SYST 699 Master's Project

for the

US Department of Agriculture (USDA)

Food Safety Inspection Service (FSIS)

MT60 Case Study - Final Report

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Executive Summary

Background

The Food Safety and Inspection Service (FSIS) is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged. Today, the FSIS employs approximately 7600 inspectors, working in over 6500 plants nationwide.

FSIS needs to establish staffing levels that are supported with data and are defensible to stakeholders, such as Congress and the labor union. FSIS knows the type and quantity of inspection tasks that are performed each year, but lacks current data on how long it takes its team members to complete their assigned tasks (i.e., "work measurement data").

FSIS aggregates their work measurement data into four groupings:

1. Direct inspection time (i.e., actual observation or hands-on task time)
2. Indirect inspection time (e.g., data entry, research, and analytical time)
3. Internal travel time (i.e., inside the plant)
4. External travel time (i.e., outside of the plant)

For workforce planning purposes, FSIS currently assumes that the amount of indirect time required to perform an inspection is approximately 0.8 times the amount of direct time. This is the “indirect multiplier.” The total inspection time is calculated by multiplying the direct inspection time by 1.8 to obtain the total inspection time. Travel time is allocated separately and is not included in the "inspection time."

Case Study

As a precursor to a possible larger-scale effort to collect FSIS work measurement data, FSIS tasked George Mason University (GMU) Master’s Degree students to plan and implement a case study to demonstrate a process for:

- Defining and decomposing an inspection task
- Developing a plan and implementation instructions for collecting work measurement data
- Analyzing work measurement data

The purpose of this case study was to assess the indirect multiplier for the MT60 sampling program and to provide an extensible and defensible methodology for the measurement of direct and indirect inspection tasks.

The MT60 sampling program involves the collection and testing of beef trimmings to detect E. coli and six relevant non-E. coli STEC serogroups. The MT60 sampling program employs two methods of sample collection: N=60 and 2-lb grab. These methods are differentiated primarily by whether the inspector slices the beef samples themselves or simply grabs pre-sliced samples.

Data Collection

Data collection was performed by Supervisory Consumer Safety Inspectors (SCSIs) and Public Health Veterinarians (PHVs), using the GMU-developed Data Collection Sheets (DCSs). FSIS collected 107 DCSs for this study from 89 different establishments. However, 13 were submitted blank and 6 were unusable due to data quality issues, leaving 88 DCSs for analysis. The sample size was sufficiently large to develop several conclusions based on statistical analysis.

Data Analysis

The collected data was entered into Microsoft Excel and analyzed. The primary analysis techniques were Analysis of Variance (ANOVA) and T-Test. Both of these techniques aid in determining whether work measurement data from two or more data groupings (e.g., small plant vs. large plant) are drawn from populations with the same mean values. This indicates whether the data grouping has a statistically significant impact on the work measurement data (e.g., does it take longer to perform an MT60 in a small plant as compared to a large plant).

Results

The results of the indirect multiplier analysis show there is no correlation between direct and indirect inspection times. Figure 1 shows that the slope of the regression line for indirect task time vs. direct task time is essentially "flat." The current multiplier (0.8) is plotted as reference in red. Analysis of the regression line shows that the amount of direct time required to perform an inspection task has no statistically significant effect on the amount of indirect time required to perform that task.

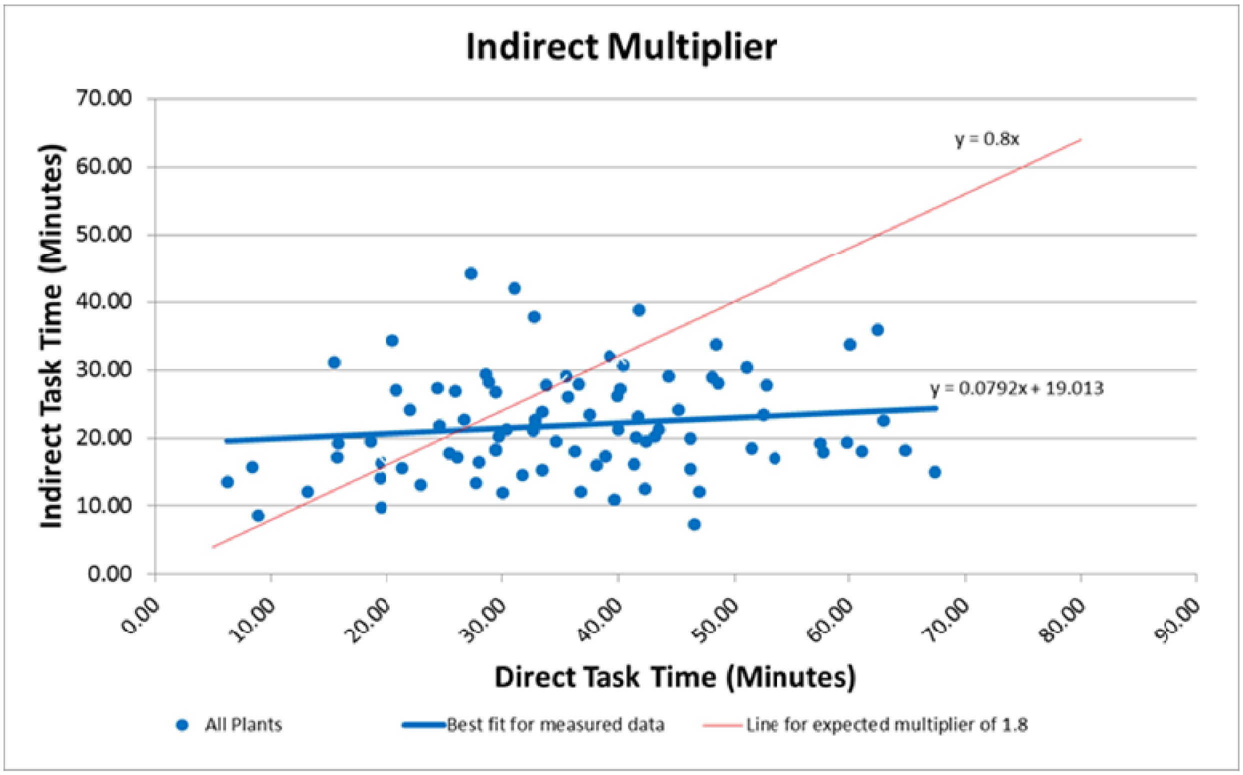

Figure 1. Indirect Multiplier Analysis

The measured MT60 inspection times are shown in Table 1.

Table 1. MT60 Inspection Times

Measure	*Mean*	*(+/-) 95% Confidence Interval*	*Lower Bound (Minutes)*	*Upper Bound (Minutes)*
Direct Time	36.1	2.9	33.2	39.0
Indirect Time	21.9	1.6	20.3	23.5
Total Time	**58.0**	**4.5**	**53.5**	**62.5**

The mean direct time is 36.1 minutes. The measured indirect time is 21.9 minutes, or 61% of the direct time. This is 24% lower than the 1.8 multiplier that is currently assumed by FSIS. It is close to the previous 1.6 multiplier used by FSIS prior to increasing it to 1.8.

Table 2 shows the analyzed parameters and whether they had an effect on inspection times. A checkmark indicates that the parameter impacts the inspection time, while an "X" indicates that it does not. A question mark indicates the results of the analysis are indeterminate. For the direct labor analysis, the size of the plant has a very weak effect on the amount of time required to perform direct labor. However, the results are very close, meaning there is a weak statistical significance and a true interpretation of results is indeterminate.

Table 2. Summary of Parameter vs. Inspection Time Impacts

Parameter	Affects Direct Inspection Time?	Affects Indirect Inspection Time?	Analysis Technique
Plant Size	?	✗	ANOVA
N=60 vs. 2lb Grab	✓	✗	T-Test
Measurement Team Size	✗	✗	T-Test
District	✓	✗	ANOVA
Connection Type	✗	✗	ANOVA

Recommendations and Future Work

The GMU proposes the following recommendations and future work:

- Implement a large-scale work measurement program to collect work measurement data in support of “right-sizing” FSIS staffing levels. This data could also serve as a baseline for process improvement.
- Collect work measurement data on additional sampling programs to determine whether a common, fixed duration allocation for indirect tasks could be applied. This could avoid the need to collect indirect work measurement data for some sampling programs.
- Include the union in all aspects of the work measurement (e.g., planning, data collection, analysis, reporting). This will foster goodwill, increase their level of buy-in, and make the data collection and resulting implementation go more smoothly.
- When preparing to collect work measurement data for other sampling programs, define draft process decompositions and validate them with inspectors prior to collecting work measurement data. This will minimize the number and scale of the deviations from the defined process, which will contribute to more consistent work measurement data.
- As processes are decomposed and discussed among the inspectors, document the “As-Is” process and collect recommendations for process improvements. Make resources available to support process improvements.
- Measure and re-use work measurement data for repeatable processes, such as PHIS interactions, to reduce the amount of work measurement data that needs to be collected.
- Incorporate a timer into PHIS to measure the time required to perform tasks in PHIS.
- To ensure consistent work measurement data collection, develop and provide training for the Timers.
- Incorporate experience from 1968 FSIS work measurement study, such as employing the concept of pace rating and/or selecting an “average pace” worker to capture more accurate work measurement data.
- Revise the DCS based on lessons learned from the MT60 case study.
- Analyze internal and external travel data collected under the MT60 case study.

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1. Introduction

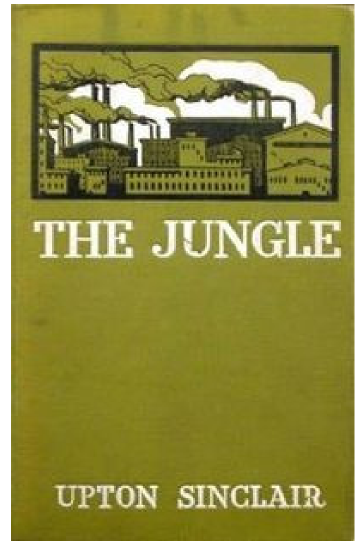

Figure 2. The Jungle, by Upton Sinclair

In 1905, the publication of "The Jungle" by Upton Sinclair (see Figure 2) caused public outcry with its description of the unsafe and unsanitary conditions present in the meatpacking industry. In response, in 1906 President Theodore Roosevelt signed into law the Pure Food and Drug Act and the Federal Meat Inspection Act (FMIA). These acts were the foundation for the regulations and inspections of today, which safeguard public health through inspection of the quality of meat, poultry, and egg products. It is the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA) which provides this mandated oversight.

The department's mission statement is: "The Food Safety and Inspection Service (FSIS) is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged"(per Reference 1.5.1).

Today, the FSIS employs approximately 7600 inspectors, working in over 6500 plants nationwide. Balancing workloads and staffing levels for such a large workforce is a tremendous undertaking, which requires careful planning and monitoring.

1.1 FSIS Background and History

In 2011 FSIS began implementing the Public Health Information System (PHIS), a web-based application that the Agency uses to perform the following activities:

- Managing profile information for the establishments it regulates
- Tasking its inspection personnel with verifications to be performed
- Recording and reporting the results of those verification tasks

- Supporting online coordination of FSIS in-plant resources through the resource information functions of the system

In short, the system uses: (1) the inspection tasks that are to be performed at each establishment based on the establishment's profile, (2) the planned frequencies of those tasks, and (3) the amount of time required to complete those tasks; to determine the amount of work to be done (in hours) for each establishment. Establishments are then grouped together into assignments, targeting a 100% (75%-125%) workload for each assignment, based on a 40 hour work week. Inspection assignments are then grouped into circuits and districts, and are then nationalized and annualized to determine the overall national inspection staffing level for the Agency.

FSIS aggregates their work measurement data into four groupings:

1. Direct inspection time (i.e., actual observation or hands-on task time)
2. Indirect inspection time (e.g., data entry, research, and analytical time)
3. Internal travel time (i.e., inside the plant)
4. External travel time (i.e., outside of the plant)

Many of the direct inspection task times have not been time measured since the 1980s. When FSIS implemented PHIS, it changed the factor to determine indirect task time from 0.6 times the direct task time to an estimated 0.8 times the direct task time. However, this factor was not validated. In addition, new sampling tasks and techniques, in conjunction with outdated work measurement data have led to the complaint that the workloads assigned by PHIS are in some instances overly burdensome. This means that inspection personnel cannot perform all of the verification tasks that the Agency expects them to complete. Agency Program Managers believe that the indirect task time multiplier may not be adequate to determine the actual data entry, research, and analytical time required for each task, resulting in inaccurate determinations of needed staffing.

1.2 Purpose

One of the more recent sampling activities performed by FSIS personnel is the N=60 sampling method, which is used to collect samples of beef trim for the MT60 sampling program. This sampling program is designed to detect Escherichia coli (E. coli) O157:H7 and six relevant non-O157 Shiga Toxin-Producing E. Coli (STEC) serogroups (O26, O45, O103, O111, O121, and O145) in beef. E. coli O157:H7 is the most common STEC to occur and accounts for approximately 36% STEC-related foodborne illnesses, while the six relevant non-O157 STEC serogroups combined had resulted in half STEC related foodborne illnesses. The six non-O157 STEC serogroups can cause illness on the same magnitude as E. coli O157:H7.

FSIS has performed some work measurement studies to determine the amount of time that should be allocated for the direct activities related to an N=60 sampling task, but there is insufficient data available to account for the associated indirect activities. These indirect activities include such tasks as the use of PHIS to reserve lab time for sample analysis, working with the inspected plants to determine the sample lot and the timing of inspection, and the entry of inspection data into PHIS.

The purpose of this study is to investigate the current multiplier (factor) used for estimating indirect task time. Currently, the multiplier is set at 1.8. This means that the total time allocated for a sampling program is calculated with the following equation:

Total Time = Indirect Time + Direct Time

Indirect time is calculated from the direct time, using the 0.8 factor, as follows:

Indirect Time = 0.8 * Direct Time

Substituting the second equation into the first yields the following equation for total inspection time:

Total Time = Indirect Time + Direct Time

Total Time = (0.8 * Direct Time) + Direct Time

Total Time = 1.8 * Direct Time

The 1.8 in the final equation above is referred to as the "indirect multiplier."

The tasks related to the MT60 sampling program will be used as a case study to assess this indirect multiplier and to provide an extensible and defensible methodology for the measurement of direct and indirect inspection tasks.

1.3 Scope

1.3.1 Large Scale Work Measurement Program

After consideration of the challenges facing FSIS in its effort to appropriately scale indirect workloads, the GMU team recommended an approach for an overall work measurement study. The necessary artifacts and activities are detailed below in Figure 3. While a project of this scale was not achievable in the timeframe allowed for this study, it provided context for the case study which was conducted.

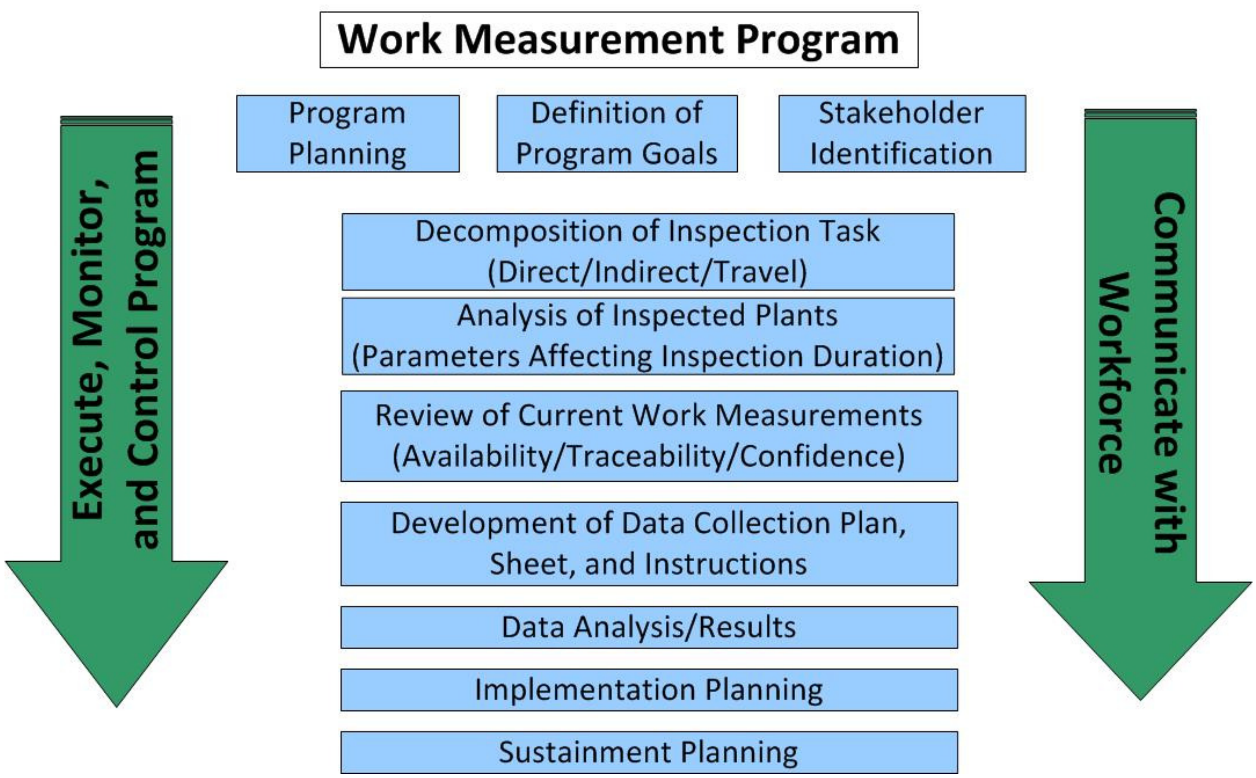

Figure 3. Large Scale Work Measurement Program Framework

1.3.2 Case Study

The large scale work measurement program described in Figure 3 is well beyond what can be accomplished within a semester of work. Therefore, the GMU team worked with FSIS to limit the study to a useful effort that was achievable within the established time and effort limits.

The scope of this project was to perform a subset of the work measurement program tasks described above, for the MT60 sampling program. This case study focuses on the task decomposition, data collection, and data analysis of the direct and indirect tasks related to the MT60 sampling program, as illustrated in Figure 4.

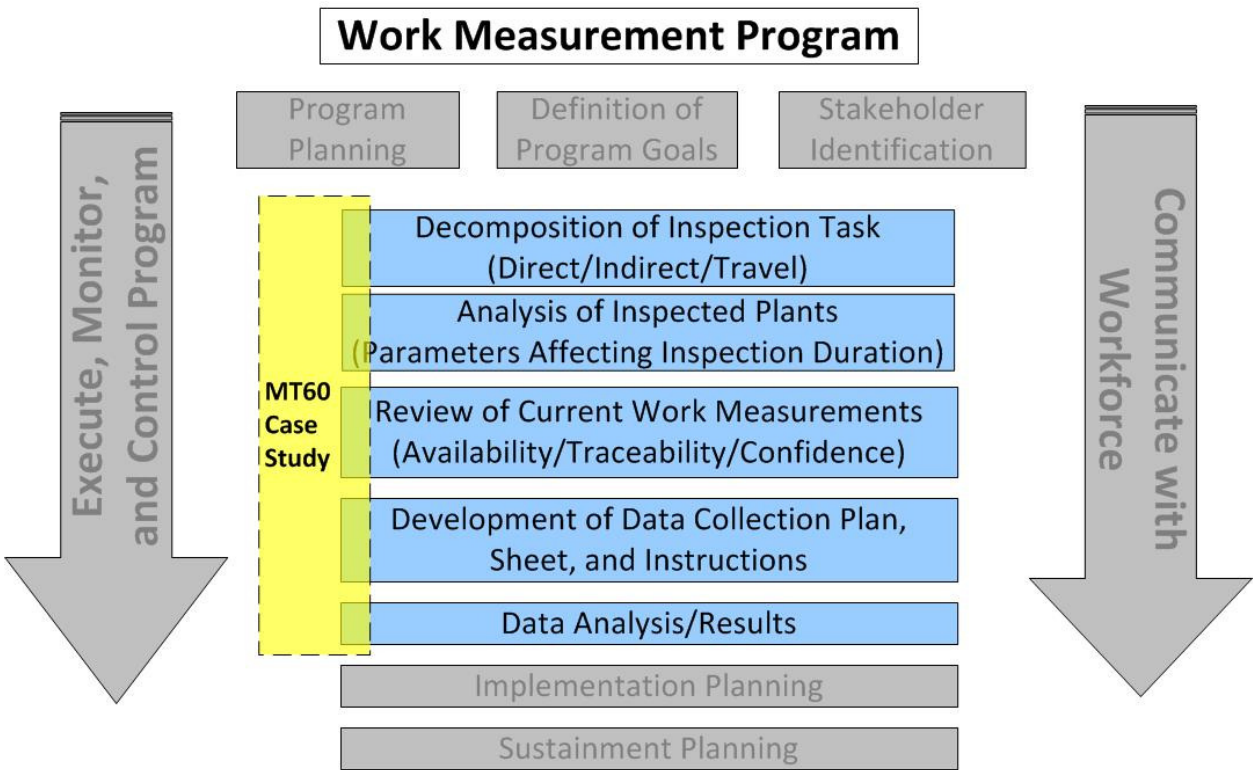

Figure 4. Large Scale Work Measurement Program Framework - Case Study

1.4 Assumptions

The high level assumptions that influenced the structure of this study are described below.

- Training needed for inspectors to successfully and efficiently perform the MT60 sampling-related tasks is accounted for separately within staffing estimates. Therefore, no data on training was collected during this study.

- In preparation for performing MT60 sampling in a given plant, the inspector must be familiar with the Hazards Analysis and Critical Control Points plan (HACCP). Time to read and become familiar with the HACCP is not specific to the MT60 task, so no data on this activity was collected during this study.
- If a sample collected in the MT60 sampling program detects the presence of E. coli or any of the six relevant non-E. coli STEC serogroups, the inspector must take further actions. Those actions are excluded from this case study.
- The learning curve related to changes in the PHIS workflow and interfaces is not considered a factor in this study.

1.5 References

The GMU team conducted a literature search for information related to time and motion studies and standards used in other professions (e.g., nursing, law), FSIS documentation, and quantitative analysis. Individual references are shown in the sections that follow.

1.5.1 FSIS Website

1.5.2 FSIS Notice 47-13: Verification Testing for Non-0157 Shiga Toxin-Producing Escherichia Coli (Non-0157 STEC) Under MT60, MT52, and MT53 Sampling Programs

- Inspection program personnel's (IPP) effective testing date of beef manufacturing trimmings for six non-O157 STEC serogroups under the MT60 sampling program to include the reasons behind this kind of testing.

1.5.3 FSIS Notice 62-13: Randomly Selecting Beef Trim to be Collected Under the Beef Manufacturing Trimmings (MT60) Sampling Program

- Sampling code changed from MT50 to MT60 to include a more risk-based design in May 2012.
- Inspection program personnel's (IPP) responsibilities to accept, schedule and complete a MT60 when the task popped up in the Public Health Information System (PHIS).

1.5.4 FSIS Directive 10,010.1 Revision 3: Verification Activities for Escherichia Coli O157:H7 in Raw Beef Products

- General sampling instructions to include notifying the establishment, making proper arrangements, ordering lab supplies, restrictions, shipping directions, and checking lab results.
- A general description is given on different FSIS sampling project numbers for E. Coli O157:H7 testing including MT60 formerly known as MT50.
- MT60 Sample Collection Procedures for Beef Manufacturing Trimmings
- Incorporates new changes and a review of the N=60 Sampling method.
- Review the list of supplies needed for a N=60 sampling.

1.5.5 FSIS Directive 13,000 Series: Public Health Information System (PHIS)

- Provide a list of PHIS's terminology with their definitions.
- Provides instructions to IPP on how to schedule and accept tasks in the PHIS.
- Explain the different task's priority determined by the potential public health impact.
- Describe IPP's responsibilities associated with PHIS.
- Provides general instructions to the Inspection Program Personnel (IPP) and Enforcement Investigation and Analysis Officers (EIAOs) on conducting sampling tasks using PHIS.
- Provides two guidance documents as attachments for IPP.

1.5.6 Applied Statistics and Probability for Engineers, Fifth Edition. Montgomery, Douglas C and George C Runger. Hoboken, NJ: Wiley, 2011. Pg 258, 365, 517

- Reference provided methodology and equations for conducting T-test, Analysis of Variance (ANOVA), and confidence interval analysis.

1.5.7 Student's t-test Wikipedia Page

1.5.8 Probability and Statistics for Engineering and the Sciences, Fifth Edition. Devore, Jay L. Pacific Grove, CA: Brooks/Cole, 2000. Pg 299-300, 524-526

- Reference provided a description and usage of prediction interval.

2. MT60 Process

2.1 General Description

The MT60 sampling program is designed to detect E. coli and six relevant non-E. coli STEC serogroups in beef manufacturing trimmings produced via on-site slaughter of cattle. According to reference 1.5.3, "Randomly Selecting Beef Trim to be Collected under the Beef Manufacturing Trimmings (MT60) Sampling Program", the intent of the MT60 sampling program is to "assess the effectiveness of slaughter and dressing operations and to verify that establishments are effectively addressing STEC [Shiga toxin-producing *Escherichia coli*]".

The MT60 sampling program begins with assignment of an MT60 task to an inspector via PHIS. Using PHIS, the inspector accepts and schedules the assignment at the specified plant, coordinating a time for sampling with the specified plant and an FSIS laboratory.

Once a sample window to collect the samples is determined, the Inspection Program Personnel (IPP) "randomly selects a day, shift, and time within the sample window" according to FSIS Directive 10,010.1 Revision 3. The IPP must give notice to the plant establishment prior to the sample collection. This is to allow the plant to make preparations to hold the whole sampled lot, but not enough time so that they may alter the process. In most cases, one to two day notice prior to the sample collection is sufficient. However in some cases, more than two day notice is allowed due to the plant establishment's process flow and specific product. On the day of the sample collection, IPP are to randomly select containers within the production lot to collect their samples for testing.

Onsite at the plant, the inspector collects information about a given lot of trimmings and also collects a sample of trimmings in accordance with the N=60 collection method or 2-lb grab method. These samples are sent to the pre-determined lab for testing. The results are sent back to the inspector and the plant.

2.2 N=60 Sampling Method

The MT60 program typically uses the N=60 sampling method, during which 60 individual samples of beef trim are collected for testing. In this sampling method, the CSI or PHV performing the sampling chooses bins from a given lot of beef trim, and collects 60 1” wide x 3” long x 1/8” thick samples from the surface of that trim. These 60 individual sample pieces should weigh approximately ¾ pounds. Collection of an additional sample that is 1 ¼ pounds of non-specified size is needed, with the total combined sample collection weighing two pounds.

The N=60 sampling method name originates from the fact that 60 pieces in size 1” wide x 3” long x 1/8” thick will always be collected regardless the number of containers located in the lot. Table 3 shows the number of sample pieces to collect from each container. For a lot containing more than five containers, five containers are chosen at random to collect 12 sample pieces from each container, resulting in the 60 sampling pieces of the required size.

Table 3. N=60 Sampling Method

Number of Sample Pieces to Collect Per Container	
# of containers in each specific lot	*# of sample pieces to select from each container*
5	12 pieces
4	15 pieces
3	20 pieces
2	30 pieces
1	60 pieces

Courtesy of Reference 1.5.4

The samples are put into the collection bags for transport to the laboratory where tests are performed. After sample collection, the CSI or PHV records the warmest temperature measured from the top pieces of trim of randomly selected containers.

As an alternative to the N=60 sampling method, the “2-lb Grab” sampling method may be used, wherein the CSI or PHV collects 2 pounds of randomly sized trim pieces to send for testing.

An MT60 sample collection performed using the 2lb Grab sampling method is essentially the same as one performed with the N=60 method, except that instead of slicing surface samples, the inspector collects samples by simply grabbing small pieced of pre-cut trim weighing a total of 2 pounds.

2.3 Process Decomposition

Based on input from FSIS, the GMU team developed a structured decomposition of the MT60 process (“MT60 decomposition”), including direct, indirect, internal travel, and external travel process steps. The MT60 decomposition is shown in Section 9.2.

3. Data Collection Approach

3.1 Data Collection Philosophy

The goal of this study was to determine the amount of time required to perform MT60 sampling. With approximately 6500 plants within the FSIS purview, it is infeasible to have a measurement plan that records and maintains data on every plant individually. Instead, a representative subset of plants were measured and those measurements were analyzed to determine program-wide averages.

3.2 Data Collectors

A more broadly scoped, future data collection program could include trained data collectors who have no stake in the results of the study. Using the same individuals to perform all measurements at all sites would remove some variability from the process. For this case study, it was not possible to develop such a team of collectors, so experienced SCSIs and PHVs performed the data collection. These individuals have the advantage of being familiar with the workforce in the field and the inspection sites. They bring an understanding of the processes involved in the MT60 sampling program, and are able to perform quantitative measurements in the field.

3.3 Level of Data Collection Detail

The study was designed to collect data at the lowest level needed for data analysis. Decomposition of the MT60 task steps was done to a level that could be accurately measured by a Data Collector with a stop watch. A concern with decomposing to an extremely low level was that the Data Collector might have a difficult time keeping up with the measurement and documentation if each leaf-level step in the decomposition was overly short in duration. This was seen as a potential source of error, which could result in inaccurate data.

Conversely, a lower level of decomposition was desired, beyond the largest block of direct, indirect, and internal/external travel time. While this level of data would be sufficient for the purpose of validating the indirect multiplier, it would not fully support the other goal of this case study, to develop a data collection methodology that would be applicable to the larger, future work measurement program. To that end, it is desirable to collect measurements that apply to multiple inspection programs. For example, most inspection programs would likely include logging into PHIS, navigating to the assigned tasks, and adding a task to the calendar. Measuring to this level of detail would allow FSIS to reuse this work measurement data for multiple tasks, thereby reducing the number of required measurements.

3.4 Sample Size

This case study was considered highly successful in the amount of data collected. At the outset, a goal of obtaining data from at least 10-20 different plants was established. FSIS successfully collected 107 DCSs for this study. However, 13 were blank and 6 were unusable for reasons described in section 4.3, leaving 88 data collections sheets for analysis. The sample size was sufficiently large to develop several conclusions from statistical analysis.

3.5 Data Collection Methodology

The data collection methodology for this case study was defined in the Data Collection Plan. It defined several major data collection steps:

- Pre-Collection Planning, during which the data collectors familiarized themselves with conducting the MT60 process, operating the stopwatch, and the contents of the DCS.

- Pre-Collection Meeting, during which the data collector met with the plant manager and inspector to discuss the work measurement activity
- Executing the MT60 task, including detailed steps within three major process phases: inspection scheduling, sample collection, and documentation in PHIS.

3.6 Data Collection Tools

A DCS was developed by the GMU team in coordination with FSIS. This form was a simple form designed for use by Data Collectors to document their work measurement data.

Along with the DCS, Data Collectors were provided the MT60 DCS Instructions for entering data in each of the data fields as well as general Data Collection Instructions. Finally, each data collector was given a stopwatch to capture work measurement data.

4. Data Collected

4.1 Establishments

Establishments that were included in this case study were identified by FSIS Headquarters and were selected based on the following considerations:

- Headquarters used a centralized database to identify plants likely to engage in the relevant sampling activities in the timeframe of the study.
- The list of identified likely plants was sent to field and cross-referenced with actual sampling activities.
- Some plants were excluded due to lack of relevant operations or lack of personnel available to take the samples.

107 MT60 DCSs were received from 89 establishments, ranging in size from 30 to 938,000 sq ft. Establishments from 10 districts across the country reported data. Most establishments performed the MT60 sampling using the N=60 method, but several reported data on the 2-lb Grab method. Some smaller plants reported data where a single individual timed themselves performing the MT60 sampling tasks, while larger plants had two individuals involved – one to perform the MT60 tasks and the other to operate the stopwatch and record data.

4.2 Data Aggregation

Each SCSI or PHV that collected MT60 work measurement data submitted the completed hardcopy DCSs to the GMU team. Each form was issued a unique serial number by the GMU team to identify each specific form. The serial number format is a 5-digit number starting with a unique three digit number , followed by “-13” to indicate that the data was collected in 2013. For example, the first DCS has a serial number of “001-13”, the second is “002-13”, and so on. The GMU team entered the raw data from the forms into Microsoft Excel to support data analysis.

4.3 Data Quality

The Food Safety and Inspection Service sent out data collection packages to establishments across the country that were scheduled to perform the MT60 task during the data collection period for this case study. The data collection period began on November 1, 2013 and ended on November 15, 2013. Among the 107 DCSs, 13 DCSs indicated either that the MT60 task was not being performed during the data collection window or were simply blank.

In several cases, minor data discrepancies were identified on the DCS, which would have affected the analysis if left unresolved. Assumptions and corrective actions were taken for these discrepancies in order to proceed with the next step of the analysis. The sections that follow describe the different data discrepancy types that were addressed, along with the corresponding assumptions and/or corrective actions. The DCSs that had each data discrepancy type are also noted in the section.

4.3.1 Elapsed Time Format Discrepancy

The DCS requested elapsed time in the format of Hours:Minutes:Seconds, but some of the received DCSs recorded time in the format of Minutes:Seconds:1/100 Seconds.

Among the three work measurement sections 2 through 4, few tasks in section 3 were expected to ever reach the hour mark. Based on this assumption, a reasonableness check was performed on task times to determine when the data collector had reported in the format Minutes:Seconds:1/100 Seconds instead of the requested Hours:Minutes:Seconds format.

Applicable DCS serial numbers were: 001-13(p. 2), 009-13, 017-13, 024-13, 025-13, 028-13, 029-13, 030-13, 035-13(p. 1), 039-13(Sec 2-3), 045-13, 048-13, 061-13, 063-13. 066-13, 067-13, 071-13(except 3.h. and 3.i.), 074-13(except 3.f.-3.i.)

4.3.2 Elapsed Time versus Individual Time Discrepancy

For some DCSs, the recorded times were not elapsed times, but were individual durations for each step.

When observations were made concluding that the times were not cumulative of the preceding steps, then it was assumed the times provided were the duration of individual steps. When this occurred, the data was not entered "as is" from the DCS, but rather was recalculated to reflect the appropriate elapsed/cumulative times. This consistency of format was enforced in the Excel spreadsheet in order to allow consistent use of automated calculations and equations.

Applicable DCS serial numbers were: 003-13 (p. 2), 033-13, 034-13(Sec 2), 035-13(3.d. 3.e.), 038-13, 042-13, 052-13, 069-13, 081-13, 091-13

4.3.3 Step Sequencing Discrepancy

For this data discrepancy type, the SCSI/PHV did nothing wrong, rather the results had to be adjusted during analysis to fit the analysis model as-built. Formulas in Excel calculated durations with the assumption that the steps laid out within each section in the DCS were performed in the order listed in the DCS.

For example, on DCS Serial #080-13: The SCSI/PHV conducted step 3.h. at the beginning of section 4. Times were recalculated to reflect as if step 3.h. was performed in section 3 along with the simultaneous recalculation of the steps in section 4 to reflect the excluded step 3.h.

Applicable DCS serial numbers include: 080-13, 082-13, 087-13

4.3.4 Logic Error Discrepancies

In some cases, the data reported on the DCS could not be correct. For example, in some cases, it is not possible to deviate from the DCS-specified sequence of steps: E.g., the SCSI or PHV cannot complete step 3.c. “Collect Sampling Supplies” prior to completing step 3.b. “Walk to the Sampling Supplies.”

Table 2 details some of the apparent logic error discrepancies reported in the received DCSs. Also included in the table are the corrective actions and assumptions taken for these cases.

Table 4. Logic Error Discrepancies

Ref#	Description	Assumptions/Corrective Actions
1	DCS Serial #007-13: The elapsed time indicated that step 3.c. “Collect Sampling Supplies?” was completed prior to step 3.b. “Walk to the Sampling Supplies?”. It is impossible to collect the supplies prior to reaching the destination.	DCS Serial #007-13: It was assumed a writing error had occurred. The recorded time on step 3.b. “Walk to the Sampling Supplies?” was 51 seconds while on step 3.c. “Collect Sampling Supplies?” was 34 seconds. The assumptions was made that for step 3.c., the time was actually meant to be 1 minute: 34 seconds. This way it is more reasonable and an analysis could be done.
2	DCS Serial #017-13: Step 4.k. was recorded as 11:62:21 (written in minutes:seconds:1/100 seconds). This is an error since the stopwatch would not show passed 59 seconds.	DCS Serial #017-13: An assumption was made that the “6” in 11:62:21 is a “5” instead. “5” is the highest possible number that particular position can be.
3	DCS Serial #018-13: Step 2.g. “Take part of the Questionnaire” was left blank with no explanation but a time was written for step 2.h. “Stop the Stopwatch”.	DCS Serial #018-13: Time written for step 2.h. was assumed as the time for step 2.g. This will result in step 2.g. taking a total of 46 seconds which is a reasonable time duration.

Ref#	Description	Assumptions/Corrective Actions
4	DCS Serial #063-13: The elapsed time indicated that step 2.d. “Add the task to the Schedule, including Check Lab Availability, etc?” was completed prior to step 2.b. “Log Into PHIS?” and 2.c. “Filter for Establishment and Type of Task?”. It is impossible to do step 2.d. prior to 2.b. and 2.c.	DCS Serial #063-13: The recorded time on step 2.d. “Add the task to the Schedule, Including Check Lab Availability, etc?” was 1 minute: 2 seconds while on step 2.b. “Log Into PHIS?” was 1 minute: 46 seconds and for 2.c. “Filter for Establishment and Type of Task?” was 1 minute: 58 seconds. The assumption was made to change the time to 2 minutes: 2 seconds for step 2.d. This way it is more reasonable and an analysis could be done.
5	DCS Serial #069-13: Both N=60 and 2 lb Grab methods were circled. Only one method can be used.	DCS Serial #069-13: N=60 was the assumed method used in this particular case. The timer originally used pencil to fill out the sheet and went over in pen. There is a faint pencil mark around N=60 and none on the 2 lb Grab. It is assumed the Timer mistakenly circled the 2 lb Grab.
6	DCS Serial #074-13: On step 3.e., the time was reported as 4 minutes: 96 seconds:59/100 seconds. Stopwatch doesn’t show passed 59 seconds. The “9” in “96” seconds is an error.	DCS Serial #074-13: The DCS was held up to the light since the original writing was whited-out. The original writing indicated 56 seconds. Therefore, it was assumed the time for step 3.e. is 4 minutes: 56 seconds: 59/100 seconds.

Ref#	Description	Assumptions/Corrective Actions
7	DCS Serial #092-13: Both N=60 and 2 lb Grab methods were circled. Only one method can be used.	DCS Serial #092-13: N=60 was the assumed method used in this particular case. The assumption was based on the time to collect the sample which was recorded as 43 minutes. It is more likely, the method used is N=60 than 2 lb Grab.

4.3.5 Excluded Data

The above sections detail the corrections that were made to provided data based on assumptions or reasonableness checks. However, there were several cases where the data provided was unsalvageable, and had to be excluded from analysis entirely. This is, of course, less than desirable – each DCS took time and effort to populate, and so great care was taken when excluding data. In total, 19 of the received DCSs were excluded from analysis. Of those excluded, 13 were completely blank. The reasons for exclusion of the remaining six DCSs are detailed in Table 5.

Table 5. Excluded Data

DCS Serial #	Reason for Exclusion
016-13	Mean duration for step 4.d. from all plants is under one minute. The duration of step 4.d. for this establishment was almost an hour. This is a statistical anomaly, much greater than 5 standard deviations from the mean. The following comment was included on the form explaining the duration “had to wait almost an hour for the plant to finish processing the entire carcass to obtain the total weight of the product [from] which the sample was taken.”
025-13	The notes on this DCS indicated that the steps were performed significantly out of order in relation to the form, some steps were omitted, and some steps had more than one recorded time.
044-13	Excluded because the following comment on the form indicated the times reported were estimates, and that they did not come from an actual MT60 event. This was considered to be invalid data, although the efforts of staff at this establishment are much appreciated. “Due to the unavailability of this product, the sample times were taken from a "dry run"/simulation. Some of the times were estimates. There was no actual sample taken.”
051-13	Insufficient resolution to the data provided. Only three times were provided - the duration of the entire step 2, entire step 3, and entire step 4. This did not allow allocation of time correctly to indirect, direct, and travel categories.
056-13	Mean duration for step 4.d. from all plants is under one minute. The duration of step 4.d. for this establishment was approximately 45 minutes. This is a statistical anomaly, much greater than 5 standard deviations from the mean.
066-13	Mean duration for step 3.f. from all plants is 25 minutes . The duration of step 3.f. reported from this establishment was under one minute. This is a statistical anomaly, much greater than 5 standard deviations from the mean.

5. Quantitative Analysis Methods

5.1 Analysis of Variance (ANOVA)

Analysis of Variance (ANOVA), is a statistical tool used to determine whether a given parameter has any impact on the results of a data set. A null hypothesis is stated indicating that two or more parameters of interest do not affect the mean value of the data. ANOVA uses the variances within each parameter's data sets and compares the variances between data sets. Variance is the square of standard deviation, which is the average amount of difference from the mean. The variance of the total data set ("expected variance") is compared to the calculated variance between subsets of the total data set ("found variance"). Subsets are selected by grouping the data based on a single model variable. The ratio of the expected variance to the found variance is the F-ratio. An F-ratio close to one indicates that the chosen variable under consideration is not likely to influence the results of the data. An F-ratio not close to one indicates that the chosen variable is likely to influence the results of the data. The size of that likelihood is reported in terms of the P-value. A P-value of 0.05 or less indicates that the variable did influence the data. A P-value of greater than 0.05 means that the variable did not influence the results of the data. The results of the ANOVA follow an F distribution based on the degrees of freedom. The area under the curve to the right of the calculated F-critical value is equal to a given p-value (confidence level). The F value (F observed) is calculated and compared to the F-critical. If the F-value is less than the F-critical, the null hypothesis is not rejected (accepted). Figure 5 illustrates how to interpret the F-distribution plots with the results of the ANOVA analysis.

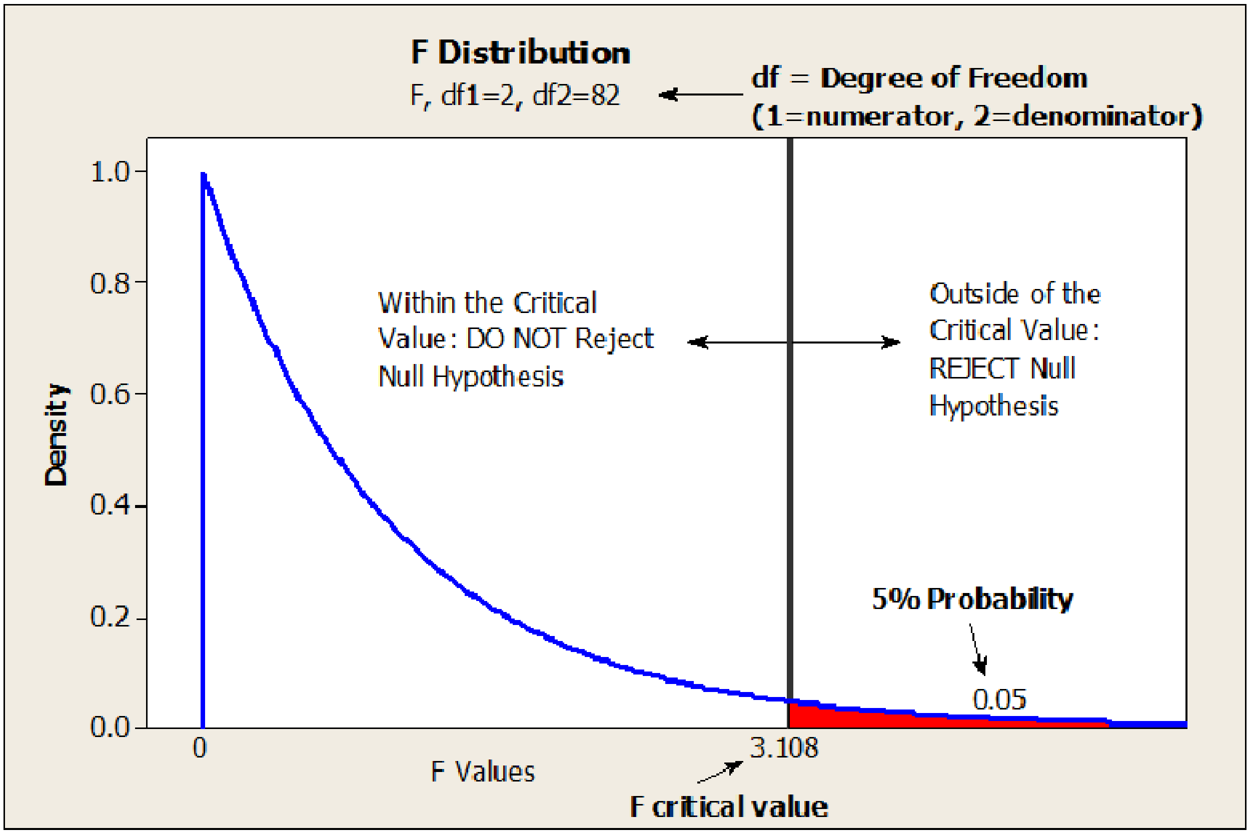

Figure 5. Description of F Distribution and Interpretation of ANOVA Results

5.2 T-Test

A t-test is conducted to determine whether one set of data is statistically different than another. A t-test allows for an inference (or judgment) to be made regarding the differences between sets of data. There are several assumptions made during the t-test analysis. First, both sets of data are assumed to be of normal distribution. For this analysis, there is also the assumption that the variances of two data sets are not assumed equal. The t-test uses the following methodology:

There is a seven-step procedure for the t-test (see Reference 1.5.6)

1. Determine Parameter of Interest – The primary analysis is determining whether there is a difference in the two populations based on the mean (or average) time for each type of inspection (direct or indirect).

2. Determine the Null Hypothesis – The null hypothesis is that the means of the two populations are equal. (H_0: $\mu_1 = \mu_2$)

3. Determine the Alternative Hypothesis – The alternative hypothesis is the means of the two populations are not equal (H_1: $\mu_1 \neq \mu_2$)

4. Calculate the test statistic – The test statistic is calculated from the following equation:

$$\mathrm{t}_0 = \frac{\bar{x}_1 - \bar{x}_2 - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where:

$\bar{x}_1 = Mean\ of\ First\ Sample\ Population$

$\bar{x}_2 = Mean\ of\ Second\ Sample\ Population$

$s_1 = Standard\ Deviation\ of\ First\ Sample\ Population$

$s_2 = Standard\ Deviation\ of\ Second\ Sample\ Population$

$n_1 = Sample\ Size\ of\ First\ Sample\ Population$

$n_2 = Sample\ Size\ of\ Second\ Sample\ Population$

5. Calculate the degrees of freedom – Since the variances are NOT assumed equal, the following equation must be used*:

$$\nu = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

*round down if not an integer

6. Determine the t-critical value – Based on the degrees of freedom and a user defined alpha (or confidence level), the t-critical is found in the Student t-distribution table.

7. Conclusion and Interpretation of Results – The test statistic is compared to the t-critical value. Since this is a two-tail test, the Null Hypothesis would be rejected if the test statistic is greater than the positive t-critical value or less than the negative t-critical value.

Figure 6 illustrates an example of a T distribution with the results from a t-test. The test statistic (t_0) is referenced within the T distribution. The areas of rejection are highlighted in red for a given probability. Since this is a two tail test, the probability is divided by 2. Therefore, for a 95% probability the rejection areas are 2.5% on both sides of the distribution to equal a total of 5% probability of rejection. If the test statistic is within the two tails of the distribution, then the null hypothesis is not rejected (accepted). If the test statistics is outside of the two tails, then the null hypothesis is rejected.

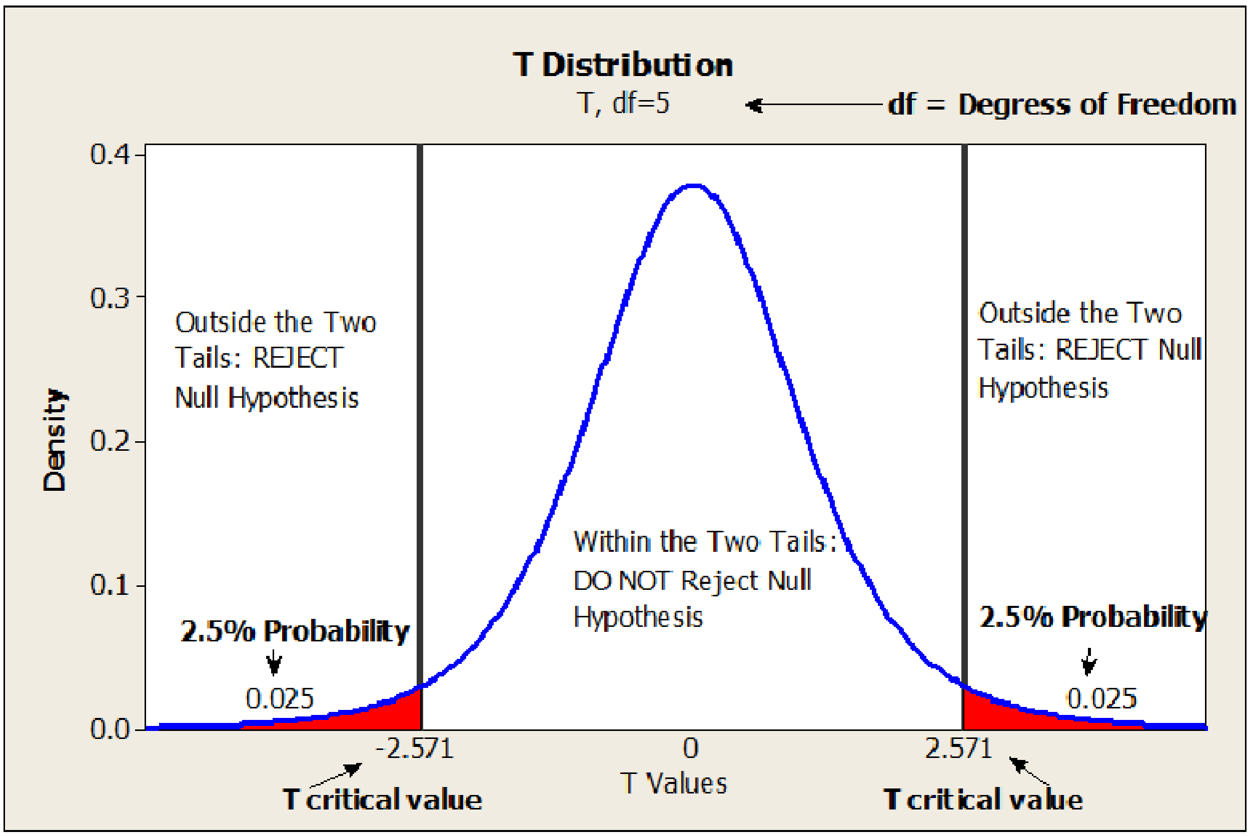

Figure 6. Description of T Distribution and Interpretation of Results

5.3 Confidence Intervals

The confidence interval represents a calculated margin of error for the entire population mean. Based on the data collected, a level of confidence can be applied to an interval, which states that the entire population mean is within the calculated interval. Since the sample size for the data collection is considered large (>40), the central limit theorem implies that the mean of the population compared to the individual samples has approximately a standard normal distribution. Therefore the following equation can be applied to calculate a desired confidence interval (see Reference 1.5.6):

$$\bar{x} - z_{\alpha/2} \cdot \frac{s}{\sqrt{n}} \leq \mu \leq \bar{x} + z_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

Where:

$\bar{x} = Mean\ of\ Sample\ Population$

$\alpha = Desired\ Confidence\ Interval\ (default\ 95\%)$

$z_{\alpha/2} = Z\ value\ for\ \alpha/2\ (two\ tail) from\ Standard\ Normal\ Table$

$s = Standar\ Deviation\ of\ Sample\ Population$

$n = Sample\ Size\ of\ Population$

5.4 Boxplots

Boxplots offer a fast and easy way to visualize the collected data. Figure 7 describes the layout of the boxplots presented in this report. Outliers are easily identified by an asterisk. When comparing different populations, the boxplots provide a visual understanding of the differences within each data set.

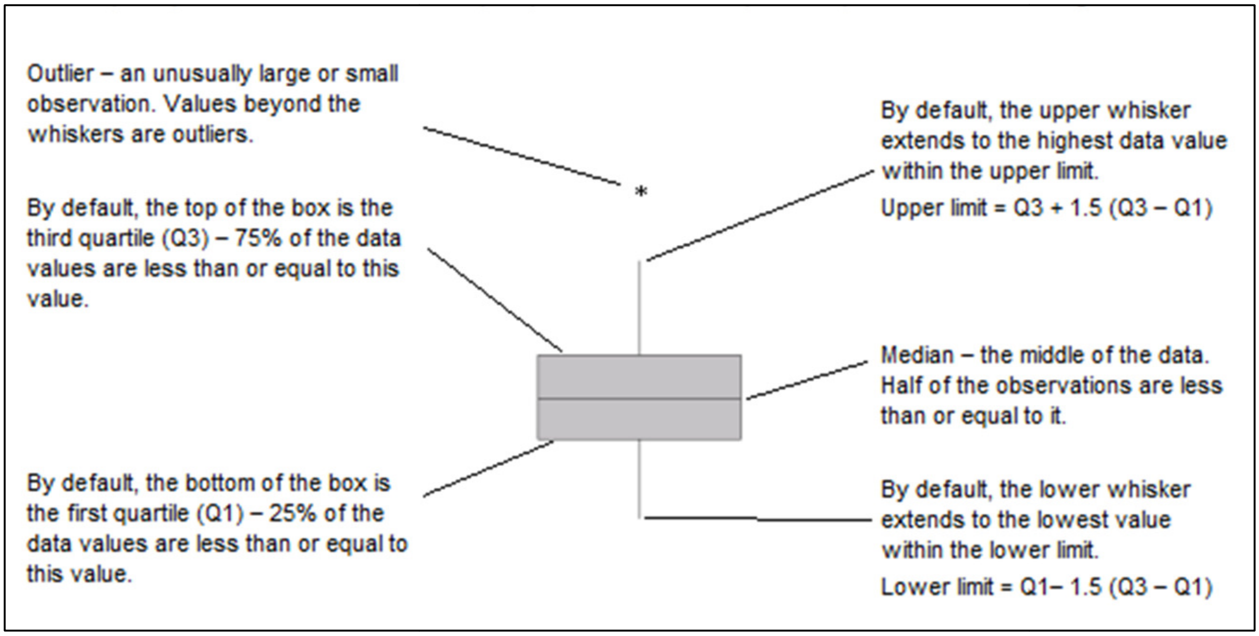

Figure 7. Boxplot Description Directly from Minitab v16

5.5 Analysis Verification

The quantitative analysis was conducted using MS Excel. Verification of the spreadsheets was performed to ensure data integrity by careful review of each worksheet by two different team members. Verification of the quantitative analysis was conducted using Minitab statistical software. The results of all quantitative analyses were replicated in Minitab to ensure consistency. This verification establishes confidence that the analytical technique was applied correctly and mathematical solutions are calculated accurately.

6. Results

6.1 Analysis of Indirect Multiplier

The indirect multiplier for each plant was calculated by dividing the time required to complete the indirect tasks by the time required to complete the sum of the direct and indirect tasks. The average Indirect Multiplier for the total population was 1.61, which is 11% lower than the 1.8 multiplier that is currently used by FSIS. However, results indicate an indirect multiplier is not a valid methodology for time allocation.

Figure 8 illustrates the indirect task time plotted against the corresponding direct task time. The plot shows no obvious trends or correlation between the direct and indirect task time. A regression line is plotted for the data in blue. The slope of this line shows the average relationship between indirect and direct time – the required multiplier. Because the slope is so close to zero, the line is essentially "flat", which indicates that the amount of indirect time needed is not related to the amount of direct time needed for the task. For reference, the 1.8 multiplier is also plotted, in red, to illustrate the line that would be expected to reflect such a multiplier. As described in Section 1.2, an indirect multiplier of 1.8 times the direct time provides the total time for the task. The indirect time would be obtained by multiplying the direct time by 0.8.

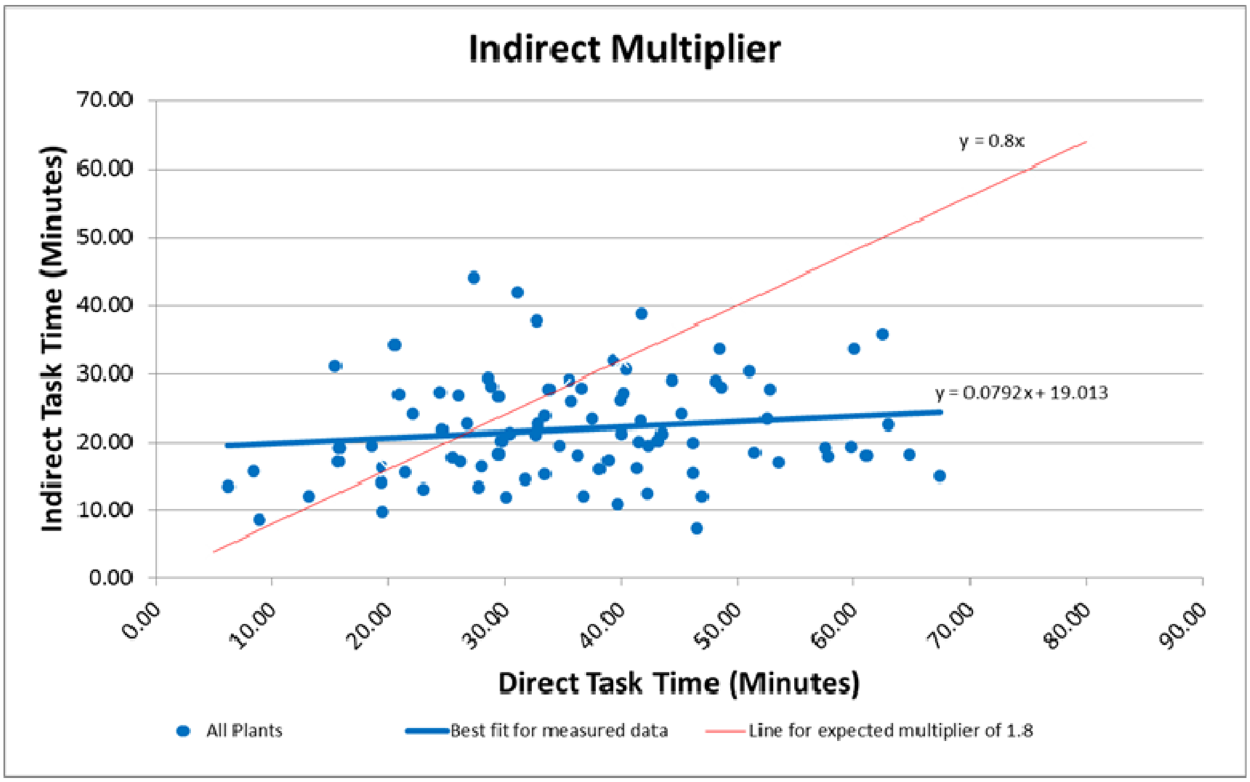

Figure 8. Direct vs. Indirect Task Time

The trend of the plot in Figure 8 indicates there is no correlation between direct and indirect task time and therefore, utilizing a multiplier to establish time required is not a validate method. A test on the regression line was conducted to determine whether the slope is statistically significant. The regression test concluded with over 95% confidence, that the slope of the line is not statistically significant. So, the amount of direct time required to perform an inspection task has no statistically significant effect on the amount of indirect time required to perform that task.

Rather than the multiplier concept used previously by the FSIS to predict the amount of time needed to execute the indirect work associated with the MT60 sampling program, the above analysis indicates that instead, it is more appropriate to assume a fixed amount of time for indirect work, as is done with direct labor for the sampling program.

6.2 Determination of Inspection Times

Section 6.1 illustrated that there is no correlation between direct and indirect inspection time for the MT60 sampling program. The descriptive statistics for the sample population are shown in Table 6. These statistics are for the entire sample population.

Table 6. Total Population Statistics

Total Population Statistics			
Measure	***Direct (Minutes)***	***Indirect (Minutes)***	***Travel (Minutes)***
Mean	36.1	21.9	6.6
Std Dev	13.7	7.6	5.6
Sample Size	88	88	88

Using the above equation, the inspection times required for the MT60 sampling are calculated from the descriptive statistics in Table 6. The results are shown in Table 7.

Table 7. Inspection Time Required with 95% Confidence Intervals

Inspection Time Confidence Intervals				
Confidence Level (%)	95			
Z value	1.96			
Measure	***Mean***	***(+/-) Interval***	***Lower Limit (Minutes)***	***Upper Limit (Minutes)***
Direct Time	36.1	2.9	33.2	39.0
Indirect Time	21.9	1.6	20.3	23.5
Total Time	**58.0**	**4.5**	**53.5**	**62.5**

The results of the confidence interval (CI) calculations are graphically shown in Figure 9 and Figure 10. The plot shows the histogram of the direct and indirect inspection times collected, overlaid with the normal distribution probability plot for the population's specific mean and standard deviation. The 95% CI is shown by the blue bar and X. The defined confidence interval means that there is a 95% confidence that the entire population mean for this parameter is within the defined interval.

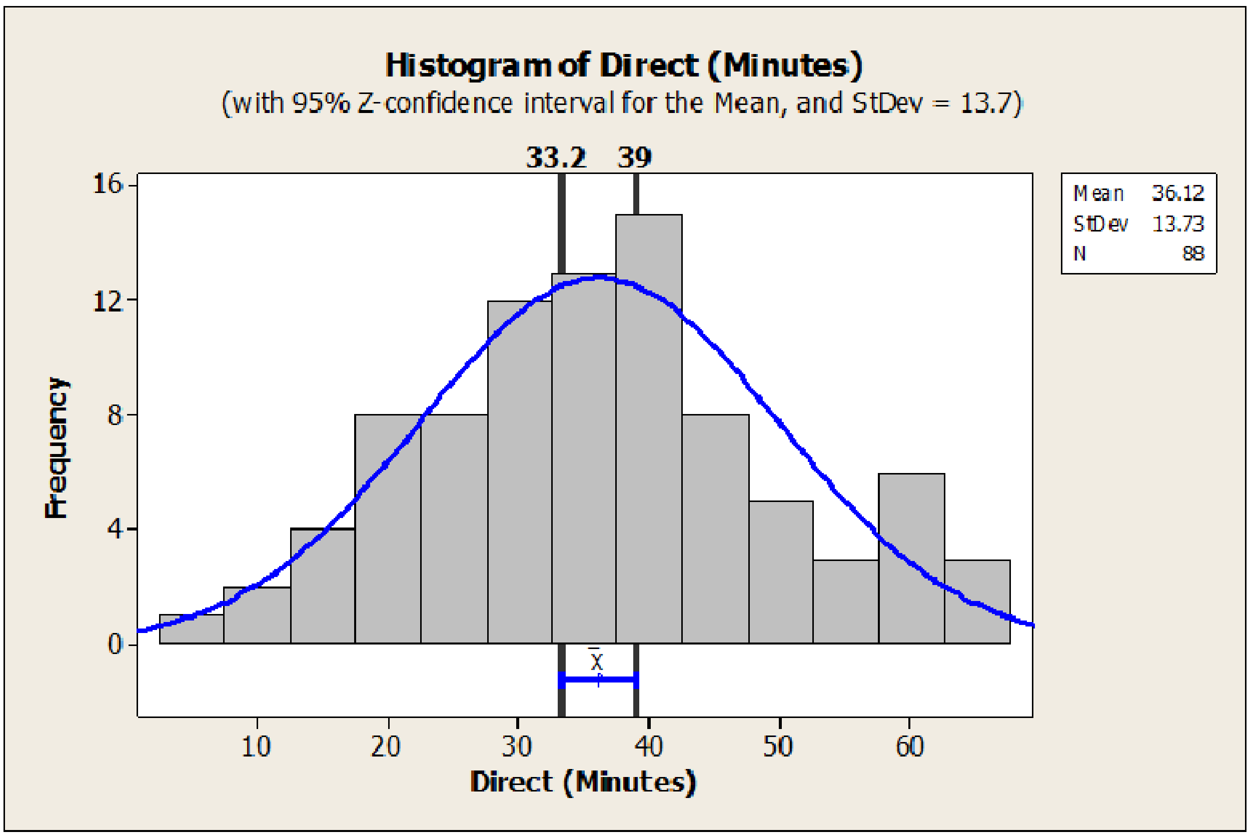

Figure 9. 95% Confidence Interval on Direct Time Mean

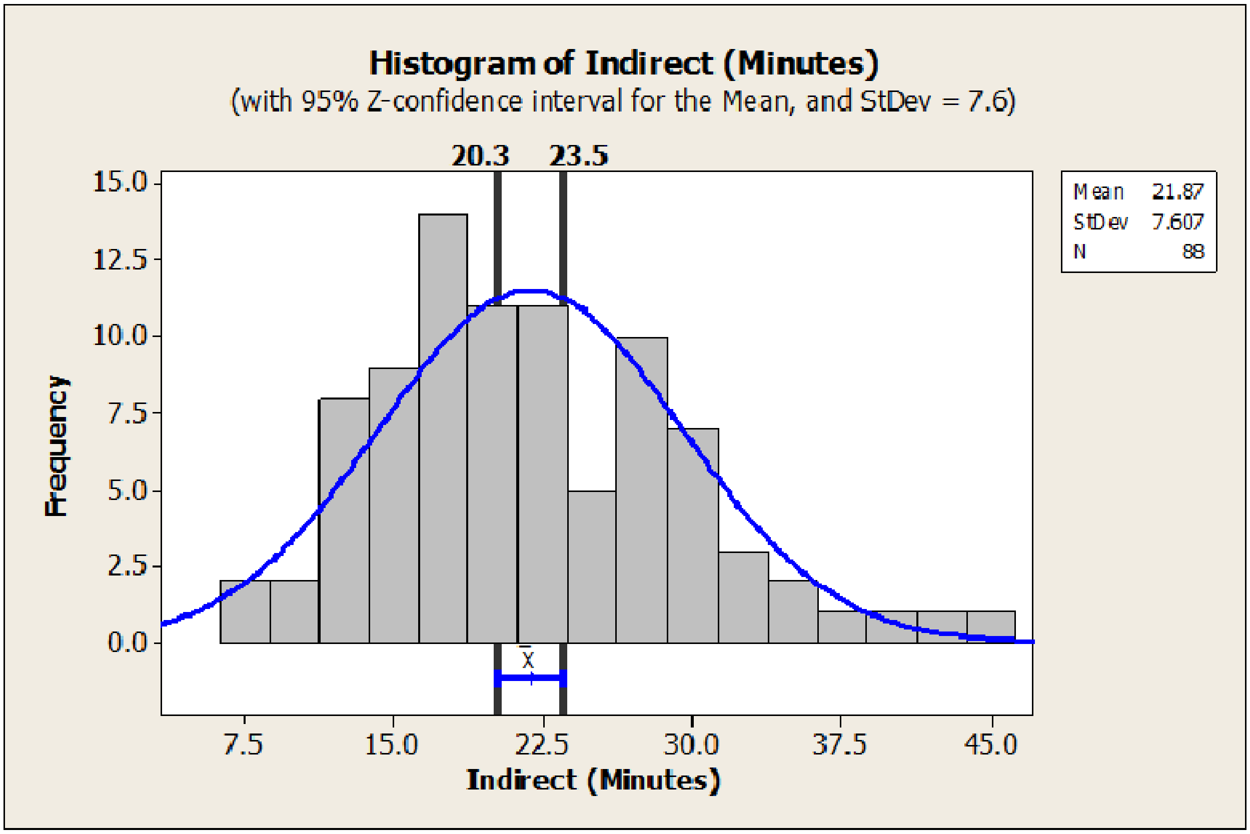

Figure 10. 95% Confidence Interval on Indirect Time Mean

The results illustrate the following regarding the mean time required for the entire population:

- Direct Inspection Time Required: 95% CI → 33.3 – 39.0 minutes
- Indirect Inspection Time Required: 95% CI → 20.3 – 23.5 minutes
- Total Inspection Time Required: 95% CI → 53.5 – 62.5 minutes

Based on the collected data, the required MT60 inspection time is approximately 62.5 minutes. A 62.5 minute time allowance for the inspection provides a 95% confidence that the entire population is below this value. The confidence interval can be adjusted to increase the amount of time allotted and to provide higher confidence the mean time of the population is captured.

6.3 Sensitivity Analysis

Sensitivity analysis of the confidence interval for the population means was conducted. The confidence interval was increased to 99% to understand the amount of variation within the interval given a certain confidence level. Table 8 shows the inspection time required with a

99% confidence level. Figure 11 and Figure 12 show the histograms of the Direct and Indirect Time with corresponding 99% CI.

Table 8. Inspection Time Required with 99% Confidence Intervals

Inspection Time Confidence Intervals				
Confidence Level (%)	99			
Z value	2.54			
Measure	***Mean***	***(+/-) Interval***	***Lower Limit (minutes)***	***Upper Limit (minutes)***
Direct Time	36.1	3.7	32.4	39.8
Indirect Time	21.9	2.1	19.8	24.0
Total Time	**58.0**	**5.8**	**52.2**	**63.8**

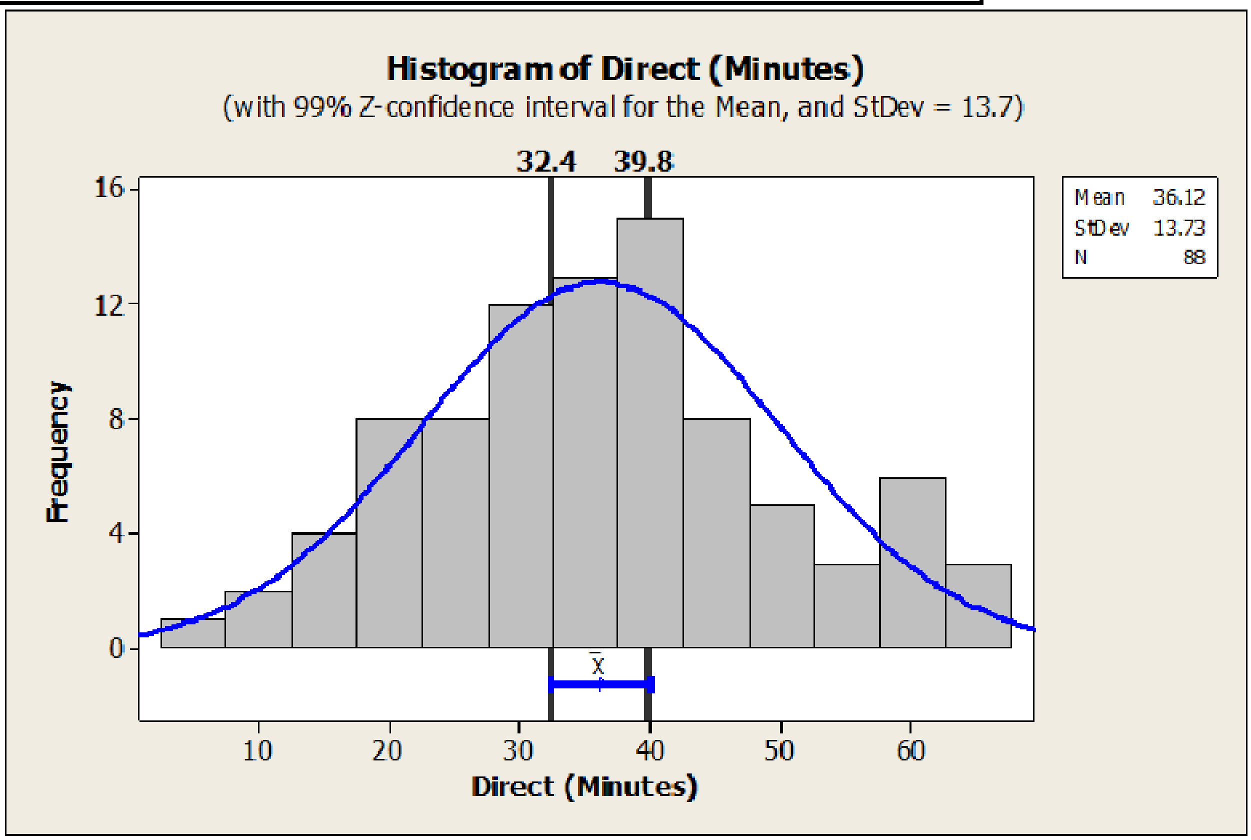

Figure 11. 99% Confidence Interval on Direct Time Mean

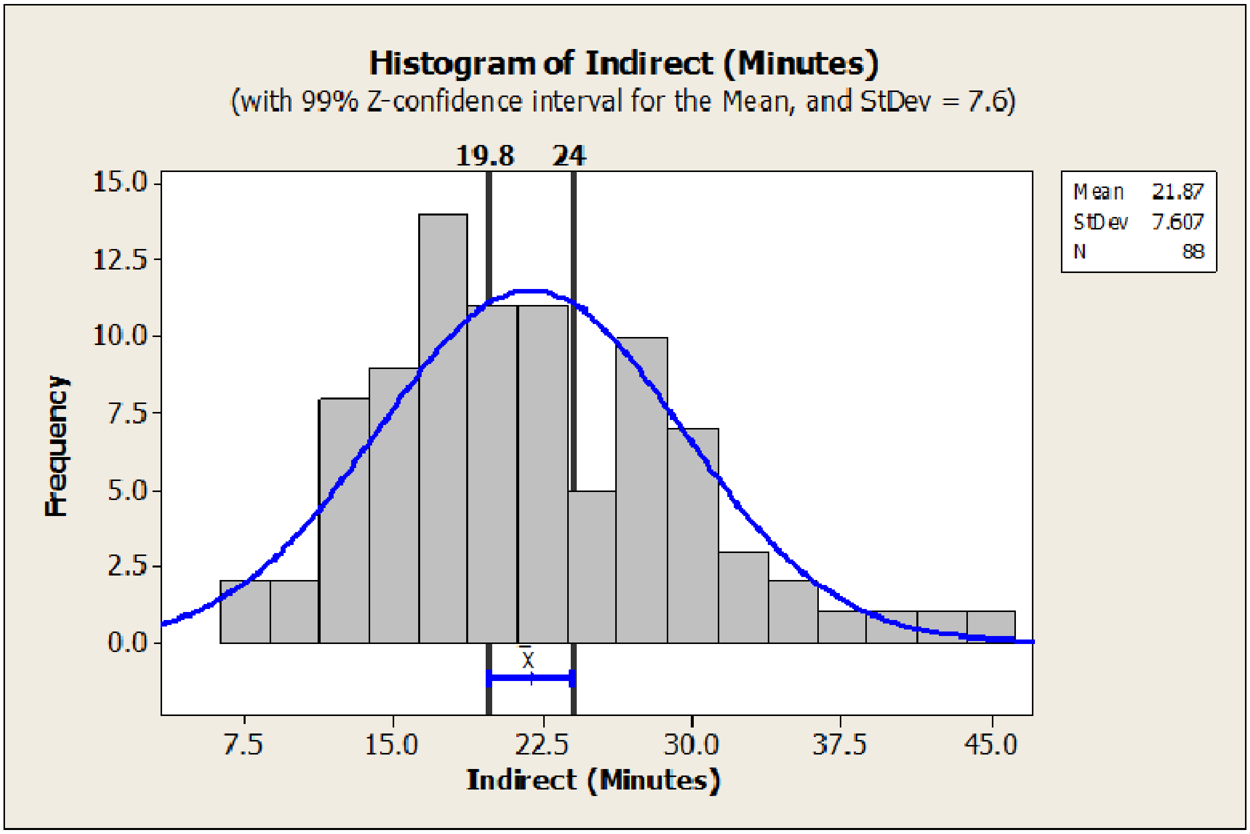

Figure 12. 99% Confidence Interval on Indirect Time Mean

The results illustrate the following:

- Direct Inspection Time Required: 99% CI → 32.4 – 39.8 minutes
- Indirect Inspection Time Required: 99% CI → 19.8 – 24.0 minutes
- Total Inspection Time Required: 99% CI → 52.2 – 63.8 minutes

The difference in times between 95% and 99% confidence intervals are very small. Table 9 shows the difference in inspection times for the different confidence intervals.

Table 9. Comparison of Confidence Intervals and Inspection Times

Inspection Time Confidence Intervals				
Measure	***Mean***	***95% CI(+/-)***	***99% CI (+/-)***	***Difference in CI***
Direct Time	36.1	2.9	3.7	0.8
Indirect Time	21.9	1.6	2.1	0.5
Total Time	**58.0**	**4.5**	**5.8**	**1.3**

The difference in the confidence interval between 95% and 99% is less than one minute for both direct and indirect time, and just over one minute for the total inspection time required. This result demonstrates that both the sample size and variance within these parameters are strong enough to have high confidence in the collection data. The data isn't very sensitive to differences in confidence levels or intervals when conducting overall population analysis.

6.4 Analysis of Individual Parameters vs. Inspection Time

The GMU team hypothesized that one or more of the following parameters might impact the inspection times:

- Plant Size vs. Inspection Time
- N=60 vs. 2lb Grab vs. Inspection Time
- Measurement Team Size vs. Inspection Time
- District vs. Inspection Time
- Connection Type vs. Inspection Time

These hypotheses are analyzed in the sections that follow.

6.4.1 Plant Size vs. Inspection Time

One hypothesis in this study was that the plant size might affect the amount of time needed for direct inspection activities. To test this hypothesis, the establishments were divided into three groups by size (square footage):

- Small: plant size <= 5,000 sq ft
- Medium: plant size > 5,000 sq ft, but <= 30,000 sq ft
- Large: plant size > 30,000 sq ft.

These groups were developed from the establishment profiles available for MT60 collection during the month of November 2013. The three groups provide a reasonable distribution among the establishments. FSIS had existing plant size data for 147 of the 170 establishments identified by FSIS as candidates for this study. Based on the above scales, 34% were considered

Small Plants, 38% were considered Medium Plants, and 28% were considered Large Plants. This breakdown provides a fairly even distribution of plant sizes for each bin.

Figure 13 illustrates a pie of the sizing analysis based on the 147 plants.

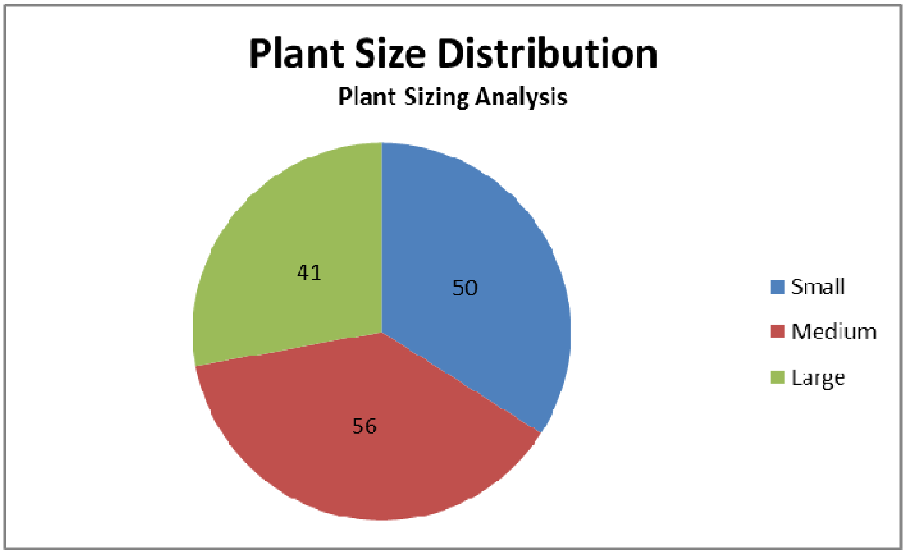

Figure 13. Plant Sizing Analysis

The sizes of the plants that provided DSCs were distributed very much like the 147 plants on the original candidate plant list. The data collection breakdown was as follows: 24- Small (27%), 29- Medium (33%), 33- Large (38%), 2-Not Reported (2%).

Figure 14 shows a pie chart of the plants for each bin that submitted DCSs used in the analysis.

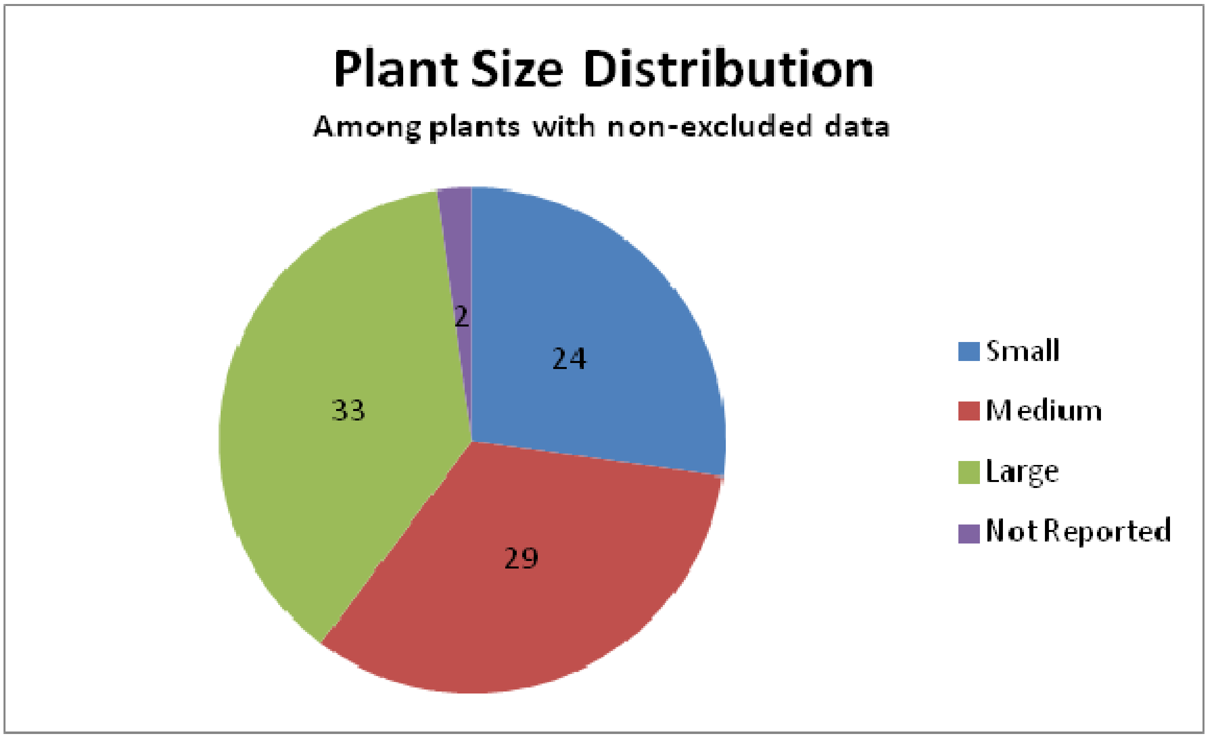

Figure 14. Plant Size Distribution

ANOVA permitted a comparison of the results of each sub-group against the results of the total data set.

6.4.1.1 Plant Size vs. Direct Time

For direct time, ANOVA showed that there was a very weak correlation between plant size and the amount of time needed to perform direct labor related to the MT60 sampling program. A boxplot of the data for each plant size is shown in Figure 15. The null hypothesis of small = medium = large for direct inspection time was tested. The results of the ANOVA analysis are shown in Table 10 and Table 11 and graphically displayed in Figure 16.

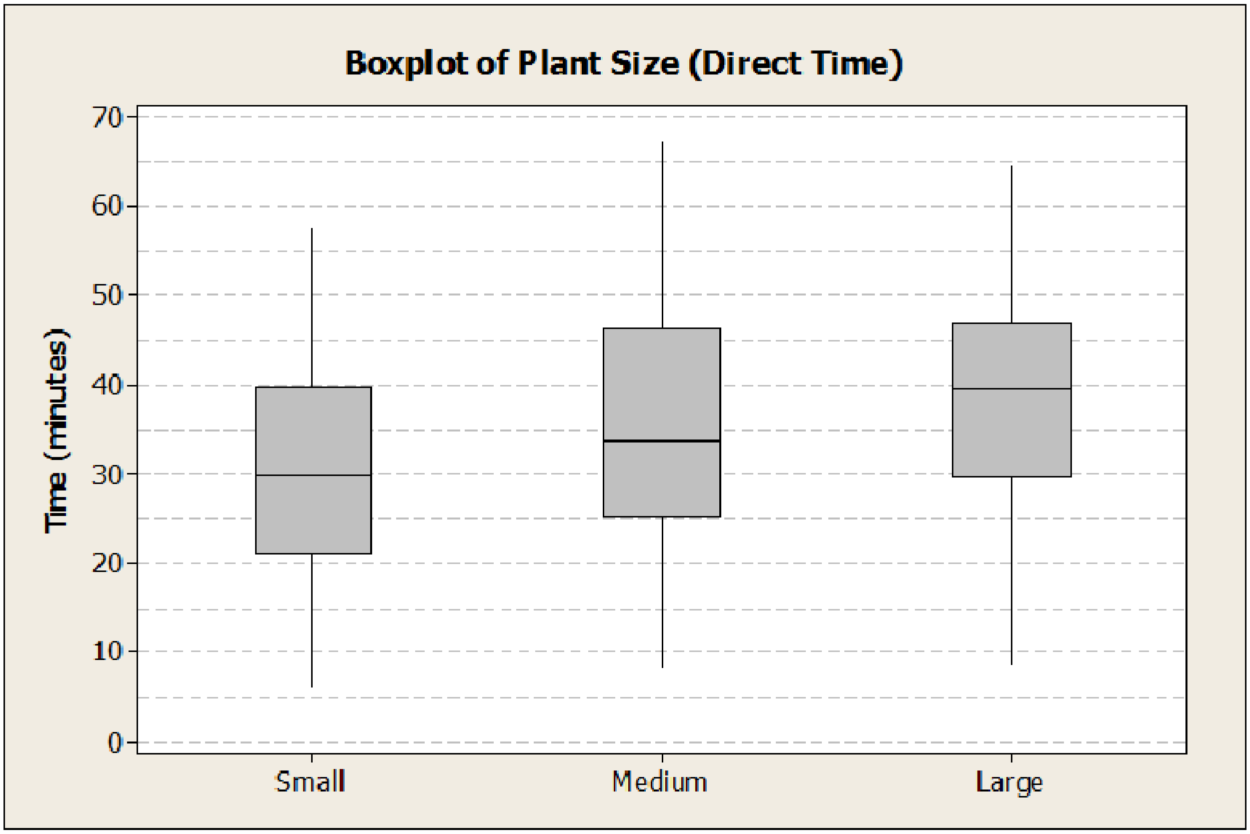

Figure 15. Boxplot by Plant Size (Direct Time)

Table 10. ANOVA Data Summary (Direct Time by Plant Size)

Summary				
Plant Size	***Count***	***Sum***	***Average***	***Variance***
Small	24	742.9	31.0	158.5
Medium	29	1055.1	36.4	222.2
Large	33	1312.8	39.8	159.5

Table 11. ANOVA Results (Direct Time by Plant Size)

ANOVA		
F	*P-value**	*F crit*
3.00	0.055	3.1

* P-value > 0.05 means there is **no correlation** between plant size and direct time.

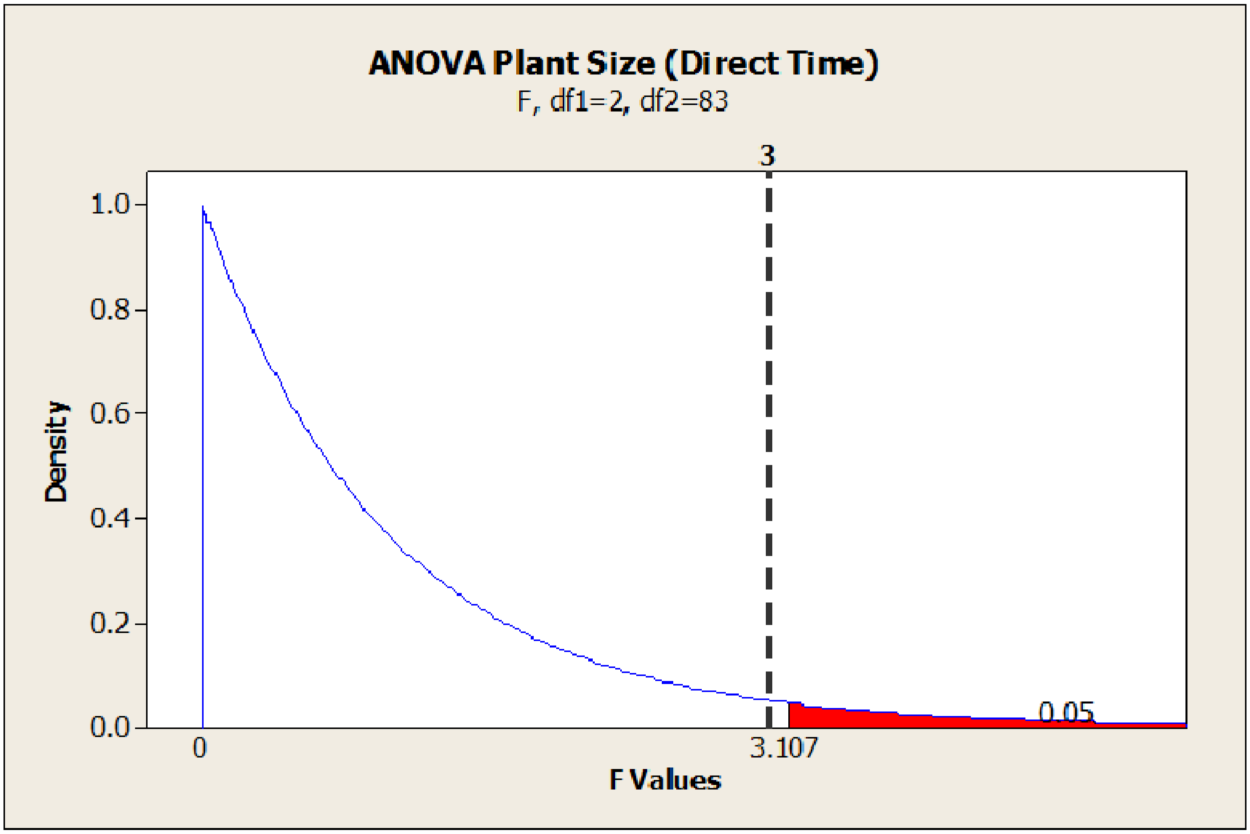

Figure 16. ANOVA Results for Direct Time

In Table 11 above, F is the ratio of the variance between the sub-groups and within the entire data set. The P-value is the likelihood of this ratio occurring naturally in a data set. A P-value of 0.05, or 5% is considered the cutoff point – a P-value below 5% means it is unlikely that the data would work out this way unless the factor being studied does in fact affect the results. Figure 16 plots the F value to demonstrate that the result of the ANOVA is accepting the null hypothesis of no difference between population means. For the direct labor analysis, the size of the plant has a very weak effect on the amount of time required to perform direct labor. However, the results are very close, meaning there is a weak statistical significance and a true interpretation of results is indeterminate.

6.4.1.2 Plant Size vs. Indirect Time

Similar to the ANOVA analysis performed for direct time, the effects of plant size on indirect time was also calculated. The null hypothesis of small = medium = large for indirect inspection time was tested. The results strongly indicate that plant size has no influence on the time needed to perform indirect tasks. Figure 17 shows the boxplots of the Indirect Time for each of plant sizes. Graphically, there appears to be no influence of plant size on the time required for indirect inspection. The results of the ANOVA are shown in Table 12 and Table 13, where the P-Value is very high, showing that it is unlikely that plant size impacts indirect time.

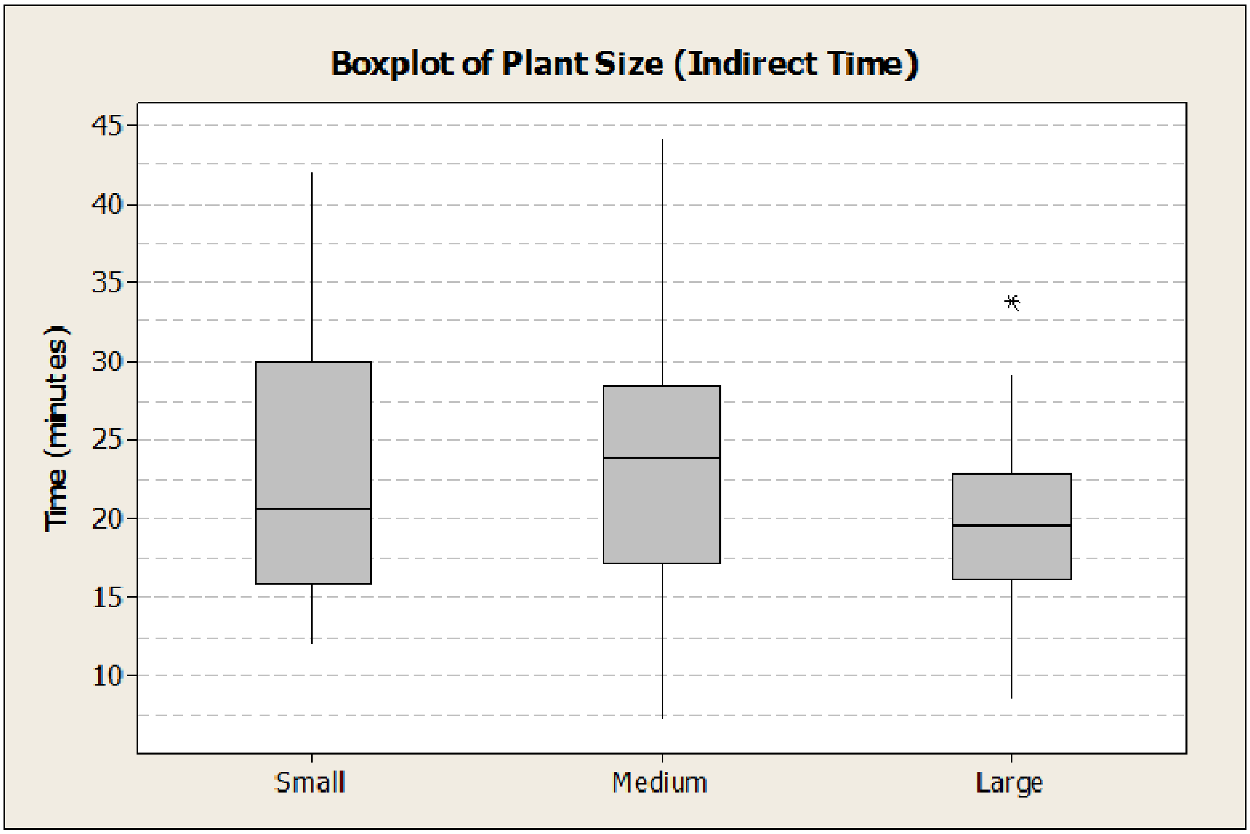

Figure 17. Boxplot by Plant Size (Indirect Time)

Table 12. ANOVA Data Summary (Indirect Time by Plant Size)

Summary				
Plant Size	*Count*	*Sum*	*Average*	*Variance*
Small	24.0	546.5	22.8	65.7
Medium	29.0	681.1	23.5	75.3
Large	33.0	658.2	19.9	33.6

Table 13. ANOVA Results (Indirect Time by Plant Size)

ANOVA		
F	*P-value**	*F crit*
1.92	0.15	3.11

* P-value > 0.05 means there is **no correlation** between plant size and indirect time.

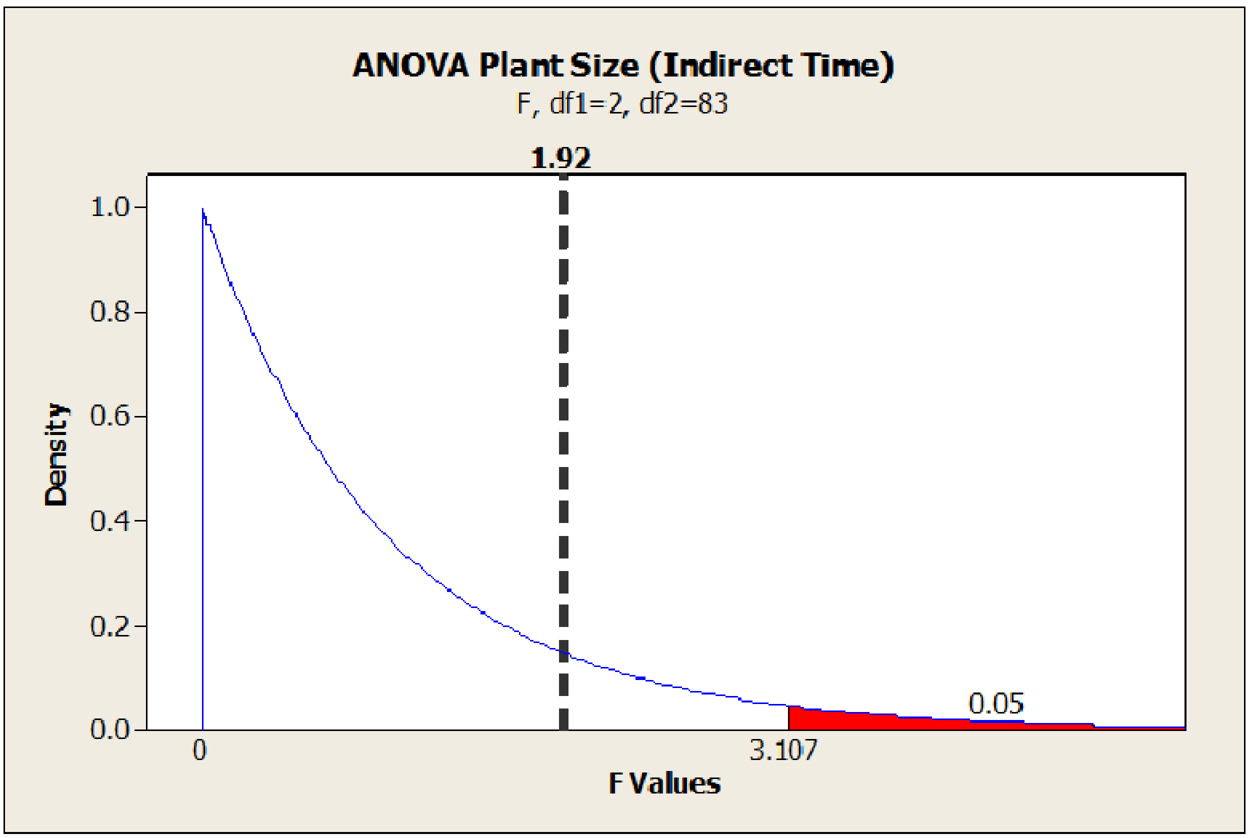

Figure 18. ANOVA Results for Indirect Time

Figure 18 illustrates there is no statistical correlation between plant size and indirect inspection time. The data samples for each population had very similar means and variances.

The results are clear and convincing from the ANOVA analysis that plant size does not affect indirect inspection time.

6.4.1.3 Plant Size vs. Individual Task Time

To identify differences in individual task durations across different plant sizes, Figure 19 shows the task durations for each task, by plant size. The durations for the individual tasks were found to be sufficiently similar across the plant sizes, leading to the conclusion that, on average, plant size does not affect the time it takes for the inspector to complete the individual tasks that make up the MT60 task. However, 3.f is part of direct inspection effort and the graphic shows approximately a 5 minute difference between large and small plants.

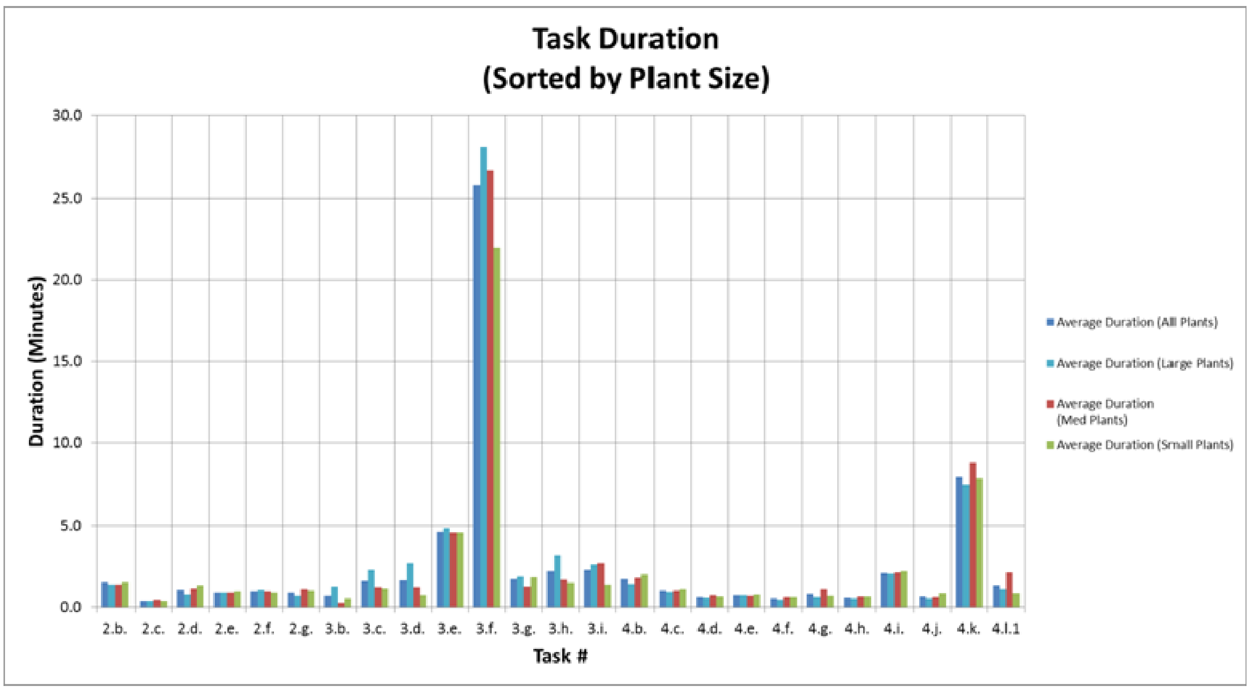

Figure 19. Task Durations by Plant Size

The amount of time spent on tasks 3.f (physically collecting the sample) and 4.k (obtain shipping materials and prep the samples for shipment) had the longest durations.

6.4.2 N=60 vs. 2lb Grab vs. Inspection Time

Most of the plants reporting data on the MT60 sampling program for this case study performed their sample collection using the N=60 sampling method. A small subset of the plants, however, used the 2lb Grab method. The breakdown is shown in Figure 20. The number of plants reporting data using the 2lb Grab method, 9, was considered sufficient for analysis of the differences between the two methods.

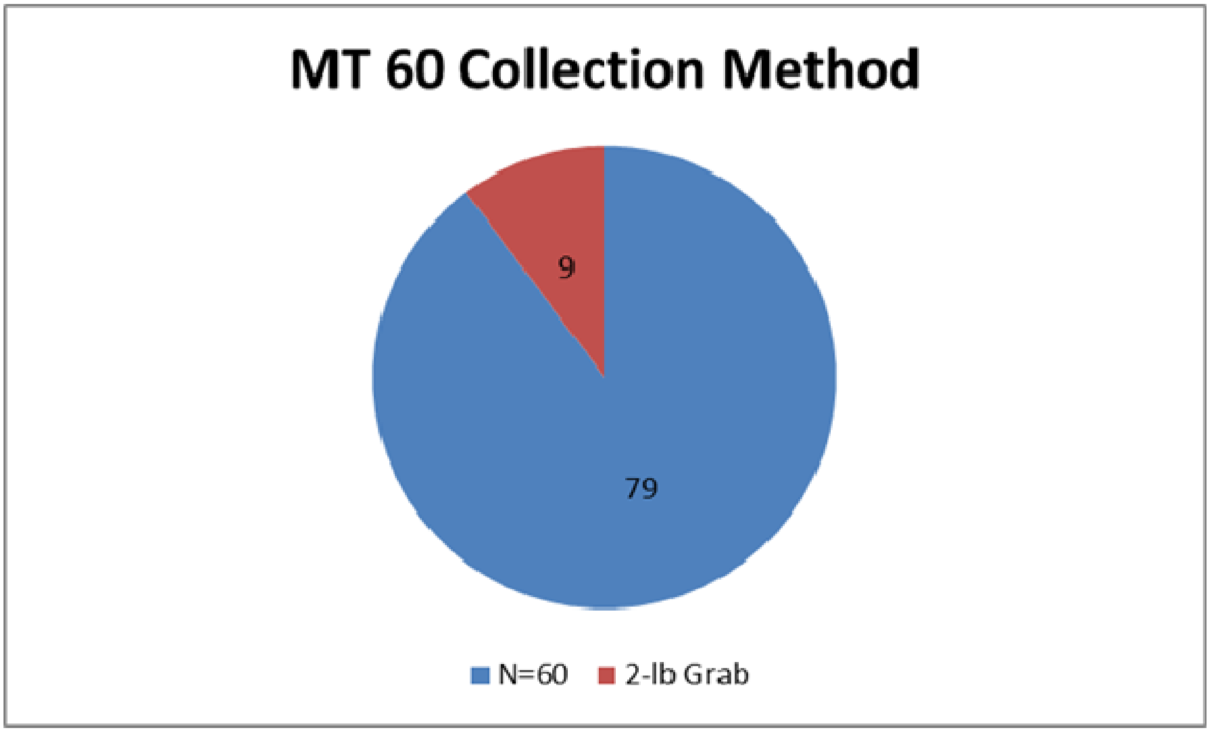

Figure 20. Sample Collection Method

A t-test was conducted to determine whether the times spent on indirect and direct inspection were statistically different between the N=60 and 2lb grab inspections. The null hypothesis for the test was that the means of the two populations are equal. Therefore the alternative to the null hypothesis is that the means of the two populations are not equal.

Table 14 contains the means, standard deviations (Std Dev), and sample sizes of the populations performing the 2lb Grab and the N=60 sampling methods.

Table 14. N=60 and 2lb Grab Population Statistics

	2lb Grab (Direct)	2lb Grab (Indirect)	N=60 (Direct)	N=60 (Indirect)
Mean	18.6	20.3	38.1	22.0
Std Dev	9.7	6.5	12.7	7.7
Sample Size	9.0	9.0	79.0	79.0

Figure 21 and Figure 22 show the boxplots of the two MT60 sampling methods for direct and indirect inspection times.

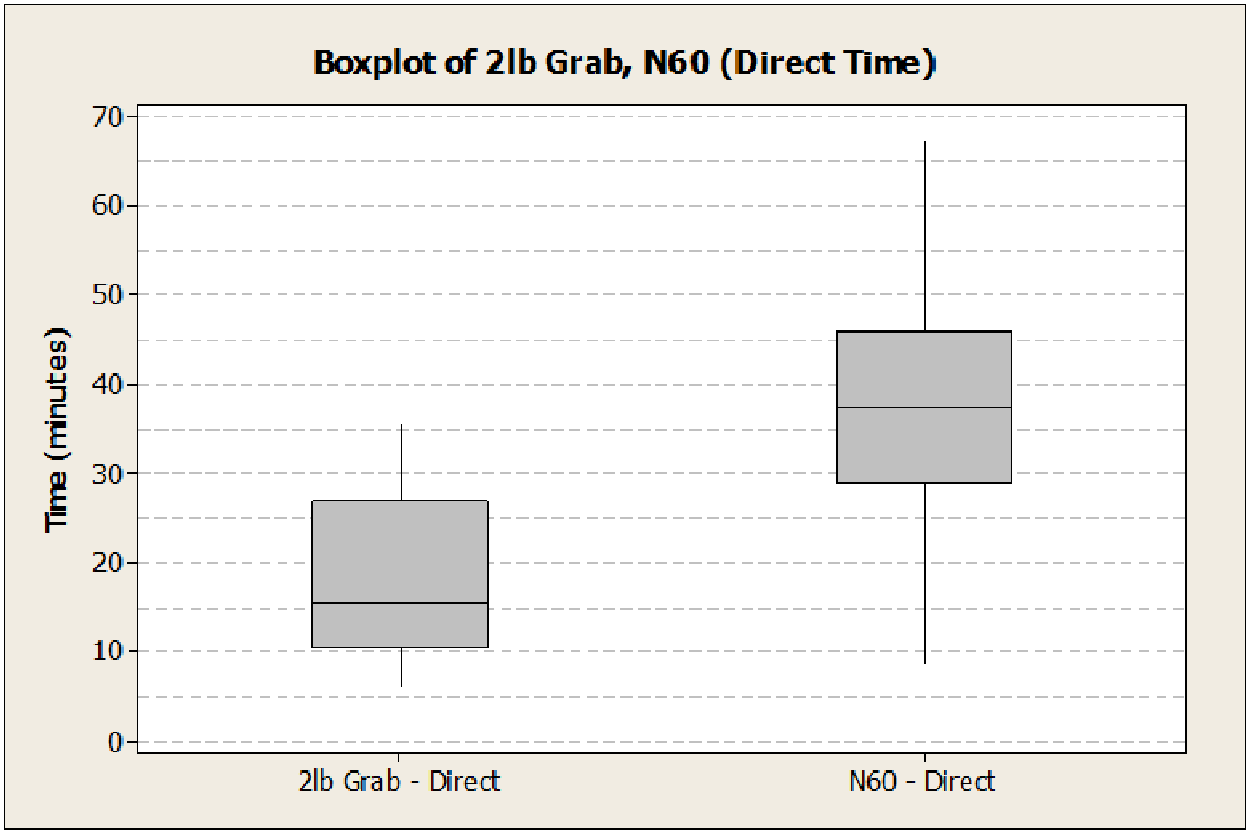

Figure 21. Boxplot of MT60 Collection Methods (Direct Time)

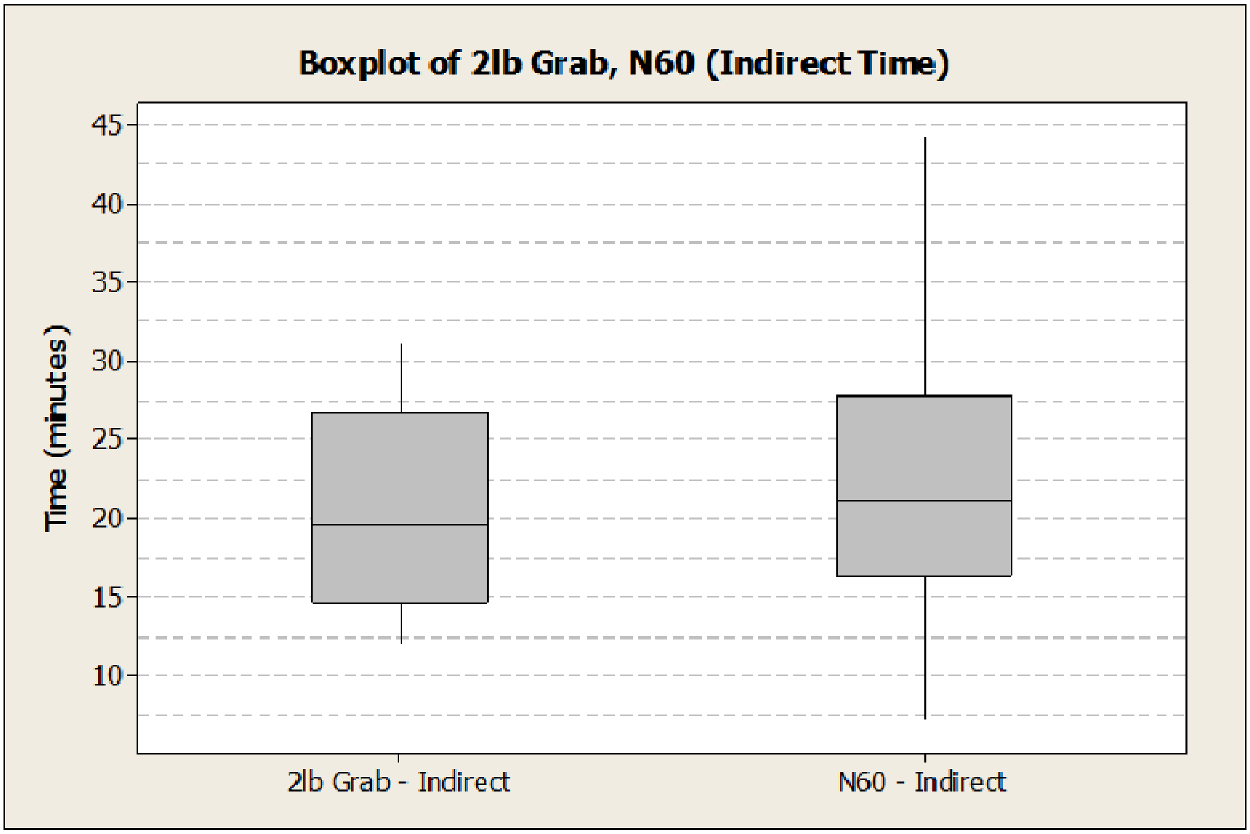

Figure 22. Boxplot of MT60 Collection Methods (Indirect Time)

Based on the data in Table 14, the t-test was conducted on the direct and indirect time. Table 15 and Table 16 show the results. Figure 23 graphically displays the results of the t-test.

Table 15. T-Test Results (Direct Time for N=60 vs. 2lb Grab)

Direct Time			
***Null Hypothesis:* N=60 = 2lb Grab**			
N=60		***2lb Grab***	
Mean	38.1	Mean	18.6
Standard Deviation	12.7	Standard Deviation	9.7
Sample Size	79.0	Sample Size	9.0

t-Test	
df	11
alpha	0.05
t-value calculated	5.528
t-value critical	2.20
Results: Reject	

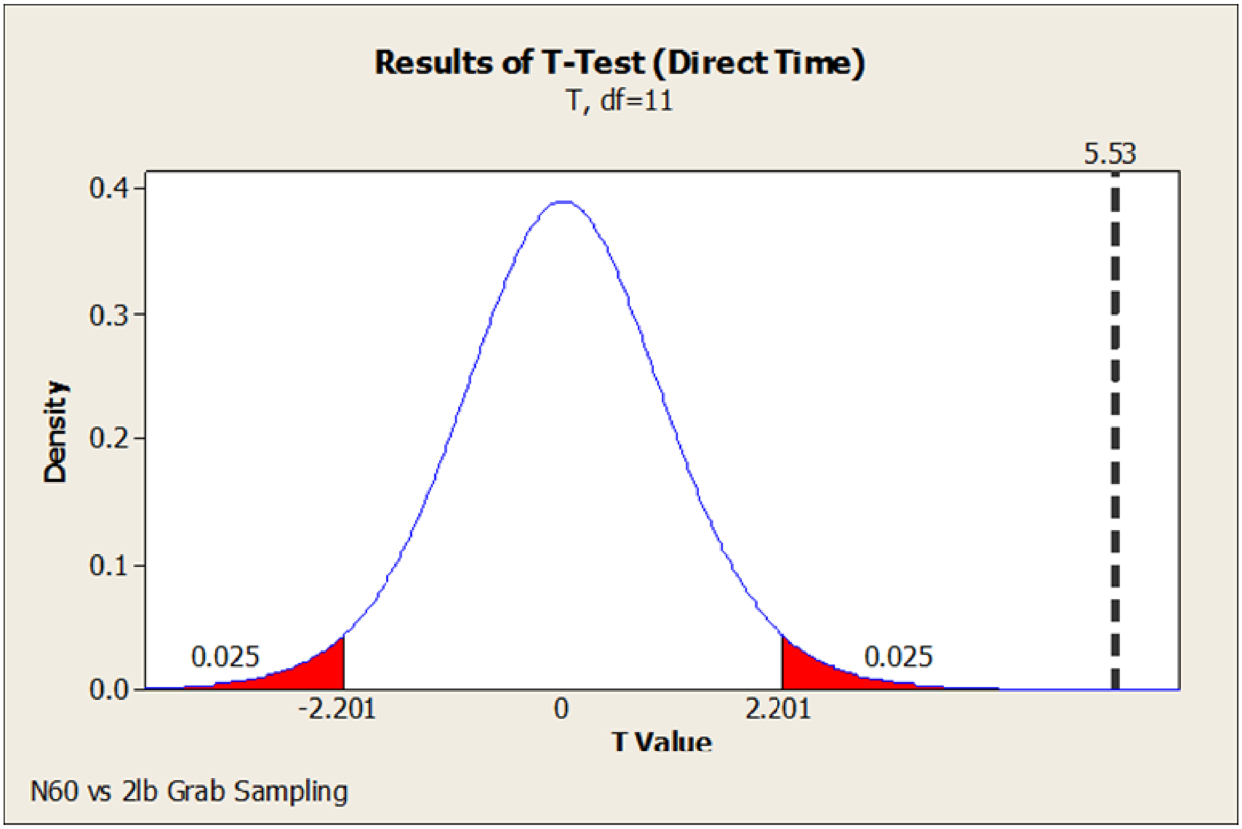

Figure 23. T-Test for N=60 vs 2lb Grab (Direct Time)

Figure 23 shows the results of the t-test are for rejection of the null hypothesis. The rejection of the null hypothesis demonstrates that the means of the two populations for direct inspection time are statistically different. Therefore the sampling method does impact the mean time required for the direct inspection task. This result is expected since the 2lb Grab method requires less precision than the N=60 method.

The t-test is conducted on the indirect inspection time for the sampling methods. Table 16 was used to populate the required parameters for the t-test and shows the results of the t-test for the indirect time required for the N60 and 2lb grab sampling methods.

Table 16. T-Test Results (Indirect Time for N=60 vs. 2lb Grab)

Indirect Time			
Null Hypothesis: **N=60 = 2lb Grab**			
N=60		***2lb Grab***	
Mean	22.0	Mean	20.3
Standard Deviation	7.7	Standard Deviation	6.5
Sample Size	79.0	Sample Size	9.0

t-Test	
df	10
alpha	0.05
t-value calculated	0.737
t-value critical	2.228
Results: Accept	

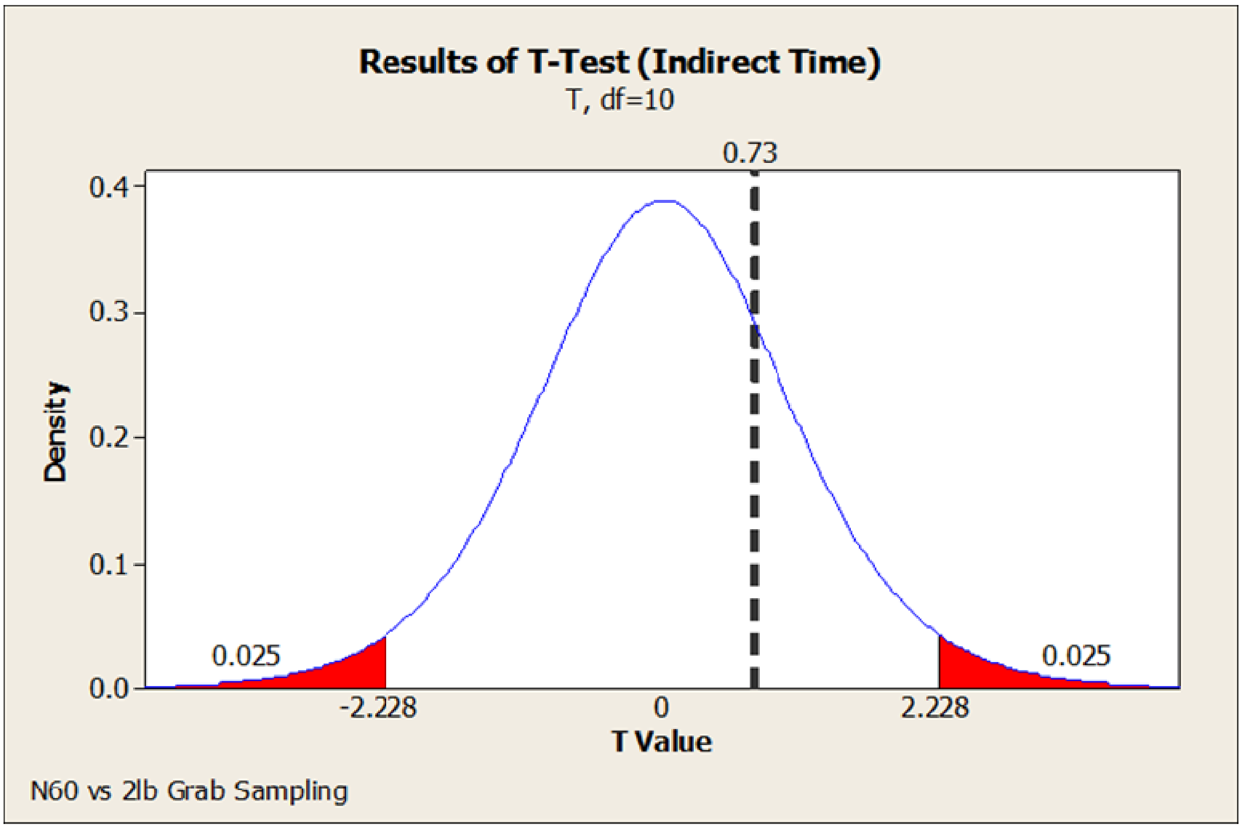

Figure 24. T-Test for N=60 vs 2lb Grab (Indirect Time)

Figure 24 illustrates the results of the t-test and shows that the null hypothesis is not rejected (accepted). The acceptance of the null hypothesis dictates that there is not enough difference between the two population means to state that they are different in a statistically significant way. This indicates that the sampling method does not impact the mean time required to conduct the indirect inspection tasking.

6.4.3 Measurement Team Size vs. Inspection Time

In some cases, plants had a single person performing the MT60 procedure and simultaneously capturing the associated work measurement data. To determine whether this had an impact on the Indirect Multiplier, the data was sorted by the team size from largest (2 people) to smallest (1 person) and a t-test analysis was performed. Table 17 illustrates the descriptive statistics for both the 2 person and 1 person teams.

Table 17. Measurement Team Size Statistics

		2-Person	1-Person
Direct	Mean	35.8	41.0
	Std Dev	14.0	8.8
Indirect	Mean	21.9	21.9
	Std Dev	7.4	10.7
Sample Size		82.0	6.0

The breakdown of team size is shown in Figure 25.

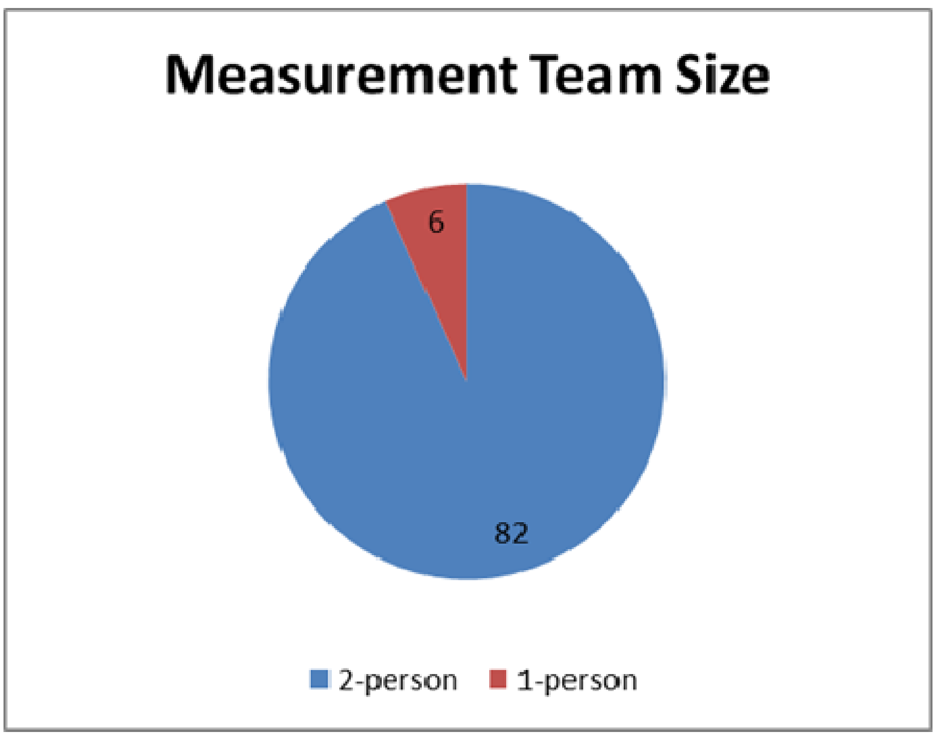

Figure 25. Measurement Team Size

Using the descriptive statistics from Table 17, a t-test analysis was performed for direct and indirect inspection times. Boxplots for the data collection teams for direct and indirect inspection times are shown in Figure 26 and Figure 27. Due to the limited sample size of 1 person collection teams, normality was explicitly tested to ensure the validity of the t-test. This test was conducted to determine whether the data is in fact normally distributed. The results of the normality test are shown in Figure 28 and Figure 29. The data samples pass the test of normality with 95% confidence. The results of the t-test analysis are shown in Table 18 and Table 19.

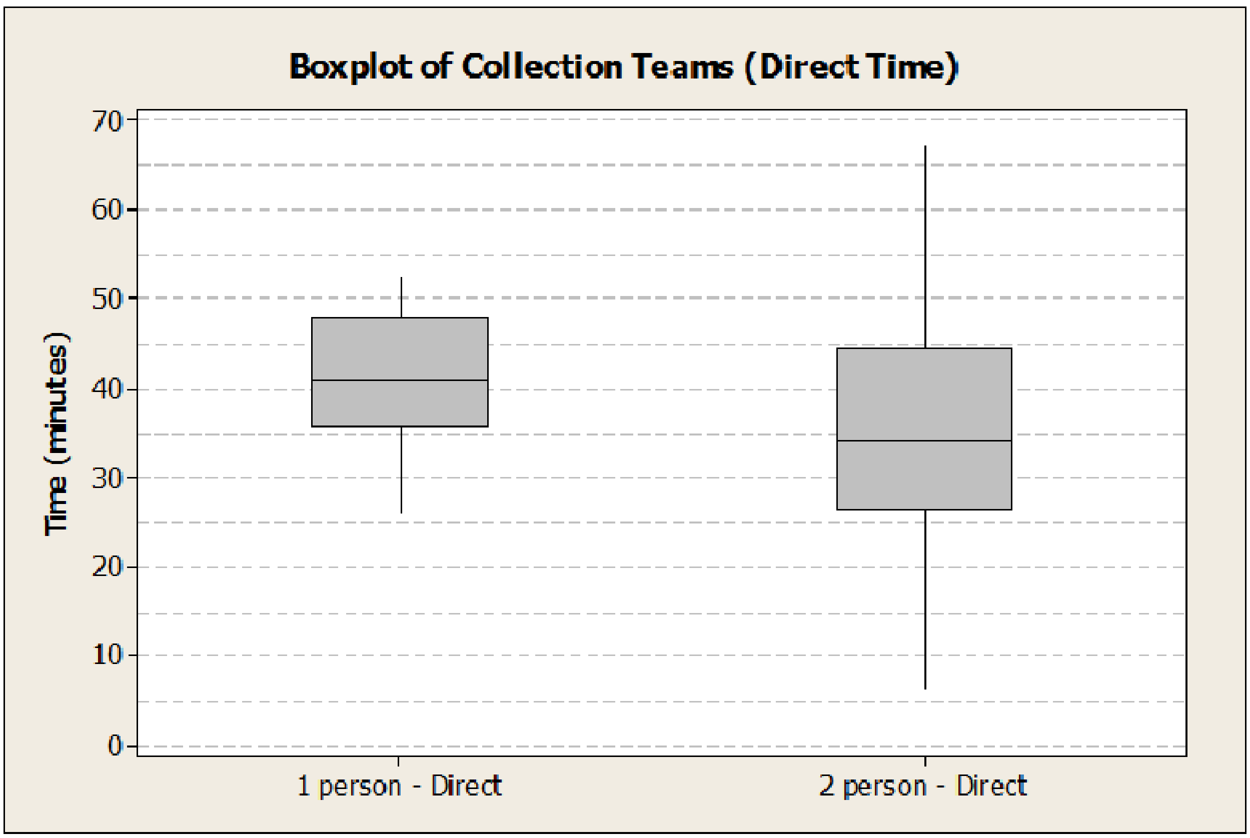

Figure 26. Boxplot of Collection Team Size (Direct Time)

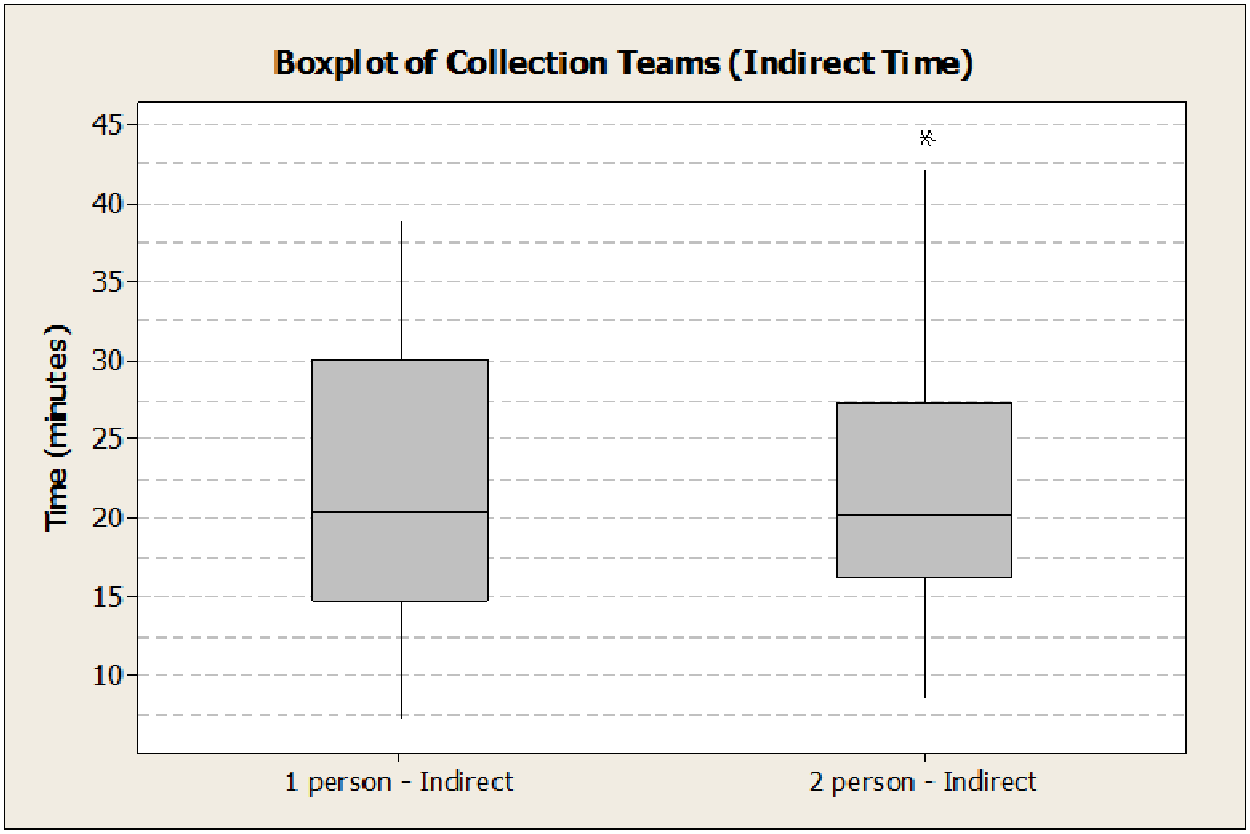

Figure 27. Boxplot of Collection Team Size (Indirect Time)

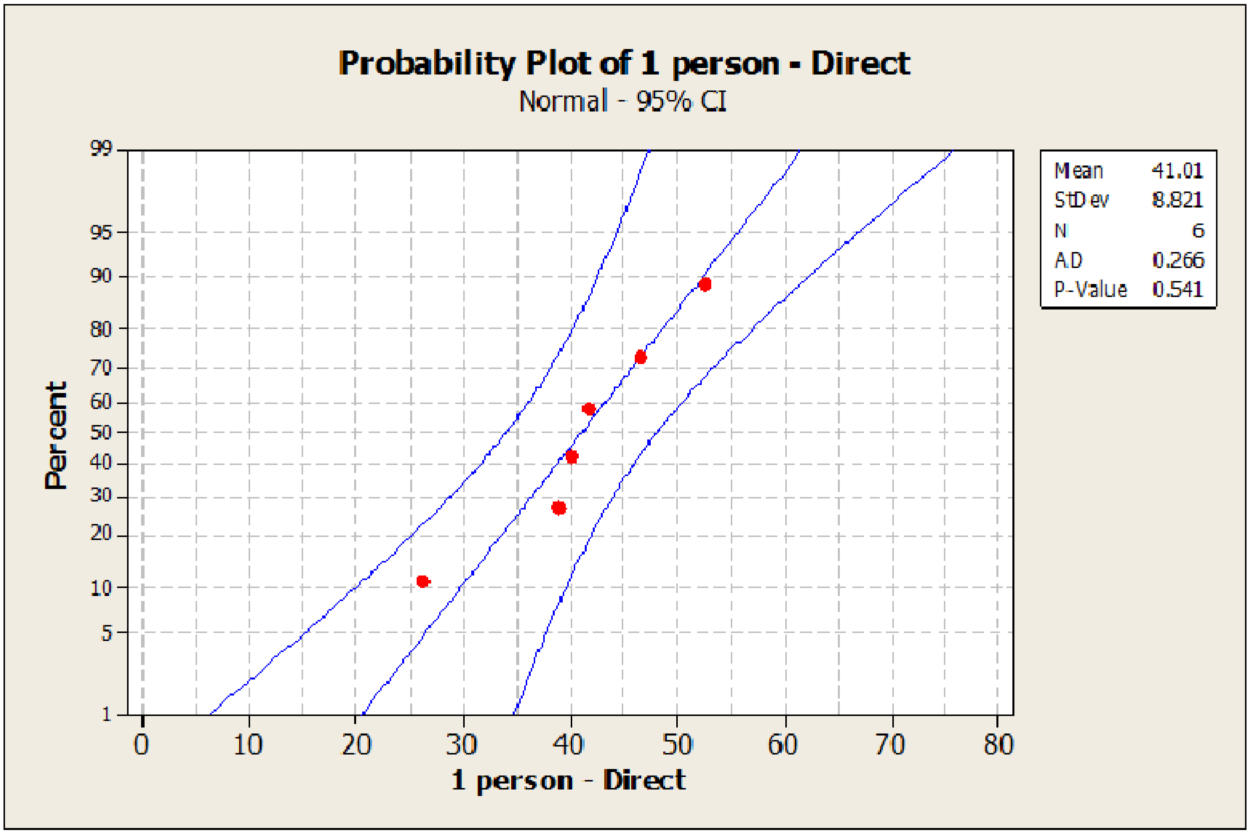

Figure 28. Normality Test for 1 person Collection Team (Direct Time)

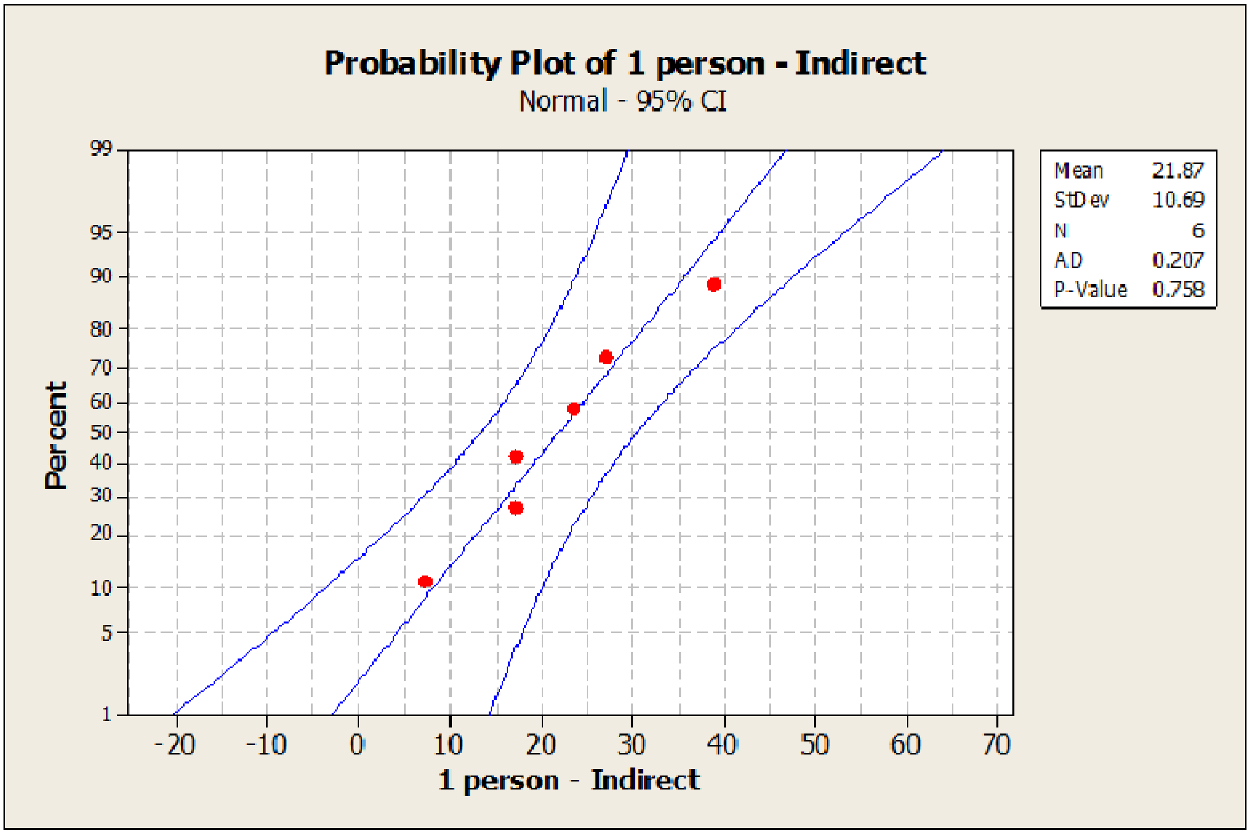

Figure 29. Normality Test for 1 person Collection Team (Indirect Time)

Table 18. T-Test Results (Direct Time for 1-Person vs. 2-Person Teams)

Direct Time			
***Null Hypothesis:* 1-Person Team = 2-Person Team**			
1-Person		***2-Person***	
Mean	41.0	Mean	35.8
Standard Deviation	8.8	Standard Deviation	14.0
Sample Size	6.0	Sample Size	82.0

t-Test	
df	6
alpha	0.050
t-value calculated	1.339
t-value critical	2.447
Results: Accept	

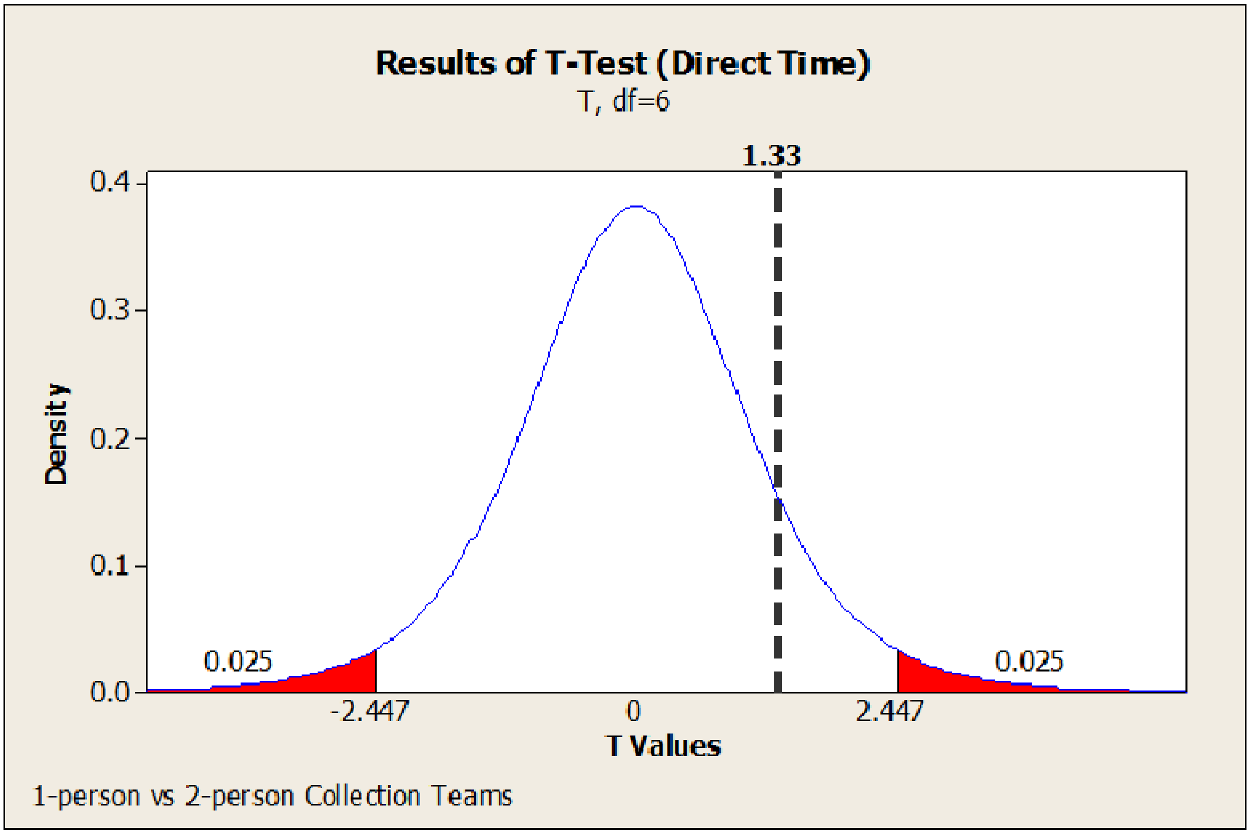

Figure 30. T-Test Results for Collection Team Size (Direct Time)

Figure 30 shows that the null hypothesis is accepted. The difference in team size did not change the mean time required for the direct inspection time in a statistically significant way. This is an interesting and perhaps a very important result for the FSIS. From this test, the requirement for 2 person teams for data collection versus 1 person is not necessarily valid for data integrity. This can potentially reduce the required resources for future work measurement data collections. However, due to the limited sample size of the 1 person collection teams, ***further sampling and analysis is recommended***.

Table 19. T-Test Results (Indirect Time for 1-Person vs. 2-Person Teams)

Indirect Time			
Null Hypothesis: **1-Person Team = 2-Person Team**			
1-Person		***2-Person***	
Mean	21.9	Mean	21.9
Standard Deviation	10.7	Standard Deviation	7.4
Sample Size	6.0	Sample Size	82.0

t-Test	
df	5.0
alpha	0.050
t-value calculated	0.00
t-value critical	2.571
Results: Accept	

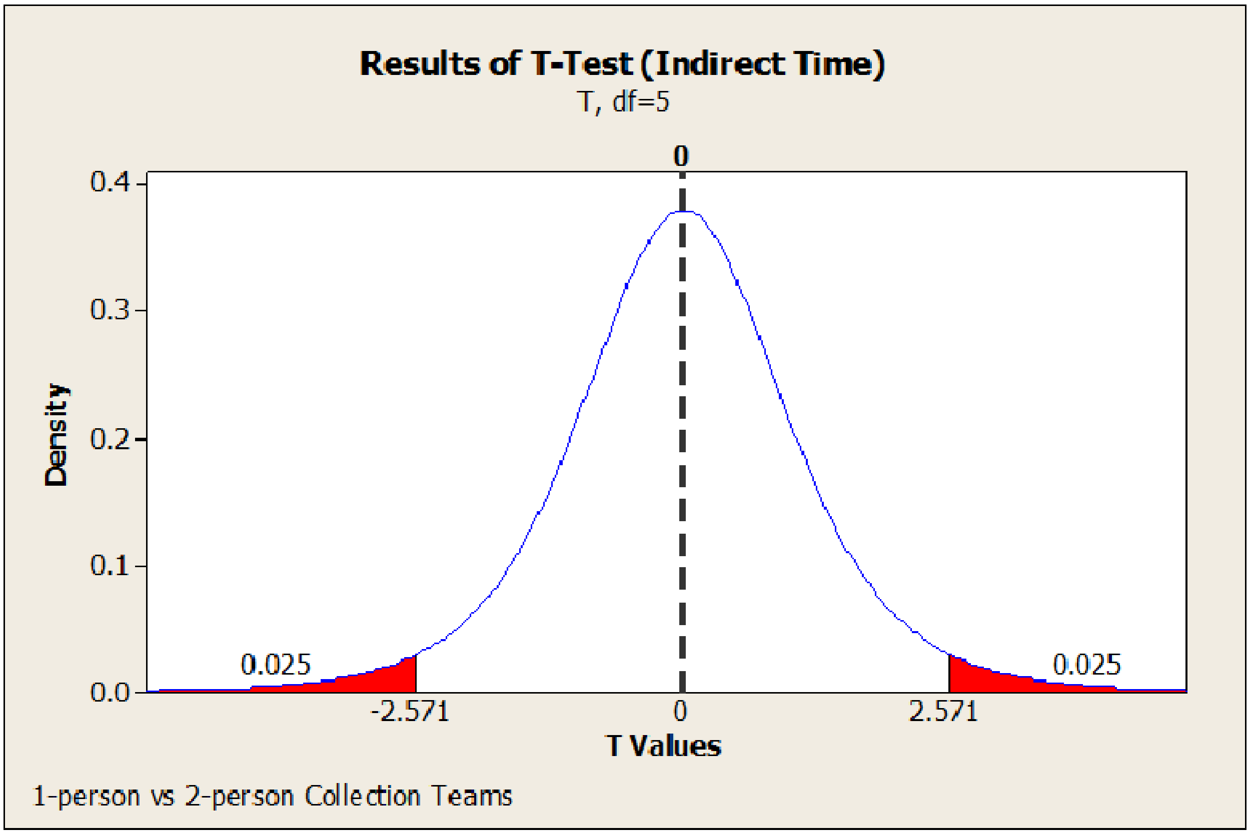

Figure 31. T-Test Results for Collection Team Size (Indirect Time)

Figure 31 illustrates that the null hypothesis is accepted. The difference in team size did not change the mean time required for the indirect inspection time in a statistically significant way. Again, this is perhaps a very important result for the FSIS. From this test, the requirement for 2 person teams for data collection versus 1 person is not necessarily valid for data integrity. Therefore, FSIS could potentially reduce the required resources for future work measurement data collections. Again, due to the limited sample size of the 1 person collection teams, ***further data collection and analysis is recommended***.

6.4.4 District vs. Inspection Time

To determine whether the direct times and indirect times were different across districts, an ANOVA analysis was performed. Boxplots for district inspection times are illustrated in Figure 32 and Figure 34. The data summary and results of the ANOVA analyses for direct time and indirect time are shown in Table 20, Table 21, Table 22, and Table 23.

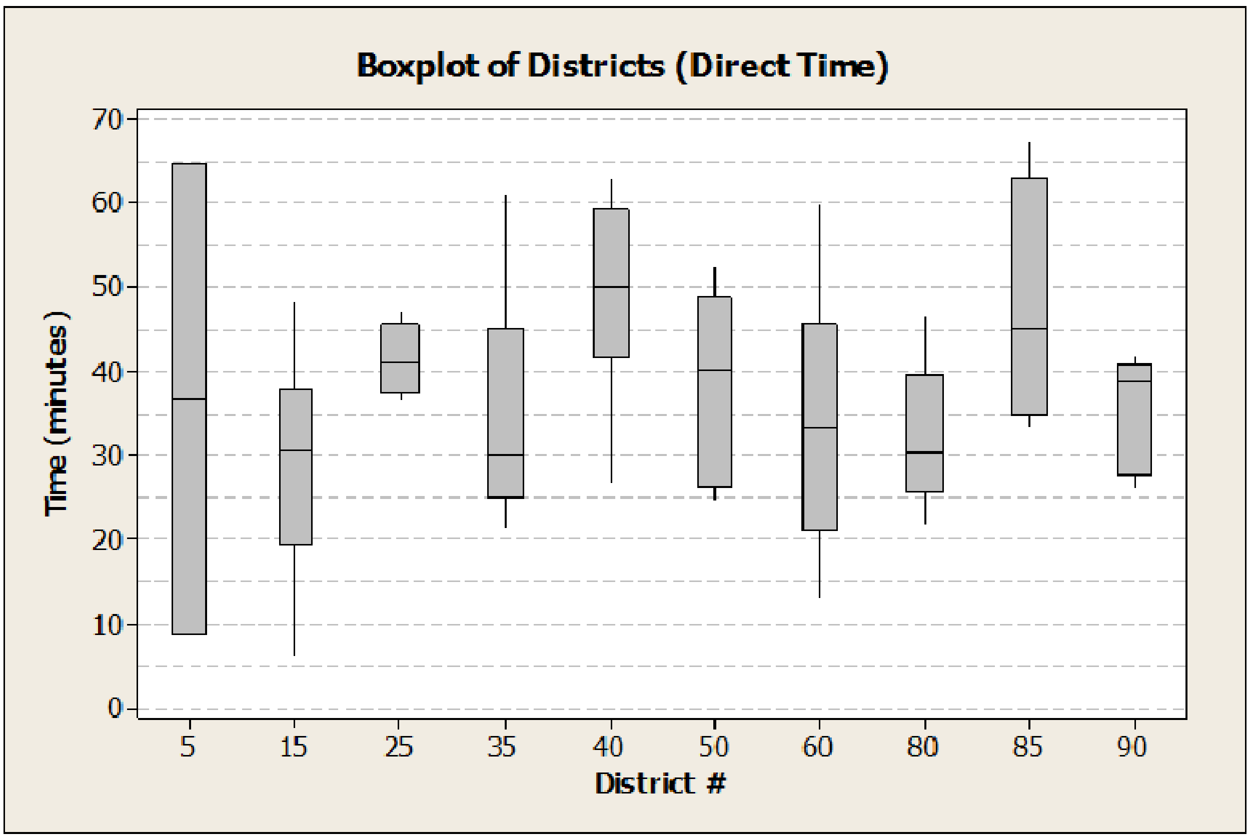

Figure 32. Boxplot of Direct Time per District

Table 20. ANOVA Data Summary (Direct Time by Districts)

Summary				
District	***Count***	***Sum***	***Average***	***Variance***
5	2	70	35.2	1316
15	26	793	30.5	102
25	4	166	41.6	12
35	9	315	35.0	174
40	12	572	47.7	118
50	5	187	37.5	108
60	16	545	34.1	207
80	5	157	31.4	77
85	4	194	48.5	253
90	5	176	35.3	50

Table 21. ANOVA Results (Direct Time by Districts)

ANOVA		
F	*P-value**	*F crit*
2.62	0.010	2.002

* P-value < 0.05 means there **is a correlation** between district and direct time.

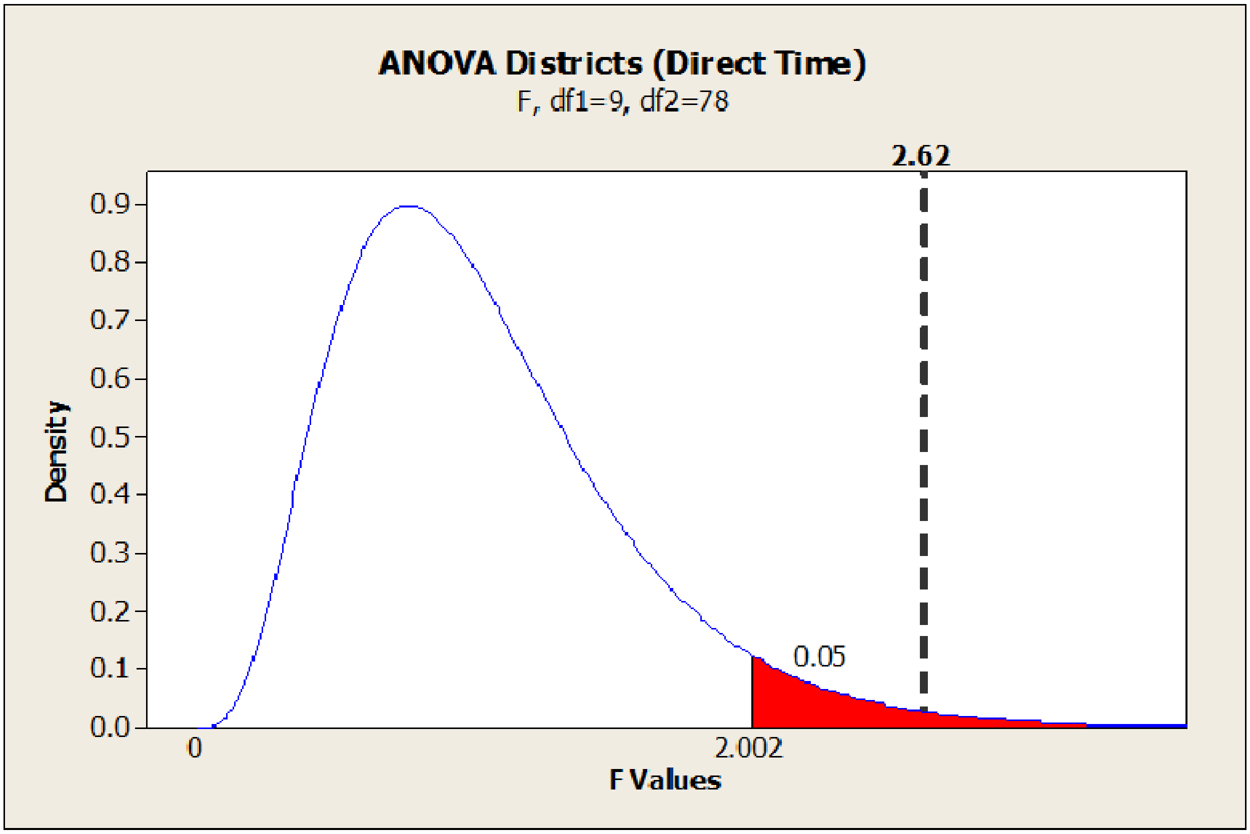

Figure 33. ANOVA Results for Districts (Direct Time)

The results of the direct time ANOVA analysis show a p-value of 0.01 which is less than 0.05, indicating that there is a statistically significant difference between the districts and the average time required for the direct time inspections. This reasoning for the differences across districts was not investigated. However, there are several factors that should be considered when analyzing the root cause of this discrepancy. The districts could have different training methods, plant specific challenges within certain regions, or different frequencies for the inspection resulting in longer times due to inspector learning curves. These are just a few factors that might contribute to the differences in the direct inspection times. Additional sample collection and analysis is recommended due to the limited sample sizes for several districts.

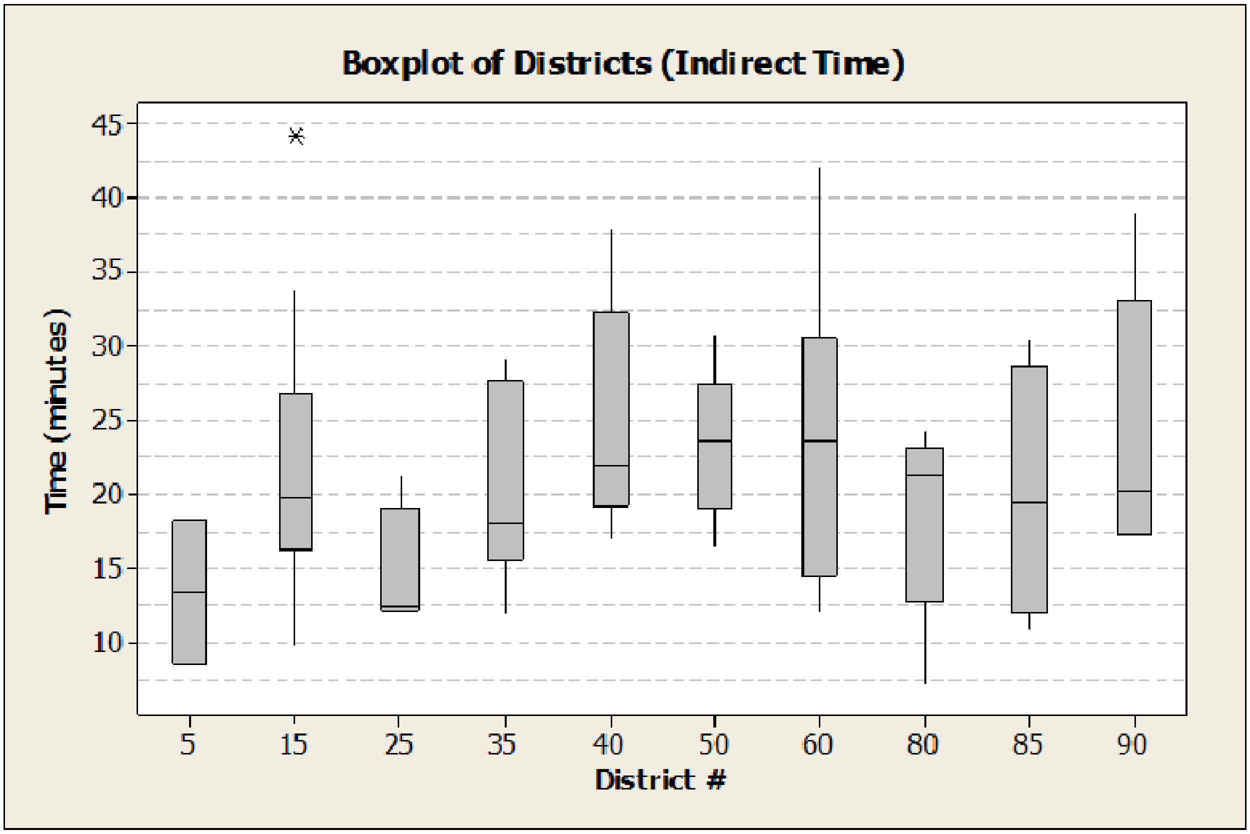

Figure 34. Boxplot of Indirect Time per District

Table 22. ANOVA Data Summary (Indirect Time by Districts)

Summary				
District	*Count*	*Sum*	*Average*	*Variance*
5	2	27	13.4	46.1
15	26	567	21.8	53.6
25	4	58	14.5	20.3
35	9	190	21.1	43.4
40	12	296	24.7	53.3
50	5	117	23.3	26.4
60	16	377	23.6	79.8
80	5	93	18.6	44.2
85	4	80	20.0	76.4
90	5	121	24.1	83.5

Table 23. ANOVA Results (Indirect Time by Districts)

ANOVA		
F	*P-value**	*F crit*
1.19	0.309	2.002

* P-value > 0.05 means there is **no correlation** between district and indirect time.

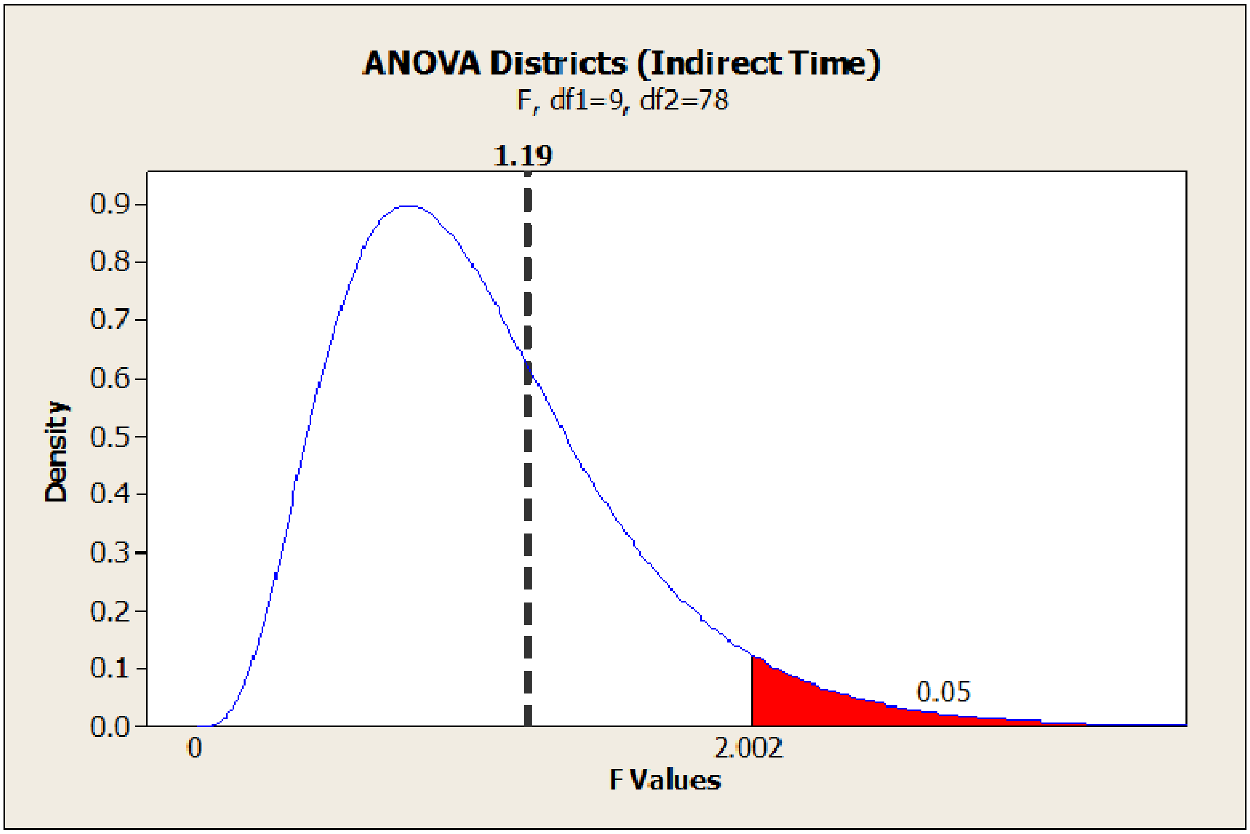

Figure 35. ANOVA Results for Districts (Indirect Time)

The p-value resulting from the indirect time ANOVA analysis is 0.309, which is greater than 0.05, indicating that there is no correlation between district and indirect inspection time. Figure 35 graphically displays the results, which indicate that the null hypothesis is accepted. This result is expected because the work done on the computer shouldn't be affected by any direct inspection time challenges.

6.4.5 Connection Type vs. Inspection Time

As part of the MT60 process, the inspector interacts with PHIS. This interaction occurs via network connection (T1, EVDO, DSL, or WiFi). Figure 36 illustrates the boxplot of collected data for direct time. Figure 38 illustrates the boxplot of collected data for the indirect time. To determine whether the direct times and indirect times were different across connection types, an ANOVA analysis was performed. The data summary and results of the ANOVA analyses for direct time and indirect time are shown in Table 24, Table 25, Table 26, and Table 27.

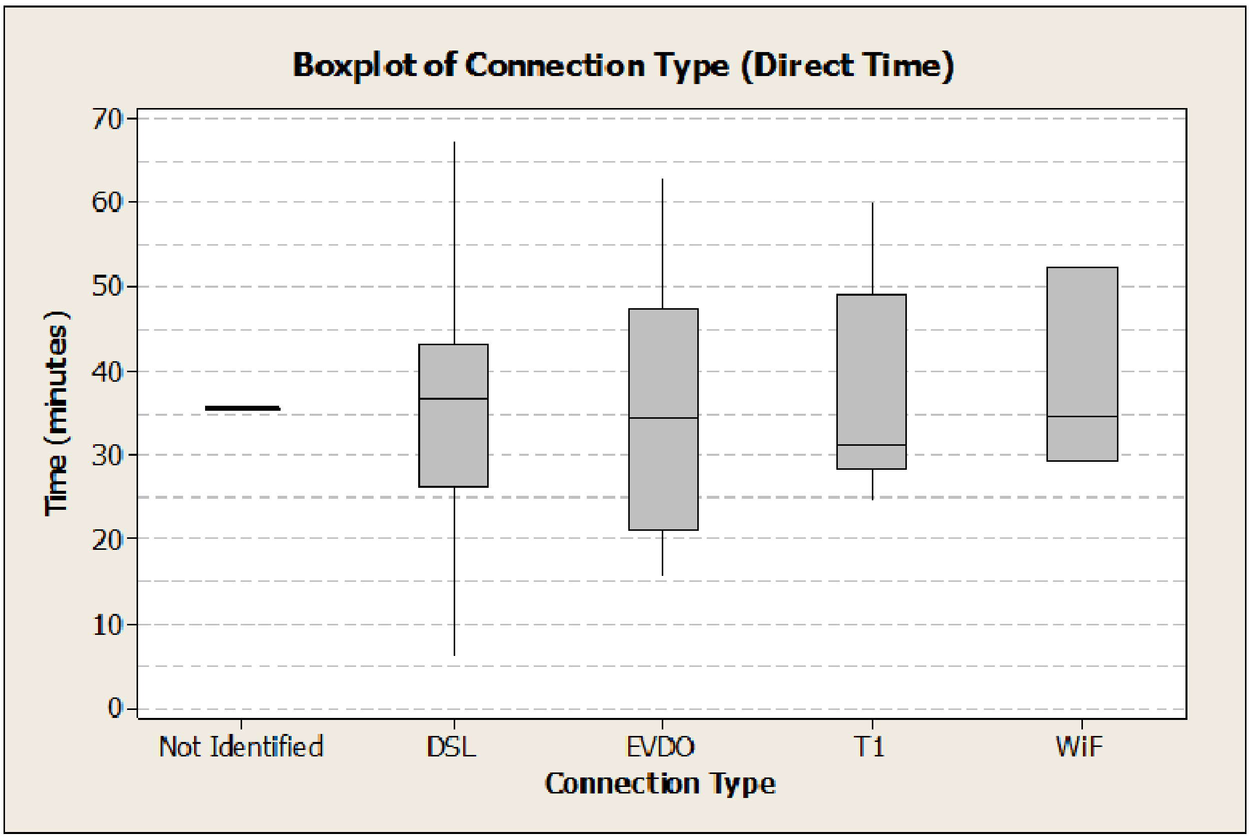

Figure 36. Boxplot of Connection Type for Direct Time

Table 24. ANOVA Data Summary (Direct Time by Connection Type)

Summary				
Connection Type	***Count***	***Sum***	***Average***	***Variance***
Not Identified	2	71	35.6	0.02
DSL	59	2112	35.8	192
EVDO	16	583	36.5	251
T1	8	295	36.9	164
WiFi	3	117	38.9	147

Table 25. ANOVA Results (Direct Time by Connection Type)

ANOVA		
F	*P-value**	*F crit*
0.046	0.995	2.483

* P-value > 0.05 means there is **no correlation** between connection type and direct time.

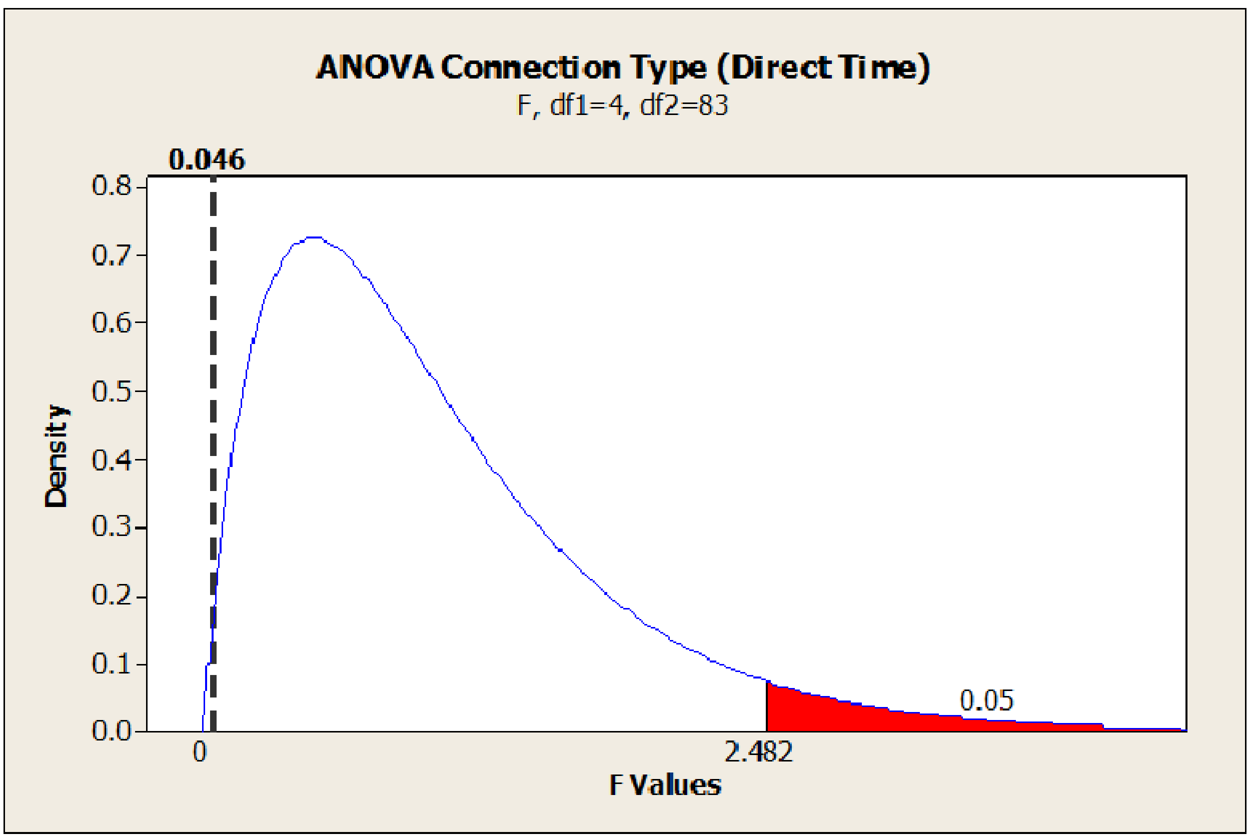

Figure 37. ANOVA Results for Connection Type (Direct Time)

Figure 37 shows the results of the ANOVA analysis based on connection type for direct time. The results show a p-value of 0.995, which is greater than 0.05, and an F-value of 0.046, which is less than the F-critical value resulting in the acceptance of the null hypothesis. This result indicates that the connection type (DSL, EVDO, T1, WiFi) does not have a statistically significant effect on the direct inspection time. These results are expected, since the direct inspection is conducted offline and the type of connection should not be a factor in the overall time required to conduct the direct inspection.

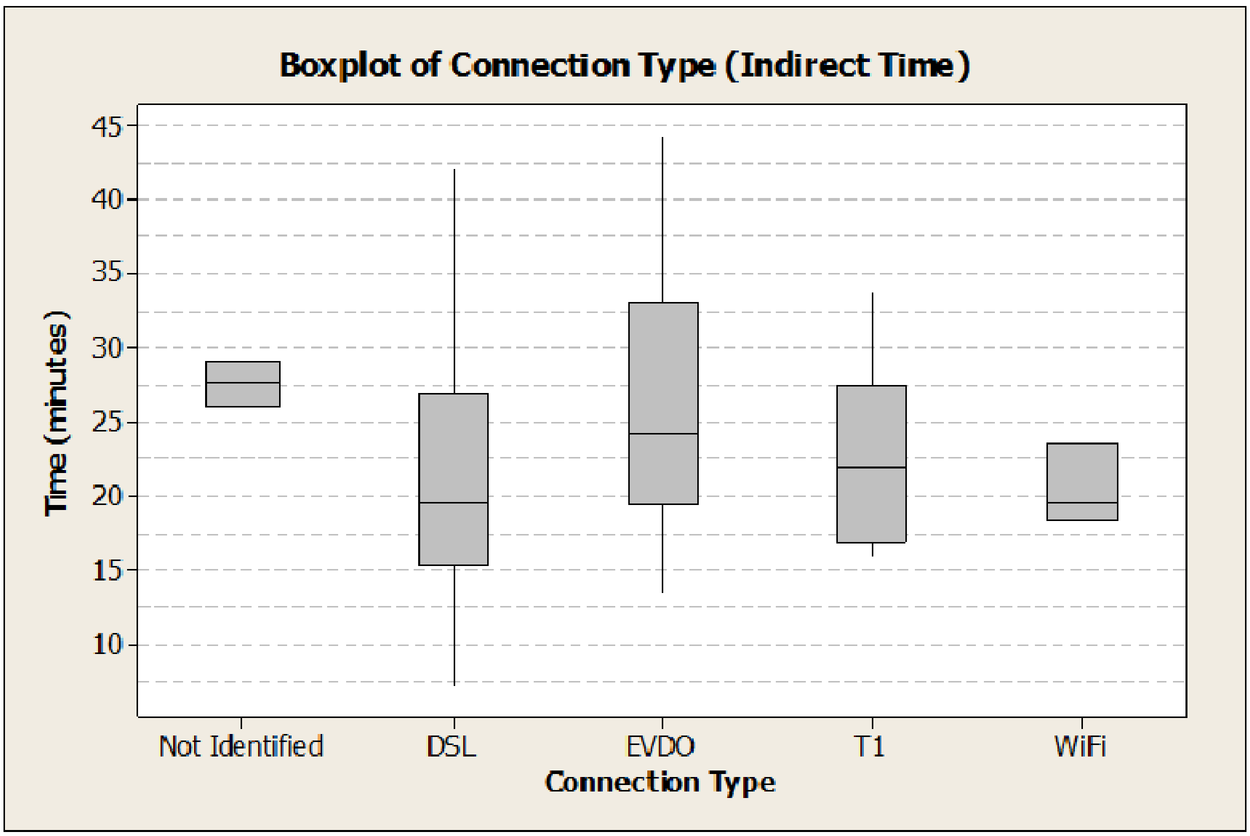

Figure 38. Boxplot of Connection Type for Indirect Time

Table 26. ANOVA Data Summary (Indirect Time by Connection Type)

Summary				
Connection Type	*Count*	*Sum*	*Average*	*Variance*
Not Identified	2	55	27.6	4.6
DSL	59	1211	20.5	56.8
EVDO	16	406	25.4	76.8
T1	8	183	22.8	38.4
WiFi	3	67	22.2	31.8

Table 27. ANOVA Results (Indirect Time by Connection Type)

ANOVA		
F	*P-value**	*F crit*
2.019	0.099	2.482

* P-value > 0.05 means there is **no correlation** between connection type and indirect time.

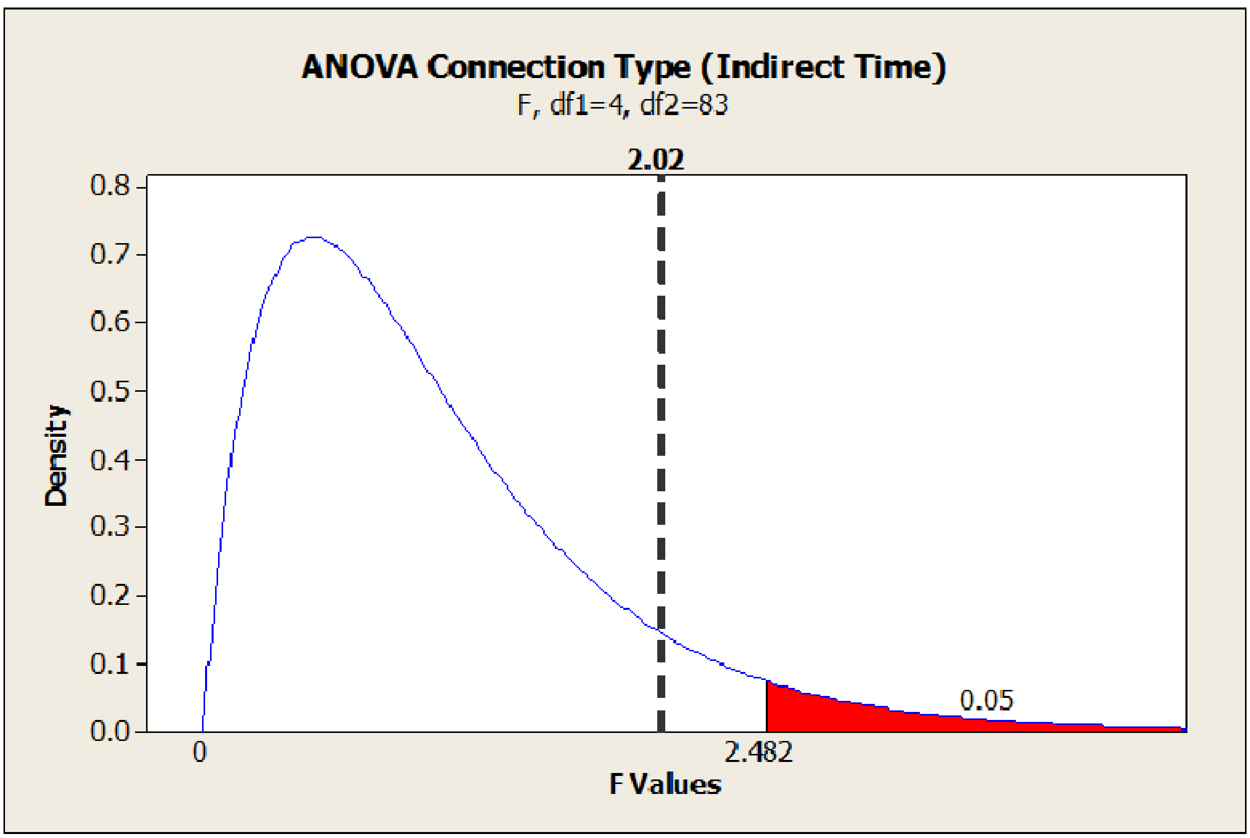

Figure 39. ANOVA Results for Connection Type (Indirect Time)

Figure 39 graphically displays the result of the ANOVA analysis. The results of the ANOVA calculate a p-value of 0.099, which is greater than 0.05, and f-value of 2.02, which is less than the f-critical value causing the null hypothesis to be accepted. This result indicates there is not a statistically significant correlation between the connection type (DSL, EVDO, T1, WiFi) and the time required to complete the indirect inspection tasks. This result is interesting and unexpected. The type of connection an inspector has to the Internet does not have a statistically significant effect on the time required to complete indirect tasks. One interpretation of these results is that even if there are differences in the performance of the connections, the performance differences do not significantly affect the time required to complete the indirect inspection tasks.

7. Summary of Results

There is no correlation between direct and indirect inspection times. So, changes in direct time have no statistically significant affect on the indirect time.

The measured MT60 inspection times are shown in Table 28.

Table 28. MT60 Inspection Times

Measure	*Mean*	*(+/-) 95% Confidence Interval*	*Lower Limit (Minutes)*	*Upper Limit (Minutes)*
Direct Time	36.1	2.9	33.2	39.0
Indirect Time	21.9	1.6	20.3	23.5
Total Time	**58.0**	**4.5**	**53.5**	**62.5**

The mean direct time is 36.1 minutes. The measured indirect time is 21.9 minutes, or 61% of the direct time. This 11% lower than the 1.8 multiplier that is currently assumed by FSIS. In fact, this is close to the previous 1.6 multiplier used by FSIS prior to the increase to 1.8.

Table 29 shows the analyzed parameters and whether they had an impact on inspection times. A checkmark indicates that the parameter impacts the inspection time, while an "X" indicates that it does not. A question mark indicates the results of the analysis are indeterminate. For the direct labor analysis, the size of the plant has a very weak effect on the amount of time required to perform direct labor. However, the results are very close, meaning there is a weak statistical significance and a true interpretation of results is indeterminate.

Table 29. Summary of Parameter vs. Inspection Time Impacts

Parameter	Affects Direct Inspection Time?	Affects Indirect Inspection Time?	Statistical Technique
Plant Size			ANOVA
N=60 vs. 2lb Grab			T-Test
Measurement Team Size			T-Test
District			ANOVA
Connection Type			ANOVA

8. Recommendations and Future Work

8.1 Implement a Large-Scale Work Measurement Program

Implement a large-scale program to collect and maintain work measurement data. This will support "right-sizing" FSIS staffing levels and serve as a baseline for process improvement. At the top level, the program plan, goals, and stakeholders should be identified and formally documented. This documentation provides bounds and direction for all the activities in the program. Each inspection task should be decomposed into its subtasks, including both the direct tasks involved in the sampling method and the related indirect tasks.

The data collection plan and data analysis plan should be created and modeled on the MT60 case study. These two plans should be developed concurrently to ensure that all needed data can be collected, and to prevent rework or unnecessary expenditure of resources during data collection. Data collection and analysis would then proceed according to the established plans.

The analysis results would inform the Implementation Plan for proper introduction back into the FSIS workflow. The implementation should include adjustments to PHIS and modifications to the inspector tasking. In addition, implementation would consist of a strategy for defensible workforce planning to cover the FSIS mission and coordinated communication to the current workforce. Finally, a sustainment plan should consist of a method for introduction of new inspection tasks and regular verification of currently utilized work measurements.

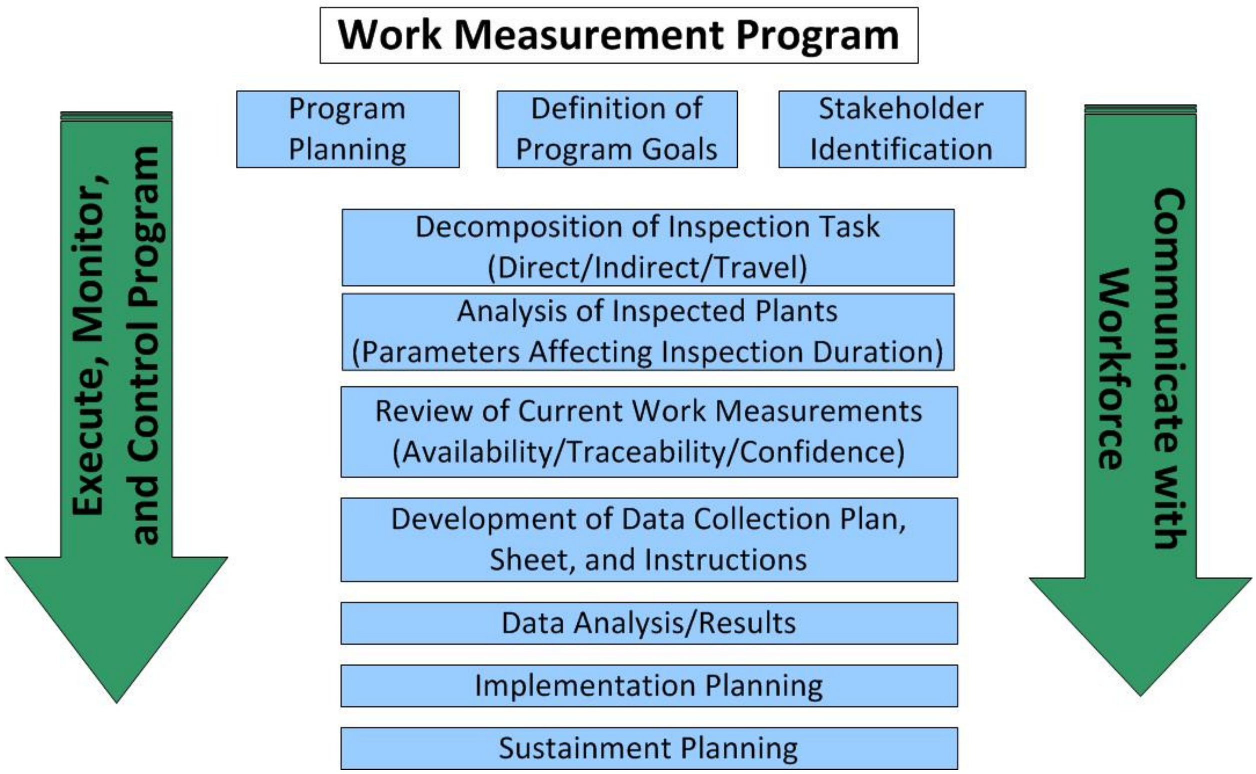

Figure 40. Large Scale Work Measurement Program Framework

8.2 Assess Feasibility of Standard Time Allocation for Indirect Tasks

As the measurement program is expanded to other sampling programs beyond the MT60, two approaches can be taken to determine the indirect time needed for all assignments. The first is to perform a comprehensive study, wherein all the various sampling programs are examined for their direct and indirect time.

The second, less expensive method is to choose a subset of 10-20 sampling programs for measurement of direct and indirect time. In this method, the indirect/direct time for each sampling program should be plotted in a fashion similar to that used in Figure 8 in this report. Fitting a line to these data points will show if there is a relationship between the amount of indirect and direct time needed for inspections. It is possible that overall, the "multiplier" concept is not correct and that a standard amount of time should be allocated any sampling program assigned, instead of allocating a percent of the expected direct time.

8.3 Analyze Internal and External Travel Time

Analyze the internal and external travel time data that was reported in the 88 valid DCSs. The case study excluded this analysis due to time constraints. Both internal and external travel time is readily available and ready for analysis.

8.4 Team with the Union for Work Measurement

Including the union in all aspects of the work measurement (e.g., planning, data collection, analysis, reporting) will foster goodwill, increase their level of buy-in, and make the data collection and resulting implementation go more smoothly. The union is a significant stakeholder and should be informed and participate throughout the process.

8.5 Validate Decomposed Processes with Inspectors

Once a draft process decomposition has been defined, validate decomposed processes with inspectors prior to collecting work measurement data. This will minimize the number and scale of the deviations from the defined process, which will contribute to more consistent work measurement data. If this validation is done in a group setting, inspectors can share best practices and identify opportunities for process improvement. Inspectors will be more likely to accept process feedback from colleagues than they will from Management.

8.6 Perform Business Process Re-Engineering

As processes are decomposed and discussed among the inspectors, document the "As-Is" process and collect recommendations for process improvements. Make resources available to support process improvements.

8.7 Measure and Re-Use Repeatable Processes

Some processes are common to multiple inspection activities (e.g., scheduling inspections in PHIS). Once these common processes are measured a sufficient number of times to provide a high level of confidence in their accuracy, Timers will not need to continue to collect those work measurement times going forward.

8.8 Collect Work Measurement Data Using PHIS

Incorporate a timer into PHIS to measure the time required to perform tasks in PHIS. With this automated work measurement in place, a human timer is not needed to collect this data. Also, the amount of data will be substantial, which will provide a high level of confidence in its accuracy. Consideration must be made for the research time needed to collect data to enter in PHIS (e.g., time to get the lot number for an inspection, which may require several minutes to obtain) when implementing time-outs in this system.

8.9 Train the Timers

To ensure consistent work measurement data collection, develop and provide training for the Timers. They should be trained in:

- Communicating with the Plant Manager
- Communicating with the Inspector
- Using the stopwatch and when to start/stop it during the work execution
- Filling out the DCS
- Best practices / lessons learned that are developed during prior work measurement data collection activities

8.10 Incorporate Experience from 1968 FSIS Work Measurement Data Collection

Determine the "Average" Amount of Time Required to Perform Tasks by employing one of the following methods:

- Assess Pace Rating to Develop "Average" Times. Pace rating is an assessment of the pace of work being measured by the Timer(s), relative to the "average" pace of work. During the

USDA 1968 Work Measurement effort, the work measurement team assigned a pace rating value to each inspection activity that was measured. For example, for a task that took 10 minutes, if the pace rating was determined to be 90%, then the estimated "average" amount of time required to complete that task would be 10 minutes x 0.9 = 9 minutes.

- Select an inspector to measure, in coordination with the union, who is considered to work at an "average" pace. It is critical that all inspectors conducting time measurements have the same understanding of what the "average" pace or work performance should be.

8.11 Revise the DCS

The DCS went through rigorous review by both FSIS and the GMU Team, and currently stands at version 10. Further improvements can be made after reviewing two weeks of data collection responses. Table 30 shows recommended improvements to the DCS. Many of these recommendations have been rolled into a version 11 of the DCS, provided as an output of this case study.

Table 30. Recommended Changes to the DCS

Current Version	Recommended Change	Rationale
Step 1.d. What Time Did You Start This Data Collection Sheet?	Step 1.d. What Time (indicate AM or PM) Did You Start This Data Collection Sheet?	This analysis did not include an analysis of how different sampling times can affect speed of accomplishing the task. In future work measurements if enough data is collected, an analysis could be done to determine the difference in sampling during the day when compared to the middle of night when an inspector may be more tired.
Steps 2.h., 3.j., 4.m. Stop the Stopwatch	Wording should remain the same but "Elapsed Time When Complete" for these steps should be grayed out.	No times are needed for these steps. This would make collecting data more efficient.

Current Version	Recommended Change	Rationale
Step 3.g. Check the product temperature of the top pieces from randomly selected containers; Record the temperature of the warmest piece?	Step 3.g. Measure and record the product temperature of the top pieces from randomly selected containers?	There is some confusion with this step, some timers recorded only the temperature while some timers recorded both the temperature and elapsed time. The goal is to collect the time taken to perform the temperature recording activity.
Step 4.k. Obtain the Appropriate Shipping Materials; Complete the needed sheets; Label the Samples and sheet Accordingly with the ID labels; Pack the Box and Label?	Step 4.k. Obtain the Appropriate Shipping Materials; Complete the needed sheets; Label the Samples and sheet Accordingly with the ID labels; Pack the Box and Label; if necessary call to arrange for the package pickup?	This change is due to the comments made on DCS Serial #090-13. Calling to make pickup arrangement is "standard collection process" and should be part of the DCS.
Step 5.b. Mailing Instructions: Please send completed sheets to George Mason University, via overnight UPS (charge code 5110014). Please use the following address: Professor Karla Hoffman, SEOR Project, Mail Stop 4A6, George Mason University, Fairfax, VA 22030. Phone number 703-993-1670.	Update to reflect new charge code, point of contact, address and phone number.	Version 10 of the DCS indicates a point of contact at GMU; this may not be valid for future studies.

8.12 Consider Prediction Interval for Implementation Plan

The goal of this GMU study was to either validate or reject the 1.8 multiplier currently used by FSIS. The GMU team had determined that there is no correlation between the indirect task time and direct task time and therefore reject the multiplier concept. Further analysis to be conducted by a future GMU study should include the concept of a prediction interval.

As mentioned earlier, the confidence interval for direct task mean time was determined to be from 33.2 to 39 minutes. This range is an estimated average for the entire population and should not be mistaken as the plausible time given to an Inspection Program Personnel (IPP) to carry out their duties with direct inspection. Rather, further analysis is needed to determine the appropriate prediction interval for direct inspection time. Confidence interval was used as an estimation of the average inspection time while the prediction interval is used to predict what the future value would be and involves more uncertainty. Therefore, the prediction interval is expected to be wider in range when compared to a confidence interval. A prediction interval's wider range would allot more time to the IPP than the confidence interval would allowed.

9. Appendix

9.1 Acronyms

- CCP - Critical Control Point
- DCS - Data Collection Sheet
- DO - District Office
- EIAO - Enforcement, Investigations, and Analysis Officer
- FI - food inspector. Inspects slaughter houses.
- FLS - Front Line Supervisor
- FMIA - Federal Meat Inspection Act
- FSA - Food Safety Assessment
- FSIS - Food Safety and Inspection Service
- Hazard Analysis Critical Control Point (HACCP)
- IIC - Inspector-in-Charge
- IPP - Inspection Program Personnel
- IPS - a set of plants assigned to one inspector
- NR - noncompliance record
- OPPD - Office of Policy and Program Development
- PBIS - Performance Based Inspection System
- PHIS - Public Health Information System
- PHVs - Public Health Veterinarians
- RMS - Recall Management Staff
- SCSI - Supervisory Consumer Safety Inspector
- USDA - United States Department of Agriculture

9.2 Appendix A. MT60 Decomposition

9.2.1 Assumptions and Legend

- Training time for the MT60 process is excluded from the analysis
- Time to read the plant-specific documentation is excluded from the analysis
- Study does not account for the fact that there is a new PHIS workflow / interface for SCSIs to deal with, which may result in longer work measurement times
- Turning on the computer and getting to the Internet is excluded from this measurement data
- Time to order inspection supplies is excluded from the analysis
- Grey Text indicates Indirect work
- Black Text indicates Direct work
- Blue Text indicates Internal Travel

9.2.2 Main Process Flow

1. **Schedule Inspection**
   - 1.1. **Log into PHIS**
   - 1.2. **Go to Task Calendar**
   - 1.3. **Review Assigned Tasks**
   - 1.4. **Filter for Establishment and Type of Task**
   - 1.5. **Select a Task (MT60)**
   - 1.6. **Add Inspection Task to Calendar**
     - 1.6.1. **Check Lab Availability**
     - 1.6.2. **Determine Appropriate Date and Shift for Sampling**
     - 1.6.3. **Set inspection date**
2. **Open "Document" to enter additional task info**
   - 2.1. **Fill-out the "Generate a Sample" Tab – select the type of samples**
   - 2.2. **Fill-out the "Sample Collection Data" Tab**
     - 2.2.1. **Set Date for Sample Selection and Parcel Pickup**
   - 2.3. **Obtain and enter product collection information [production date, product name, Lot Held (Y/N), Lot Number]**
   - 2.4. **Go to the "Additional Info" tab and take part of the questionnaire (this step may be delayed until after samples are collected)**
3. **Notify Plant of Scheduled Inspection**
4. **Internal Travel from Office to Collect Supplies**
5. **Collect Samples**
   - 5.1. **Prepare for Sample Collection**

5.1.1. **Collect supplies for sample collection**
5.1.2. **Internal Travel from supply collection location to inspection location**
5.1.3. **Sanitize hands, caddy, knife, and hook, work station, and prepare for sample collection**
5.1.4. **Select containers for sampling**
5.1.5. **Put on cut-resistant glove and sterile over-glove**

5.2. **Cut samples and place them in the 1st sample bag**
5.3. **Cut samples and place them in the 2nd sample bag**
5.4. **Check the temperature of the top pieces of trimmings from the containers. If the trimmings are warmer than 40F, place the samples in a cooler to chill before shipping.**
5.5. **Complete Form 10210-3**

6. **Internal Travel from Inspection Location to Office**
7. **Complete MT60 documentation in PHIS**
   7.1. **Log into PHIS**
   7.2. **Go to the "Additional Info" tab**
      7.2.1. **Complete the questionnaire**
      7.2.2. **Submit the questionnaire**
   7.3. **Click "Lab Sampling" to return to the task**
   7.4. **Print Form – Goes in with sample**
   7.5. **Click "Submit to Lab" and logout of PHIS**
8. **Travel to Retrieve Samples and go to Shipping Dock**
9. **Package Samples and apply Fedex label**
10. **Ship samples <Note: This may be internal or external travel.>**

9.2.3 Alternate Process Flows

1. **Cancel or Reschedule Task**
   1.1. Right-click the task to cancel, reschedule, or order supplies.
   1.2. Cancel or Reschedule
2. **Order Supplies**
   2.1. Right-click the task to cancel, reschedule, or order supplies
   2.2. Order supplies