord	0.92
June-4	June	4	C-204 pull cord	1.78
June-4	June	4	other	51.77
June-4	June	4	C-202 pull cord	1.08
June-4	June	4	other	2.45
June-4	June	4	other-computer restore	26.62
June-4	June	4	C-202 pull cord	0.55
June-4	June	4	other	1.17
June-4	June	4	C-202 pull cord	0.58
June-4	June	4	C-202 pull cord	1.08
June-4	June	4	C-202 pull cord	0.88
June-4	June	4	C-202 pull cord	0.77
June-4	June	4	C-202 pull cord	0.75
July-1	July	1	C-202 pull cord	1.50

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
July-1	July	1	C-202 pull cord	2.08
July-1	July	1	C-202 pull cord	0.97
July-1	July	1	C-202 pull cord	1.17
July-1	July	1	C-202 pull cord	3.17
July-1	July	1	C-204 pull cord	0.42
July-1	July	1	C-202 pull cord	1.38
July-1	July	1	C-202 pull cord	2.28
July-1	July	1	C-202 pull cord	0.92
July-1	July	1	C-204 pull cord	0.58
July-1	July	1	C-202 pull cord	1.85
July-1	July	1	C-202 pull cord	3.60
July-1	July	1	C-202 pull cord	2.00
July-1	July	1	C-202 pull cord	1.78
July-1	July	1	C-204 pull cord	3.35
July-1	July	1	C-202 pull cord	0.83
July-1	July	1	C-204 pull cord	0.33
July-1	July	1	C-202 pull cord	1.80
July-1	July	1	C-202 pull cord	1.57
July-1	July	1	C-202 pull cord	1.88
July-2	July	2	C-202 pull cord	0.57
July-2	July	2	C-202 pull cord	0.70
July-2	July	2	C-202 pull cord	1.07
July-2	July	2	C-202 pull cord	0.87
July-2	July	2	other	1.32
July-2	July	2	C-202 pull cord	0.23
July-2	July	2	C-202 pull cord	0.95
July-2	July	2	C-202 pull cord	1.10
July-2	July	2	C-204 pull cord	2.27
July-2	July	2	E-212 motor failure	1.67
July-3	July	3	C-204 pull cord	2.57
July-3	July	3	C-202 pull cord	0.75
July-3	July	3	C-202 pull cord	0.68
July-3	July	3	C-204 pull cord	0.95
July-3	July	3	C-204 pull cord	1.70
July-3	July	3	C-204 pull cord	1.43
July-3	July	3	Jammed Disc Screen	1.63
July-3	July	3	C-204 pull cord	1.33
July-3	July	3	C-204 pull cord	1.92
July-3	July	3	Jammed Disc Screen	3.52
July-3	July	3	C-204 pull cord	0.52
July-3	July	3	Jammed Disc Screen	38.87

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
July-3	July	3	other	2.97
July-3	July	3	C-202 pull cord	1.25
July-3	July	3	C-202 pull cord	2.27
July-4	July	4	C-202 pull cord	0.70
July-4	July	4	C-202 pull cord	0.72
July-4	July	4	C-202 pull cord	0.98
July-4	July	4	C-202 pull cord	1.02
July-4	July	4	other	2.63
July-4	July	4	other	2.68
July-4	July	4	C-202 pull cord	0.67
July-4	July	4	C-202 pull cord	2.00
July-4	July	4	C-202 pull cord	0.67
July-4	July	4	C-202 pull cord	1.25
July-4	July	4	C-204 pull cord	0.80
November-1	November	1	C-206 pull cord	1.33
November-1	November	1	C-200 motion failure	0.38
November-1	November	1	C-202 pull cord	0.65
November-1	November	1	C-202 pull cord	0.62
November-1	November	1	C-202 pull cord	0.48
November-1	November	1	C-202 pull cord	1.10
November-1	November	1	C-204 pull cord	0.93
November-1	November	1	E-212 motion failure	1.88
November-1	November	1	C-202 pull cord	0.90
November-1	November	1	C-202 pull cord	0.55
November-1	November	1	C-202 pull cord	0.62
November-1	November	1	C-202 pull cord	0.60
November-1	November	1	C-202 pull cord	1.25
November-1	November	1	C-202 pull cord	0.60
November-2	November	2	C-202 pull cord	0.80
November-2	November	2	C-202 pull cord	3.43
November-2	November	2	C-202 pull cord	2.32
November-2	November	2	C-202 pull cord	0.58
November-2	November	2	C-202 pull cord	0.62
November-2	November	2	C-204 pull cord	3.00
November-2	November	2	C-202 pull cord	2.00
November-2	November	2	C-202 pull cord	0.60
November-2	November	2	C-202 pull cord	0.58
November-2	November	2	C-204 pull cord	12.08
November-3	November	3	C-202 pull cord	1.03
November-3	November	3	C-204 pull cord	1.33
November-3	November	3	C-401 belt scale	28.12

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
November-3	November	3	C-202 pull cord	0.62
November-3	November	3	excavator issue	2.90
November-3	November	3	C-202 pull cord	1.18
November-3	November	3	C-204 pull cord	1.67
November-3	November	3	C-202 pull cord	1.05
November-3	November	3	C-200 motion failure	2.22
November-3	November	3	C-202 pull cord	1.43
November-3	November	3	C-202 pull cord	0.58
November-3	November	3	C-202 pull cord	1.85
November-3	November	3	C-202 pull cord	1.25
November-4	November	4	C-102 pull cord	0.83
November-4	November	4	C-102 pull cord	1.08
November-4	November	4	C-102 pull cord	0.52
November-4	November	4	C-110 pull cord	0.67
November-4	November	4	C-102 pull cord	2.07
November-4	November	4	C-102 pull cord	0.45
November-4	November	4	C-110 pull cord	4.45
November-4	November	4	C-902 pull cord	2.32
November-4	November	4	C-401 belt scale	4.75
November-5	November	5	C-102 pull cord	0.87
November-5	November	5	C-102 pull cord	0.83
November-5	November	5	C-102 pull cord	0.47
November-5	November	5	C-102 pull cord	4.40
November-5	November	5	C-102 pull cord	2.55
November-5	November	5	C-102 pull cord	0.87
November-5	November	5	C-102 pull cord	1.00
November-5	November	5	C-102 pull cord	2.33
November-6	November	6	C-102 pull cord	0.13
November-6	November	6	C-102 pull cord	0.60
November-6	November	6	C-104 pull cord	2.58
November-6	November	6	C-110 overload (Jam)	15.03
November-6	November	6	E-112 motion failure	2.00
November-6	November	6	C-102 pull cord	1.15
November-6	November	6	C-604 pull cord	5.85
November-6	November	6	C-604 pull cord	0.87
November-6	November	6	C-110 overload (Jam)	7.72
November-6	November	6	C-604 pull cord	3.38
November-6	November	6	C-604 pull cord	2.35
November-6	November	6	C-104 pull cord	0.60
November-6	November	6	Break stop T-103	0.78
November-6	November	6	C-102 pull cord	1.27

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
November-6	November	6	C-104 pull cord	2.30
November-6	November	6	C-102 pull cord	0.88
November-6	November	6	C-102 pull cord	0.90
November-6	November	6	C-104 pull cord	1.35
November-6	November	6	C-102 pull cord	1.08
November-6	November	6	C-102 pull cord	0.67
November-6	November	6	C-102 pull cord	0.88
November-6	November	6	C-102 pull cord	0.23
November-6	November	6	C-104 pull cord	1.32
November-6	November	6	C-102 pull cord	1.10
February-1	February	1	C-202 pull cord	0.12
February-1	February	1	C-202 pull cord	4.18
February-1	February	1	C-202 pull cord	0.60
February-1	February	1	C-202 pull cord	0.92
February-1	February	1	E-212 motion failure	2.05
February-1	February	1	C-202 pull cord	0.72
February-1	February	1	C-202 pull cord	1.08
February-1	February	1	C-100 pull cord	1.42
February-1	February	1	C-700 pull cord	2.05
February-1	February	1	C-204 pull cord	2.08
February-1	February	1	C-202 pull cord	5.25
February-1	February	1	C-202 pull cord	0.95
February-1	February	1	C-204 pull cord	1.18
February-1	February	1	V-213 pull cord blockage	8.22
February-1	February	1	C-202 pull cord	0.92
February-1	February	1	C-202 pull cord	0.67
February-2	February	2	C-202 pull cord	1.33
February-2	February	2	C-201 pull cord	1.83
February-2	February	2	C-202 pull cord	0.92
February-2	February	2	C-204 pull cord	0.90
February-2	February	2	C-702 pull cord	1.18
February-2	February	2	C-602 pull cord	1.33
February-2	February	2	C-202 pull cord	1.00
February-2	February	2	C-702 pull cord	4.63
February-2	February	2	E-212 motion failure	1.17
February-2	February	2	C-202 pull cord	2.22
February-3	February	3	C-204 pull cord	2.25
February-3	February	3	E-212 motion failure	1.85
February-3	February	3	C-202 pull cord	1.00
February-3	February	3	C-202 pull cord	0.88
February-3	February	3	C-204 pull cord	0.67

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
February-3	February	3	E-212 motion failure	2.72
February-3	February	3	C-204 pull cord	1.78
February-3	February	3	C-204 pull cord	0.28
February-3	February	3	C-202 pull cord	0.77
February-3	February	3	C-202 pull cord	1.05
February-3	February	3	E-212 motion failure	1.08
February-3	February	3	C-202 pull cord	1.67
February-3	February	3	C-202 pull cord	1.00
February-4	February	4	C-109 pull cord	25.58
February-4	February	4	C-102 pull cord	1.17
February-4	February	4	C-102 pull cord	0.90
February-4	February	4	C-102 pull cord	1.25
February-4	February	4	C-102 pull cord	1.12
February-4	February	4	C-104 pull cord	1.97
February-4	February	4	C-102 pull cord	1.25
February-4	February	4	C-102 pull cord	3.42
February-4	February	4	C-104 pull cord	1.08
February-4	February	4	C-102 pull cord	1.17
February-4	February	4	C-102 pull cord	0.92
February-5	February	5	C-104 pull cord	2.88
February-5	February	5	C-104 pull cord	2.78
February-5	February	5	C-102 pull cord	3.23
February-6	February	6	E-stop Jam in C-403/404	44.80
February-6	February	6	C-102 pull cord	0.50
February-6	February	6	C-102 pull cord	1.47
February-6	February	6	C-102 pull cord	0.72
March-1	March	1	C-210 pull cord	2.00
March-1	March	1	C-205 shut off	5.00
March-1	March	1	C-202 pull cord	3.00
March-1	March	1	C-202 pull cord	1.00
March-1	March	1	C-202 pull cord	1.00
March-1	March	1	C-202 pull cord	1.00
March-1	March	1	C-202 pull cord	1.00
March-1	March	1	C-204 pull cord	2.00
March-2	March	2	C-204 pull cord	1.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-202 pull cord	2.00
March-2	March	2	C-204 pull cord	1.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-204 pull cord	2.00
March-2	March	2	C-202 pull cord	1.00

Table C-2: Downtime recorded during trommel trials

Trial ID	Month/Year	Trial	Reason of Downtime	Downtime Duration (min)
March-2	March	2	C-204 pull cord	1.00
March-2	March	2	C-206 pull cord	2.00
March-2	March	2	C-204 pull cord	2.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-204 pull cord	1.00
March-2	March	2	V-213 pull cord blockage	31.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-202 pull cord	1.00
March-2	March	2	C-202 pull cord	2.00
March-3	March	3	C-204 Pull cord	1.00
March-3	March	3	C-202 pull cord	3.00
March-3	March	3	C-202 pull cord	1.00
March-3	March	3	C-202 pull cord	3.00
March-3	March	3	C-202 pull cord	1.00
March-3	March	3	C-202 pull cord	3.00
March-3	March	3	C-202 pull cord	1.00
March-3	March	3	C-202 pull cord	1.00

Table C-3: Summary of Operation Downtimes Categorized Based on Season and Feed Rate

Winter (<40 t/h)	Trial Included are: Jan-1; Jan-2, Jan-4, Feb-6 and Mar-1					
Downtime Reason	**Count of Downtime Duration**	**Sum of Downtime Duration (min)**	**Average of Downtime Duration (min)**	**StdDev of Downtime Duration (min)**	**Max of Downtime Duration (min)**	**Min of Downtime Duration (min)**
C-102 pull cord	3	2.68	0.89	0.51	1.47	0.50
C-202 pull cord	5	7.00	1.40	0.89	3.00	1.00
C-204 pull cord	1	2.00	2.00		2.00	2.00
C-205 shut off	1	5.00	5.00		5.00	5.00
C-210 pull cord	1	2.00	2.00		2.00	2.00
E-stop Jam in C-403/404	1	44.80	44.80		44.80	44.80
magnet	2	3.37	1.68	0.73	2.20	1.17
pull cord	47	68.28	1.45	1.11	6.17	0.25
Grand Total	**61**	**135.13**	**2.22**	**5.66**	**44.80**	**0.25**
Winter (40-65 t/h)	**Trial Included are: Jan-2, Feb-4, Feb-5 and Mar-2**					
Downtime Reason	**Count of Downtime Duration**	**Sum of Downtime Duration (min)**	**Average of Downtime Duration (min)**	**StdDev of Downtime Duration (min)**	**Max of Downtime Duration (min)**	**Min of Downtime Duration (min)**
C-102 pull cord	9	14.42	1.60	0.99	3.42	0.90
C-104 pull cord	4	8.72	2.18	0.84	2.88	1.08
C-109 pull cord	1	25.58	25.58		25.58	25.58
C-202 pull cord	10	12.00	1.20	0.42	2.00	1.00
C-204 pull cord	6	8.00	1.33	0.52	2.00	1.00
C-206 pull cord	1	2.00	2.00		2.00	2.00
magnet	1	2.20	2.20		2.20	2.20
pull cord	21	30.18	1.44	1.37	6.17	0.50
V-213 pull cord blockage	1	31.00	31.00		31.00	31.00
Grand Total	**54**	**134.10**	**2.48**	**5.23**	**31.00**	**0.50**
Winter (>65 t/h)	**Trial Included are: Jan-3, Feb-4, Feb-5, Mar-2 and Mar-3**					
Downtime Reason	**Count of Downtime Duration**	**Sum of Downtime Duration (min)**	**Average of Downtime Duration (min)**	**StdDev of Downtime Duration (min)**	**Max of Downtime Duration (min)**	**Min of Downtime Duration (min)**
C-102 pull cord	9	14.42	1.60	0.99	3.42	0.90
C-104 pull cord	4	8.72	2.18	0.84	2.88	1.08
C-109 pull cord	1	25.58	25.58		25.58	25.58
C-202 pull cord	17	25.00	1.47	0.80	3.00	1.00
C-204 pull cord	7	9.00	1.29	0.49	2.00	1.00
C-206 pull cord	1	2.00	2.00		2.00	2.00
e-stop	1	3.15	3.15		3.15	3.15
pull cord	16	48.85	3.05	3.52	11.90	0.60
V-213 pull cord blockage	1	31.00	31.00		31.00	31.00
Grand Total	**57**	**167.72**	**2.94**	**5.32**	**31.00**	**0.60**
Summer and Fall (<50 t/h)	**Trial Included are: June-2, June-3, July-4, Nov-5**					
Downtime Reason	**Count of Downtime Duration**	**Sum of Downtime Duration (min)**	**Average of Downtime Duration (min)**	**StdDev of Downtime Duration (min)**	**Max of Downtime Duration (min)**	**Min of Downtime Duration (min)**
C-102 pull cord	8	13.32	1.66	1.34	4.40	0.47
C-202 pull cord	18	17.08	0.95	0.39	2.00	0.42
C-204 pull cord	6	8.23	1.37	0.74	2.68	0.78
other	2	5.32	2.66	0.04	2.68	2.63
Grand Total	**34**	**43.95**	**1.29**	**0.87**	**4.40**	**0.42**
Summer and Fall (>60 t/h)	**Trial Included are: June-1, June-4, July-3, Nov-4**					
Downtime Reason	**Count of Downtime Duration**	**Sum of Downtime Duration (min)**	**Average of Downtime Duration (min)**	**StdDev of Downtime Duration (min)**	**Max of Downtime Duration (min)**	**Min of Downtime Duration (min)**
C-102 pull cord	5	4.95	0.99	0.65	2.07	0.45
C-110 pull cord	2	5.12	2.56	2.68	4.45	0.67
C-202 pull cord	43	57.10	1.33	0.73	3.60	0.32
C-204 pull cord	21	32.10	1.53	1.05	4.00	0.00
C-401 belt scale	1	4.75	4.75		4.75	4.75
C-902 pull cord	1	2.32	2.32		2.32	2.32
Jammed Disc Screen	3	44.02	14.67	20.97	38.87	1.63
other	5	84.97	16.99	22.14	51.77	1.17
Grand Total	**81**	**235.32**	**2.91**	**7.48**	**51.77**	**0.00**

The following tables summarize downtimes presented in Table C-3 based on season and feed rate for all types of downtime.

Table C-4-a: Summary of Operation Downtimes Based on Season and Feed Rate (organized for all downtimes)

Downtime Reason	Winter (<40 t/h)		Winter (45-65 t/h)		Winter (>65 t/h)		Summer and Fall (<50 t/h)		Summer and Fall (> 65 t/h)	
	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)
Feeding (chain conveyors)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
First sort room conveyor	8.0	9.7	19.0	26.4	26.0	39.4	26.0	30.4	48.0	62.1
Second sort room conveyor	1.0	2.0	10.0	16.7	11.0	17.7	6.0	8.2	21.0	32.1
First or second sort room conveyor (unspecified)	47.0	68.3	21.0	30.2	16.0	48.9	0.0	0.0	0.0	0.0
Disc screen feeding conveyor	1.0	2.0	1.0	25.6	1.0	25.6	0.0	0.0	2.0	5.1
Jammed disc screen	0.0	0.0	1.0	31.0	1.0	31.0	0.0	0.0	0.0	0.0
Post second sort room conveyors	1.0	44.8	0.0	0.0	1.0	3.1	0.0	0.0	1.0	4.8
<2" collecting conveyors	1.0	5.0	1.0	2.0	1.0	2.0	0.0	0.0	0.0	0.0
Overhead magnets	2.0	3.4	1.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
E motion failure	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.3	5.0	85.0
C-902 pull cord	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.3

Table C-4-b: Summary of Operation Downtimes Based on Season and Feed Rate (organized for all downtimes, others lumped up)

Downtime Reason	Winter (<40 t/h)		Winter (45-65 t/h)		Winter (>65 t/h)		Summer and Fall (<50 t/h)		Summer and Fall (> 65 t/h)	
	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)
Feeding (chain conveyors)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
First sort room conveyor	8.0	9.7	19.0	26.4	26.0	39.4	26.0	30.4	48.0	62.1
Second sort room conveyor	1.0	2.0	10.0	16.7	11.0	17.7	6.0	8.2	21.0	32.1
First or second sort room conveyor (unspecified)	47.0	68.3	21.0	30.2	16.0	48.9	0.0	0.0	0.0	0.0
Subtotal	56.0	80.0	50.0	73.3	53.0	106.0	32.0	38.6	69.0	94.2
Disc screen feeding conveyor	1.0	2.0	1.0	25.6	1.0	25.6	0.0	0.0	2.0	5.1
Jammed disc screen	0.0	0.0	1.0	31.0	1.0	31.0	0.0	0.0	0.0	0.0
Post second sort room conveyors	1.0	44.8	0.0	0.0	1.0	3.1	0.0	0.0	1.0	4.8
<2" collecting conveyors	1.0	5.0	1.0	2.0	1.0	2.0	0.0	0.0	0.0	0.0
Overhead magnets	2.0	3.4	1.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.3	6.0	87.3
Total	**61.0**	**135.1**	**54.0**	**134.1**	**57.0**	**167.7**	**34.0**	**44.0**	**78.0**	**191.3**

Table C-5: Number and duration of downtimes measured during trials (Note that all values are expressed as percentages). This table supports Table 4-2 in Chapter 4 of the thesis.

Downtime Reason	Winter (<40 t/h)		Winter (45-65 t/h)		Winter (>65 t/h)		Summer and Fall (<50 t/h)		Summer and Fall (> 65 t/h)	
	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)	Count of Downtime Duration	Sum of Downtime Duration (min)
First sort room conveyor	13.1%	7.2%	35.2%	19.7%	45.6%	23.5%	76.5%	69.2%	61.5%	32.4%
Second sort room conveyor	1.6%	1.5%	18.5%	12.5%	19.3%	10.6%	17.6%	18.7%	26.9%	16.8%
First or second sort room conveyor (unspecified)	77.0%	50.5%	38.9%	22.5%	28.1%	29.1%	0.0%	0.0%	0.0%	0.0%
Subtotal	*91.8%*	*59.2%*	*92.6%*	*54.7%*	*93.0%*	*63.2%*	*94.1%*	*87.9%*	*88.5%*	*49.2%*
Disc screen feeding conveyor	1.6%	1.5%	1.9%	19.1%	1.8%	15.3%	0.0%	0.0%	2.6%	2.7%
Jammed disc screen	0.0%	0.0%	1.9%	23.1%	1.8%	18.5%	0.0%	0.0%	0.0%	0.0%
Post second sort room conveyors	1.6%	33.2%	0.0%	0.0%	1.8%	1.9%	0.0%	0.0%	1.3%	2.5%
<2" collecting conveyors	1.6%	3.7%	1.9%	1.5%	1.8%	1.2%	0.0%	0.0%	0.0%	0.0%
Overhead magnets	3.3%	2.5%	1.9%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.9%	12.1%	7.7%	45.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

- Values are calculated based on corresponding values in Table C-4-b divided by the corresponding total.

Table C-6: Estimated average mean time between failures (MTBF) and average mean time to repair (MTTR) for each downtime (Note that all values shown are in minutes).

Downtime Reason	Winter (<40 t/h)		Winter (45-65 t/h)		Winter (>65 t/h)		Summer and Fall (<50 t/h)		Summer and Fall (> 65 t/h)	
	MTTR	MTBF	MTTR	MTBF	MTTR	MTBF	MTTR	MTBF	MTTR	MTBF
First sort room conveyor	1.2	204.3	1.4	68.5	1.5	59.3	1.2	30.2	1.3	14.5
Second sort room conveyor	2.0	919.4	1.7	124.5	1.6	133.4	1.4	116.4	1.5	32.3
First or second sort room conveyor (unspecified)	1.5	38.3	1.4	62.2	3.1	94.2	-	-	-	-
Subtotal	1.4	32.3	1.5	26.8	2.0	29.7	1.2	24.7	1.4	10.2
Disc screen feeding conveyor	2.0	919.4	25.6	684.6	25.6	800.6	-	-	2.6	237.1
Jammed disc screen	-	-	31.0	684.6	31.0	800.6	-	-	-	-
Post second sort room conveyors	44.8	919.4	-	-	3.1	800.6	-	-	4.8	355.6
<2" collecting conveyors	5.0	919.4	2.0	684.6	2.0	800.6	-	-	-	-
Overhead magnets	1.7	612.9	2.2	684.6	-	-	-	-	-	-
Other	-	-	-	-	-	-	2.7	271.7	14.5	101.6
Total	2.2	29.7	2.5	24.9	2.9	27.6	1.3	23.3	2.5	9.0

- MTTR values are "Sum of Downtime Duration" of corresponding downtime divided by the corresponding "Count of Downtime Duration" in Table C4-b.
- MTBF values are total net operation time of relevant trials (shown in Table C-1) divided by the total count of respective downtime (shown in Table C-4-2-b) plus one in the denominator.

Table C-7: Mean Time Between Failure (Uptime) Data

Summer						Winter		
All Uptimes		Pre-Trommel Uptimes		Post-Trommel Uptimes		All Uptimes		
>65 t/h	<50 t/h	>65 t/h	<50 t/h	>65 t/h	<50 t/h	>60 t/h	45-60 t/h	<40 t/h
C1	C2	C3	C4	C5	C6	C7	C8	C9
8.8	3.0	8.8	3.0	17.4	67.0	6.3	6.3	16.0
8.7	5.9	13.3	5.9	106.5	75.2	14.4	14.4	4.1
4.7	39.4	2.8	39.4	4.3	25.3	5.0	5.0	3.3
2.8	1.8	17.3	9.2	33.3	30.6	6.3	6.3	24.6
15.2	9.5	23.1	96.6	12.1	186.5	10.7	10.7	18.9
23.1	36.2	6.6	71.0	34.2	184.3	23.1	23.1	20.9
6.6	4.6	8.3	13.8	12.9	--	16.3	16.3	2.1
8.3	13.5	1.4	63.3	4.5	--	52.1	52.1	35.4
1.4	30.6	15.0	27.3	31.4	--	1.2	1.2	9.4
8.6	19.3	60.8	20.8	52.7	--	4.0	4.0	10.5
27.3	13.8	7.0	2.5	85.5	--	98.3	98.3	12.5
4.3	32.1	23.0	19.8	23.2	--	3.1	3.1	0.9
29.2	27.3	28.2	57.8	54.4	--	13.3	13.3	7.9
4.1	11.2	15.5	8.5	12.7	--	12.9	12.9	9.3
2.9	9.6	49.8	72.2	8.7	--	24.4	24.4	18.4
9.2	2.5	13.0	5.3	65.8	--	8.3	8.3	5.3
23.0	19.8	16.5	7.3	2.5	--	14.4	14.4	1.5
11.2	17.1	13.3	7.6	5.4	--	1.6	1.6	22.6
11.2	7.8	15.6	1.5	10.1	--	4.5	4.5	1.9
1.4	2.4	5.3	40.6	6.0	--	18.6	18.6	27.0
0.5	14.8	2.3	6.3	16.7	--	9.3	9.3	10.9
15.1	39.2	10.1	32.3	29.7	--	37.1	37.1	4.6
16.3	5.3	1.0	52.6	109.3	--	44.7	22.6	2.8
18.5	7.3	14.3	7.4	--	--	2.0	1.9	12.0
13.0	7.6	1.6	30.8	--	--	20.9	27.0	8.3
6.3	3.3	5.6	6.4	--	--	1.8	10.9	4.5
9.4	1.5	6.3		--	--	2.3	4.6	40.3
0.8	40.6	25.9		--	--	7.9	2.8	6.0
6.3	6.3	33.7		--	--	20.7	12.0	0.5
2.4	3.5	9.9		--	--	53.8	8.3	25.7
0.9	52.6	9.7		--	--	22.2	4.5	6.7
14.7	7.4	14.8				8.8	40.3	113.0
5.3	27.7	10.3				16.0	6.0	71.0
2.3	6.4	2.6				7.0	0.5	54.0
10.1		4.4				27.3	25.7	72.0
1.0		25.2				6.0	6.7	6.0
14.3		13.2				41.0	6.0	18.0
1.6		7.7				13.0	41.0	12.0
5.6		9.5				66.0	13.0	5.0
6.3		46.9				11.0	66.0	8.0
25.9		4.3				88.0	11.0	10.0
31.8		82.0				13.0	88.0	18.0
1.9		6.5					13.0	6.0
9.9		18.2					113.0	20.0
3.1		33.9						5.0
1.7		35.4						36.0
5.2		53.0						23.0
10.3		71.2						35.0
2.6		2.5						5.0
4.4		26.1						19.0
24.1		26.8						18.0
1.1		45.8						11.0
11.7		5.5						51.0
1.5		12.3						17.0
7.7		53.4						14.0
9.5		2.9						27.0

	8.7								33.7
	4.3								15.0
	4.3								
	19.4								
	2.5								
	5.4								
	0.0								
	5.1								
	4.3								
	3.6								
	13.1								
	13.6								
	1.4								
	3.0								
	6.5								
	18.2								
	11.6								
	0.8								
	18.3								
	4.7								
	5.9								
	51.7								
	1.4								
	3.0								
	6.2								
	2.5								
	26.1								
	26.8								
	45.8								
	5.5								
	4.9								
	11.4								
	5.7								
	2.9								
	2.6								
	4.8								
	3.9								
Mean	9.4	15.6	19.3	27.3	32.1	94.8	20.4	20.7	18.9
STDEV	9.6	13.9	18.7	26.7	32.3	72.8	22.6	25.9	20.3
Count N	93.0	34.0	56.0	26.0	23.0	6.0	42.0	44.0	58.0
SE	1.0	2.7	2.6	5.3	6.7	38.7	3.2	3.1	2.5

Weibull Cumulative Distribution Function is fitted to uptime data sets of Columns C1 to C4. See Next Pages for Curve Fitting.

Frequency Counts for Weibull Cumulative Distribution Function fitting to pre-trommel uptimes recorded during summer trommel trials at >65 t/h and <50 t/h

Bin Center Frequency Counts	Bin End Frequency Counts	Count Frequency Counts of Pre-Trommel (>65 t/h)	Cumulative Count Frequency Counts of Pre-Trommel (>65 t/h)	Relative Frequency % Frequency Counts of Pre-Trommel (>65 t/h)	Cumulative Frequency % Frequency Counts of Pre-Trommel (>65 t/h)	Count Frequency Counts of Pre-Trommel (<50 t/h)	Cumulative Count Frequency Counts of Pre-Trommel (<50 t/h)	Relative Frequency % Frequency Counts of Pre-Trommel (<50 t/h)	Cumulative Frequency % Frequency Counts of Pre-Trommel (<50 t/h)
1	3.5	8	8	14.28571	14.28571	3	3	11.53846	11.53846
6	8.5	11	19	19.64286	33.92857	7	10	26.92308	38.46154
11	13.5	11	30	19.64286	53.57143	2	12	7.69231	46.15385
16	18.5	8	38	14.28571	67.85714	1	13	3.84615	50
21	23.5	2	40	3.57143	71.42857	2	15	7.69231	57.69231
26	28.5	5	45	8.92857	80.35714	1	16	3.84615	61.53846
31	33.5	0	45	0	80.35714	2	18	7.69231	69.23077
36	38.5	3	48	5.35714	85.71429	0	18	0	69.23077
41	43.5	0	48	0	85.71429	2	20	7.69231	76.92308
46	48.5	2	50	3.57143	89.28571	0	20	0	76.92308
51	53.5	3	53	5.35714	94.64286	1	21	3.84615	80.76923
56	58.5	0	53	0	94.64286	1	22	3.84615	84.61538
61	63.5	1	54	1.78571	96.42857	1	23	3.84615	88.46154
66	68.5	0	54	0	96.42857	0	23	0	88.46154
71	73.5	1	55	1.78571	98.21429	2	25	7.69231	96.15385
76	78.5	0	55	0	98.21429	0	25	0	96.15385
81	83.5	1	56	1.78571	100	0	25	0	96.15385
86	88.5	0	56	0	100	0	25	0	96.15385
91	93.5	0	56	0	100	0	25	0	96.15385
96	98.5	0	56	0	100	1	26	3.84615	100

Weibull Cumulative Distribution Function fitted to associated with pre-trommel uptimes recorded during summer trommel trials at >65 t/h

Nonlinear Curve Fit (WeibullCDF) (1/1/2017 18:14:46)

Parameters

		Value	Standard Error	t-Value	Prob>|t|	Dependency
Cumulative Frequency	y0	4.012	3.97579	1.00911	0.32794	0.98733
	A1	97.87417	5.08266	19.25648	1.71463E-12	0.98879
	a	17.22994	1.07652	16.00529	2.87743E-11	0.85401
	b	0.81335	0.07383	11.01678	7.02581E-9	0.89554
	mu	19.29584	1.36613			
	sigma	23.89287	3.57071			

Reduced Chi-sqr = 4.00439844672
COD(R^2) = 0.99398959911268
Iterations Performed = 6
Total Iterations in Session = 6
Fit converged. Chi-Sqr tolerance value of 1E-9 was reached.
Standard Error was scaled with square root of reduced Chi-Sqr.
mu, sigma are derived parameter(s).

Statistics

	Cumulative Frequency
Number of Points	20
Degrees of Freedom	16
Reduced Chi-Sqr	4.0044
Residual Sum of Squares	64.07038
R-Square(COD)	0.99399
Adj. R-Square	0.99286
Fit Status	Succeeded(100)

Fit Status Code :
100 : Fit converged. Chi-Sqr tolerance value of 1E-9 was reached.

Summary

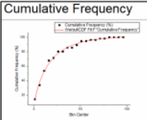
	y0		A1		a		b		mu	sigma	Statistics	
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value		Reduced Chi-Sqr	Adj. R-Square
Cumulative Frequency	4.012	3.97579	97.87417	5.08266	17.22994	1.07652	0.81335	0.07383	19.29584	23.89287	4.0044	0.99286

ANOVA

		DF	Sum of Squares	Mean Square	F Value	Prob>F
Cumulative Frequency	Regression	4	145251.6184	36312.9046	9068.25459	0
	Residual	16	64.07038	4.0044		
	Uncorrected Total	20	145315.68878			
	Corrected Total	19	10659.91709			

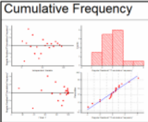
Fitted Curves Plot

Cumulative Frequency



Residual Plots

Cumulative Frequency



Weibull Cumulative Distribution Function fitted to associated with pre-trommel uptimes recorded during summer trommel trials at <50 t/h

Nonlinear Curve Fit (WeibullCDF) (1/3/2017 18:56:52)

Parameters

		Value	Standard Error	t-Value	Prob>|t|	Dependency
Cumulative Frequency	y0	-18.7216	33.79712	-0.55394	0.58728	0.99975
	A1	770.25548	6656.67703	0.11571	0.90932	1
	a	30582.26551	1.0704E6	0.02857	0.97756	1
	b	0.30825	0.29279	1.05282	0.30806	0.99999
	mu	251398.54851	9.81858E6			
	sigma	1.28338E6	5.26658E7			

Reduced Chi-sqr = 5.64338768488
COD(R^2) = 0.99156630311577
Iterations Performed = 400
Total Iterations in Session = 400
Fit did not converge. Maximum iteration setting of 400 was reached.
Standard Error was scaled with square root of reduced Chi-Sqr.
mu, sigma are derived parameter(s).

Statistics

	Cumulative Frequency
Number of Points	20
Degrees of Freedom	16
Reduced Chi-Sqr	5.64339
Residual Sum of Squares	90.2942
R-Square(COD)	0.99157
Adj. R-Square	0.98998
Fit Status	Failed(-200)

Fit Status Code :
-200 : Fit did not converge. Maximum iteration setting of 400 was reached

Summary

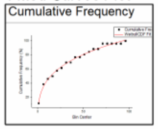
	y0		A1		a		b		mu	sigma	Statistics	
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value		Reduced Chi-Sqr	Adj. R-Square
Cumulative Frequency	-18.7216	33.79712	770.25548	6656.67703	30582.26551	1.0704E6	0.30825	0.29279	251398.54851	1.28338E6	5.64339	0.98998

ANOVA

		DF	Sum of Squares	Mean Square	F Value	Prob>F
Cumulative Frequency	Regression	4	120249.94248	30062.48562	5327.02825	0
	Residual	16	90.2942	5.64339		
	Uncorrected Total	20	120340.23669			
	Corrected Total	19	10706.36095			

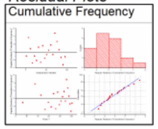
Fitted Curves Plot

Cumulative Frequency



Residual Plots

Cumulative Frequency



Frequency Counts for Weibull Cumulative Distribution Function fitting to all uptimes recorded during summer trommel trials at >65 t/h and <50 t/h

Bin Center Frequency Counts	Bin End Frequency Counts	Count Frequency Counts of All Uptime Data (>65 t/h)	Cumulative Count Frequency Counts of All Uptime Data (>65 t/h)	Relative Frequency % Frequency Counts of All Uptime Data (>65 t/h)	Cumulative Frequency % Frequency Counts of All Uptime Data (>65 t/h)	Count Frequency Counts of All Uptime Data (<50 t/h)	Cumulative Count Frequency Counts of All Uptime Data (<50 t/h)	Relative Frequency % Frequency Counts of All Uptime Data (<50 t/h)	Cumulative Frequency % Frequency Counts of All Uptime Data (<50 t/h)
1	3.5	27	27	29.03226	29.03226	6	6	17.64706	17.64706
6	8.5	28	55	30.10753	59.13978	10	16	29.41176	47.05882
11	13.5	17	72	18.27957	77.41935	4	20	11.76471	58.82353
16	18.5	8	80	8.60215	86.02151	3	23	8.82353	67.64706
21	23.5	4	84	4.30108	90.32258	2	25	5.88235	73.52941
26	28.5	5	89	5.37634	95.69892	2	27	5.88235	79.41176
31	33.5	2	91	2.15054	97.84946	2	29	5.88235	85.29412
36	38.5	0	91	0	97.84946	1	30	2.94118	88.23529
41	43.5	0	91	0	97.84946	3	33	8.82353	97.05882
46	48.5	1	92	1.07527	98.92473	0	33	0	97.05882
51	53.5	1	93	1.07527	100	1	34	2.94118	100

Weibull Cumulative Distribution Function fitted to all uptimes recorded during summer trommel trials at >65 t/h

Nonlinear Curve Fit (WeibullCDF) (2/12/2017 18:43:07)

Parameters

		Value	Standard Error	t-Value	Prob>|t|	Dependency
Cumulative Frequency	y0	19.71375	2.20236	8.95118	4.41924E-5	0.98478
	A1	80.01321	2.59012	30.89174	9.61618E-9	0.98485
	a	8.82552	0.35286	25.01167	4.1662E-8	0.81266
	b	0.96232	0.0618	15.57166	1.08885E-6	0.85679
	mu	8.97726	0.28946			
	sigma	9.33085	0.7219			

Reduced Chi-sqr = 0.812131171689
COD(R^2) = 0.99884323416716
Iterations Performed = 5
Total Iterations in Session = 5
Fit converged. Chi-Sqr tolerance value of 1E-9 was reached.
Standard Error was scaled with square root of reduced Chi-Sqr.
mu, sigma are derived parameter(s).

Statistics

	Cumulative Frequency
Number of Points	11
Degrees of Freedom	7
Reduced Chi-Sqr	0.81213
Residual Sum of Squares	5.68492
R-Square(COD)	0.99884
Adj. R-Square	0.99835
Fit Status	Succeeded(100)

Fit Status Code :
100 : Fit converged. Chi-Sqr tolerance value of 1E-9 was reached.

Summary

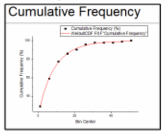
	y0		A1		a		b		mu	sigma	Statistics	
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value		Reduced Chi-Sqr	Adj. R-Square
Cumulative Frequency	19.71375	2.20236	80.01321	2.59012	8.82552	0.35286	0.96232	0.0618	8.97726	9.33085	0.81213	0.99835

ANOVA

		DF	Sum of Squares	Mean Square	F Value	Prob>F
Cumulative Frequency	Regression	4	83554.26421	20888.56605	25720.68008	1.65423E-14
	Residual	7	5.68492	0.81213		
	Uncorrected Total	11	83559.94913			
	Corrected Total	10	4914.49353			

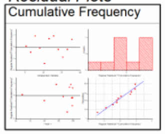
Fitted Curves Plot

Cumulative Frequency



Residual Plots

Cumulative Frequency



Weibull Cumulative Distribution Function fitted to all uptimes recorded during summer trommel trials at <50 t/h

Nonlinear Curve Fit (WeibullCDF) (2/12/2017 18:43:32)

Parameters

		Value	Standard Error	t-Value	Prob>|t|	Dependency
Cumulative Frequency	y0	-25.85322	53.61802	-0.48217	0.64439	0.99992
	A1	584.25073	4076.85983	0.14331	0.89008	1
	a	6624.47622	209477.00991	0.03162	0.97565	1
	b	0.28994	0.35973	0.806	0.44676	0.99999
	mu	71805.96118	2.69219E6			
	sigma	418357.98214	1.68361E7			

Reduced Chi-sqr = 2.46726980549
COD(R^2) = 0.99724584123493
Iterations Performed = 400
Total Iterations in Session = 400
Fit did not converge. Maximum iteration setting of 400 was reached.
Standard Error was scaled with square root of reduced Chi-Sqr.
mu, sigma are derived parameter(s).

Statistics

	Cumulative Frequency
Number of Points	11
Degrees of Freedom	7
Reduced Chi-Sqr	2.46727
Residual Sum of Squares	17.27089
R-Square(COD)	0.99725
Adj. R-Square	0.99607
Fit Status	Failed(-200)

Fit Status Code :
-200 : Fit did not converge. Maximum iteration setting of 400 was reached

Summary

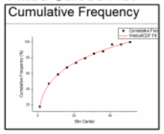
	y0		A1		a		b		mu	sigma	Statistics	
	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value	Standard Error	Value		Reduced Chi-Sqr	Adj. R-Square
Cumulative Frequency	-25.85322	53.61802	584.25073	4076.85983	6624.47622	209477.00991	0.28994	0.35973	71805.96118	418357.98214	2.46727	0.99607

ANOVA

		DF	Sum of Squares	Mean Square	F Value	Prob>F
Cumulative Frequency	Regression	4	66159.1997	16539.79992	6703.68514	1.8292E-12
	Residual	7	17.27089	2.46727		
	Uncorrected Total	11	66176.47059			
	Corrected Total	10	6270.83989			

Fitted Curves Plot

Cumulative Frequency



Residual Plots

Cumulative Frequency