Maintaining Performance

Evidence-Based Educational Facility Management Through A Decision-Support Tool Leveraging Prior Empirical Research

by

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ABSTRACT

Public institution facility operations and maintenance is a significant factor enabling an institution to achieve its stated objectives in the delivery of public service. To meet the societal need, Facility Directors must make increasingly complex decisions managing the demands of building infrastructure performance expectations with limited resources. The ability to effectively measure a return-on-investment, specific to facility maintenance indirect expenditures, has, therefore, become progressively more critical given the scale of public institutions, the collective age of existing facilities, and the role these institutions play in society.

This research centers on understanding the method of prioritizing routine work in support of indirect institutional facility maintenance expense through the lens of K-12 public education in the state of Arizona. The methodology documented herein utilizes a mixed method approach to understand current facility maintenance practices and assess the influence of human behavior when prioritizing routine work. An evidence-based decision support tool, leveraging prior academic research, was developed to coalesce previously disparate academic studies. The resulting process provides a decision framework for prioritizing decision factors most frequently correlated with academic outcomes.

A purposeful sample of K-12 unified districts, representing approximately one-third of the state's student population and spend, resulted in a moderate to a strong negative correlation between facility operations and student outcomes. Correlation results highlight an opportunity to improve decision making, specific to the academic needs of the student. This research documents a methodology for constructing, validation, and

testing of a decision support tool for prioritizing routine work orders. Findings from a repeated measures crossover study suggest the decision support tool significantly influenced decision making specific to certain work orders as well as the Plumbing and Mechanical functional areas. However, the decision support tool was less effective when prioritizing Electrical and General Maintenance work orders.

Moreover, as decision making transitioned away from subjective experience-based judgment, the prioritization of work orders became increasingly more consistent. The resulting prioritization, therefore, effectively leveraged prior empirical, evidence-based decision factors when utilizing the tool. The results provide a system for balancing the practical experience of the Facility Director with the objective guidance of the decision support tool.

DEDICATION

For Guap, who often reminded me “anyone can do this” yet gave selflessly to ensure I wasn’t alone in the journey.

For Cooper, Brooklyn, and Taylor reminding me to always be my best and teaching me that a life less challenged is a life less fulfilled.

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I would like to acknowledge the Arizona School Facilities Board, the Washington Association of Maintenance and Operations Administrators, and the many district Facility Directors who so generously gave their time, contributing their collective experience to this research. Having completed this journey, I've come to understand better the challenges and sacrifices made in support of our educational system.

Most importantly, I would like to acknowledge my family: my wife, Julie Beauregard Esq., MBA, my children Cooper Max and Brooklyn for their patience, understanding, and quiet encouragement. Each of you has endured this journey with me. Collectively you have sacrificed, enabled, and provided me the opportunity to pursue my passion for learning. Thank you for enabling me to become the best version of myself. You are my everything, and I love you.

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CHAPTER 1

INTRODUCTION

Facility operations and maintenance organizations provide value by optimizing facility conditions to support the overall performance of a public institution. In order for these facility operations and maintenance organizations to successfully provide this value, the decisions they make must directly address the needs of the institution. More specifically, building system and or environmental conditions that enable improved performance should factor in the decision-making process.

The practice of facility management is at a crossroads, and educational building infrastructure is not spared from the issues that plague the profession of facility management. There is mounting evidence that building infrastructure is underfunded (ASCE 2013;2017; Leachman et al., 2016), and the availability of qualified technical personnel is declining (Sullivan et al., 2010). At this same time, facility equipment and building infrastructure are becoming progressively complex. Institutions are increasingly relying on the availability and performance of facilities to meet the expectations of institutional performance goals. Prioritizing the day-to-day maintenance decisions may best serve the academic district in the long-term. Additionally, the ability of a facility operations and maintenance organization to align these prioritization decisions with the strategic objective of the K-12 academic district enables institutional performance. While this may appear reasonable, there is little evidence to suggest decision factors such as this are currently taken into consideration when allocating resources or prioritizing routine work.

The nation's school systems are not alone in their endeavor to create increased public value while minimizing the costs associated with facility management. Across the nation, public institutions occupy more than three billion square feet of building infrastructure (US General Services Administration, 2012). The cost to maintain these facilities exceeds $30 billion annually, and by many accounts, this figure falls considerably short of what is needed (ASCE, 2017). The availability of data specific to the Nation's public-school systems provides an instrument from which to study the larger issues facing the Nation's institutional building infrastructure. This research utilizes K-12 education in the state of Arizona to study the problem

America's educational infrastructure by many accounts is underfunded and in a state of decline. At the same time, society has a higher degree of visibility to academic performance and standardized test scores. To address this issue, the state of Arizona allocates approximately one-billion dollars annually to maintain the facility operations of primary and secondary educational buildings (Auditor General, 2016). Nationally the data suggests Arizona residents are not alone in their efforts to provide well managed educational facilities. Each year a similar amount is spent, per state, for this same purpose (NCES, 2016; Snyder et al., 2016).

Academic research suggests this funding is critical, playing an essential role in the performance of school systems. A growing body of academic research has established a positive correlation between the performance of building systems, facility conditions, and academic outcomes (Cash, 1993; Earthman, 2002; Duyar, 2010). Considering that academic research has established this relationship, together with the lack of evidence that facilities maintenance and operations teams are currently using this research to guide

decision-making, highlights an opportunity for researchers to create a better way for practitioners to make decisions that are guided by existing research. The opportunity to influence decision-making in a strategic and targeted way motivates this research.

This dissertation utilizes a mixed-method approach to explore the extent to which decision factors are accounted for when prioritizing routine facility maintenance spending. The findings provide an opportunity for improved, evidence-based decision making enabling the greatest benefits to student learning for the money spent.

This chapter evolves by first introducing the reader to the research questions addressed and referenced throughout the dissertation. Next, the research methods are introduced, leading to a presentation of research contributions. Chapter 1 concludes by presenting the overall organization of the dissertation.

1.1 Motivation

I began this research having studied and practiced in the areas of Architecture, Construction, Facility Management, Finance, and Strategic Sourcing. My experience is deliberately structured to provide a comprehensive understanding of the built environment. Moreover, I have strived to understand the role of decision making and how those decisions impact the use and associated costs of maintaining building infrastructure.

At that time, I recognized two truths specific to the practice of Facility Management. Firstly, Facility Operations and Maintenance is an enabling organization. Executed efficiently, institutional facilities enable an organization to do what they do, only better. Secondly, experience had taught me that facility maintenance decisions were primarily made based on the needs of the asset, defined in terms of preventative,

predictive, and corrective maintenance. With the noted exception of an annual budget, neither the Owner nor Facility Management appeared to prioritize the needs of the organization over the apparent needs of the asset.

However, Facility Operations and Maintenance appears to be at a crossroad. There is mounting evidence building infrastructure is underfunded, and the availability of qualified technical personnel is declining. At this same time, facility equipment and building infrastructure are becoming progressively complex. Institutions are increasingly relying on the availability and performance of facilities to meet the expectations of institutional performance goals. How then are the day-to-day decisions made to prioritize work that best serves the performance goals of the organization? Furthermore, how are these prioritization decisions aligned with performance goals and strategic objectives of the institution, positioning a facility maintenance organization to enable performance? Collectively, these questions constitute the basis of my motivation for this dissertation.

1.2 Research Questions

Throughout this study research questions were used to help guide the overall direction and focus of the dissertation. The research questions, listed in terms of the research paper supported, are as follows:

Chapter 2, research article 1(Beauregard and Ayer, 2018):

RQ1: Does a correlation exist between facility maintenance expense spending and educational outcomes suggesting that practitioners are leveraging prior research?

RQ2: What processes or procedures guide discretionary spending decision-making?

Chapter 3, research article 2 (Beauregard and Ayer, 2019):

RQ3: Can prior academic research detailing the beneficial impact of facility condition with regard to academic performance be leveraged to aid decision-making?

RQ4: Does the resulting decision support tool (DST) provide a method of decision making that is both comprehensive and easy-to-use?

Chapter 4, research article 3:

RQ5: To what extent does the DST influence the prioritization of routine facility maintenance work orders?

RQ6: In what contexts does the DST impact, or not impact prioritization?

1.3 Research Method

This study utilizes a mixed method approach to the research, leveraging qualitative and quantitative research techniques to develop and analyze the data. The approach consists of a comprehensive literature review, structured and informal interviews, questionnaire surveys, focus groups, and a repeated measures crossover activity. Collectively, this research approach allowed the study to define the performance opportunity and address the contexts by which the proposed DST may or may not influence decision making. Furthermore, the mixed method approach enabled the

researcher to achieve a greater degree of understanding specific to the process of prioritizing work in support of institutional building infrastructure.

The development of this Ph.D. dissertation consisted of three research stages (see Figure 1). Each research stage represented a milestone, culminating in the publication of an academic article. Dissertation chapters 2,3, and 4 provide further detail of the methodology specific to each stage of research.

The author met with industry professionals throughout the study, who collectively provided insight into the inner workings of a Facility Maintenance organization. The resulting conclusions represent a permutation of multiple sources collected over the four-year duration of the investigation.

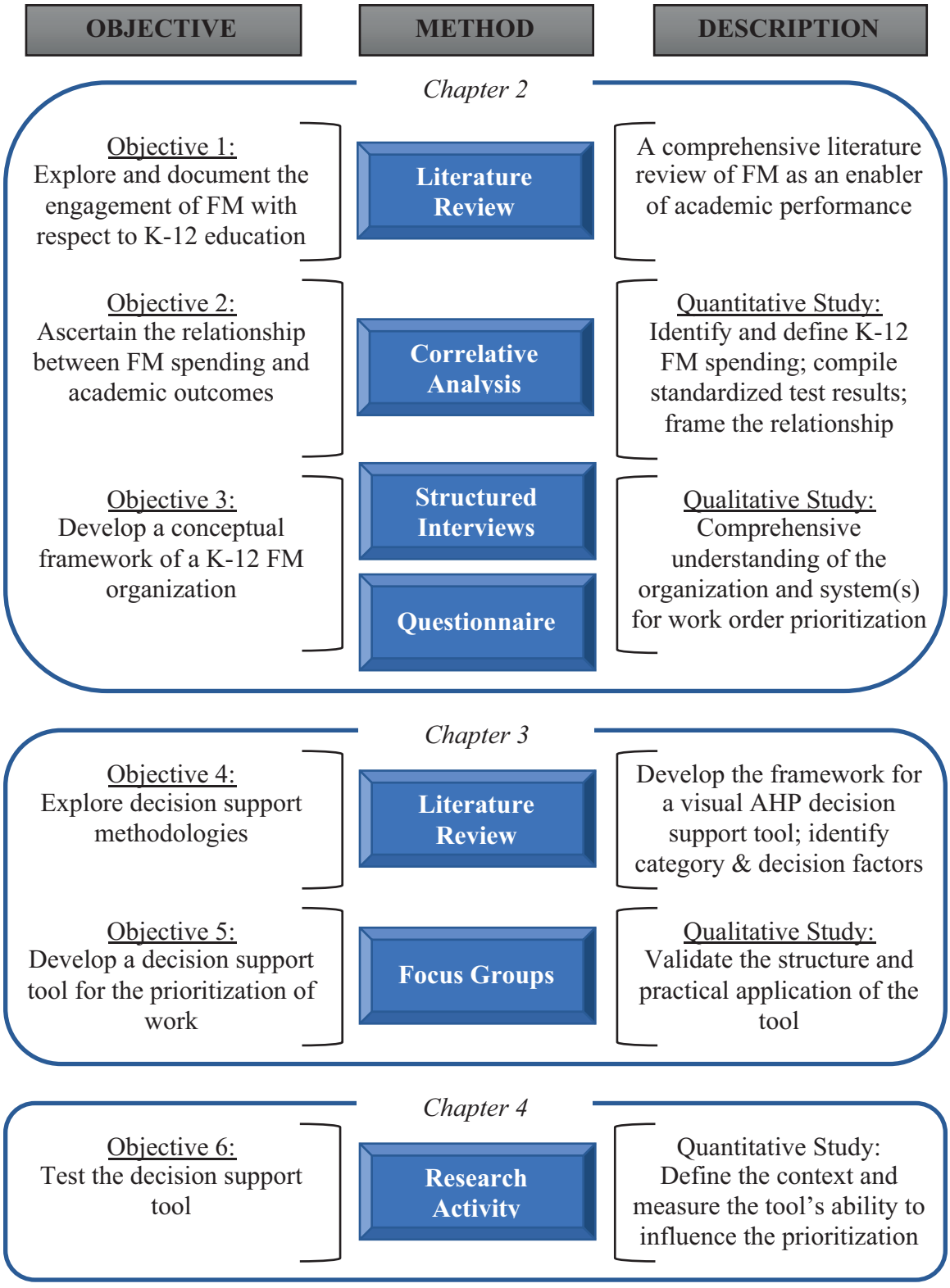

Figure 1: Methodology and stages of the dissertation

1.4 Scope of Research

There are limited examples of academic studies that have resulted in empirical evidence establishing an association between institutional performance and facility maintenance and operations indirect expense spending (OpEx). More often, prior research addressing this relationship has largely refrained from differentiating between Capital Expense (CapEx) projects and OpEx maintenance. Considering that public institutions have performance targets that are often unique to the institution, facility maintenance research and academic writings have traditionally prioritized the needs of the asset in terms of preventative or predictive maintenance. As a result, efforts were taken to overcome this limitation to some degree, by conducting informal interviews with academic district Superintendents and Facility Directors to define the research opportunity better and identify relevant sources of information that could be used to define the research approach.

The scope of this research is limited to spending associated with Plant Maintenance and Operations OpEx, omitting work orders defined as CapEx. The funding mechanism for capital projects is separate and distinct from OpEx funding. Additionally, the decision-making and spending associated with CapEx projects for a school district can be quite complex and politically charged, at times involving multiple departments, public committees, or public hearings. The decision process, therefore, may not require a formal work order. By contrast, the process for allocating and prioritizing OpEx is largely subjective, often determined by the Functional Area Lead or Technician (Beauregard and Ayer, 2018). For these reasons, a decision was made to omit CapEx projects from the research scope.

The scope is further limited to work orders associated with regular and routine asset maintenance. Decision-making specific to work orders determined to be consistent with Emergency or Critical repairs are fundamentally limited as these decisions are routinely given the highest level of priority due to the critical nature of the repair. Therefore, Emergency and Critical repair work orders are not in scope for this research. This process of strategically reducing the scope of work orders to only include routine OpEx work orders enabled the researcher to study how decision-making would be impacted for the types of work orders that may be most impacted by current, potentially subjective, decision-making practices.

The resulting methodology is intended to subordinate the needs of the asset for the needs of the institution. Furthermore, the methodological approach detailed herein uses both qualitative understandings and quantitative empirical data to define the relationship between OpEx prioritization and institutional performance.

1.5 Research Contribution

Facility operations and maintenance is widely recognized as an enabling organization. However, academic studies addressing the role of facility condition and operational performance provide limited distinction between the financial allocation of CapEx projects and facility operations and maintenance OpEx initiatives. Therefore, an understanding of the function that routine work order prioritization plays in the successful execution of operational objectives has received relatively little attention. The purpose of this research is to coalesce previously disparate research to enable evidence-based decision-making in support of institutional performance. K-12 education in the state of

Arizona provides an institutional framework for this study. The contributions that this research offers to facility operation and maintenance literature and the AEC industry are as follows:

- Development of an evidence-based DST for the prioritization of routine facility maintenance work orders
- Development and demonstration of a methodology to investigate and organize the decision factors that influence institutional performance
- Testing of the DST effectively influences the process of decision-making in support of K-12 academic facility management
- Defining the contexts in which the DST may or may not affect the prioritization of work

The intended outcome is to provide a process enabling institutional facility administrators to make pro-active and informed decision aligned with the strategic direction of the organization they support. The expected outcome from the research will add to the body of knowledge in Facilities Management as well as providing a practical tool for K-12 facility administration.

1.6 Dissertation Organization

Chapter 2 presents a comprehensive literature review, a qualitative understanding of facility management for a K-12 district in Arizona, and a correlative analysis. The literature review first takes a macro-approach to the role of facility management as an enabler of institutional performance, then narrows the focus to two main facets: Building conditions as an enabler of academic performance and remediation or replacement of

specific facility assets associated with academic performance. Meetings were then held with a purposeful sample of academic Facility Managers to understand better the detail and nuances associated with the day-to-day responsibilities of managing an academic portfolio. Finally, a correlative analysis was conducted to demonstrate if the relationship as defined in the literature review and subsequent qualitative interviews translated to a measurable correlation between plant maintenance and operation indirect expense spending and academic performance as measured by standardized academic testing.

The third chapter is methodological, presenting a framework for a DST derived from the initial journal article, findings from the literature review and feedback from industry professionals. The resulting DST defines both Decision Categories and Decision Factors based upon prior quantitative and qualitative academic studies. Moreover, chapter three introduces a modified analytical hierarchy process to visually organize and then aid decision making.

Chapter 4 details a method for validating the DST defined in the prior chapter. Here, a repeated measures crossover study is used to provide a baseline and additional data necessary to measure a perceived change in behavior. Moreover, this chapter identifies decision factors and environmental context(s) influencing decision making as defined in research question RQ5 and RQ6.

The fifth chapter comprehensively summarizes the findings from this work. This chapter also proposes opportunities for future research based on the data presented in this dissertation. Chapter 5 concludes by addressing the research contribution to the overall body of academic knowledge associated with strategic facility management.

CHAPTER 2

CORRELATING FACILITY CONDITIONS AND ACADEMIC PERFORMANCE

An emphasis on academic performance has gained both political and public momentum in recent years, specifically the implementation of standardized systems for evaluating student performance. This pursuit of academic achievement culminated in the implementation of Common Core or equivalent testing methods adopted by more than forty states (Coburn et al. 2016). Today, academic standards-based testing is administered to align educational curriculum, educator professional development, and establishing a baseline for measuring academic performance (M. S. Smith et al. 1991). Greater accountability is expected with respect to academic spending as the expectations of educational administrators intensify. The importance of establishing processes designed to deliver repeatable and measurable value specific to facility infrastructure spending is, therefore, one of many important aspects of educational reform (Young et al. 2003). The scope of facility infrastructure spending, explicitly the process of prioritizing plant maintenance and operations work, is inherently complex and, for the most part, subjective (Atkin and Brooks 2014). The maintenance and upkeep of educational facilities are at the discretion of academic districts. Therefore, this research aims to understand the method for decision–making that guides this discretionary thought process.

Capital costs are out of the scope of this paper. Educational infrastructure CapEx improvement projects traditionally have a dedicated source of funding whereby, performance expectations are explained in detailed project specifications, and scope of work clearly defines a metric of success. Although many academic districts would prefer

new facilities, it is not reasonable to expect CapEx projects as a remedial course in place of routine preventative maintenance of existing capital assets.

Academic districts faced with economic constraints are forced to make difficult and, at times, highly complex decisions concerning facility maintenance. For context, the U.S. spends an estimated $50B annually, maintaining public school infrastructure that collectively averages fifty years of age (NCES 2014). A 2013 study by the American Society of Civil Engineers (ASCE) estimates the price tag for infrastructure remediation at primary and secondary K-12 educational facilities exceeds $270B (ASCE 2013). More recently, ASCE published findings which estimate the funding gap increases annually by approximately $38B (ASCE 2017). Although the figures identified by ASCE are substantial, the discretionary budget at a district level has become increasingly constrained (see Figure 2) (Snyder et al., 2016). To summarize, the nation's educational infrastructure has been suggested to be in a state of decline (Alexander and Lewis 2014). Therefore, this work aims to determine how work is being prioritized as a guide to maximizing the return on investment of future maintenance initiatives.

An existing body of academic research has established a relationship between CapEx improvement projects to educational infrastructure and academic outcomes. The purpose of this paper is to empirically assess if a similar relationship is observable between facility operational indirect expense spending and educational outcomes. The primary goal is to answer the following research questions: does a correlation exist between facility maintenance expense spending and educational outcomes suggesting that practitioners are leveraging prior research (RQ1)?; and what processes or procedures guide discretionary spending decision-making (RQ2)? To explore this topic, publicly

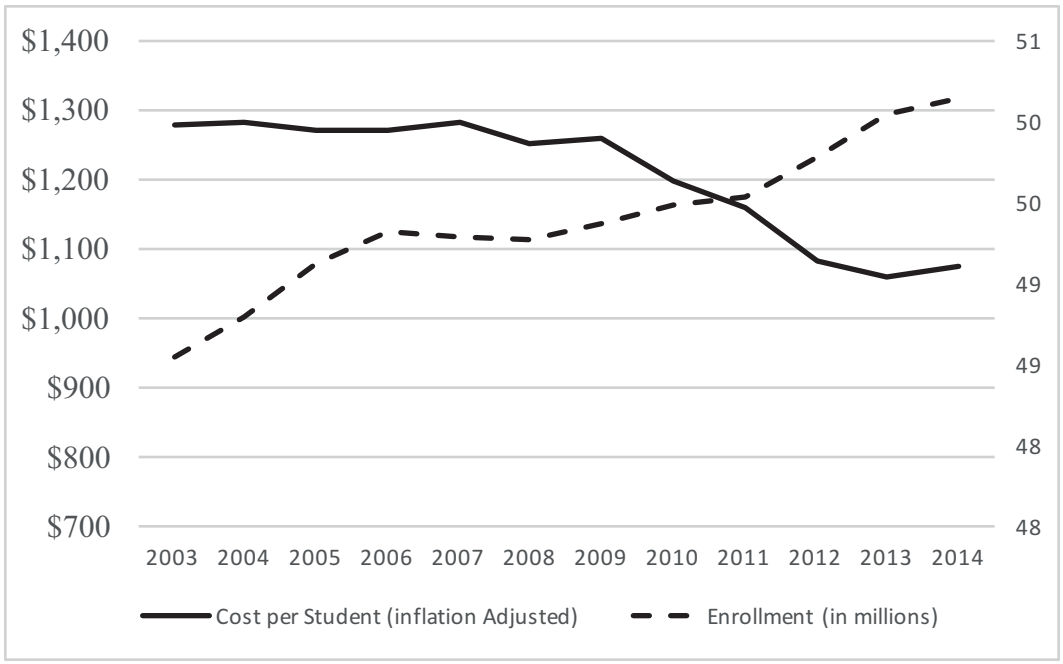

Figure 2: National educational per student spending (inflation adjusted) and student enrollment

available data including the OpEx spending associated with Plant Maintenance and Operations and the results of standardized academic testing was collected for public school districts in the state of Arizona from 2010 through 2015. A correlative analysis was performed using this data for a sample population and performed again for a purposeful sample of schools of similar size, demographics, and spending. Furthermore, Facility Directors within the purposeful sample were interviewed to understand the organizational structure of the Facility Maintenance and Operations department and how the process of prioritizing reoccurring work may factor into the correlation. Key differences in the results of the correlation are identified, highlighting the potential impact of business processes on the correlation. Finally, results of the study are summarized, providing a potential direction for future research.

2.1 Background

A well-managed facility maintenance organization enables the conversion of operational expense to a return on that investment (Womack et al. 1990). Optimization of the facility, therefore, requires the identification of value, defined in terms of a product, a capability and or the customer (Womack and Jones 2010). A business's ability to identify the intended value of an operational expense, then to manage the asset in accordance to the value proposition is defined in terms of a Return-On-Assets (Selling and Stickney 1989) and is understood to be a metric of operational effectiveness. If the organization is civic, the perceived value may become unclear. Such is the case with the nation's public-school systems.

Academic studies have highlighted the importance of building condition and educational environment as an enabler of education, constructing a method of delivering Return-On-Assets. An investigation by the Milwaukee public school's system determined the physical condition of the facility have the most significant impact on the academic success of the student (Lewis 2001). A similar study of the Scottsdale Unified District concluded that a positive relationship was present between upgraded school facilities and math achievement (Maxwell 1999). Additional studies point out specific building systems such as heating, ventilation and air conditioning (HVAC) and lighting as enablers of academic performance (Schneider 2002). These studies indicate strategic CapEx improvements as catalysts for change. However, the majority of educational environment costs are expense-related, not capital, and are therefore discretionary. In this regard, it is vital that decisions made specific to the prioritization of facility maintenance

and operations work provide the most value given the economic constraints placed on the educational system (Wenglinsky 1997).

The level of satisfaction teachers and students have in the condition of their respective school facilities has a direct influence on the performance of the teacher and subsequent academic performance of the student (Hopland and Nyhus 2015; Schneider 2002). Findings from a 2001 study of the Milwaukee school system, performed by the Council of Educational Facility Planners (Association for Learning Environments), identified Facility Management attributable for 10% to 15% of the difference in school-to-school academic performance (Lewis 2001). Lewis writes:

> *"When differences in individual ability are controlled, facility condition may impact student performance more than many social and economic variables."*

Similar studies conducted in Washington DC (Edwards 1991; Berry 2002), Scottsdale (Maxwell 1999), and New York (Durán-Narucki 2008) have yielded comparable results. Additional studies link the performance of specific building systems such as indoor air quality, natural lighting, interior use of color and quality of finishes with a direct impact on student performance. Moreover, the performance of building systems may influence indirect performance factors such as teacher retention and student absentee rates (Hanushek 1989; Kok et al. 2015; Schneider 2002). Studies such as these appear to suggest an expectation of a Return-On-Assets measured in terms of academic outcomes. A 2015 study by the National Bureau of Economic Research concluded that per-pupil spending benefited not only educational outcomes but also positively influenced wages, family income, long-term wealth and a reduction in adult poverty (Jackson et al. 2015).

Academic research specific to facilities management and education categorizes educational environments as either being in a state of decline (ASCE 2017), serving as an impediment to educational outcomes (Durán-Narucki 2008; Cash 1993), or as an enabler of improved student performance resulting from a building renewal project or the replacement of building systems (Buckley et al. 2004; Duyar 2010). Research addressing the opportunity presented by an investment in educational infrastructure to positively affect educational outcomes, highlight capital investments by an academic district, institution, or school board as a systemic catalyst for change. A growing body of peer-reviewed research on building systems to include air quality (Cash 1993; Earthman 2002; Schneider 2002), thermal comfort (Schneider 2002, Earthman 2002), natural lighting (Higgins et al. 2005; Lemasters 1997; Schneider 2002), building quality (Tanner 2000; Tanner and Lackney 2006; Earthman 2009; Schneider 2002), and building acoustics (Woolner et al. 2007; Woolner 2010) have collectively built a case for investment in educational infrastructure. There is little evidence in prior research, however, that differentiates between CapEx improvements and the day-to-day prioritization of routine facilities maintenance. It is therefore uncertain if a similar relationship exists between total plant maintenance and operations indirect expense spending and student academic performance. Furthermore, it is not clear if these day-to-day decisions regarding the allocation of facility operations resources create value for the benefit of the student, as the prior research might suggest. Considering the annual expense specific to plant maintenance and operations of K-12 schools, determining a correlation and understanding the method by which work is prioritized in support of that correlation may

enable future researchers to develop tools that will allow districts to allocate and prioritize resources more efficiently.

2.2 Research Methodology

A correlation was performed utilizing a bivariate dataset consisting of standardized test scores and plant maintenance and operation indirect expense spending per student. Following the correlation, the author met with academic districts to complete an informative questionnaire and participation in a semi-structured interview. The resulting mixed method analysis (see Figure 3) provided an in-depth understanding of the facility maintenance and operations organizational structure, processes, and the prioritization of routine work in support of the objectives of the districts they support.

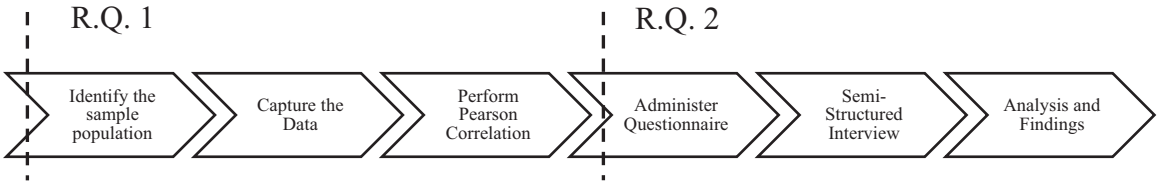

Figure 3: Mixed method process of understanding

For this paper, the term data is defined as publicly available information regarding the results of standardized academic testing and Plant Maintenance and Operation spending by academic districts in the state of Arizona. Because decisions regarding the prioritization of facility maintenance are centralized, all measures were aggregated to a district level. The research utilized education spending information based upon information provided by the State of Arizona Department of Education and the State of Arizona Auditor General's office. The results of standardized academic testing are made available by the State of Arizona Superintendent of Public Instruction. These academic

test scores were used as a measure of building occupant performance, a measure of value, to determine if similar trends to those suggested by prior research are observable.

The study utilized a mixed method analysis to understand better the academic district's process of prioritizing facility maintenance and operational OpEx spending. A quantitative study of facility expense spending and student academic performance was measured over a five-year period establishing a basis for the correlation. A subsequent qualitative analysis of district Facility Maintenance and Operation organizations, to include a questionnaire and interview, was then applied to construct a more thorough understanding of those factors used by the academic district to prioritize maintenance. The following sections provide a methodology for both the quantitative and qualitative aspects of the research.

2.2.1 Academic Performance

Standardized academic testing in the state of Arizona was used to measure educational outcomes. Academic test results were identified by district for the Arizona Instrument to Measure Standards (AIMS) test administered in academic years 2010 through 2014 and again for the AzMERIT standardized test conducted by the state in 2015. Derived from Common Core (Porter et al. 2011), both the AIMS and AzMERIT assess student understanding and proficiency in Math, English, and Science. Only those districts identified as "Public Districts" were explored in this paper. Test results were collected and aggregated by subject. For this paper, a filter was applied isolating "Mean" scores which were aggregated by district. The AzMERIT allows for filtering by Test Level (Grade Level), Subgroup/Ethnicity, and Performance Level whereas the AIMS test

provided a single category for all students who completed the exam. For this paper, the AzMERIT mean test results were collected and aggregated by district, filtering for "ALL" Test Levels and "ALL" Subgroups. The data presented therefore reflects the overall mean score per subject by year within the study's total sample population.

2.2.2 Plant Maintenance and Operation Indirect Expense Spending

The Uniform System of Financial Records (USFR) account code 2600 was used to determine the extent of facility maintenance related expenses. This account code is used by all public schools in the state of Arizona to include "Activities concerned with keeping the physical plant open, comfortable, and safe for use, and keeping the grounds, buildings, and equipment in effective working condition and state of repair (Auditor General 2016)." Therefore, this account code includes spending information from each district related to these activities. For example, should a school replace a light bulb, repaint a wall, or perform preventative maintenance on an air handler, the cost would be archived in the 2600 cost code for that fiscal year.

It is important to note that USFR account code 2600 should not include CapEx or the procurement of items that may otherwise be depreciated. The lack of CapEx is of specific importance to this paper as capital spending is associated with particular district bond initiatives, federal improvement grants, or additional dedicated sources of revenue. Capital spending has also been the traditional focus of academic research studying the impact of the built environment on student performance. Therefore, the use of this account code enabled the author to specifically study whether a relationship exists between current facility management spending and student performance.

For this paper, Plant Maintenance and Operations OpEx spending totals are aggregated by district according to information provided by the Arizona Department of Education. Performance metrics specific to accounting cost code 2600 were then gathered from the state Auditor General's public reports.

2.2.3 Determining a Sample Population

The primary filter used to establish a sample population aggregated data at a district level. The decisions regarding maintenance and operations of academic facilities, except for daily custodial services, are managed centrally at a district level. Furthermore, data regarding indirect facility expense and educational performance are similarly aggregated and communicated at a district level.

A secondary filter excluded academic districts identified by the state as either Private or Charter from the sample population. The construction of public K-12 schools within the state of Arizona is formulaic, accounting for growth projections within the community and include such amenities as gymnasiums, sports fields, playgrounds, bus access, and adequate parking. In contrast, Charter and Private schools are designed and constructed in support of an approved charter or business model, providing for a significant degree of ambiguity with respect to the infrastructure and amenities (Bulkley 2005). Furthermore, the Charter school movement in Arizona is a relatively new practice, introduced by the state legislature in 1994. Many charter schools are, therefore, new or recently constructed thereby mitigating the related facility expense costs associated with the aging infrastructure of public schools within the state.

The residual database consisted of more than 200 academic districts throughout the state of Arizona. Collectively, these academic districts range in size from a single schoolhouse supporting a rural community to large urban districts servicing tens of thousands of students requiring several million square feet of educational facilities. Apart from the regional disparity, the structure and targeted student population of each academic district create an additional layer of differentiation and complexity. This complexity is reflected in annual facility expense spend, resulting in data outliers requiring an extra level of data clarity.

More than one-third (39%) of the public districts identified for the study reported $0.00 U.S. dollars of annual OpEx spend for the period beginning January 2010 through December 2015. While it is theoretically possible to subordinate facility maintenance to the point of defunding the program, it is more plausible the expenses were not accounted for per USFR requirements. Therefore, for this paper, academic districts reporting no spend associated with USFR account code 2600 were excluded from the results, hence providing a more credible source of data for analysis. Furthermore, given the purpose of the correlation, districts that failed to report standardized test results were also omitted from the sample population. Finally, one district reported an annual profit associated with facility maintenance, contradicting the base assumption of an expense associated with facility maintenance. The data, if accurate, may indicate either an error in reporting on the part of the district or a material difference in the management of district employees. The district reporting a net profit was therefore excluded from the sample population.

A secondary purposeful sample consisting of eight Unified academic districts, serving students enrolled in grades Kindergarten through Grade Twelve, was then

selected in cooperation with the Arizona School Facilities Board (AZSFB). Districts selected for the purposeful sample have relative equality concerning funding, location, and utilization (see Table 1). Similarities within the purposeful sample may serve to address those factors which have been shown to influence educational outcomes such as poverty and proximity to social services (Earthman 2002). The resulting purposeful sample represents approximately one-third of the students enrolled in public K-12 education in the state of Arizona and an equivalent amount of the state's Plant Maintenance and Operations annual budget.

Table 1: Profile of the Purposeful Sample

District	*Annual Operations Spend*	*Gross Square Feet (GSF)*	*Facility Spending per Student*	*Facility Spending per GSF*	*Students Teacher Ratio*	*Graduation Rate*
1	$76.3 M	4.4 M	$1,861	$6.69	19:1	92%
2	$32.6 M	4.4 M	$1,001	$5.28	18:1	92%
3	$20 M	4.8M	$562	$5.32	16:1	89%
4	$43.2 M	8.3M	$715	$6.46	19:1	76%
5	$28 M	4.7M	$791	$5.71	18:1	93%
6	$34 M	4.2 M	$1,461	$5.66	20:1	87%
7	$25.1 M	8 M	$547	$6.44	19:1	80%
8	$4.6 M	1.3M	$391	$7.52	19:1	86%
State Total	**$965.5 M**	**138.6 M**	**$1,025**	**$6.09**	**18:1**	**75%**

The purposeful sample represents approximately 27% of the state's spending total and 29% of the gross facility square feet. A more detailed listing of state totals may be found in Appendices A, B, and C.

2.2.4 Correlation

A Pearson bivariate correlation model was used to explore the relationship between academic performance, as expressed in standardized testing and USFR account code 2600 facility operations and maintenance spending. Data was collected covering a five-year period from 2010 through 2015 for this study. Annual correlations of cost per student and academic outcomes, as well as cost per gross square foot with academic outcomes, were measured then plotted year-over-year over the duration of the study.

2.2.5 Questionnaire and Qualitative Analysis

A qualitative assessment was employed to understand better the process and procedures used by a district to govern the prioritization of facility maintenance and operations, eschewing the use of the empirically based correlation. The heuristic nature of the qualitative analysis allowed the author to understand the method for prioritizing work at each of the districts identified for the purposeful sample utilizing the author' experience and knowledge to drive the raw material from the empirical data. The interview-based qualitative research study was conducted and written following a hermeneutic phenomenological perspective (Willig and Rogers 2008). This method of understanding enabled the research to appreciate better the role of the senior Facility Director and the responsibility of allocating and prioritizing OpEx spend in support of the academic district's primary objectives.

Each of the purposeful sample districts employs a full-time Facility Director charged with the strategy and management of facility maintenance and operations at the district. These Facility Directors are responsible for managing a top-down budget,

forecasting headcount, managing capital planning and projects, and executing a strategy supporting facility expenditures to maintain the districts educational infrastructure. Facility Directors representing the purposeful sample were asked to participate in an initial questionnaire to establish a baseline understanding of the district's real estate portfolio and the scope of the Facilities Maintenance and Operations department. Facility Directors were asked to provide information relevant to measuring the scale and related performance of the organization, including:

- Annual facility maintenance and operation spend
- Gross Square Feet of the real estate portfolio
- Total Acres of Land owned or managed by the district
- Organizational structure

The data provided by the districts not only served to construct an overall scope and responsibility for the Facilities Management organization, but the information also helped to validate data provided by the Arizona Department of Education and the State Auditor General.

Once the initial questionnaire was complete, a one-hour semi-structured interview served as a basis for the qualitative analysis. The author met with Facility Directors from each of the districts completing a questionnaire. Interviews were open to Functional Area Leads (Custodial, Landscape, Technical Services) and maintenance management system administrators as needed. Unlike the survey, a semi-structured interview allowed the researcher to better discern the attitudes and motives of the participating Facility Directors (H. W. Smith 1981). Employing this method also prevented the participant

from seeking external support in responding to the questions (Bailey 2008). A formal interview guide was developed to include clear directions for both the interviewer and interviewee, ensuring consistency in the structure of the interview and comparable data resulting from the discussion (Cohen and Crabtree 2006). The interview was categorized in terms of (1) Organizational Structure, (2) Performance Metrics, and (3) Budgeting Process and included such questions and prompts as:

- Describe your organizational structure.;
- Does the district use mobile technicians?;
- How often are rounds and readings conducted? And;
- Is there a formalized process for prioritizing work orders?

Secondary follow-up interviews, 1 hour in length, were conducted to address survey questions or provide additional context not addressed in the initial meeting. In summary, the questionnaire and interview provided a construct of the organization and context regarding how routine work is prioritized by a district (see Figure 4).

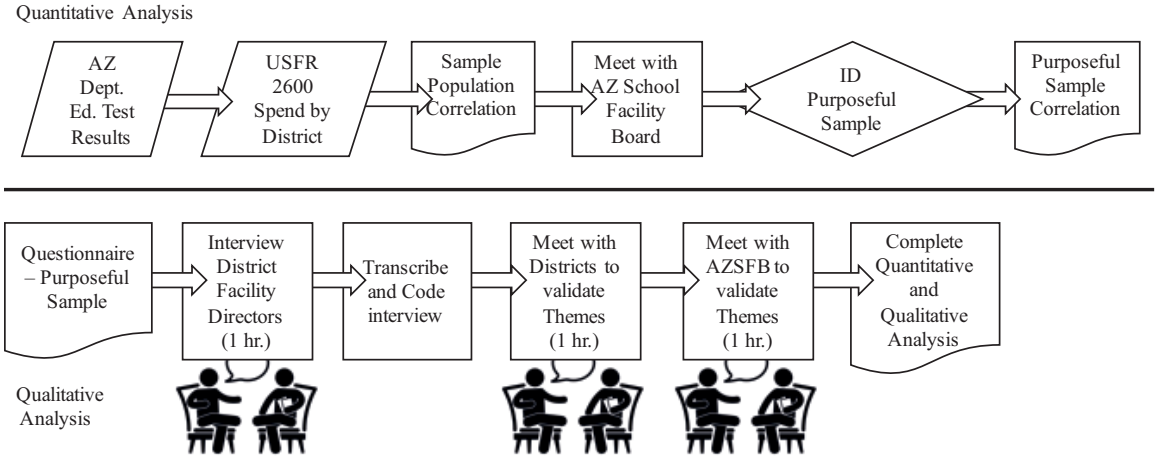

Figure 4: Process of Understanding, Quantitative and Qualitative

Structured interviews were audio-recorded with the verbal consent of the

participant, following Institutional Review Board requirements. All interviews were later transcribed for analysis. The theoretical basis for the study employed a phenomenology analysis method. Moustakas's (Moustakas 1994) method of analysis of phenomenological data provided a consistent and structured method to assess the role of the Facility Director and the process by which work is identified and prioritized with each of the participants interviewed. The process of analyzing the interview transcripts included the following measures:

- Coding of all statements relevant to the prioritization of work and the measurement of performance.
- Codes (meaning units) were then clustered to form themes.
- Meaning units and themes were synthesized to form contextual descriptions.
- A revised narrative, capturing the interview and transcript, was constructed based on the descriptions as authored by the researcher. Initial codes were then reviewed and verified for accuracy and structure of the coding. Final coding aligned to Strauss and Corbin's (Corbin and Strauss 1990; Strauss and StCorbin 1998) process producing central themes (see Figure 5).

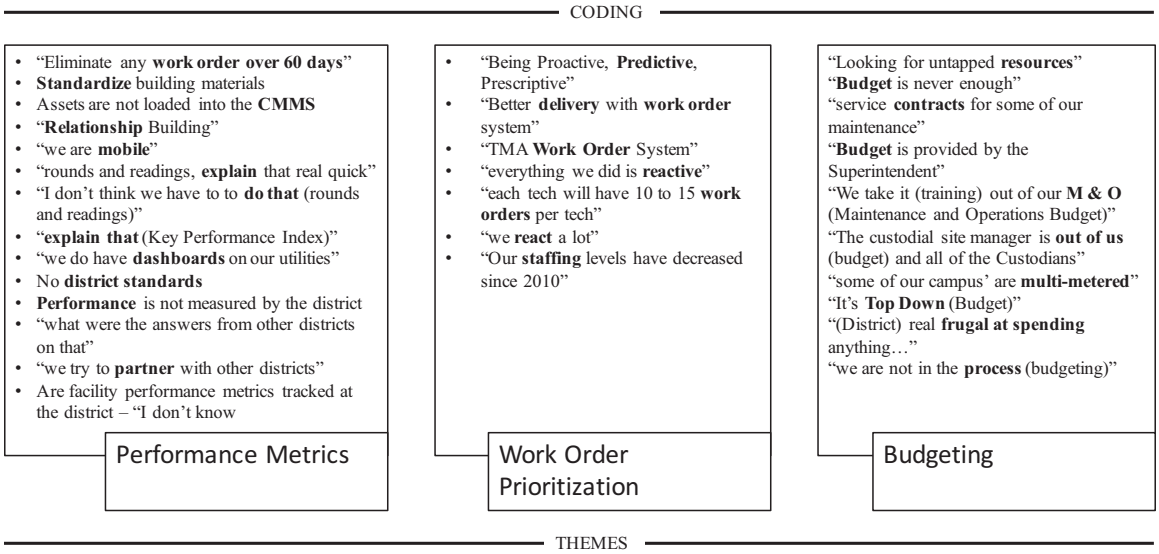

Figure 5: Identification of relevant Codes and development of interview Themes

2.3 Results

The results of the research are organized according to the correlation, questionnaire, and categories of the semi-structured survey. Furthermore, the results correspond to the two research questions presented: (RQ1) is there an empirical correlation between facility OpEx spending and educational outcomes; and, (RQ2) what the processes and the procedures are governing discretionary spending by a district. A summary analysis of both the research questions and the qualitative interview is then documented in the Discussion of this paper.

2.3.1 Correlation

To expect a relationship between the physical condition of a school, campus, or district with the academic performance of students would appear reasonable. For example, a well-cared for school may convey confidence the environment is more conducive to learning. The first correlation, however, which included a sample population of K-12 public school districts throughout Arizona, resulted in virtually no

correlation (see Table 2). A secondary correlation of the purposeful sample was then used to measure the linear relationship while mitigating variability, given the many inherent differences between academic districts in the total sample population. Again, the results of the study did not align with the findings of prior research as essentially no positive relationship was observed (see Table 3). Unlike the first correlation, the purposeful sample yielded a moderate to a strong negative correlation (μ -0.423) between academic outcomes and indirect facility operations and maintenance expense spend. There are various potential reasons for this, as outlined in the discussion section.

Table 2: Correlation of public K-12 schools in the State of Arizona

CORRELATION	**$ / GROSS SQUARE FEET**	**$ / STUDENT**
MATH	-0.102	-0.156
SCIENCE	-0.109	-0.149
READING	-0.035	-0.065
WRITING	-0.038	-0.077

Table 3: Correlation of Purposeful Sample

CORRELATION	**$ / GROSS SQUARE FEET**	**$ / STUDENT**
MATH	-0.056	-0.569
SCIENCE	-0.008	-0.359
READING	-0.145	-0.273
WRITING	-0.204	-0.489

2.3.2 Questionnaire

A questionnaire was issued to each of the districts identified for the purposeful sample. A subsequent semi-structured interview was then completed for those districts responding to the survey. Results of the study provided a contextual baseline from which to understand better the complexity of each district. Furthermore, results of the questionnaire were used to identify potential differences, outliers, between districts that may have influenced the results of the correlation. A review of the facility maintenance

organization for academic districts enabled the author to identify similar roles and responsibilities creating a standard specification for the Facility Management organization for the analysis. Although there were slight differences between the role(s) and responsibilities of the Facility Directors and their respective organizational structures, the bases of each facility management department aligned, achieving the desired outcomes of each district. The facility-related process was intended to support the strategic objectives of each district by creating an appropriate educational environment.

Each of the districts responding to the questionnaire utilized a subscription-based Computerized Maintenance Management System (CMMS) to generate and manage work orders. All but one of the districts employed a dedicated CMMS manager, responsible for managing work orders in the system and providing the initial prioritization of work orders. When generating a work order, each district allowed the author of the work order the ability to assign a "priority level" to that work order. Once a work order was logged in the system, four of the districts utilized the CMMS application to assign the second level of prioritization of work orders based on the developers' specifications. The CMMS application developer customized the prioritization of work orders according to district specifications at two participant districts. Despite the utilization rate of a CMMS application, a key finding of the questionnaire was that all but one of the districts had not completed an inventory of assets nor had the districts entered asset tags into the CMMS. Furthermore, the final degree of work order prioritization was at the discretion of the mobile technician or on-site manager/custodian.

Given the lack of positive correlation between facility maintenance expense spending and academic performance, the study found that four districts identified for the

purposeful sample believe the prioritization of work orders is aligned with the stated mission and objectives of the academic district. Moreover, all of the districts believe in some degree the prioritization of work met the needs of the student, while five of the districts thought the work performed by the facility maintenance organization promoted academic achievement.

2.3.3 Organizational Structure

Each participant district utilized similar organizational structures, serving as the facilities maintenance leadership team for the district (see Figure 6). The organizational structure, therefore, was not a primary factor differentiating the ability of a district to prioritize and disposition work orders. The organization structure of the facility maintenance and operations department does, however, provide insight into the mechanisms governing the dispositioning of work orders.

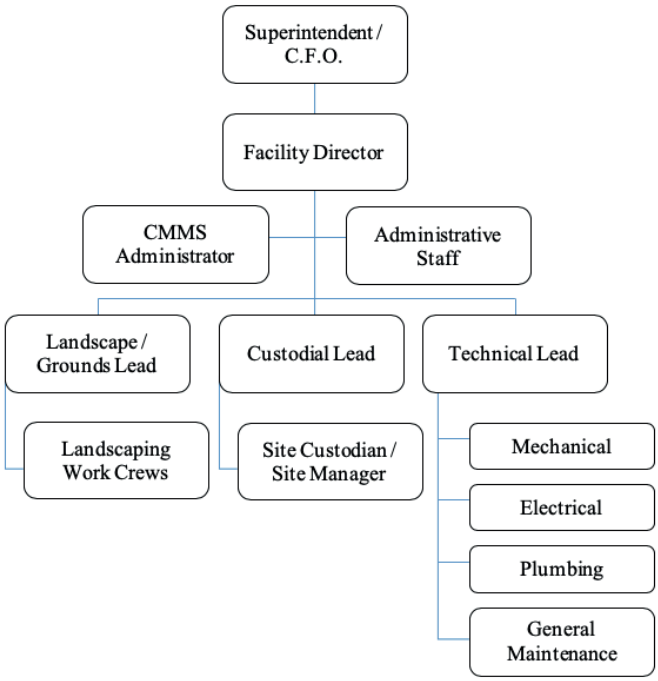

Figure 6: Organizational structure of Facility Maintenance and Operations at a district

A maintenance Site Lead or Custodial Lead, reporting to either the district Facility Director or school Principal, serves as the first responder for work orders, emergency services, and visual inspections of the school. The Site / Custodial Lead is a lower skilled position within the organization, capable of performing a limited variety of recurring and related tasks. All but one of the districts interviewed employed the Lead as a full-time employee within the Facilities Department. A central administrator dispositions work orders to both a Functional Area Lead and a Site / Custodial Lead as the district receives work orders. Site Leads serve as initial responders, enabled to either fulfill the work order on-site or deny the service request, pushing it back into the system for dispositioning by the Functional Area Lead or Facility Director. Site Leads also serve a necessary function in troubleshooting simple facility maintenance issues, providing a cause analysis or simply referring the service ticket to the mobile technician.

2.3.4 Performance Metrics

A common theme of each interview was the perceived importance of establishing operational goals and measuring departmental performance. Given that Plant Maintenance and Operations spending levels are on average lower today than in 2010 (see Figure 2), economic constraints placed on each district warrant a sound fiscal policy supported by robust performance indicators. Despite the apparent need for analytics, a significant finding of the questionnaire was the absence of performance metrics. The ability to quantify performance, aligned with district goals, may have enabled progress reporting specific to the objectives verbally discussed by the districts, to include the cost contribution of facility expense as a measure of value defined in terms of academic performance. Instead of a formal managerial dashboard, an informal system of

accountability appears to be present whereby the facility operations staff strived to close out work orders, provide routine maintenance of facility equipment, while subjectively identifying opportunities to enhance the educational experience.

2.3.5 Prioritization

Districts interviewed for the purposeful sample did not indicate or provide a defined procedure for prioritizing regular and routine work orders. A common trait of each district interviewed, however, was the reactive assessment of the challenges presented on any given day. This element of perceived unpredictability was commonly understood as both a measure of job satisfaction by the district Facility Directors while also recognized as a primary challenge in the management of the district. Each of the districts interviewed cited the unpredictable nature of their role as a principal factor inhibiting the authoring of written process and procedures intended to govern the day-to-day operations of the Facility Maintenance and Operations department.

Two districts interviewed for the study claimed to have a written process for prioritizing corrective work orders, one of which provided written documentation of the process. The similarity in the organizational structure and use of a CMMS, however, indicate the districts interviewed for the purposeful sample share a common informal process of prioritization. The prioritization of preventive and corrective work appeared to start with the Functional Area Leads, whereby work was either assigned to the Site / Custodial Lead or assigned to a Mobile Technician. Prioritization of work orders beyond this point, although at the discretion of the technician, is influenced by the number of backlog work orders within the district and the geographic proximity or grouping of work

orders. Prioritization was, therefore, a mostly informal, organic, and yet coherent process. Given the lack of documentation specific to the process of prioritization and performance metrics, it remains unclear to what extent the prioritization of work may have leveraged the learnings of prior research. Findings of the correlation and subsequent qualitative analysis indicate an opportunity, at a district level, to implement a performance-based decision-support tool, thereby directly adding value in the form of academic outcomes.

A critical observation of the study was the disparity between full-time employees and the backlog of work orders. Within the current system, the existing work order backlog at several of the districts would require either staff augmentation or the dispositioning of work orders to effectively reduce the volume of backlog work orders to a manageable level. For example, one of the districts participating in the study managed a backlog of existing work orders in the CMMS exceeded 600 days. As the backlog of work orders increases in the CMMS, the importance of establishing a formal process of prioritization becomes increasingly essential, presenting a more significant challenge for the organization.

2.4 Discussion

The performance metric Return-On-Assets is an indicator of operational effectiveness. For this paper, the metric applies to educational infrastructure, defined as a product of academic achievement and expressed in terms of standardized test scores. Prior research, cited herein, observed a positive relationship between facility CapEx improvement projects and academic outcomes. This paper distinguishes itself in using facility maintenance OpEx spending as the independent variable. The findings represent

the ability of an institutional facilities management strategy to enable organizational objectives thus creating value, which, in this situation, is measured as the academic performance by a school district. The prioritization of ongoing routine work within a district is an essential factor in this strategy.

Given the two variables, a correlation of facility maintenance and academic achievement did not indicate a positive relationship. In both the sample population as well as the purposeful sample no such positive association was observed. Due to the category and nature of spending present in USFR account code 2600, attributing facility management as a causal relation to academic outcome cannot be determined from a correlation alone. Instead, the findings more accurately suggest two factors are contributing in whole or in part to the negative correlation.

First, current methods of prioritization do not result in a similar positive relationship with academic performance, as indicated by prior research. This finding is counter-intuitive, as many of the processes that fall within the scope of account code 2600 directly impact the performance of those building systems that have been suggested to enable improved student academic achievement. To be clear, the author does not suggest that the findings illustrate a shortcoming concerning the management of district Plant Maintenance and Operation spending. Instead, they suggest that there is not currently evidence that the conclusions of the prior research are already being leveraged on a large scale.

Second, the decline in Arizona's OpEx spending may directly contribute to a deferred or corrective maintenance strategy. It is estimated that Arizona's backlog of

deferred maintenance exceeds $200 Million (Filardo, 2016). Although the focus of this research is not to address the impact of deferred maintenance, it has been established that a deferred maintenance strategy will increase the life cycle cost of an asset (Lewis and Payant, 2007). If all other factors remain unchanged, increasing the cost associated with facility operations and maintenance will have a negative impact on the correlation with academic outcomes.

Findings such as these highlight an opportunity for future work to specifically explore whether strategic spending decisions, leveraging prior research findings, could lead to similar performance benefits through targeted and strategic operational spending as those observed with CapEx improvement spending.

K-12 Facility Maintenance organizations have an opportunity to leverage prior research, thereby prioritizing those work orders that maximize educational benefit. However, the current method of each of the districts studied is to prioritize the needs of the asset, adhering to a top-down budget, and thereby reducing costs while increasing the usable life of the asset. Specific to this study, the district's understanding or recognition of an assets ability to enable the delivery of education was a critical gap in their process of prioritizing work. For example, accounting for the ability of lighting to positively influence academic attainment or air quality to influence student engagement (Earthman 2004) may materially influence the prioritization of one work order over another. In this way, leveraging academic research as a primary method when prioritizing work orders would give precedence to educational outcomes.

While the opportunity exists to leverage prior research more directly in facility maintenance work order prioritization, there is also a likely need to continue to leverage

the current Facility Directors for decision making. Collectively, these experienced professionals have an understanding of the logistical challenges and needs of a particular school building. Their knowledge could help in decision-making to ensure that prioritized work orders are performed in a manner which mitigates any possible negative impact on the students. For example, this may involve strategically delaying work order remediation until the close of a school day or between classes when the associated tasks would not interrupt student learning activities. The combination of a generalizable, research-based, decision support tool and building-specific knowledge could yield benefits for student performance without negatively impacting the learning environment during the completion of the work order.

2.5 Limitations

The study may not reflect each district's approach to Facility Maintenance and Operation. Furthermore, a fundamental assumption of this paper is the sample population accurately account for expenses associated with facility maintenance and operations. The views and methods shared by the districts identified in the purposeful sample, however, may not reflect the opinions and practices of other districts within the state of Arizona.

The study aimed to identify if a correlation between OpEx spending and academic outcomes was present. Additionally, the study sought to understand better if or how the prioritization of work factored into that correlation. The author was not able to identify with specificity the role of work order prioritization as a causality due to the inherent complexity of an academic district and the absence of a formalized process of prioritizing routine work. Despite these limitations, the author was able to determine similarities in

the organizational structure and system for managing the district assets, resulting in a common informal process of prioritizing work orders.

2.6 Conclusion

The purpose of this paper was two-fold. First, the objective was to quantify the relationship between facility maintenance OpEx spending and the goals of the organization. In answer to this question, a quantitative bivariate correlation resulted in no significant positive relationship between the two variables. The lack of positive correlation should not be understood as a resolution to defund facility maintenance supporting K-12 education. To the contrary, a number of academic studies have in fact established a strong positive correlation between the condition of the built environment with educational outcomes (Young et al. 2003; Duyar 2010; Earthman and Lemasters 1998). Moreover, there is a direct link between a decline in academic performance and the degradation of academic facilities (Walberg 1982). Rather, the results of this study suggest there may be an opportunity for performance improvement concerning indirect facility maintenance expense and questions how facility maintenance work is prioritized to fulfill that opportunity.

The paper also strived to understand the process of prioritizing regular and reoccurring work orders. More specifically, the author explored how the prioritization of work may factor into the performance of the organization, leveraging prior research, and thereby creating value. To this end, the qualitative analysis addressing each district's process and method of prioritizing work was perhaps the more insightful aspect of the paper's mixed method approach. Here the research findings indicate there is no clear

prioritization of work orders at a district level, highlighting the need for an empirically based DST for the prioritization of work. Moreover, the author identified an opportunity to link a DST to performance metrics aligned to the strategic objectives of the district. In contrast, the author observed an informal yet familiar process whereby written processes and procedures were directly or indirectly subordinate to the daily function of problem-solving. Within the Facility Maintenance and Operations organization, a lack of formalized procedures specific to the prioritization of work resulted in each district utilizing an informal process of actively managing workflow and subjectively prioritizing departmental objectives within the district. Similarities in the organizational structure and asset management system, however, contributed to a shared approach to work order prioritization.

While the sample studied was localized to Arizona, the types of decisions that need to be made by facility managers due to an aging infrastructure may match the workload requirements of many other K-12 facility managers throughout the nation, requiring strategic, operational spending. In this way, the findings from this work justify future research aimed at directly incorporating prior research findings into a decision-support tool that may aid facility managers to more effectively prioritize facility maintenance and operation OpEx spending.

CHAPTER 3

A DECISION SUPPORT TOOL FOR INSTITUTIONAL FACILITY MAINTENANCE

Within the United States, Federal and local governments are increasingly faced with constrained resources, while managing a vast amount of building infrastructure, ranging from schools to stadiums to hospitals. The primary purpose of these facilities is to serve a public function deemed necessary and commonly understood to be of public benefit. Institutional facilities must, therefore, be managed and maintained expertly to serve their intended purpose while in operation.

Frequently, this process of maintenance requires facility managers to prioritize work in a manner that best supports the intended purpose of the facility. In other words, for these types of institutions, facility managers are often inundated with requests to address reported building problems (i.e., replace a burned-out light, or adjust the temperature for a given space). Often there are more of these types of work order requests than there are available personnel or resources to address them. The subsequent backlog creates a need to prioritize work orders, resulting in the completion of those work orders deemed most important and of highest priority. Others that are determined to be less critical may be delayed or dispositioned, based on the facility manager's judgment.

This process of informed prioritization and subsequent completion of work orders can have a significant impact on the overall performance of a building and the performance of those people working in a facility. Many research publications, as well as anecdotal evidence, indicate that poor facility conditions can hinder operational performance. For example, there is a variety of institutional research, specific to Kindergarten through 12th grade (K-12) education, indicating that attributes of the built

environment can have a direct impact on student performance (Cash, 1993). This impact can be beneficial or detrimental, depending on the specific condition. While most prior studies do not explicitly state that effective facility management (FM) can directly lead to better student performance, it is clear that effective FM can impact the condition of a built space, which prior works have indicated can impact student performance. Furthermore, prior research that explores trends in the performance of various public institutions indicates that there are opportunities for significant improvements in the way buildings are managed, including K-12 specifically (Beauregard and Ayer, 2018), and other public institutions in general (Amaratunga and Baldry, 2003; ASCE, 2001; Herrmann, 2013). This highlights the opportunity for decision-makers to directly leverage the findings of prior research to prioritize work based on what has been reported to be beneficial for the overall performance of a facility.

While the potential need for a better decision-making process in public institutions may seem apparent from a cursory review of the literature, the process for guiding decision-making is less transparent. Therefore, this work proposes a methodological approach to create a DST that leverages existing literature that specifies attributes of the built environment that may benefit the overall performance of the institution. This approach leverages principles suggested by Analytical Hierarchy Process (AHP) literature and also includes methods for identifying and organizing existing literature related to building performance. The developed tool is intended to be comprehensive, yet easy-to-use, enabling building managers to implement the tool on a daily basis.

The author chose to use K-12 education as the field for testing this DST development approach. There is a wealth of published literature related to attributes of the built environment that impact student performance, and there is also an opportunity for improvement for K-12 infrastructure. While K-12 was the focus of the study, the aim was to create a methodology that could be used to generate evidence-based DST's for other types of building environments that require work order prioritization. The developed DST was validated using a targeted focus group of industry professionals and includes four primary FM categories. The DST structure and overall process used for development of the DST are envisioned to be usable for a variety of building applications. The contribution of this work is in providing a reusable methodology that may be implemented to create subsequent DST's for enabling evidence-based decision-making among building managers in various built environments.

3.1 Background

The U.S. Federal Government is the nation's largest institutional property owner and manages more than 3.3 billion square feet of real estate, which costs more than $30 billion annually (US General Services Administration, 2012). The portfolio of federal properties includes 43 million gross square feet (GSF) of correctional facilities, 266 million GSF of educational space, and almost 130 million GSF of hospital facilities (US General Service Administration, 2018). The U.S. Postal Service alone manages approximately 30,000 sites across the nation (US General Service Administration, 2018). The list of institutional facilities includes public parks, universities, school districts, transit sites, police and fire stations, courthouses, correctional facilities, and similar

governmental properties requiring regular preventive, predictive, and corrective maintenance.

The ability of a facility operations organization to successfully integrate the management of building infrastructure maintenance with the strategic near- and long-term objectives of an institution contributes to an environment that supports the primary objectives of that institution (Barrett and Baldry, 2009). When appropriately managed, the FM organization can positively impact an institution's end requirements (Becker, 1999). Similarly, the metric of institutional facility efficiency may be realized as that institution's success in creating public value (Amaratunga and Baldry, 2003; Tucker and Pitt, 2009).

While many different factors can impact overall FM performance, one of the critical tasks that must be accomplished among FM teams relates to the prioritization and completion of routine work orders that support the quality of the built environment and enable overall organizational effectiveness. Facility managers and directors are typically responsible for assigning priority to routine maintenance requests (work orders). While some evidence suggests opportunities for this prioritization process to be improved (Beauregard and Ayer, 2018), these managers are tasked with a complicated job that frequently requires them to balance competing interests. They must prioritize work orders to utilize institutional resources efficiently, support a financial return on investment, support organizational performance, maximize assets, assess environmental impact, and most recently anticipate social awareness (Alexander, 2013). Furthermore, they may face a host of issues internal to facility maintenance including continuous operations, optimized performance, human resources, and the active integration of FM with the

parent business or institution (Tay and Ooi, 2001). Therefore, this paper does not aim to suggest that the current facility managers are failing at their jobs. Instead, the author suggests that the current environmental factors that surround work order prioritization make it nearly impossible for any individual to consistently make spending decisions that will always provide the most significant positive impact on a facility. For this reason, the author intended to create a structured DST aimed at supporting consistent, evidence-based, spending decisions to empower decision-makers.

3.1.1 Academic Districts

This research studies the prioritization of work at institutional facilities, using the public K-12 education system as a paradigm. Prior research frequently suggests a relationship between the condition of educational buildings and academic performance (Earthman, 2002; Earthman and Lemasters, 1998). More specifically, research has shown relationships between the built environment and various factors, including teacher retention (Buckley et al., 2004; Earthman and Lemasters, 2009); school culture (Bejou, 2013); and academic climate (Billings and Terkla, 2014; Tanner, 2008). Similarly, a 2002 study by Amaratunga and Baldry identified a positive correlation between facility condition and organizational performance (Amaratunga and Baldry, 2003). These prior works collectively highlight the potential for FM organizations to use prior evidence when guiding work order prioritization.

Despite these opportunities for K-12 spending decisions to impact student performance, data from the National Center for Educational Statistics shows that funding for routine facility maintenance in support of education infrastructure is in a state of

decline (Snyder et al., 2016). Presently, many K-12 organizations are resorting to a deferred maintenance approach for prioritizing spending (Alexander and Lewis, 2014). For example, facility maintenance spending for K-12 education buildings in the state of Arizona was $1,170 per student for the 2003 academic year, which equates to approximately $1,430, when adjusting for inflation. In 2014, the annual spend per student totaled $922, a decline of approximately 21%. Over this same period, student enrollment in Arizona's K-12 educational system increased by more than 26% (NCES, 2014). Moreover, the National Center for Educational Statistics estimates the states K-12 enrollment will continue to grow by another 9% by 2027. While the exact enrollment and spending trends vary by state (Hunting, 2013), the need for the U.S.'s K-12 academic institutions to perform better with fewer resources is consistent among many states. When considered in conjunction with the wealth of prior literature indicating specific attributes of the built environment that may uniquely support academic performance, this highlights a significant opportunity for a structured DST to offer value to FM decision-making.

3.1.2 AHP as a Decision Support Tool for Facility Management

This paper employs principles of AHP to guide FM decision-makers to leverage findings reported by prior research. AHP provides a technique for handling uncertain, multi-criteria information, utilizing pair-wise comparisons while leveraging the experience of subject matter experts (SME) to derive priorities objectively (Saaty, 1999, 2008). The selection of AHP as a decision method provides insight where existing decision protocol such as Life Cycle Asset Management, Return on Investment, and Net Present Value do not address both the economic and analytical factors influencing the

decision process (Chan et al., 2000; Klir and Yuan, 1996). AHP has been practically applied as a decision support archetype for healthcare facilities (Lavy and Shohet, 2007), building maintainability (Das et al., 2010), facility benchmarking (Gilleard and Wong Yat-lung, 2004), building renovation (Nielsen et al., 2016), residential asset management (Shen et al., 1998; Vilutienė and Zavadskas, 2003), along with many other relevant aspects of construction and building management. This research contributes to the existing body of work applying AHP as a decision framework. The methodology for organizing previously un-structured research into an easy-to-use DST for routine FM OpEx spending, specific to large-scale institutional facilities, constructively expands upon the existing research.

3.2 Methodology

The process for developing a DST that leverages prior research for prioritizing FM spending was created through four sequential steps (see Figure 7). A comprehensive literature review was initially developed to identify, and then aggregate, institutional performance enablers specific to facility infrastructure and K-12 education. Analytical hierarchy process was then selected as an archetype decision support methodology based on AHP's ability to facilitate complex, multi-variate, problems. Moreover, AHP provides SME's a vehicle to influence their decision. A framework was then constructed, based on K-12 education, to enable decision-makers to determine the extent to which a given work order would align with building attributes suggested to enable student success. Lastly, a targeted focus group consisting of practicing Facility Directors, technicians, and SME's was convened for validating the feasibility and practical application of the developed DST. The resulting process provides a reusable method for developing a DST that

leverages existing research aligned with institutional objectives for the prioritization of routine work orders. This section describes the process for development of the DST.

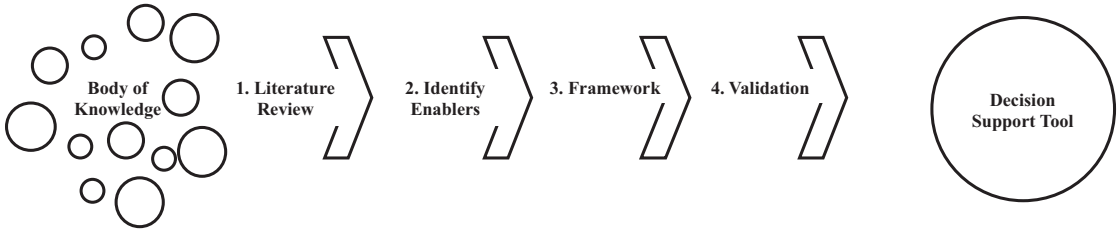

Figure 7: Four-step research method

3.2.1 Step 1: Literature Review

A literature review of academic publications documenting the relationship between facility condition and institutional performance (academic outcomes) provides the underpinning for this research. The author considered three publishers' databases (Elsevier, Emerald Insight, and Taylor and Francis) compiling and aggregating a comprehensive body of knowledge for this study. These bibliographic databases were selected because they all have high quality, peer-reviewed, publications that specifically relate to the practice of FM, Facilities, and Education.

Prior research has identified a positive correlation between facility condition and organizational performance (Amaratunga and Baldry, 2002). Comparable studies have established a similar relationship between the condition of educational facilities and the academic outcomes of students (Earthman, 2002). Initially, search terms relating to facility attributes, and building systems that may relate to institutional performance were selected based on previously published work (Cash, 1993). The scope of FM, however, extends beyond building systems and architectural attributes. Therefore, the list of search terms was expanded to include facility infrastructure attributed to the development of an

institution's climate and culture as that correlation became better understood (Maslowski, 2001; Wang et al., 1997). Climate (ambiance) and culture (ethos) can be influenced by work orders addressing items such as signage, seasonal landscaping, repaint, and custodial, which can collectively influence the performance of an organization (Kumari and Dhull, 2017).

After identifying relevant papers that relate facility conditions to organizational objectives, an additional layer of filters was applied to further refine the search results. Academic journals were first filtered to limit publications to only those dated 1990 through 2018. Given the changes in FM such as technology innovation, building systems, maintenance management systems, and asset management analytics, the filter excluded those studies that may now be out of date. Furthermore, if any publications in this time frame cited technologies or other practices that are no longer used, they were omitted from the analysis. Results were further refined to include only scholarly academic journals. Professional practice or Academic publications, such as those published by the Building Owners and Managers Association (BOMA), the International Facility Management Association (IFMA) and the Association for Learning Environments, although informative, were excluded from the search findings as these publications are not generally peer-reviewed. Furthermore, papers published as a result of conference proceedings were also omitted. Often conference papers represent incremental findings that support larger research efforts published in peer-reviewed journals. By excluding conference proceedings, it enabled the author to prevent redundant findings that would artificially indicate greater importance from the same work previously published in various outlets.

The final filter used for this study narrowed the scope of research to a selected public institution: K-12 education in the United States. International studies have been published detailing a relationship between facility condition and academic performance (Hopland and Nyhus, 2015; Mei-yung Leung and Ivan Fung, 2005). The nature of educational funding and academic infrastructure in other parts of the world does not necessarily apply to domestic K-12 education. Interstate similarities with respect to instructional delivery, educational infrastructure, funding mechanisms, and the assessment of academic performance provide an ideal environment from which to assess the viability of the DST domestically. Furthermore, where prior studies have documented the results of CapEx improvements to facility infrastructure (Edwards, 1991; Lewis, 2000; Maxwell, 1999), this study documents a methodology for prioritizing routine work orders, which are indirect financial expenses.

3.2.2 Step 2: Development Approach

The literature review intent is to understand the role of institutional facilities' infrastructure through the lens of K-12 education. This specific focus enabled the author to identify fundamental aspects of educational infrastructure that have been suggested to have a positive relationship with academic performance. To organize these aspects of infrastructure, Analytical Hierarchy Process provides an ideal decision framework as it allows for multiple independent variables according to how each variable serves the needs of the organization (Saaty, 1990). Moreover, AHP utilizes pairwise comparisons, relying on the assessment of SME's to establish priority (Saaty, 2008). The process of AHP enables the user to categorize multiple independent variables based on the variables' ability to influence, and positively impact the organization. The framework of

AHP is transferable, thereby allowing for the development of institution-specific solutions.

In selecting AHP as a method of prioritizing research, the author had to address the tradeoff between a precise calculation of preference with the practical usability of the tool. A distinguishing benefit of AHP as a decision support archetype is the pairwise comparison, allowing the decision-maker the ability to assign value and thus prioritize multiple variables. The challenge of adopting AHP as a decision method, however, is the eigenvalue method of calculating priorities (Saaty and Hu, 1998), which for some users presents a challenge. Using this traditional method, the final decision is ultimately a mathematical calculation accounting for both a weighted distribution and conditioning factors.

For a large-scale institution, a proper pairwise comparison may quickly become labor intensive as facility SME's are asked to evaluate and quantify hundreds of variables. Moreover, the perceived complexity of the mathematical calculations may inhibit adoption. Consequently, practitioners may revert to their initial subjective assessment rather than adopt the numerical pair-wise valuation (Scholz, 1983). This concern, if realized, would negate the whole motivation of developing a structured DST.

In response to this challenge, the author chose a modified AHP structure that utilizes a visual 5 stage (very high, high, moderate, low, very low) linear multi-attribute selection method to mitigate potential challenges related to the complexity that might be present for decision-makers (Baloi and Price, 2003; Boucher and Gogus, 2002). The resulting DST establishes priority through visual assessment enabling the efficient

prioritization of work. The simplicity a visual analytical hierarchy process (VAHP) of assessment was selected to support the practical adoption of the proposed tool. Moreover, a linear VAHP selection method provides a consistent and repeatable platform for evaluating maintenance, improving the accuracy of the work order prioritization.

3.2.3 Step 3: Constructing a Decision Framework

A total of four primary categories were selected to serve as the principal framework for the DST: Influence, Building Status, Building Usage, and Institutional Enabler(s). Each category was selected based on either the universal application of the category or prior academic research establishing a positive relationship between the category and the successful operations of a facility. Furthermore, this structure allows the DST to first address operational (macro-level) categories of performance before narrowing the focus to those factors enabling operational success.

Within each category resides a secondary layer of variables specific to the targeted institution. This secondary layer of variables provides FM and operational administration the opportunity to customize the DST to the specific needs of their organization while also providing a platform by which to prioritize work orders aligned with the strategic objectives of that organization. The secondary variables within each category, for this study, are aligned with K-12 education.

Central to the development of each category is defining the voice of the customer (Griffin and Hauser, 1993). The prioritization of work orders is a method for value creation and responds to the needs of the customer. The allocation of resources, aligned with facility attributes is, therefore, prioritized according to those work orders that are

systemic to the success of the customer, synergistic with the objectives of the organization, or at some lesser level discrete (Palmer, 2004). For K-12 education, defining who the customer may or may not be can be difficult and may be politically charged. This study defines the Teacher-Student engagement as the customer, given that academic performance is the primary measure of success for academic districts (Christenson et al., 2012; Wang et al., 1997). The term systemic, specific to K-12 facility maintenance, addresses those facility characteristics with the most significant impact on the delivery of education. The following paragraphs summarize the process of identifying each category and subsequently selecting the variables.

The first category, 'Influence,' addresses "who is most likely to benefit from completing the work order and what is their role in creating value?" Traditionally the owner is responsible for creating value and is, therefore, the primary stakeholder or customer in the maintenance and operations of a facility (Alshubbak et al., 2015). Similarly, the selection of Influence as the primary category of the decision support framework recognizes the department, team, or individuals most capable of generating value for the organization. A report by the Mid-Atlantic lab for student success identified "Classroom Management" and "Student/Teacher Social Interaction" as two primary factors in the delivery of education (Wang et al., 1997). Hence, concerning K-12 education, the Teacher was identified as the primary customer having the most influence generating value for an academic district and is, therefore, FM's primary customer (Griffin and Hauser, 1993). The priority given to other organizational roles and responsibility, such as district or school administration and support staff, declines as the intended work moves further away from the teacher-student engagement.

The second category, 'Building Status,' represents the relative importance of the building or space regarding function and usage (Shen, 1997; Spedding and Holmes, 1994). The category, therefore, prioritizes work orders that have the most significant effect on the overall institution. For example, building systems such as cooling towers or boilers may service an entire site, warranting a higher FM priority. By contrast, the risk associated with the failure of a lighting ballast may be limited to the given range of the failed light. Moreover, the surrounding light fixtures or natural day-lighting may supplement the failing ballast. Therefore, a work order associated with an overhead fluorescent light may, therefore, be a lower priority than a work order associated with primary building systems, such as cooling towers. Concerning K-12 education, work orders impacting an overall campus are assigned a higher priority than an alternate work order that may service a building, a classroom, or a single administrative office, (see Figure 8).

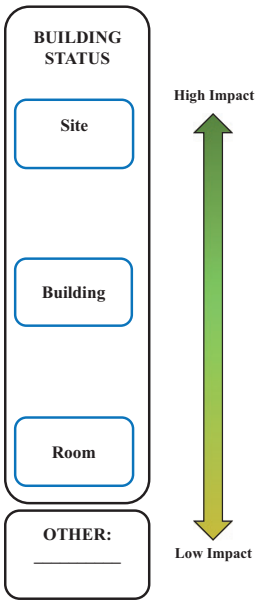

Figure 8: Primary Category, Building Status

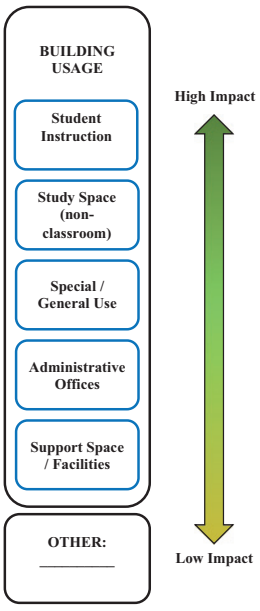

Figure 9: Primary Category, Building Usage

'Building Usage', the third category (see Figure 9), represents the importance of the building function and answers how a given space contributes to an organization's overall productivity, prioritizing those spaces having a use most closely aligned with the organization's mission (Shen et al., 1998; Spedding and Holmes, 1994). Prior research suggests that most real estate officers do not integrate their activities with the activities of other functional areas (Gibler et al., 2002). Therefore, this category encourages decision-makers to actively consider how a given work order will impact the function of the facility. For example, a manufacturer might prioritize the up-time of the manufacturing floor thereby maximizing operational output. Similarly, for prioritizing education, this category recognized the importance of instructional spaces over non-instructional (administrative offices, multi-purpose space, support facilities), as instructional spaces have the most significant impact on student performance (Earthman and Lemasters, 1998, 2009; Tanner, 2008). Support spaces and support facilities are assigned the lowest priority, which may include such areas as transportation yards, central storerooms, janitorial closets, utility yards, or other tertiary spaces supporting the district (Cyros and Korb, 2006).

The fourth category of the decision framework leverages the findings of the literature review (step one of the methodology) to identify and categorize scholarly publications that report a relationship between facility condition and academic outcomes. Furthermore, facility infrastructure or improvements to the existing facility infrastructure, architectural elements, or building envelope shown to have a positive effect on academic climate or culture were identified (Ariani, 2015; Bejou, 2013; Gonder and Hymes, 1994; Hines, 1996). The resulting category, 'Institutional Enabler(s),' prioritizes the findings of

Table 4: Academic research citations attributing academic performance with facility conditions

Academic Enabler	*Percentage of Citations*
Play	21%
Instructional Space	19%
Technology Zone	17%
Reference Space	14%
Creative Space	9.0%
Comfort	5.0%
Landscaping	4.0%
Cafeteria	1.0%
Lighting	1.0%
Magnet School	1.0%
Paint / Patch	1.0%
Room Equipment and Furnishings	1.0%
Air Quality	1.0%
Circulation	1.0%
Electrical	1.0%
Hardware	1.0%
Safe Place	1.0%
Visualization	1.0%
Bathroom	0.40%
Acoustics	0.27%
Plumbing	0.24%
Overall Impression	0.17%
Natural Lighting	0.13%
Temperature Control	0.10%
Quiet Room	0.07%
Activity Pockets	0.05%
Learning Zone	0.02%
Total	**100%**

the literature review according to the volume of scholarly publications (see Table 4). In doing so, this study provides a method for assessing a work order based on that work order's potential impact to the building elements most often reported to benefit education.

To better illustrate this structure, of the scholarly publications identified through the literature review, 17% addressed Technology Zones and academic outcomes. This hierarchy is not claiming that completion of the work order will result in a pre-determined percentage of improvement in academic outcomes. Furthermore, the author is not suggesting that Technology Zones are more significant than building systems or other building attributes cited less frequently. Instead, the structure places a value on a work order associated with Technology Zones based on the prevalence of academic research correlating Technology Zones with academic outcomes.

Having identified institutional enablers specific to K-12 education, the author then established a hierarchy aligned with a visual AHP providing Facility Managers a method to quickly prioritize a given work order leveraging prior research (see Figure 10).

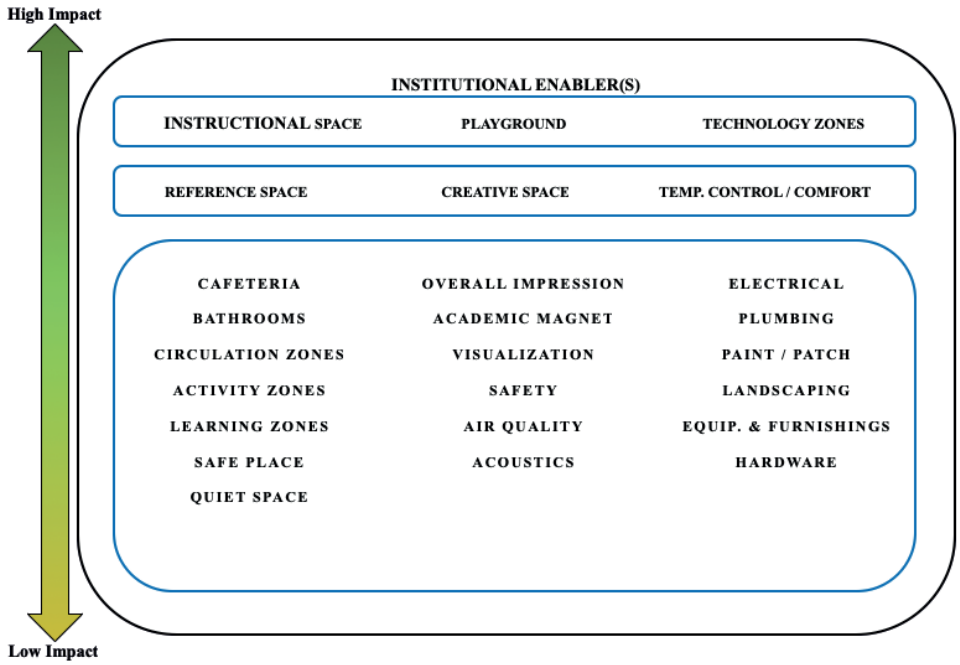

Figure 10: Primary Category 4, Academic Enablers

Each of the four categories as detailed in this methodology are intended to be universally applied to institutional facilities. The aim of identifying variables within each category is to provide a customizable framework that could enable the efficient prioritization of work orders while introducing to the facility operations team research-based factors that may not have otherwise been considered. The purpose of this research is not to elicit 100% agreement on all work orders nor is the intent to provide a comprehensive list of variables. Use of the DST is intended to create consistent relative value for the institution as it incorporates the subject matter expertise of facility management, addresses the voice of the client, integrates relevant academic research, and aligns with the strategic direction of the institution. In other words, identifying more elements of higher priority on the DST should guide thinking for work orders that were otherwise seemingly similar.

3.2.3.1 Scope of Work

For this study and the intent of the DST, work orders defined as major repairs, including “Emergency” or “Critical Break-Fix” are out of scope and not intended to be prioritized with the aid of the DST. Response times for such work orders are of the highest priority and may, in fact, proceed without the formal documentation of a work order. The issues that constitute a major repair are defined and developed by the parent institution as a method to mitigate risk. Although the definition of a major repair is subjective according to the needs of the institution, the intent to signify a heightened sense of priority and a timely response is common in FM (Lewis and Payant, 2007). For these reasons, the DST methodology excludes Emergency or Critical issues, focusing instead on those work orders defined by an organization as routine or regular.

3.2.4 Step 4: Targeted Focus Group

After constructing the framework, the fourth and final step was to validate whether current practitioners would understand the developed DST for prioritizing routine work. A targeted focus group was convened for validating the proposed DST using a non-directed, yet controlled, discussion (Flores and Alonso, 1995). The use of a focus group was intended to provide a more in-depth perspective resulting from the interaction between the moderator and the participants (Lederman, 1990). A moderator was selected and charged with facilitating the discussion following the study’s objectives. For this study, the focus group participants collectively formed a “purposive” sample of the target population, which in this case references facility maintenance personnel responsible for the prioritization of work orders (Lederman, 1990). The focus group also served a phenomenological function, sharing their perceptions and experiences specific to the prioritization of work (Moustakas, 1994).

The targeted focus group included facility maintenance and operation professionals from Arizona State University. The framework of the tool is intended to be universally applied to large-scale institutional facilities, although the research utilizes K-12 education as an area of focus. Soliciting critical feedback from the university's Facility Maintenance and Operations staff provided a format that was both institutional in scale and transferable concerning the complexity and organizational mission. Focus group participants were understood to be SME's in their field. The individual responsibilities of participants included those with management responsibilities to include the allocation of resources for prioritizing and completing work orders. In total, 5 Facility Administrators volunteered to participate in the targeted focus group, which utilized a snowball sampling technique (Burgess, 1984).

Participants were asked to prioritize five example work orders representative of routine K-12 facility maintenance. The participants then responded to questions concerning the logic, viability, and practical application of the DST. Discussion questions encouraged dialog specific to the construction and functionality of the tool such as:

- How might one edit the DST to improve the ease of use and/or logic to enhance the tool making it a more intuitive experience? And;
- What does the process of prioritizing work orders involve and what factors are considered?

Additional probing questions addressed the practical application of the DST:

- Please explain how the introduction of a DST might influence resource allocation. And;

- How might the tool align with the institution's objectives?

Focus group discussions were audio recorded for later transcription. Transcripts were coded manually using NVivo® software to produce a categorization of data thereby expanding upon the moderator's notations to add clarity and specifics. The process of overlaying the notes and audio transcript aligns with the "note-expansion" approach enabling a more rigorous understanding of the notes (Bertrand, 1992). Transcript coding was then used to develop primary themes and learnings. Several subcategories were developed further within the themes to provide greater context.

Primary themes and learnings from the focus group were used to modify and improve the developed DST. Additionally, the author reviewed specific recommendations or directives from the participants for constructively enhancing the tool.

3.2.5 Prioritizing a Routine Work Order

In this section, routine work orders are used to explain and illustrate the implementation process of the proposed visual AHP multi-criteria decision support methodology. An initial example is provided. Then five actual work orders are prioritized by a focus group of industry professionals using the DST methodology.

3.2.6 Illustrative Example

A routine work order is provided to better illustrate the utilization of the proposed visual AHP DST, (see Table 5). Suppose a work order was generated by an employee and must now be reviewed by an operations administrator or someone with similar

responsibilities charged with the prioritization of work. According to the steps described herein, the individual decision-maker must evaluate multiple decision alternatives utilizing the framework of the DST as a method of categorizing and understanding each alternative.

Table 5: Example of a routine work order submitted by an academic district

Work Order #	OP-142027		**Request Date**	09/25/2017 11:55
Location ID	GHSGND – PRKG LOT		**Completion Date**	
WO Type	Corrective Maintenance			
Description				
Request	Channel drain behind kitchen falling apart, can we have it repaired/replaced		**Total Hours**	
Priority Description	Routine		**Total Cost**	0
Item Description	Item Number	Item Type	Task Code	Task Description
Parking Lot-PRKG Lot	GHSGND-PRKG LOT	Area	PL11020	Inspection

The scope of the work order, "flush valve in the Men's restroom," has a direct impact on the educational staff, male teachers (Influence C_1), working within the building where the flush value has presumably failed. It may be reasonable to expect there is more than one faculty Men's restroom servicing the campus. At this point, however, it is unclear if this is the only faculty Men's restroom servicing the building (Building Status C_2). Restrooms are not considered to be "instructional spaces," nor would the restroom be "administrative." Therefore, the function of the Men's restroom, building usage C_3, can be defined as "Special / General Use." Within this category, and specific to K-12 education, the term "Special / General Use" may apply to such areas as administrative offices, restrooms, multi-purpose rooms or similar tertiary spaces available to faculty, students, and staff supporting the primary function of the institution (Cyros and Korb, 2006).

The fourth category in the DST (Institutional Enabler C_4) includes those factors identified through a comprehensive literature review that meet the criteria of the filters and thus imply a relationship between academic performance and facility condition. Here the DST leverages the professional experience of the Facility Manager given the work order may address “Plumbing” as a building system and “Bathroom” as a quality of the campus.

In summary, completing the DST and prioritizing the work accordingly may result in a visual assessment of “Moderate” to “High” given the aggregate score of each of the four categories (see Figure 11). In practice, however, the tool requires the input of the Facility Manager to be successful. For example, specific to this work order, the building may have multiple Men’s restrooms, there may be no male employees at this school, or the leak may simply be overstated given the experience of the service technician. Regardless, the DST methodology requires both a subjective and objective assessment of the work order to appropriately prioritize the work.

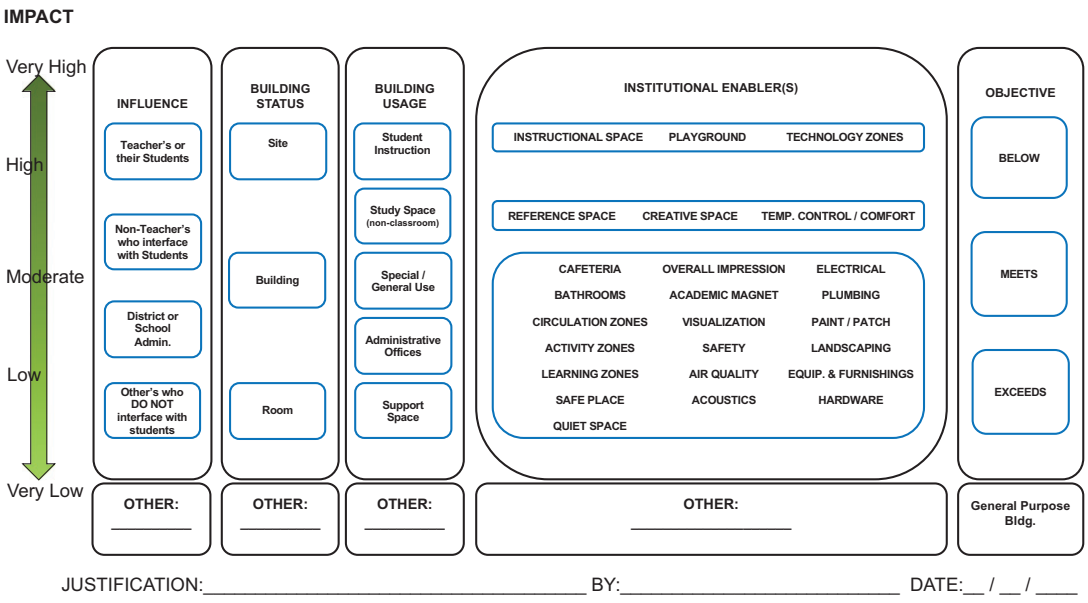

Figure 11: Decision support tool for prioritizing routine facility maintenance, K-12 academic districts

3.3 Findings and Discussion

To verify the effectiveness of the proposed DST, work orders representing routine facility maintenance at a K-12 district were presented to the focus group. For comparison purposes, all work orders were obtained from a participating academic district and provided to the focus group with limited edits to anonymize the source of the original work orders. The focus group included five Facility Managers responsible for decision-making concerning routine facility maintenance and repair. The participants of the focus group FG_P (P=1, …, 5) were asked to evaluate five work orders WO_n (n=1, …, 5) utilizing the four categories as presented in the DST, where C_1 represents 'Influence', C_2 represents 'Building Status', C_3 represents 'Building Usage', and C_4 represents 'Institutional Enabler.'

The prioritization activity was purposefully designed to familiarize the

participants with each of the four categories, introducing the variables within each category. Work order "1" was intended to be understood as a "Very High" priority work order, given the scope of work and by virtue that all four categories should theoretically be marked as such on the DST. In contrast, work order "2" was purposefully selected as "Very Low," again reflecting the intent of the DST. Work order "3" addressed a fire sprinkler system and was intended to be identified as an "Emergency" repair and thereby omitted from the results. According to the methodology, matters of Fire/ Life Safety are deemed Emergency and of the highest priority. The objective of the DST is to prioritize those work orders that may be categorized as routine and prioritized subjectively at the discretion of the institution. The observed results indicate the DST was effectively used and understood by the participants, without requiring clarification. Participants were quickly able to translate the scope of work, as documented in the work order, to the DST format. At this stage in the research, the order of prioritization is subordinate to the process of utilizing the DST. The findings suggest the DST successfully functioned as a usable and efficient method for prioritizing work orders.

Having completed the prioritization exercise, participants were asked a series of qualitative questions intended to solicit constructive dialog within the focus group. According to the panel, the format and process of completing the DST were understood to be intuitive and user-friendly. Once the method of evaluating the visual AHP was understood, participants estimated the time to complete a DST specific to a given work order, would "*not add more than 15 seconds to the process*." The focus group did express reservations, however, with the volume of work orders entered into the asset management system and that point at which the DST would become a burden on the system

administrator or Functional Area Lead tasked with prioritizing work orders. While this feedback makes sense from a practical perspective, it also seems to highlight the underlying motivation for why a DST would be necessary with such a plethora of work orders to handle. Furthermore, when considering the types of tasks necessary to schedule a work order currently, the estimated 15 additional seconds to complete this DST may not be unreasonable if it were to be broadly implemented.

The focus group agreed on the four primary categories of Influence, Building Status, Building Usage, and Institutional Enablers to accurately frame the scope and responsibilities of a FM operation. Moreover, the focus group recognized the importance of modifying the DST according to the needs of an institution while preserving the overall structure of the tool as significant. In doing so, the transferability of the tool resonated with the focus group and was generally understood to be of benefit. Furthermore, the simplicity of the design was recognized to be a positive attribute, adding to the transferability of the tool. One participant noted "*I like the simplicity*," expressing that as an institutional facility becomes more complicated the tendency of the technician is to complicate the prioritization of the work orders in the queue. The DST's framework encourages the technician to simplify the process, resulting in a more objective assessment of the work order.

The findings from the purposive focus group suggest that while the DST is transferable between institutional facilities, the subcategories or determinants within each category are dependent on the nature and function of the institution. While this limits the transferability of the specific DST developed by the author, it provides further validation to the DST process development defined in this paper (i.e., steps 1-3), which require

future researchers to first identify or define institutional enablers that are appropriate to a new type of institution. As the needs and characteristics of an organization are unique identifiers, so too are the forces which govern the prioritization of work.

The allocation of resources and ultimately the prioritization of work is likely to be influenced by the function of the institution, geographic layout of the building infrastructure, the complexity of the building systems, and the personal experience or ability of the technician charged with prioritizing work. While this might initially seem like a limitation for a DST to rely partly on potentially subjective judgments of technicians, this approach also allows for considerations related to the context of a specific work order that may be nuanced and not directly considered by the previous research findings, which are incorporated into the DST. There are, in fact, many competing variables that factor into the prioritization of work. The involvement of human judgment in this process may help to handle qualitative assessments that a strictly quantitative approach might incorrectly assess.

3.4 Limitation

The objective of this paper is to propose a methodology illustrating the process and development of a DST for the prioritization of routine facility maintenance. Although the results suggest the process can successfully lead to a DST that is understood by practitioners, the author cannot at this time claim the extent to which the proposed DST influences the decision-making process.

A working prototype of the DST, built upon the results of this study and in cooperation with facility maintenance and operations SME's, will be developed to serve

as a basis for a counterbalance measures assessment. This next phase of research will A.) validate the prototype DST's ability to standardize the prioritization of work, and B.) assess the ability of the tool to influence the end users thought process when prioritizing routine facility maintenance requests.

3.5 Conclusion

This paper proposes a visual multi-criteria methodology for the prioritization of routine institutional facility maintenance. Regarding initial focus group testing results, it is clear that when utilizing differing work orders and the proposed structure of four primary categories, the proposed visual AHP methodology can effectively be used and understood to prioritize multi-criteria work orders. Furthermore, this process can support the development of a DST that is simple to use, which may offer value for practical implementation by organizations in the future. The findings documented in this paper suggest that the proposed visual AHP multi-criteria methodology has a potential application for the prioritization of routine institutional facility maintenance. The contribution of this paper is in providing a reusable methodology that aims to coalesce the findings of disparate research findings into an easy-to-use DST that allows practitioners to make evidence-based spending decisions about routine facility maintenance in order to improve overall institutional performance.

CHAPTER 4

EVIDENCE-BASED EDUCATIONAL FACILITY MANAGEMENT

The maintenance and operations of K-12 academic infrastructure in the United States represent a considerable cost for both State and the Federal government's and directly impacts the conditions of facilities where American students are educated. The importance of K-12 academic district facilities cannot be overstated in providing a foundation for the nation's civic and economic development. A 2001 paper commissioned by the Mid-Atlantic Institute for Student Success concluded that "when differences in individual ability are controlled, facility condition may impact student performance more than many social and economic variables (Lewis, 2001)." Similar studies from throughout the country echoed these findings (Buckley et al., 2004; Maxwell, 1999; Picus et al., 2005). The prioritization of routine building maintenance that has been shown to influence academic performance, creating long term-value, requires special consideration by facility operations and maintenance staff (Durán-Narucki, 2008; Earthman, 2002; Lemasters, 1997).

K-12 academic facility administrators face an extremely complicated task. Not only must they make complex decisions regarding the maintenance of district assets, but these decisions may be influenced by environmental factors such as limited data, the risk of building system failure, and declining indirect expense budgets. In the state of Arizona, Plant Maintenance and Operation spending when adjusted for inflation declined by 21% between 2003 and 2014 (Auditor General, 2016). During this same period, student K-12 enrollment in Arizona has increased by 26% (NCES, 2016). Arizona is not alone in its challenge to fund education. Across the nation, enrollment numbers have

increased while per-pupil spending has declined (NCES, 2014; Snyder et al., 2016). In order for facility management teams to support effective educational environments, they must address work orders that provide the most significant return using any available funding.

The need for educational institutions to better support student performance has pushed educational researchers to study different attributes of the built environment to understand how those attributes impact learning. A large body of literature reports various potential benefits and drawbacks related to various building characteristics. For example, Earthman and Lemasters' research specifically addressed the condition of educational buildings and academic performance (Earthman, 2002; Lemasters, 1997), while other studies address the ability of specific building systems to influence educational outcomes (Cash, 1993; Schneider, 2002). Despite scholarly literature suggesting specific building attributes that may enable student performance, there is not clear evidence that academic facility operation and maintenance teams are effectively able to leverage this knowledge (Beauregard and Ayer, 2018). This may be due in large part to the disparate nature of reported findings related to educational environments and student performance. In other words, it may take years for a facility administrator to become versed in relevant publications in order to strategically prioritize spending based on student performance because there is not a simple method to apply these disparate findings quickly.

This paper evaluates a previously designed visual analytical hierarchy-based DST that coalesces the disparate research findings related to building attributes and student performance in order to guide work order prioritization (Beauregard and Ayer, 2019).

The DST provides a process for prioritizing routine work that is two-fold. First, the tool leverages prior academic research correlating specific facility conditions with measured academic performance. Second, the tool uses a visual analytical hierarchy process (Boucher and Gogus, 2002; Saaty, 2008) to enable the facility maintenance practitioner to leverage her or his unique experience when establishing the importance and subsequent priority of the work order. This paper addresses the following research questions: To what extent does the DST influence the prioritization of routine facility maintenance work orders? Moreover, in what contexts does the DST impact, or not impact prioritization?

Findings from this work will help K-12 institutions determine whether they should implement a similar DST, and also guide them to determine the context in which the use of this type of tool is appropriate. This can lead to more consistent and predictable decision making in K-12 organizations. Beyond offering value for K-12 education, if future studies leverage the previously-defined methodology for developing this DST (Beauregard and Ayer, 2019), the findings from this paper may offer evidence-based strategies for supporting spending decisions in other types of institutional organizations. The findings from this paper will help those organizations determine how they should implement the tool to yield prioritized work orders benefiting specific performance goals.

4.1 Background

A 1999 study commissioned by the U.S. Department of Education National Center for Educational Statistics (NCES) found that approximately one-quarter of the nation's schools required extensive repairs (US Department of Education, 1999). The nation's General Accounting Office (GAO) agreed, estimating the cost of building

infrastructure maintenance and repair to exceed $100 billion (US GAO, 1996). More than a decade later, the American Society of Civil Engineers (ASCE) estimated the cost to bring the nation's K-12 educational facilities infrastructure up to acceptable standards exceeded $300 billion (ASCE, 2017). While there appears to be a consensus at the national level that significant K-12 facility funding is needed, the funding responsibility resides with the States, and secondarily, with individual communities.

Funding for school facilities dropped by approximately 50% since 2007 (Snyder et al., 2016). A study by the Center on Budget and Policy Priorities found that funding for K-12 education dropped below 2008 levels in 31 states (Leachman et al., 2016). During this same period, not only has academic enrollment continued to grow (Alexander and Lewis, 2014; NCES, 2014), but more pressure has been placed upon academic districts to increase in-class spending (Kumari and Dhull, 2017). As a result, Facility Administrators have to do more with less. Economic pressures have resulted in a shift to facility maintenance strategy, moving districts away from predictive and preventative maintenance towards a corrective maintenance strategy (Beauregard and Ayer, 2018).

4.1.1 Continuity

An essential factor for consideration when prioritizing work orders is the continuity within a facility maintenance organization. The process of prioritizing routine facility maintenance work orders is largely subjective (Atkin and Brooks, 2014; Beauregard and Ayer, 2018). While the technicians interviewed in these studies frequently reported making decisions based on what is best for the students, their own experience guided the prioritization process, which can lead to inconsistencies between decision-makers.

An empirical study of facility maintenance and operations determined the profession was “at risk,” given the rate of attrition and the absence of an adequate professional pipeline for qualified facility administrators (Sullivan et al., 2010). If Sullivan’s assessment is accurate, and funding for plant operations and maintenance continues to decline (ASCE, 2017; NCES, 2016), the profession can expect a higher degree of attrition specific to the full-time employees tasked with prioritizing work. This further highlights the need for a strategic work order prioritization system that can retain critical institutional memory to balance attrition and turnover.

Successfully maintaining institutional infrastructure requires multifaceted decisions involving multiple stakeholders who, at times, may have divergent objectives (Lewis and Payant, 2007). To successfully manage a K-12 district building infrastructure, Facility Administrators must quickly determine who will benefit most from servicing a building system and what their role in creating value for the district may be (Alshubbak et al., 2015). Therefore, Facility Administrators will benefit from an objective DST enabling the optimization and allocation of limited resources that is not solely dependent on human intuition.

4.1.2 Decision Support Tool

DST’s provide a structured and repeatable process intended to generate value for the organization. Utilizing a DST enables the effective use of limited district resources, aligning those factors that optimize organizational outcomes while providing a structure for improved institutional performance.

Prior academic research acknowledges the complex relationships between building systems, building components, and the challenges faced by facility operation

and maintenance organizations (Harris, 1996; Lavy and Bilbo, 2009; Shohet and Perelstein, 2004). Categorizing the components of building infrastructure into a hierarchical framework of functional systems, risk, and opportunity is central to the application of the analytical hierarchy process methodology (AHP) (Saaty, 1996). This study presents the AHP methodology facilitating the structure of the DST.

AHP has been used to enable objective decision making in site selection (Alavi et al., 2013; Mohajeri and Amin, 2010; Yalcin, 2008), project delivery method selection (Al Khalil, 2002; Mahdi and Alreshaid, 2005), and supplier selection (Fong and Choi, 2000; Sarkis and Talluri, 2002). Several studies have similarly used AHP to determine the most effective prioritization of ongoing facility maintenance (Shen et al., 1998; Shen and Spedding, 1998; Spedding, 1994) and to assess existing educational facilities (Masood Badri et al., 2016). These studies are similar in their use of existing conditions as a method of building hierarchies of criteria and their use of pairwise analysis to facilitate any final decision. By contrast, the use of VAHP to enable the practical application of the DST differentiates this study from prior academic research. Moreover, the coalescence of disparate academic studies identifying building factors that may enable academic performance further distinguish this study from prior research.

4.1.3 Previously-Developed Decision Support Tool

The author developed a DST employing VAHP to organize disparate academic research and professional experience for the prioritization of facility operations and maintenance spending (Beauregard and Ayer, 2019). The previous paper provides a reusable methodology that may aid future developers in creating a similar type of tool for other applications. Facility Administrator interviews were used to validate the

methodology, ensuring the tool was understandable and logical by current practitioners. However, the resulting DST was not empirically tested. This paper aims to test it with K-12 facility practitioners to determine how it impacts decision-making.

The developed DST's structure consists of four primary decision categories, which collectively serve as the principal framework for the DST:

1. *Influence* identifies who is most likely to benefit from the completed work order;
2. *Building Status* represents the relative importance of the building or space;
3. *Building Usage* addresses how a building or space contributes to an organization's overall productivity; and,
4. *Institutional Enabler* leverages research literature to identify building attributes or conditions that are consistently reported as beneficial for organizational outcomes.

The DST (see Figure 12, adapted from Beauregard and Ayer, 2019) was designed to apply to K-12 organizations, but the methodology and framework used to create the tool are intended to be universally applicable to any institutional facility (Beauregard and Ayer, 2019). The variables within each of the four categories are customizable to meet the specific needs of the organization or institution.

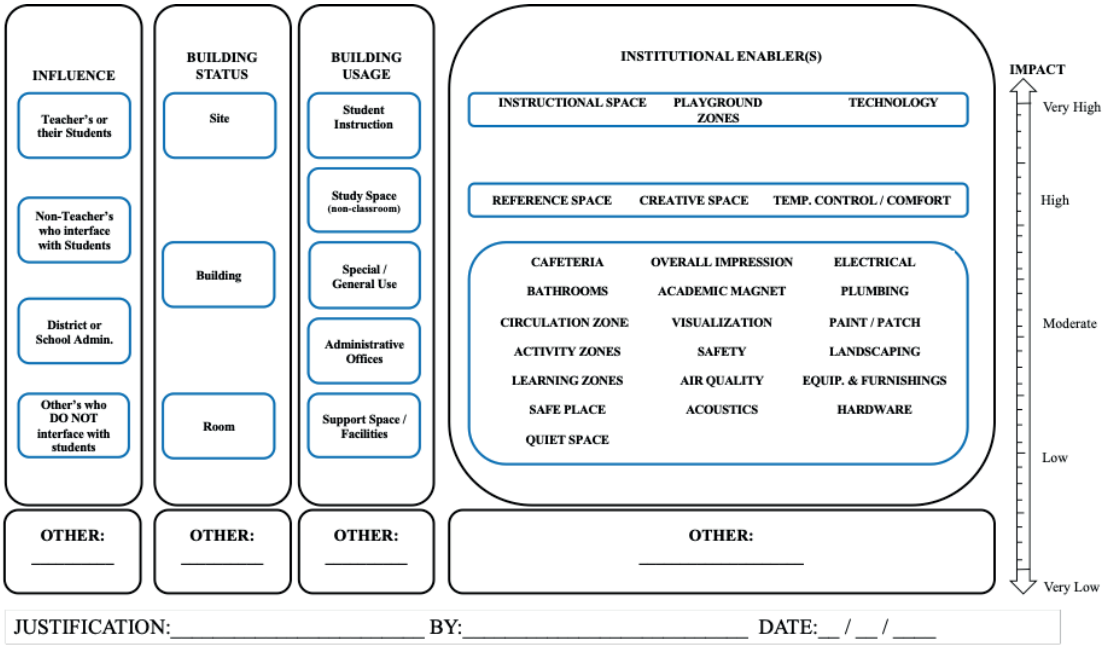

Figure 12: Decision support tool for the prioritization of routine maintenance supporting K-12 academic building infrastructure (adapted from Beauregard and Ayer, 2019

Using this DST, Facility Administrators read work orders and select the relevant decision factor(s) they believe relate to the work order. Items that are listed higher in the tool correspond to topics that are most frequently cited as having a positive impact on educational performance. After reviewing and selecting items from the four categories listed, the user can visually determine where the majority of their selections are located in the tool and mark the location on the "Impact" continuum that they believe indicates the average location of their selections, as shown in Figure 13. This paper explores how educational facilities practitioners' use of the tool impacts their prioritization of work orders.

OWNER PRIORITY #_____ OF 15

REVIEWER PRIORITY #_____OF 15

Work Order #	OP-142027	**Request Date**	09/25/2017 11:55
Location ID	GHSGND – PRKG LOT	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Channel drain behind kitchen falling apart, can we have it repaired/replaced	**Total Hours**	
Priority Description	Routine	**Total Cost**	0

Item Description	Item Number	Item Type	Task Code	Task Description
Parking Lot-PRKG Lot	GHSGND-PRKG LOT	Area	PL11020	Inspection

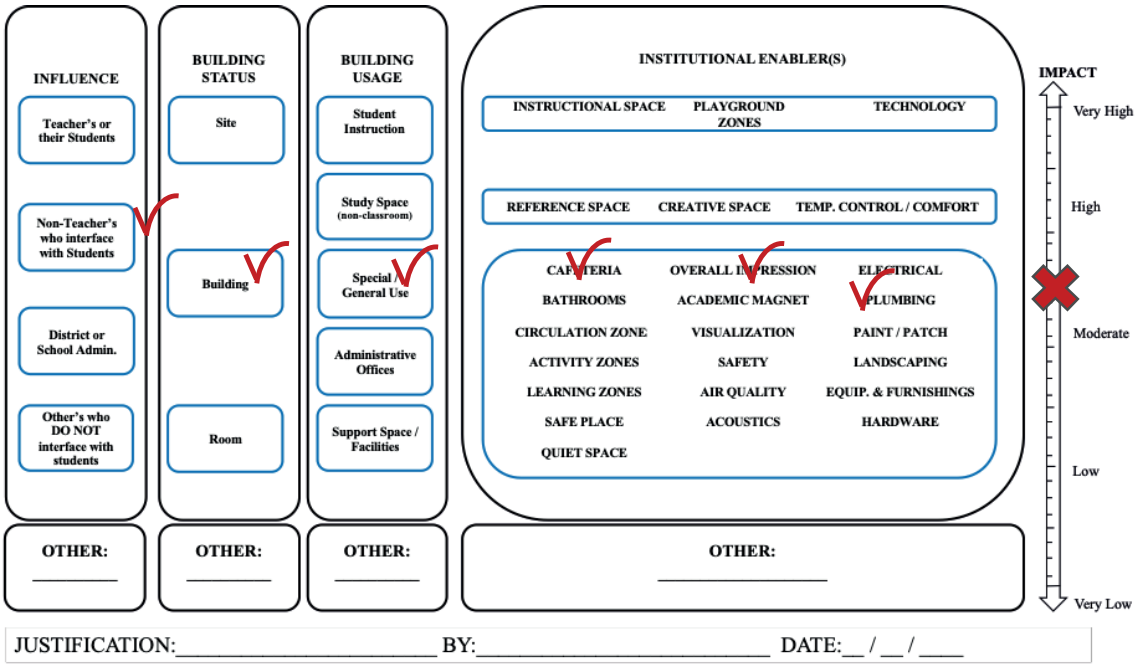

Figure 13: Example of a work order with an adapted decision support tool for the prioritization of routine maintenance (Beauregard and Ayer, 2019)

4.2 Methodology

A representative sample of work orders that should theoretically be prioritized differently was identified to evaluate the extent to which the DST impacts decision making. A modified repeated measures crossover method was applied at the Washington Association of Maintenance and Operations Administrators (WAMOA) annual conference in 2018 to test decision making in various contexts, with and without the

DST. The collected data was analyzed to identify results and noteworthy trends. The subsequent sections detail this methodological process.

4.2.1 Work Order Selection

A representative sample of routine work orders that collectively illustrate the scope, technical skill set, and breadth of facility operations supporting a K-12 academic district was required to evaluate the DST adequately. A sample of 30 work orders was purposefully selected for this study, according to the strategy defined in subsequent paragraphs. All work orders were selected from a large sample of actual work orders that were exported from a partnering K-12 institution's asset management software. The only modifications made to the content involved removing specific school names or other identifying information that could enable future participants to determine the source of the work orders.

The scope of work orders addressed by the proposed DST was limited to those work orders categorized as regular and routine. For this research, work orders designated as "Emergency Response" or "Critical" were determined to be out-of-scope as they may require immediate attention, making these work orders a top priority and thereby eluding the typical prioritization process.

However, to better understand how Facility Administrators would disposition a work order that could, in theory, be interpreted as "Critical", the author deliberately reclassified two of the thirty work orders as Fire Life Safety. In doing so, the author is not claiming that either of these work orders is or is not a life safety corrective repair, rather, it is plausible that another academic district may have considered one or both to be of a higher priority. Editing the two work orders in this way acknowledged alternative

interpretations of the scope of work while providing a context to observe if Facility Administrators would recognize the potential risk associated with the work. Accordingly, the scope of omitted work orders includes:

- Disruption to Service
- Federal or State Compliance
- Structural or Building System Failure
- Critical Environment
- Security

Finally, the purposeful sample of work orders included at least one work order reflecting the following contexts (providing a representative sample for the study):

- Administratively generated work order;
- Teacher-generated work order; and,
- Repair to a supplemental space.

After selecting 30 work orders for the study, the purposeful sample was separated further into two sets of 15. Additional care was taken to ensure that the scope of work and context of the work orders in each set was equally represented. These two sets of work orders provided two completely different packets of work orders for evaluation with and without the DST. Structuring the activity in this way eliminated the chance that participants using the DST would be influenced by their prior evaluation of the same work order when they did not have the tool. Furthermore, participants were divided in half and randomly assigned one of the two packets of 15 work orders. Half of the participants began with packet A, and the other half of participants began with packet B. This helped to reduce any potential differences in their decision making that may have been related to the specific work orders chosen. Table 6 further illustrates this methodology.

Table 6: Distribution of work orders for the repeated measures crossover study.

Distribution of Work Orders	First Envelope Provided to Participants	Second Envelope Provided to Participants
Group 1: Half of the participants randomly assigned to treatment group	Packet A (Work Order No. 1-15)	Packet B (Work Order No. 16-30)
Group 2: The residual participants randomly assigned to treatment group	Packet B (Work Order No. 16-30)	Packet A (Work Order No. 1-15)

4.2.2 Study Participants

Participants for this work were recruited from the 2018 WAMOA annual conference. This event brings together facility operation and maintenance administrators representing a variety of K-12 educational districts from throughout the state of Washington. The participants consisted of experienced facility management professionals responsible for prioritizing routine work orders.

Although there may be complete or more subtle differences between the building infrastructure and facility conditions of academic districts, there is no evidence to suggest the condition of educational facilities or the experience of facility personnel would materially change state-to-state. For example, both Arizona and Washington educate approximately one-million K-12 students in 206 and 294 school districts respectively. In 2013 Arizona spent approximately $894 per student for Plant maintenance and Operations, or roughly $6.44 per gross square foot of educational facilities. By contrast, Washing spent $893 per student or $6.92 per gross square foot (Alexander and Lewis, 2014; NCES, 2014). Therefore, the volunteer WAMOA Facility Administrators recruited

to participate in this study represent a cross-section of districts, similar to that of Arizona, enabling the study to evaluate the DST's impact on work order prioritization.

4.2.3 Experimental Procedure

Participants were provided informed consent forms upon arrival following Institutional Review Board (IRB) requirements. The participants then completed pre-activity questionnaires intended to provide an understanding of their experience, technical expertise (functional area), and their respective school district strategic goals.

Next, participants were introduced to the work order prioritization activity consisting of two main prioritization exercises where participants evaluated and prioritized work orders, with and without the DST. In the first exercise, participants simply prioritized the work orders according to their judgment and experience without the DST. In the second exercise, participants prioritized work orders utilizing the DST in several contexts that strategically included or removed opportunities to be influenced by their subjective judgment. This helped to isolate the specific contexts in which the DST affected decision making and also allowed for a comparison of these contexts to the initial subjective decisions, which has been reported as the predominant mode of work order prioritization in K-12 organizations (Atkin and Brooks, 2014; Beauregard and Ayer, 2018). The subsequent paragraphs detail these prioritization activities.

4.2.4 Subjective Prioritization ("R1")

For the first prioritization (Subjective Prioritization R1), equal portions of participants were randomly assigned work orders in either Packet A or Packet B. Regardless of the packet assigned, all participants were asked to read their given work orders and then prioritize them based on the extent to which they believed the orders

would positively impact a K-12 learning environment, according to their own professional experience. Participants were asked to organize the 15 work orders so that the top work order represented their highest perceived level of impact and the bottom work order represented the lowest perceived level of impact. Next, participants numbered their work orders from 1 (highest priority) to 15 (lowest priority) to ensure that their ranking decisions were accurately interpreted. This initial prioritization process did not introduce the DST to participants. Rather, it was intended to replicate the type of unstructured prioritization process that is currently performed in K-12 institutions (Beauregard and Ayer, 2018).

4.2.5 Prioritization with Decision Support Tool ("R2")

After completing the initial prioritization exercise, participants engaged in a second prioritization exercise utilizing the DST in several contexts. Before beginning, the DST was introduced to participants to demonstrate the process of using the tool through several example work orders. None of the example work orders presented were included in the packets distributed to participants; they simply illustrated the process of filling out the DST. Before participants evaluated any work orders on their own, a brief discussion was held to answer any questions raised by participants. After all of the questions were answered, participants began the second work order prioritization exercise.

In this second exercise with the DST, participants reviewed a different packet of 15 work orders than in the first exercise (i.e., if they started by reviewing Packet A, they were provided with Packet B and vice versa). This strategy allowed all work orders to be reviewed twice: once with the DST and once without it. It also allowed all participants to organize a different set of work orders in each prioritization exercise. Structuring the

activity in such a way forced the participants to consider each work order and not merely recall and duplicate their prioritization of a work order from the first exercise.

4.2.5.1 Assessing Impact Based on Decision Support Tool ("R2-Impact Assessment")

First, participants reviewed the work orders and identified the relevant decision factors in each DST category they believed would be impacted by the work order. They also selected a point on the *impact* continuum at the right side of the DST, based on the critical mass of individual decision factors selected in each category. While participants defined the impact for each work order, they were instructed not to assign a priority to the work orders (i.e., they assigned a level of importance, but they did not determine whether one work order was a higher or lower priority than another work order). Instead, they merely reviewed all work orders in the given order of the packet and assigned levels of impact.

4.2.5.2 Administrative Prioritization Based on Impact Level Identified ("R2-Impact Ranking")

After assigning levels of impact (R2-Impact Assessment), participants exchanged their packets of work orders with another participant to re-order the work orders based on impact (R2-Impact Ranking). After exchanging packets, each participant examined the point of "impact" selected by their peer and organized the fifteen work orders based only on the location marked on the impact continuum on the DST. In other words, they arranged the work orders placing the work order with the highest point of impact at the top of the pile and the work order with the lowest point of impact at the bottom of the pile. During this administrative activity, participants were only asked to arrange the work orders based on the identified point of impact, and not to take time to read the work order

or provide their subjective judgment. Theoretically, this process of re-organizing work orders based only on the point of impact could have been performed by the original reviewers from R2-Impact Assessment, but it is very likely that their prior opinions from reviewing the initial work orders may have subconsciously influenced their behavior. By exchanging work orders with a peer, the study aimed to reduce subconscious bias by forcing participants to organize a different set of work orders for which they had no involvement in evaluating. After the participants organized the work orders according to the identified impact noted, the work orders were numbered and returned to the original evaluator.

4.2.5.3 Comprehensive Prioritization Based on Impact and Experience ("R2-Comprehensive Ranking")

Once the participants received their re-organized stack of work orders (from R2-Impact Ranking), they had a final opportunity to change the prioritization of work orders, based not only on impact but also using their subjective experience. This final organization of work orders (R2-Comprehensive Ranking) allowed participants to consider both the ranking of the work order determined by their objective responses from the DST, but also their personal experience and perceptions, similar to how they completed the initial, subjective prioritization exercise. The process of this activity allowed for the identification of any deviations between what the DST might suggest for a level of importance of a work order and what the participant's experience might suggest for a level of importance.

Furthermore, by re-organizing work orders by the level of impact during R2-Impact Ranking, the results illustrate instances where participants made deliberate

decisions to change a work order's priority away from what the DST might have indicated. This process enabled an understanding of the contexts in which participants used (or trusted) the DST as well as contexts where they did not.

Overall, the steps followed in this second prioritization process with the DST (i.e., R2-Impact Assessment; R2-Impact Ranking; and R2-Comprehensive Ranking) allowed the author to determine how varying levels of human involvement impact prioritization. For example, it is possible that if a decision-maker rated a work order as low importance based on the DST, but felt that it was highly significant based on her judgment, she might choose to rank the work order comparatively high, low, or somewhere in between. Regardless of her subjective decision, one cannot know what guided her thought process if this task were performed in a single step. Separating the prioritization process into distinct steps allows for an understanding of the contexts in which the DST impacted decision making and the contexts in which it did not.

4.2.6 Data Analysis

Data was collected and analyzed according to the two main prioritization exercises (R1 and R2). The first step in this analysis involved identifying the mean (μ) priority ranking of each work order for both of the prioritization exercises and during each of the sub-activities involved in the second prioritization exercise with the DST. Identifying the mean for each activity quickly enabled the study to determine if the DST influenced decision making. A Mann-Whitney U test was then performed to measure the degree to which decision making changed.

Next, the data was standardized (see Figure 14) then the difference in mean priority for each of the 30 work orders was calculated. This process was performed for

the rankings obtained from R1, R2-Impact Ranking, and R2-Comprehensive Ranking. A Mann-Whitney U test was used to determine if the differences between prioritization activities were statistically significant to indicate a change in decision making. This test was appropriate for this study considering the data collected in each of the three prioritization activities was approximately continuous, having a prioritization score for each work order that ranged from 1 to 15. Furthermore, this statistical test may be used in instances where non-paired data, as collected in this study, is compared. This analysis approach enabled the author to determine the types of work orders for which the DST impacted decision-making.

$$x_{new} = \frac{x - \mu}{\sigma}$$

Where χ is the number to be standardized;
μ is the mean of the range;
σ is the standard deviation of the range, and;
x_{new} is the resulting standardized number.

Figure 14: Equation for standardizing the data set.

4.2.7 Pairwise Comparison and Sensitivity Testing

The structure of a VAHP-based decision support tool enabled participants to consider their own subjective opinions as well as the objective aim of the tool. By contrast, a pairwise comparison mitigates subjectivity by limiting user engagement in the evaluation to the weighting of decision categories. To further determine how subjective judgment may impact decision-making, a traditional AHP pairwise comparison was replicated based on the items that participants selected from the DST files submitted during the study. The comparison enabled the author to identify trends in responses based only on the selections within the decision factors.

The analysis began by assigning all four decision categories a value of 1, meaning each decision category was of equal importance. Weighting the decision categories accordingly enabled the author to assess the importance and subsequent prioritization of the work orders based only on the decision factors selected by the Facility Administrator. The decision factor values within each category were defined based on their relative importance of each decision factor indicated by prior research (Beauregard and Ayer, 2019). For example, Academic Enabler decision factors, which were more consistently reported in the research literature (i.e., Technology Zones) were assigned a higher value of intensity importance than less frequently cited decision factors (i.e., Landscaping). Therefore, the resulting intensity importance for these decision factors aligned with their frequency of reporting. The process of a pairwise comparison is illustrated in Figure 15, using the decision factor *Influence* as an example (see Figure 15).

Next, the author wanted to understand how the DST's ability to influence decision making may be affected by changes in the perceived value of each decision category. While each decision category was initially rated equally, it is likely that some institutions would value and weight the factors differently, based on their unique needs. Therefore, a total of 154 sensitivity tests were performed, constituting a representative sample of the possible weighting combinations and providing a 95% confidence level in the results. For each test, the different decision category weights were intentionally changed to identify how these changes would impact the rankings yielded through the pairwise prioritization process. In each of these sensitivity tests, the categories of Influence, Building Status, Building Usage, and Academic Enablers were assigned all weightings ranging from 3 to 9. This process of selecting different intensities of importance followed the process used

in prior research (Wind and Saaty, 1980). Randomly assigning higher or lower weightings to the different decision categories helped to simulate the various ways that future users of a similar DST may value different categories more or less than others.

The process for calculating the importance of different work orders based on the specific items selected in the DST remained consistent for all pairwise analyses and all weightings explored through the sensitivity analysis. The value of each decision factor was calculated using a pairwise comparison. The selected decision factors were translated to a numerical value based on their frequency of reporting, according to Beauregard and Ayer (2019). Then the sum of the numerical values for the selected decision factors for each category was multiplied by the weight assigned to each decision category in all iterations of the sensitivity analysis. The resulting values for each category were totaled for each work order. Finally, the work orders were arranged according to these numerical totals. The order yielded through this study enabled the author to directly identify noteworthy trends in rating the same work orders with varying levels of subjectivity in the decision-making process. Furthermore, it enabled the author to identify the attributes involved in decision-making that consistently led to an agreement with or divergence from, the developed DST as compared to the other, more subjective, decision making contexts explored.

1

***Influence* Decision Factors**	**Importance**
Teachers or Their Students	9
Non-Teachers who interface with Students	7
District or School Administration	5
Others Who DO NOT Interface with Students	3
Other	1

1. Determine the importance of each decision factor
2. Calculate the Intensity Importance for each decision factor and populate the pairwise comparison

2

$$Intensity\ Importance = \frac{\text{Teachers or Their Students}}{\text{District or School Administration}} = 1.80$$

$$Intensity\ Importance = \frac{\text{District or School Administration}}{\text{Teacher or Their Students}} = 0.56$$

3

Sum each decision factor, left to right, then divide the total by the sum total of all decision factors to calculate the pairwise priorities

***Influence* Decision Factors**	*Teachers or Their Students*	*Non-Teachers who interface with Students*	*District or School Admin.*	*Others Who DO NOT Interface with Students*	*Other*
Teachers or Their Students	1.00	1.29	1.80	3.00	9.00
Non-Teachers who interface with Students	0.78	1.00	1.40	2.33	7.00
District or School Administration	0.56	0.71	1.00	1.67	5.00
Others Who DO NOT Interface with Students	0.33	0.43	0.60	1.00	3.00
Other	0.11	0.14	0.20	0.33	1.00

***Influence* Decision Factors**	**Priority Value**
Teachers or Their Students	= (1.00 + 1.29 + 1.80 + 3.00 + 9.00)/44.68 = 0.360
Non-Teachers who interface with Students	= (0.78 + 1.00 + 1.40 + 2.33 + 7.00)/44.68 = 0.280
District or School Administration	= (0.56 + 0.71 + 1.00 + 1.67 + 5.00)/44.68 = 0.200
Others Who DO NOT Interface with Students	= (0.33 + 0.43 + 0.60 + 1.00 + 3.00)/44.68 = 0.120
Other	= (0.11 + 0.14 + 0.20 + 0.33 + 1.00)/44.68 = 0.04

4

***Influence* Decision Factors**	**Priority Value**
Teachers or Their Students	= 0.360 / 0.360
Non-Teachers who interface with Students	= 0.280 / 0.360
District or School Administration	= 0.200 / 0.360
Others Who DO NOT Interface with Students	= 0.120 / 0.360
Other	= 0.04 / 0.360

Figure 15: The process of pairwise comparison for *Influence* decision factors

4.3 Results

A total of thirty-two K-12 district Facility Administrators from across the state of Washington participated in the study. The sample population of Facility Administrators included both men and women representing multiple areas of technical expertise. Moreover, the professional experience of these participants ranged from those having less than five years of professional experience to Senior Facility Administrators having more than 15 years of experience in the profession.

The purpose of the DST, as defined by Beauregard and Ayer (2019) is to leverage prior empirical evidence correlating facility condition and academic performance to influence decision making. Therefore, this study aims to identify a change in the perceived priority of routine work orders and if that change was statistically significant. Such a finding would indicate the decisions support tool can consistently influence decision making, providing continuity and predictability to the process of prioritizing work orders.

A comparison of the mean work order ranking was performed for the initial subjective prioritization (R1) and for when the participants used the DST (R1 v R2-Impact Ranking and R1 v R2-Comprehensive Ranking). A fourth comparison was then made based on the participants' initial subjective prioritization (R1) and their selection of un-weighted decision factors when using the tool (R1 v Pairwise) (see Table 7). Results indicate an observed change in the prioritization rank, to a greater or lesser extent, for each of the work orders included in the study. However, table 7 also identifies in bold font those work orders re-prioritized to a statistically significant degree when utilizing the DST in any one of the three methods, R2-Comparison, R2-Impact or Pairwise.

Table 7: Comparison of the mean work order ranking with bold font indicating a statistically significant change in mean rank order prioritization.

Functional Area	μ R1	μ R2: Comprehensive Ranking	Δ%	μ R2: Impact Ranking	Δ%	μ Pairwise	Δ%
Electrical	6.980	8.765	-26%	7.867	-13%	**8.988**	**-29%**
Work Order 1	1.471	6.538	-345%	3.500	-138%	**9.308**	**-533%**
2	7.412	6.500	12%	7.583	-2%	**6.000**	**19%**
3	13.000	11.786	9%	**12.636**	**3%**	10.846	17%
4	2.882	6.692	-132%	3.833	-33%	**6.308**	**-119%**
5	6.294	8.714	-38%	8.083	-28%	**10.167**	**-62%**
6	11.643	**11.471**	**1%**	**10.938**	**6%**	10.938	6%
F.L.S.	4.750	6.588	-39%	7.250	-53%	**8.484**	**-79%**
1	3.929	5.353	-36%	5.938	-51%	**9.533**	**-143%**
2	5.571	7.824	-40%	8.563	-54%	7.500	-35%
General Maintenanc	8.646	**8.757**	**-1%**	9.027	-4%	**8.212**	**5%**
1	8.235	**14.071**	**-71%**	**14.545**	**-77%**	13.846	-68%
2	6.941	8.929	-29%	9.182	-32%	10.538	-52%
3	12.824	**7.500**	**42%**	**8.545**	**33%**	**5.538**	**57%**
4	11.647	**4.714**	**60%**	**5.583**	**52%**	**2.846**	**76%**
5	4.286	7.588	-77%	8.063	-88%	**8.438**	**-97%**
6	8.412	11.143	-32%	**11.818**	**-40%**	**12.000**	**-43%**
7	11.000	8.571	22%	9.545	13%	8.231	25%
8	8.000	11.412	-43%	11.313	-41%	**9.688**	**-21%**
9	9.357	9.588	-2%	9.688	-4%	7.188	23%
10	8.588	**8.357**	**3%**	7.909	8%	**9.154**	**-7%**
11	4.647	5.143	-11%	4.167	10%	**5.615**	**-21%**
12	9.059	7.571	16%	7.818	14%	**5.308**	**41%**
I.T.	7.588	3.786	50%	4.182	45%	**3.923**	**48%**
1	7.588	3.786	50%	4.182	45%	**3.923**	**48%**
Mechanical	5.304	4.368	18%	**4.063**	**23%**	**3.188**	**40%**
1	6.000	4.235	29%	**4.000**	**33%**	**2.813**	**53%**
2	3.357	3.706	-10%	3.188	5%	**2.313**	**31%**
3	4.929	3.882	21%	3.625	26%	**3.438**	**30%**
4	6.929	5.647	18%	5.438	22%	**4.188**	**40%**
Plumbing	11.114	**9.729**	**12%**	**9.813**	**12%**	**10.725**	**4%**
1	11.643	10.000	14%	**9.000**	**23%**	10.750	8%
2	9.357	9.706	-4%	10.438	-12%	**10.563**	**-13%**
3	8.929	**8.471**	**5%**	**8.750**	**2%**	10.250	-15%
4	11.929	**9.588**	**20%**	**9.563**	**20%**	**9.875**	**17%**
5	13.714	**10.882**	**21%**	**11.313**	**18%**	**12.188**	**11%**

Results show that there were some noteworthy differences between the rankings of work orders in the subjective prioritization activity (R1) and the prioritization activity R2-Comprehensive Ranking. In both of these activities, participants were able to use their subjective expertise when ranking work orders. However, in R2-Comprehensive

Ranking, participants also had the added information of an initial ranking based on the developed DST. With each ranking, as human experience-based judgement is controlled to a greater degree, the prioritization of work orders is progressively more objective.

Table 8 documents the calculated P-Value when the comparison met or exceeded the confidence threshold of 95% (0.05) indicating that the observed change in priority was statistically significant. An arrow is then used to indicate if the perceived priority of the work order increased or decreased as a result of introducing the DST. Results of the comparison indicate that introducing the DST to aid in the prioritization of work orders significantly impacted the mean ranking of 27% of the work orders used for the study (see Table 8). In other words, in these instances, the mean ranking of work orders was changed to a statistically significant degree from the mean ranking observed through R1, which represents the current mode of prioritization used by K-12 institutions.

Furthermore, when considering the functional areas represented by the work orders in the purposeful sample selected, several functional areas included one or more work orders that obtained a significant mean ranking change in R2-Comprehensive Ranking, as compared to R1. The re-prioritization is an indication that when participants are able to subjectively assign a ranking to work orders using the developed DST, the resulting priorities of approximately one-quarter of the work orders and across most functional areas may be influenced.

Table 8: Comparison of the DST's ability to significantly influence decision making and the change in the perceived importance of a work order.

Functional Area	μ R1	R1 v R2 Comp.	R1 v R2 Impact
Electrical	6.98		
Work Order 1	1.47		
2	7.41		
3	13.00		**0.002** ⬆
4	2.88		
5	6.29		
6	11.64	**0.038** ⬆	**0.019** ⬆
Fire Life Safety	4.75		
1	3.93		
2	5.57		
Maintenance	8.65	**0.087** ⬇	
1	8.24	**0.000** ⬇	**0.000** ⬇
2	6.94		
3	12.82	**0.000** ⬆	**0.000** ⬆
4	11.65	**0.001** ⬆	**0.004** ⬆
5	4.29		
6	8.41		**0.001** ⬇
7	11.00		
8	8.00		
9	9.36		
10	8.59	**0.034** ⬆	
11	4.65		
12	9.06		
Information	7.59		
1	7.59		
Mechanical	5.30		**0.012** ⬆
1	6.00		**0.032** ⬆
2	3.36		
3	4.93		
4	6.93		
Plumbing	11.11	**0.000** ⬆	**0.000** ⬆
1	11.64		**0.039** ⬆
2	9.36		
3	8.93	**0.004** ⬆	**0.026** ⬆
4	11.93	**0.010** ⬆	**0.005** ⬆
5	13.71	**0.000** ⬆	**0.000** ⬆

While the results between R1 and R2-Comprehensive Ranking indicate that the DST did impact a substantial number of work orders, it is not clear how much the level of subjectivity impacted decision making from that comparison alone. Therefore, the author also compared R1 to R2-Impact Ranking. In this comparison, participants used the selected decision factors to identify a level of impact and the resultant priorities were compared to those from R1. This analysis strategically removes some ability to interject subjective expertise into the prioritization process. These results indicate that 37% of the total work orders had a different mean rank than in R1. This percentage of work orders impacted is higher than the percentage obtained when comparing R1 to R2-Comprehensive Ranking. Furthermore, equal or greater numbers of work orders from different functional areas impacted, comparing R1 to R2-Comprehensive Ranking were observed.

The finding that R2-Impact Ranking impacts more work orders across equal or greater functional areas than R2-Comprehensive Ranking is largely intuitive. R2-Impact Ranking eliminates some of the ability of participants to interject their subjective expertise into the prioritization process. Therefore, this process more directly diverges from the current, purely subjective, process replicated in R1.

To further determine the contexts in which participants' subjective judgment impacts prioritization, a pairwise analysis and subsequent sensitivity tests were conducted. In these comparisons, decision factors selected by the participants determined the work order ranking. While work order assessment subjectivity remains (i.e., a participant could select that a particular work order impacts a "room" or a "building" depending on how they interpret the space), the actual prioritization process is automated

and standardized. As a result, when all decision categories were weighted equally, 70% of the work orders across all functional areas were impacted to a statistically significant degree (see Table 9).

Table 9: Comparison of R1 Mean Ranking and Pairwise Comparison using the DST.

Functional Area	μ R1	Pairwise P-Value & Change in Priority	Sensitivity Tests & Change in Priority
Electrical	6.98	**0.001** ↓	
Work Order 1	1.47	**0.003** ↓	**0.001** ↓
2	7.41	**0.006** ↑	
3	13.00		**0.000** ↓
4	2.88	**0.037** ↓	**0.000** ↓
5	6.29	**0.001** ↓	
6	11.64		**0.000** ↓
Fire Life Safety	4.75	**0.008** ↓	**0.037** ↓
1	3.93	**0.022** ↓	
2	5.57		
Maintenance	8.65	**0.000** ↑	**0.001** ↑
1	8.24		**0.000** ↑
2	6.94		
3	12.82	**0.001** ↑	
4	11.65	**0.000** ↑	**0.050** ↑
5	4.29	**0.012** ↓	
6	8.41	**0.044** ↓	
7	11.00		
8	8.00	**0.009** ↓	
9	9.36		
10	8.59	**0.000** ↓	**0.011** ↓
11	4.65	**0.003** ↓	**0.000** ↓
12	9.06	**0.000** ↑	
Information	7.59	**0.000** ↑	**0.000** ↑
1	7.59	**0.000** ↑	**0.000** ↑
Mechanical	5.30	**0.000** ↑	**0.000** ↑
1	6.00	**0.001** ↑	**0.000** ↑
2	3.36	**0.000** ↑	**0.000** ↑
3	4.93	**0.006** ↑	**0.000** ↑
4	6.93	**0.000** ↑	**0.000** ↑
Plumbing	11.11	**0.000** ↓	**0.000** ↓
1	11.64		**0.000** ↓
2	9.36	**0.008** ↓	**0.000** ↓
3	8.93		**0.004** ↓
4	11.93	**0.005** ↑	**0.000** ↑
5	13.71	**0.000** ↑	**0.000** ↑

Similarly, when a representative sampling of sensitivity tests was conducted the mean number of work orders influenced when using the DST was 60% of work orders. The results indicate that even if different institutions have different priorities that they apply to the decision categories, the results calculated from a pairwise comparison consistently elicit the largest percentage of work orders impacted (mean ranking) as compared to subjective expertise alone. These results further illustrate that current practitioners can use the developed DST to influence decision making. Moreover, the context regarding the tool's use, that may enable subjectivity in the process, can directly impact the output of the prioritization process.

The prior analysis indicates that the developed DST can impact work order prioritization when compared to the current method of prioritization. Beyond merely illustrating that this tool can impact mean prioritization, the impact of the DST is further evident when considering the variance in the resultant data in the different contexts where users had more or less opportunity to incorporate their subjective expertise. Table 10 documents the change in standard deviation between each of the four prioritization activities (see Table 10). For example, the average standard deviation measured in the initial subjective prioritization (R1) measured 6.956. By comparison, the average standard deviation for R2-Comprehensive Ranking declined to 3.395, a reduction of 51%. When human behavior is controlled to a greater extent, such is the case in R2-Impact Ranking, the average standard deviation declined again to 3.125. Finally, the pairwise comparison which would limit human engagement to the weighting of decision categories further reduced the standard deviation to 2.896 representing a 58% decline.

These findings suggest that the method of implementation has a direct impact on the predictability or control of prioritization outcomes. As human perception (experience-based bias) becomes increasingly limited, the standard deviation is reduced thereby leading to more consistent outcomes.

Table 10: Comparison of the standard deviation with bold font indicating a statistically significant degree of change.

Functional Area	St. Dev. R1	Standard Deviation R2: Comprehensive Ranking	Δ%	Standard Deviation R2:Impact Ranking	Δ%	Standard Deviation Pairwise	Δ%
Electrical	4.876	4.228	-13%	4.418	-9%	**4.074**	**-16%**
Work Order 1	1.068	4.156	289%	3.261	205%	**4.553**	**326%**
2	3.299	2.410	-27%	2.314	-30%	**4.243**	**29%**
3	**2.761**	**2.887**	**5%**	**2.157**	**-22%**	2.609	-6%
4	1.654	5.376	225%	3.639	120%	**4.973**	**201%**
5	2.823	3.221	14%	2.843	1%	**1.467**	**-48%**
6	**2.925**	**3.393**	**16%**	**3.276**	**12%**	2.720	-7%
F.L.S.	4.750	3.751	-21%	4.008	-16%	**3.150**	**-34%**
1	2.999	3.639	21%	3.890	30%	**2.264**	**-25%**
2	3.777	3.540	-6%	3.794	0%	3.596	-5%
General Maintenance	8.646	4.398	-49%	4.244	-51%	4.224	-51%
1	8.235	0.917	-89%	**0.522**	**-94%**	0.987	-88%
2	6.941	3.852	-44%	3.868	-44%	3.573	-49%
3	12.824	3.878	-70%	**3.142**	**-75%**	**3.307**	**-74%**
4	11.647	4.196	-64%	**4.100**	**-65%**	**2.115**	**-82%**
5	4.286	4.515	5%	4.524	6%	**3.898**	**-9%**
6	8.412	3.697	-56%	**2.523**	**-70%**	**2.236**	**-73%**
7	11.000	3.956	-64%	3.751	-66%	3.166	-71%
8	8.000	4.094	-49%	3.240	-60%	**3.092**	**-61%**
9	9.357	4.651	-50%	4.301	-54%	4.490	-52%
10	8.588	2.341	-73%	2.844	-67%	**2.672**	**-69%**
11	4.647	3.278	-29%	2.517	-46%	**3.820**	**-18%**
12	9.059	3.480	-62%	3.816	-58%	**2.287**	**-75%**
I.T.	7.588	2.517	-67%	2.272	-70%	**1.706**	**-78%**
1	7.588	2.517	-67%	2.272	-70%	**1.706**	**-78%**
Mechanical	5.304	2.926	-45%	**2.981**	**-44%**	**2.181**	**-59%**
1	6.000	3.113	-48%	**3.266**	**-46%**	**3.082**	**-49%**
2	3.357	2.173	-35%	1.834	-45%	**0.873**	**-74%**
3	4.929	2.421	-51%	2.217	-55%	**2.421**	**-51%**
4	6.929	3.622	-48%	3.915	-43%	**1.328**	**-81%**
Plumbing	11.114	3.382	-70%	**3.288**	**-70%**	**3.118**	**-72%**
1	11.643	3.335	-71%	**3.633**	**-69%**	**3.088**	**-73%**
2	9.357	3.368	-64%	2.780	-70%	**3.577**	**-62%**
3	8.929	4.460	-50%	**4.008**	**-55%**	**2.793**	**-69%**
4	11.929	2.785	-77%	**2.804**	**-76%**	**3.222**	**-73%**
5	13.714	2.595	-81%	**2.701**	**-80%**	**2.713**	**-80%**

In addition to exploring the extent to which the DST impacted work order prioritization, additional factors or context that may have impacted the decision-making process were also explored. Each of the functional areas represented by the purposeful

sample includes at least one work order impacted by at least one of the decision-making contexts tested in this work. This indicates that the developed DST can have an impact in guiding prioritization across all functional areas, but this does not necessarily indicate that all of the functional areas will be impacted to the same degree. For example, plumbing was the most consistently influenced by the DST with at least 60% of the work orders across the different prioritization cases being influenced. By contrast, the Mechanical functional area had instances where no work orders were influenced (i.e., R2-Comprehensive Ranking v R1).

The observed change in decision-making is supported by the Facility Administrator's selection of decision factors when using the tool. Table 11 documents the average value of each decision category per work order based upon the decision factors selected by the participants (see Table 11). Here, data suggests that the perceived *Influence* of Plumbing, as a functional area, was limited to administrative or non-educational space. Consequently, participants selected decision factors that were valued to a lesser degree, thereby negatively impacting the mean value of the *Influence* decision category. Furthermore, the DST only included two *Academic Enablers,* Bathroom, and Plumbing, both of which were of limited importance and therefore valued to a lesser degree. By contrast, participants perceived Mechanical work orders as having a high impact on Teacher-Student engagement, directly benefiting classroom and similar educational environments.

Therefore, it is possible that this variation in impact based on functional area could be a result of the developed DST itself. By using the findings reported in prior literature to guide decision making as defined in Beauregard and Ayer (2019), it is

possible that the resultant DST does not include equal amounts of content related to all functional areas, which could influence decision making. Conversely, it is also possible that when participants were enabled to use their subjective evaluation of work orders, the resultant priorities more-closely matched the initial R1 results. This is further evident by the comparatively high percentage of work orders in functional areas impacted when comparing R1 results to those of the pairwise analysis.

Table 11: Average value of each decision category, per work order, based upon the participant's selection of decision factors.

				Academic Enablers		
Functional Area	Influence	Bulding Status	Building Usage	Primary	Secondary	Tertiary
Electrical	5.85	3.18	3.11	5.00	4.00	1.19
1	5.31	3.86	2.58	5.00		1.21
2	8.38	3.14	4.14	5.00		1.21
3	3.92	3.57	2.38	5.00	4.00	1.00
4	6.86	3.14	3.77	5.00		1.15
5	6.17	3.08	2.69		4.00	1.23
6	4.76	2.38	3.00	5.00	4.00	1.31
F.L.S.	4.55	4.13	2.52	5.00	4.00	1.13
1	4.20	3.87	2.50	5.00	4.00	1.07
2	4.88	4.38	2.53	5.00		1.20
Gen. Maint.	6.14	3.40	3.10	5.36	4.00	1.16
1	3.00	1.86	1.93			1.10
2	3.43	3.64	2.21	5.00	4.00	1.27
3	8.23	3.21	4.54	5.00		1.09
4	9.00	3.21	5.00	6.54		1.33
5	4.53	4.29	2.75	5.00	4.00	1.19
6	5.29	2.23	2.50		4.00	1.00
7	7.62	4.64	2.43	5.00		1.21
8	4.18	3.59	2.71		4.00	1.25
9	5.25	3.19	2.67	5.00	4.00	1.10
10	7.71	3.29	2.64		4.00	1.23
11	7.57	4.23	3.31	5.00		1.00
12	9.00	3.14	4.79	5.00		1.08
I.T.	9.00	3.29	4.85	5.36		1.00
1	9.00	3.29	4.85	5.36		1.00
Mechanical	8.91	3.02	4.93	5.00	4.00	1.19
1	8.75	3.00	4.87	5.00	4.00	1.00
2	9.00	3.00	5.00	5.00	4.00	1.30
3	9.00	3.06	5.00	5.00	4.00	1.00
4	8.88	3.00	4.87	5.00	4.00	1.33
Plumbing	4.64	3.29	2.32	5.00		1.17
1	4.13	3.38	2.33			1.31
2	4.63	3.19	2.33	5.00		1.13
3	5.93	3.06	2.56			1.00
4	5.63	3.38	2.60			1.29
5	2.87	3.44	1.73	5.00		1.13

In summary, these findings suggest that subjective experience-based decision-making influences the prioritization or work and accordingly the allocation of district resources. The results of this study also suggest the participant's perception of specific functional areas, i.e., Mechanical, may already be directionally aligned with the DST's prescriptive approach to prioritization whereas other functional areas may provide an opportunity for improved resource allocation. However, should a district aim to reduce variance in prioritization, aligning facility spending decisions with academic outcomes, a pairwise comparison provides more consistent and repeatable results.

4.4 Discussion

In response to the first research question "*To what extent does the DST influence the prioritization of routine facility maintenance work orders,*" results of the R2-Comprehensive Ranking and R2-Impact Rankings demonstrate the DST's influence on routine decision making influenced 27% and 37% of the work orders respectively to a statistically significant degree. Moreover, environmental contexts defining the work order and the process of evaluation were critical factors in decision making and the perceived importance of the work order. Consequently, it is the second research question "*in what contexts does the DST impact, or not impact prioritization*," that provides the greatest insight into the DST's ability to influence behavior. The significance of continuity, Facility Administrator participation, and the implementation method and weighting of decision categories are observations further developed herein.

4.4.1 Continuity

Results of the study suggest that decision making specific to a work order and the perceived importance of a functional area are independent evaluations and are not

mutually exclusive. The ability of the DST to influence a functional area to a significant degree does not necessarily imply a majority of the work orders within that functional area are equally influenced. Similarly, having multiple work orders significantly influenced would not necessarily result in an equally significant change in the perception of the functional area.

Moreover, the level of variance specific to the perceived importance of work orders highlights an opportunity to prioritize routine work orders more effectively. For example, collectively the data indicates a high degree of variance in the prioritization of work orders between activities R1, R2-Comprehensive, and R2-Impact. Data collected from activity R1 provides empirical evidence of the perceived importance and subjective experience-based judgment factoring into the prioritization of routine work. However, the observed variance between prioritization activities R2-Comprehensive and R2-Impact also illustrate a subjective interpretation of the work order despite the Facility Administrator's selection of decision factors within the DST.

To elucidate the subjective judgment that is present in determining the impact of a work order and the need for continuity in the prioritization process, one Electrical and one Plumbing work order are deconstructed to provide context. When using the DST to prioritize work, the facility administrator is asked to identify how a work order *influences* the academic environment (see Table 12a). In both examples, facility administrators selected virtually every option provided by the tool to describe how that work order should influence the educational process. In total, the decision category *Influence* represented approximately 75% of the variation present in the study (see Table 12b).

Table 12a: Intensity Importance assigned to decision factor *Influence*.

INFLUENCE	**Importance**
Teachers or their Students	9
Non-Teachers who interface with Students	7
District or School Administration	5
Other's who DO NOT interface with students	3
Other	1

Table 12b: Average variance by decision factor based on participant DST decision factor selections

	Variance by Decision Factor				Avg. Variance /
Functional Area	Influence	Building Status	Building Usage	Total	Work Order
Electrical	9.759	0.898	1.407	12.065	9.741
Gen. Maint.	9.855	1.630	1.822	13.306	7.289
Mechanical	**0.299**	**0.015**	**0.127**	0.441	0.431
Plumbing	8.487	2.205	0.795	11.486	10.147
Total	**76%**	**13%**	**11%**		

Despite the apparent subjectivity in the decision-making process, the DST impacted decision making as evidenced by the P-value, the observed change in priority importance, and the selection of decision factors.

4.4.2 Facility Administrator Participation

Throughout this study, data suggest that limiting subjective-experience when prioritizing routine work promotes facility conditions that may best influence academic outcomes. However, the data has also illustrated a potential limitation of the DST. Work orders related to decision factors included in the four decision categories are sufficiently represented, thereby enabling prioritization. By contrast, work orders that may not relate to the decision factors lack adequate representation and may prohibit a representative prioritization. For example, a lower level of importance for plumbing related *Influence*

decision factors was observed as a trend. The observed trend stands to reason as plumbing fixtures and equipment are typically limited to lab space and not present in traditional classrooms.

The DST includes a decision factor labeled as "Other," designed to accommodate situations where the scope of the work order may not be sufficiently represented by current scholarly research or may not otherwise be defined by the DST. Additionally, the Facility Administrator is provided an opportunity to justify her or his prioritization of the work order in the event their experience-based judgment of the work order conflicted with the direction of the DST. In total, the "Other" decision factor accounted for fewer than 5% of the total decision factors selected in the study. Furthermore, there was no evidence the Facility Administrators opted to justify their prioritization of the work order based on their selection of decision factors and professional judgment. Therefore, there is little evidence to suggest the design of the DST or the omission of any specific decision factors that influenced the results of the study to a significant degree.

Data explicitly collected to the selection of decision factors indicated a trend to not assign an *Academic Enabler* decision factor to Plumbing work orders. Of the five Plumbing work orders, Facility Administrators only identified two of these work orders as having a high *Academic Enabler* decision factor value. Facility Administrators elected not to select any second-tier *Academic Enabler*, which included Reference Space, Creative Space, Temperature Control and Comfort. As a result, the mean value of Plumbing's decision category *Academic Enabler* was only 3.172, more than 50% less than the next highest functional area's mean *Academic Enabler* value.

Here again, the number of scholarly publications correlating academic outcomes with Plumbing related facility conditions is low as compared to other functional areas where more research has been conducted. Therefore, fewer decision factors are represented in the DST, resulting in lower mean value for the decision category. This finding should not imply that Plumbing work orders should always be subordinate to other functional areas due to the lack of scholarly research. Instead, it simply means there is not currently evidence to suggest a greater value should be placed on Plumbing work orders specific to that functional area's ability to enable academic outcomes.

Similarly, there are environmental factors that a school or academic district could prioritize which may not have a positive correlation with academic outcomes or may not currently be represented in academic research. For example, work orders that address environmental issues such as school security (i.e., perimeter fencing, metal detectors, advanced door hardware), graffiti response, or exterior lighting each deserve a degree of importance relative to the unique needs of a district. Facility conditions such as these provide examples of where the DST may not comprehensively address all of the decision factors that require attention on the part of the Facility Administrator. This apparent gap in prior research or the lack of a positive correlation highlight a need for human involvement in the prioritization of work orders. For these reasons, the author recognizes the importance of balancing the objective decision factors presented in the DST with the Facility Administrator's experience-based judgment.

4.4.3 Implementation Method and Weighting of Decision Categories

Results of the study indicate that the method of implementation had an impact on the perceived importance of a work order and, moreover, the perceived importance of the

functional area. Therefore, the method of implementing the DST next served as a context by which to evaluate the tool. For example, one-third of the Electrical work orders were influenced to a statistically significant degree when administratively prioritized, R2-Impact Ranking. In total, the functional area was not influenced to a similar degree in either R2-Impact or R2-Comprehensive Rankings. When prioritizing the same work orders using a pairwise comparison, without assigning a value to the decision category, the number of work orders influenced increased to 67% and, moreover, the functional area was influenced to a statistically significant degree.

Furthermore, the observed variance within Electrical declined by approximately 45% when comparing the standardized R1 variance of 1.283 to the standardized mean sensitivity test variance of 0.699. This finding was consistent throughout the study in each of the functional areas observed. To summarize, prioritizing work using a VAHP-based approach can influence decision making to a significant degree. However, given the degree to which subjective experience influenced the selection of decision factors, a VAHP-based approach may not provide the level of stability necessary to drive predictive or prescriptive results. By contrast, when implementing the tool using a pairwise comparison, the ability of the tool to influence behavior increased in every measure.

4.5 Limitations

The purpose of this research is to validate a previously developed DST's ability to influence behavior, as measured by a change in the prioritization of routine work orders. The extent of the study was limited to the scope of work as documented in the thirty work orders and did not reflect all aspects of K-12 routine facility operations and maintenance.

It is possible that other work orders may present a different set of concerns not directly addressed in this study. Moreover, the research does not account for workplace or environmental factors, which may influence the prioritization process. For example, the impact of deferred maintenance and the availability of parts both present practical implications that should be factored into the prioritization process, but are not addressed in this study.

Similarly, the study was conducted in a controlled setting free of the influences or constraints of a K-12 district. Therefore, the results of the study further emphasize the need for a process of prioritizing routine work, given the impact of subjective, experience-based, bias as documented in this study.

The methodology for developing the fourth decision category, Academic Enablers, is limited by the availability of academic literature addressing the relationship between a building system or facility condition and student outcomes. That said, it is theoretically possible that alternate facility conditions may have an equal or similar correlation with academic outcomes but lack the necessary academic precedent. Therefore, the resulting list of Academic Enablers is not intended to be the final, definitive listing of facility conditions correlating with academic outcomes.

This study cannot claim to what extent facility administrators may or may not currently be utilizing similar information to make informed decisions. Additionally, it is theoretically plausible that professional experience may influence decision making in a manner comparable to the DST. Therefore, the tool's ability to influence prioritization 100% of the time was never an objective of this study.

Despite these limitations, this research provides empirical evidence that the DST influenced decision-making, including the role subjective experience-based decision making has concerning the alignment of facility conditions and the perceived benefit to academic outcomes.

4.6 Conclusions

Facility operation and maintenance administrators are continually evaluating the merits of routine work orders as a vehicle for allocating resources, reducing costs, and prolonging the life cycle of institutional assets. To effectively maintain the required performance of the facility systems and infrastructure, routine work orders should be prioritized in a consistent and predictive manner. The prioritization of this work must also align with the strategic objectives of the academic district, with the intent of providing a targeted benefit to the district that is measurable over a long term implementation. This paper provides empirical validation of a VAHP-based decision support tool for making evidence-based prioritization decisions, leveraging both academic and professional experience. Implemented successfully, the DST is a vehicle for supporting the districts strategic objectives, providing a method for measuring performance.

The primary contributions of this work are the understandings by which the DST may or may not influence decision making. Results of the study indicate the tool influenced the prioritization of routine work orders, to varying degrees, in each of the functional areas evaluated. Moreover, the data indicates the perceived importance of one or more work orders and the perceived importance of functional areas are independent. These findings indicate that the DST may be a useful tool for influencing decision-making specific to Plumbing, Electrical, or General Maintenance work orders. However,

the tool was shown to be less effective when prioritizing Mechanical work orders where the participant's subjective experience may more closely align with the DST's decision factors.

Furthermore, the data indicates that implementing the tool using a traditional AHP-based approach mitigates subjective experience-based judgment while enabling the Facility Administrator to influence the importance of decision categories. The pairwise approach resulted in a lower degree of variance, reduced standard deviation, and a greater degree of control over the prioritization process.

To summarize, if a district aims to effectively manage district assets for the benefit of student performance and academic outcomes, having a consistent and repeatable prioritization process is of specific importance. The DST developed by Beauregard and Ayer (2019) and tested for this study provides such a process. However, the methodology promoting an evidence-based prioritization process may also marginalize those functional areas or aspects of work that may not benefit from prior academic research. Therefore, academic districts should aim to balance the role of objective decision factors and subjective experience-based judgment play in the prioritization of routine work orders.

CHAPTER 5

RESEARCH CONTRIBUTION AND FUTURE RESEARCH

This research addresses the role of decision-making at public K-12 academic districts as an enabler of institutional performance. An analysis of plant maintenance and operations spending illustrates a moderate to strong negative correlation with academic performance (μ -0.423). This finding should not be interpreted as a declaration to constrain further or altogether stop K-12 plant maintenance and operation spending. Rather, the correlation suggests an opportunity exists to improve the allocation of district resources to serve the academic needs of the student better. Results of a literature review indicate there are preferable facility conditions that may, in part or collectively, support the academic performance of students. However, interviews with a purposeful sample of academic districts in Arizona suggest facility administrators may not currently be utilizing academic precedent when prioritizing work.

A tangential factor contributing to the negative correlation, in whole or in part, is the impact of a differed maintenance strategy. The decline in Arizona's OpEx spending mirrors that of the nation (NCES, 2016; Snyder et al., 2016). A 2016 study sponsored in part by the National Council on School Facilities and the 21st Century School fund estimates the cost of differed maintenance in the U.S. exceeds $500 Billion (Filardo, 2016). In writing "State of Our Schools" Filardo estimates that Arizona's portion of that total represents more than $200 Million in differed maintenance costs, which is problematic for two reasons. First, managing a differed maintenance strategy will increase the life cycle cost of an asset (Lewis and Payant, 2007). Second, since we understand that well maintained facilities have a positive impact on academic

performance, as cited herein, it logically follows that poorly maintained facilities will have an equally adverse effect on academic performance.

To summarize, the investigative process suggests there is an opportunity for Facility Administrators' to more-effectively prioritize routine work given the financial constraints effecting the Nation's K-12 academic districts. Changing the behavior that influences decision making may enable Facility Administrators to prioritize those facility attributes that are most consistently reported to offer benefits to students.

The author developed a DST to better support this shift in work order prioritization which can be used by facility administrators (decision-makers) for the prioritization of otherwise routine work. The developed process leverages existing, disparate research findings to generate a DST based on a visual analytical hierarchy process. Focus groups consisting of current facility administrators helped direct the development of the decision framework, ultimately validating the final DST.

The DST was tested with a sample population of K-12 facilities administrators to determine the extent to which the tool influenced their decision-making. The validation process involved practitioners evaluating two purposeful samples of work orders- with and without the development DST. This approach enabled the author to strategically compare results in order to identify impacts that the tool had on decision-making.

Through the methodology detailed herein, the research has addressed the targeted research questions:

RQ1: Does a correlation exist between facility maintenance expense spending and educational outcomes suggesting that practitioners are leveraging prior research?

- The data obtained from academic districts in the state of Arizona indicate a negative correlation was present between Plant Maintenance and Operation spending and academic performance. Results of this analysis suggest there is an opportunity for facility administrators to align the prioritization of routine work (allocation of resources) with the strategic academic objectives of the district.

RQ2: What processes or procedures guide discretionary facility spending decisions?

- Research observations and interviews with participating K-12 academic districts indicate facility administrators may not be utilizing published research evidence when deciding the prioritization of work. Rather, the prioritization of routine work appears to be mostly a subjective process, governed by the day-to-day environmental factors of the district.

RQ3: Can prior academic research detailing the beneficial impact of facility condition with regard to academic performance be leveraged to aid decision-making?

- Various building systems and environmental attributes, cited herein, establish a relationship between facility condition and academic performance. The research methodology used for this study proposed a framework for decision making based upon the frequency of citations specific to a building system and environmental factor (climate and culture). The resulting decision categories and decision factors are not intended to convey a specific academic outcome. Rather, the proposed framework serves to align the allocation of district resources with environmental factors that may lead to improved academic outcomes.

RQ4: Does the resulting DST provide a method of decision making that is both comprehensive and easy-to-use?

- Observations from a focus group consisting of current facility management practitioners suggest the tool is both practical and comprehensive, having the ability to serve K-12 academic districts. Moreover, the methodology and decision framework may be adapted to serve alternate, non-academic, institutional facilities.

RQ5: To what extent does the DST influence the prioritization of routine facility maintenance work orders?

- Research findings suggest DST's implementation method has a direct bearing on the DST's ability to influence decision making. Results of the study indicate that the Facility Administrator prioritization can be influenced to a statistically significant level, dependent on the functional area and scope of the work order. However, the tool's ability to influence the prioritization of work orders when utilizing a pairwise comparison was statistically significant in more than 70% of the work orders tested and in each of the functional areas.

RQ6: In what contexts does the DST impact, or not impact prioritization?

- The DST did not have an equal influence on decision-making, suggesting context is a factor to consider when implementing the tool.
- When using the DST, the perceived importance of work orders and functional areas was largely independent. Statistically significant decisions made regarding the prioritization of routine work orders did not influence the perception of functional areas to a similar degree.
- The DST may be an effective method for prioritizing work orders specific to Plumbing, Electrical, and General Maintenance scopes of work. However, there

are other functional areas such as Mechanical where the tool has a limited impact. These findings suggest a tailored implementation may provide the greatest benefit to an academic district.

- Facility Administrator experience-based subjective judgment is a limiting factor when implementing the DST. By contrast, reducing human engagement to the weighting of decision categories increased the impact of the DST, as measured by the number of work orders influenced to a statistically significant degree. Furthermore, reducing human engagement resulted in a reduction of the mean ranking standard deviation, suggesting the prioritization of work orders is more consistent when human engagement is controlled.
- The methodology used to create the DST currently subordinates building infrastructure and environmental factors that either may not directly influence academic outcomes or may not currently benefit from academic research. As a result, academic districts should balance the object direction of decision factors with the experience-based subjective assessment of Facility Administrator's when prioritizing routine work orders.

To summarize, results of the study indicate a visual analytical hierarchy process, leveraging prior research and the unique experience of the facility technician, enables facility maintenance practitioners to make evidence-based decisions when establishing the importance and subsequent priority of routine work orders. Moreover, the resulting DST may benefit the overall performance of the institution by aligning the allocation of resources with those environmental factors that have been shown to influence academic performance positively.

5.1 Conclusions

The primary objective of this research was to explore the impact of facility operations and maintenance as an enabler of institutional performance. The following conclusions summarize the key findings of the research. Subsequent sections provide a summary of the research, the relevant limitations of the study and recommendations for further research.

5.1.1 Key Learnings

1. *An opportunity for improved decision-making*: The lack of a positive correlation between facility OpEx spending and academic outcomes indicates an opportunity for improvement specific to the allocation of resources. The qualitative observations suggest a need for a process to govern decision-making. Moreover, the study found that facility administrators may not currently be leveraging academic findings to make evidence-based decisions when prioritizing routine work. Collectively, this research highlights an opportunity for improved decision-making to meet the strategic academic objectives of the district better.
2. *Framework for a decision support structure*: Findings from a literature review, district interviews, and subsequent focus group(s) form the framework for a DST, relating facility administrators with relevant category and decision factors attributed in part to academic performance. Areas of specific interest to the study include the voice of the client, academic climate and culture.
    a. *The client*: The prioritization of work orders, as a method for value creation, must respond to the needs of the client. Allocating resources according to those work orders that are systemic to the

success of the customer, synergistic with the objectives of the organization, is a method for creating value. Defining the Teacher-Student relationship as the client, and thereby strategically aligning district resource in support of the Teacher-Student engagement is a key learning of this research.

b. *Academic Culture and Climate*: Traditionally, facility operation and maintenance work orders address the performance needs of an asset. For example, is the asset due for scheduled preventative maintenance or is corrective maintenance necessary given the assets performance or lack thereof. Another key learning of this research is prioritizing environmental factors that contribute, in whole or in part, to the academic climate and culture of the school for the benefit of the Teacher-Student engagement.

3. *Decision Support Tool*: The decision tool was shown to be an effective method for prioritizing routine work. However, the contexts by which the DST influenced behavior was a finding of greater significance. Here results illustrate that the facility administrator's perception of a functional area, positive or negative, did not influence their perception of work within the context of that functional area. Moreover, the ability of the DST to influence decision making, changed to a greater or lesser degree, depending on the functional area. These findings suggest that functional area provides an element of context influencing the ability of the DST to impact decision making.

5.2 Practical Implications

The ability of the DST to influence decision making, as evidenced herein, serves to bridge the gap between Facility Management and academic research supporting the profession. Prior to this study, academic research correlating building systems and environmental factors was largely disparate. The research methodology documented herein provides a framework for facility administrators to effectively aggregating this research, providing a process and DST for evidence-based decision-making. Moreover, the resulting DST was shown to influence each of the functional areas tested to a greater or lesser degree.

Although the data collected as part of this study was sufficient to understand the statistical significance of the decisions support tool's ability to influence behavior, the results of the study provide an initial proof of concept. Further research, to include the long term adoption of the DST by an academic district, are needed to provide a clearer understanding of the tool's ability to improve the relationship between facility conditions and academic performance.

Academic districts can benefit from tailoring the implementation of the DST to meet the unique needs of the district: utilizing the tool where it has been shown to add value and impact academic performance or leveraging experience-based subjective judgment when human engagement provides the greatest insight. Adopting the DST to aid in the prioritization of routine work orders should serve to align the strategic objectives of an academic district with the professional challenges of managing an academic districts' building infrastructure.

5.3 Research Limitations

Despite limitations, this research provides both observed and empirical evidence supporting the need for a DST and the ability of such a tool to significantly influence decision making specific to the prioritization of routine work orders. However, future research should consider the following:

- Building infrastructure and Facility portfolios are complex systems having many interconnected and dependent relationships. Adding to this complexity is the organizational politics governing the performance requirements of the Facility Operations and Maintenance organization. This research was limited to K-12 public academic districts. The current form of the DST is limited to this scope and influence. However, the general framework of the DST was designed to be transferable and may be adapted to service other institutional building infrastructure utilizing the methodology as defined.
- The methodology behind the first three decision categories (*Influence*, *Building Status*, and *Building Use*) prioritizes facility characteristics having the most significant impact on the delivery of education. By contrast, the decision category *Academic Enabler* constructs explicitly a hierarchy of value based on the frequency of reported benefits that a building system, facility condition, or environmental factor may have on academic outcomes. The greater the number of citations, the higher the importance of that specific decision factor. Therefore, the potential limitations of the study include the availability of academic precedent correlating facility condition with academic outcomes.

- Although the scope of this research was limited to K-12 educational facilities, the author cannot claim the DST would have an equivalent impact on all academic districts given the range of variables present in any district real estate portfolio.
- The study was conducted in a controlled setting, free of the influences or constraints of a district setting. Results of the study further emphasize the need to have a process in place to prioritize work and impact decision making considering the influence subjective, experience-based, bias has in the current prioritization of work orders as documented in this study.
- The study does not account for any scope of work not defined by the thirty work orders used for the activity, nor does the study account for priorities outside the spectrum of academic performance that may ultimately influence the decision-making process. Priorities influencing a work order that may not be documented in a work order include such factors as the procurement and availability of maintenance repair and operations parts or the extent to which deferred maintenance impacts an academic district. While both part availability and deferred maintenance are critical factors influencing the prioritization process, neither are documented in a work order and therefore cannot factor into the prioritization process. Should the DST be implemented at a district, justification for factors such as these that influence priority are accounted for in the structure of the tool.

5.4 Future Research

The author recommends the following areas for future research based on the observations and experience of the current research study:

1. *Case Study*: The DST as tested in this research is a proof of concept. The adaptation and long term adoption of the DST to aid a specific academic district or institutional infrastructure may provide an opportunity for future research to study the efficacy of the DST as a case study.
2. *Institutional Facility Management*: The body of work supporting this dissertation emphasizes the correlation between plant maintenance and operations and the prioritization of routine work to further the strategic objectives of K-12 academic districts. The resulting DST was designed for this purpose, highlighting institutional enablers specific to academic success. However, future studies must explore opportunities to employ a similar DST, translating the methodology to support other, non-academic, institutional real estate portfolios.
3. Capital Projects: This dissertation explores the role of OpEx spending as an enabler of institutional performance. Future studies can explore if a similar relationship exists between capital spending and institutional performance. More specifically, how may an empirically-based decision structure better support decision-making specific to the allocation of capital funding and how does the process of decision-making account for strategic performance objectives.

The structure of the DST was intended to support alternate, non-education, facilities. The author recommends further developing the DST's fourth category, institutional enabler(s), to accommodate the needs of additional public institutions. If public institutions, like K-12 education, are faced with increasing expectations and constrained public funding, the ability to make informed spending decisions specific to

facility operations and maintenance increasingly become critical to the successful performance of that public institution.

5.5 Final Remarks

Facility Operations and Maintenance is an enabling organization and an integral component to the overall success of an organization and or institution. The profession of Facility Management is a demanding and challenging profession, requiring the practitioner to balance competing objectives continually. Decisions regarding the preventative maintenance of an asset are often dependent on the needs of the asset, independent of the needs of the overall organization, despite this complexity. Academic empirical-based research has identified building systems and facility conditions that may positively contribute to the performance of the overall organization. Leveraging this prior research in cooperation with the practical experience of industry professional offers a method to support the needs of the institution strategically, prioritizing work that may provide the greatest benefit to the organization. This dissertation bridges the divide between academia and the practice of facility maintenance by introducing a methodology to prioritize routine work in support of a public institution. The findings of this research, as detailed herein, provide a methodology for prioritizing work in support of K-12 educational facilities. The resulting DST is both scalable and may be tailored to meet the needs of an institutional facility portfolio.

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APPENDIX A

ENROLLMENT DATA PER DISTRICT

(Arizona Department of Education)

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Attenance by District					
					2010 Attendance	2011 Attendance	2012 Attendance	2013 Attendance	2014 Attendance	2015 Attendance
1	4403	100201000	Tucson Unified District	8,968,427	53,269	52,191	51,262	49,890	49,012	49,010
2	4235	70204000	Mesa Unified District	8,530,135	65,116	65,662	64,892	64,932	64,532	64,532
3	4241	70269000	Paradise Valley Unified District	5,085,048	33,012	33,478	33,380	32,927	32,732	32,732
4	4239	70241000	Gilbert Unified District	4,833,949	38,084	37,240	38,211	37,935	37,240	37,236
5	4242	70280000	Chandler Unified District #80	4,773,688	38,875	40,190	40,594	41,653	42,664	42,664
6	4237	70211000	Peoria Unified School District	4,584,353	36,860	36,944	36,988	37,052	37,069	37,064
7	4246	70297000	Deer Valley Unified District	4,447,281	35,189	35,009	34,616	33,978	34,365	34,365
8	4286	70510000	Phoenix Union High School District	4,361,240	24,947	25,906	25,827	26,392	26,814	26,813
9	4240	70248000	Scottsdale Unified District	4,303,438	26,234	26,268	25,899	25,361	24,451	24,451
10	4243	70289000	Dysart Unified District	3,283,430	24,279	25,259	26,187	26,440	26,712	26,712
11	4260	70406000	Washington Elementary School District	2,929,727	22,336	22,466	22,800	23,249	23,281	23,281
12	4406	100210000	Amphitheater Unified District	2,560,557	14,679	14,417	14,229	14,165	13,807	13,797
13	4267	70428000	Kyrene Elementary District	2,556,290	17,816	18,025	18,032	17,670	17,642	17,642
14	4285	70505000	Glendale Union High School District	2,365,011	14,839	15,033	14,975	15,181	15,254	15,254
15	4287	70513000	Tempe Union High School District	2,326,820	13,834	13,784	13,830	14,062	13,959	13,959
16	4282	70483000	Cartwright Elementary District	2,143,391	17,672	18,388	18,919	19,110	18,901	18,901
17	4407	100212000	Sunnyside Unified District	1,970,356	17,317	17,614	17,631	17,725	17,160	17,154
18	4258	70403000	Tempe School District	1,818,774	12,066	12,175	12,020	12,060	12,159	12,159
19	4192	30201000	Flagstaff Unified District	1,747,421	10,121	9,494	9,606	9,756	9,779	9,775
20	4404	100206000	Marana Unified District	1,717,323	12,878	12,562	12,353	12,351	12,523	12,518
21	4248	70260000	Higley Unified School District	1,677,682	10,094	10,532	10,969	11,254	11,459	11,459
22	4280	70468000	Alhambra Elementary District	1,583,925	14,036	14,245	14,420	14,271	13,928	13,928
23	79598	80220000	Kingman Unified School District	1,517,377	7,224	7,182	7,072	6,917	6,789	6,789
24	4279	70466000	Roosevelt Elementary District	1,487,676	10,493	10,558	10,356	10,071	9,614	9,614
25	4507	140570000	Yuma Union High School District	1,474,177	11,110	11,042	10,798	10,732	10,684	10,684
26	4271	70440000	Glendale Elementary District	1,441,452	12,790	13,311	13,600	13,934	13,897	13,896
27	4413	100220000	Vail Unified District	1,326,723	10,615	10,935	11,604	11,863	12,315	12,314
28	4288	70514000	Tolleson Union High School District	1,310,221	9,391	9,783	10,078	10,649	11,314	11,314
29	4283	70492000	Pendergast Elementary District	1,261,632	9,669	9,853	9,772	9,888	10,019	10,019
30	4437	110201000	Florence Unified School District	1,249,830	8,188	8,459	8,259	7,985	8,324	8,324
31	4256	70401000	Phoenix Elementary District	1,168,665	7,116	7,724	7,462	7,581	7,459	7,459
32	4281	70479000	Litchfield Elementary District	1,161,345	10,303	10,508	10,722	11,013	11,424	11,424
33	4499	140401000	Yuma Elementary District	1,098,098	9,578	9,133	9,140	9,027	9,007	9,004
34	4263	70414000	Creighton Elementary District	995,558	6,692	6,610	6,693	6,660	6,515	6,510
35	4289	70516000	Agua Fria Union High School District	991,777	6,743	6,851	6,938	7,235	7,535	7,535
36	4158	10224000	Chinle Unified District	975,701	3,786	3,685	3,591	3,554	3,323	3,323
37	4244	70293000	Cave Creek Unified District	952,246	5,818	5,794	5,555	5,412	5,419	5,419
38	4284	70501000	Buckeye Union High School District	903,133	3,680	3,691	3,751	1,320	3,989	3,989
39	4442	110221000	Coolidge Unified District	901,352	4,143	3,763	3,638	3,729	3,568	3,568
40	4446	110404000	Casa Grande Elementary District	896,907	7,542	7,403	7,369	7,067	7,014	7,014

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Attenance by District					
					2010 Attendance	2011 Attendance	2012 Attendance	2013 Attendance	2014 Attendance	2015 Attendance
41	4259	70405000	Isaac Elementary District	876,839	7,412	7,215	7,260	7,431	7,411	7,411
42	4175	20268000	Sierra Vista Unified District	856,511	5,642	5,571	5,515	5,467	5,780	5,780
43	4368	80201000	Lake Havasu Unified District	846,080	5,891	5,675	5,743	5,658	5,727	5,723
44	4441	110220000	Maricopa Unified School District	837,081	5,965	5,849	5,801	2,687	6,219	6,217
45	4245	70295000	Queen Creek Unified District	833,228	5,276	5,296	5,016	5,186	5,483	5,483
46	4469	130222000	Humboldt Unified District	826,072	6,051	5,982	5,860	5,781	5,827	5,824
47	4411	100230000	Sahuarita Unified District	814,183	4,984	5,131	5,313	5,566	5,672	5,672
48	4410	100216000	Catalina Foothills Unified District	808,947	4,882	5,064	5,068	5,012	5,082	5,080
49	4405	100208000	Flowing Wells Unified District	789,539	5,394	5,397	5,571	5,567	5,609	5,607
50	4443	110243000	Apache Junction Unified District	783,426	5,032	4,879	4,740	4,686	4,645	4,645
51	4466	130201000	Prescott Unified District	764,467	5,229	5,095	4,961	4,916	4,454	4,454
52	4270	70438000	Madison Elementary District	762,711	5,753	6,130	6,241	6,136	6,223	6,223
53	4272	70444000	Avondale Elementary District	760,287	6,049	5,748	5,652	5,702	5,737	5,736
54	4457	120201000	Nogales Unified District	750,318	5,866	5,822	5,859	5,909	5,824	5,824
55	4501	140413000	Crane Elementary District	712,076	6,079	6,119	6,308	6,229	6,374	6,371
56	4276	70459000	Laveen Elementary District	660,163	5,176	5,502	5,916	6,151	6,402	6,402
57	4396	90227000	Kayenta Unified District	654,650	2,097	2,057	2,002	1,908	1,876	1,876
58	4445	110244000	J O Combs Unified School District	653,277	4,289	4,477	4,582	4,556	4,555	4,554
59	4196	30208000	Page Unified District	638,103	2,882	3,009	2,878	2,799	2,781	2,780
60	4278	70465000	Littleton Elementary District	631,086	5,115	5,119	5,339	5,561	5,594	5,594
61	4394	90220000	Whiteriver Unified District	626,577	2,160	2,229	2,240	2,300	2,335	2,335
62	4154	10208000	Window Rock Unified District	626,340	2,532	9	2,370	2,173	2,172	2,172
63	4453	110502000	Casa Grande Union High School District	603,851	3,736	3,674	3,587	3,732	3,796	3,796
64	4174	20227000	Douglas Unified District	603,041	4,130	4,165	3,911	3,753	3,867	3,867
65	4157	10220000	Ganado Unified School District	587,701	1,579	1,493	1,431	1,445	1,563	1,563
66	4273	70445000	Fowler Elementary District	559,846	4,609	4,604	4,640	4,679	4,842	4,840
67	4269	70433000	Buckeye Elementary District	546,169	4,411	4,501	4,632	4,822	4,998	4,998
68	4262	70408000	Osborn Elementary District	539,469	3,125	3,037	3,025	2,978	2,924	2,924
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	2,403	2,343	2,252	2,159	2,023	2,023
70	4155	10210000	Round Valley Unified District	530,690	1,422	1,375	1,348	1,350	1,342	1,334
71	4505	140432000	Gadsden Elementary District	513,519	5,068	5,156	5,289	5,384	5,412	5,412
72	4458	120235000	Santa Cruz Valley Unified District	494,529	3,500	3,443	3,413	3,368	3,407	3,407
73	4247	70298000	Fountain Hills Unified District	483,159	2,042	2,024	1,950	1,813	1,721	1,721
74	4218	50201000	Safford Unified District	479,116	3,096	3,175	3,175	3,277	3,194	3,194
75	4387	90201000	Winslow Unified District	478,581	2,281	2,251	2,202	2,193	2,081	2,081
76	4393	90210000	Show Low Unified District	451,741	2,297	2,342	2,387	2,382	2,434	2,431
77	4268	70431000	Balsz Elementary District	446,570	2,752	2,754	2,682	2,717	2,579	2,579
78	4391	90205000	Snowflake Unified District	428,183	2,627	2,563	2,555	2,485	2,404	2,404
79	4236	70209000	Wickenburg Unified District	428,117	1,192	1,173	1,196	1,197	1,170	1,165
80	4378	80415000	Bullhead City School District	424,264	3,325	3,410	3,284	3,084	2,901	2,901

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Attenance by District					
					2010 Attendance	2011 Attendance	2012 Attendance	2013 Attendance	2014 Attendance	2015 Attendance
81	4381	80502000	Colorado River Union High School District	418,757	2,396	2,279	2,158	2,094	2,002	2,002
82	4389	90203000	Holbrook Unified District	412,976	2,001	2,153	2,227	2,154	2,132	2,124
83	4209	40210000	Payson Unified District	403,279	2,475	2,410	2,329	2,418	2,351	2,341
84	4264	70417000	Tolleson Elementary District	392,313	2,711	2,835	2,799	2,935	3,037	3,037
85	4266	70425000	Liberty Elementary District	380,368	3,554	3,214	3,208	3,285	3,333	3,333
86	4156	10218000	Sanders Unified District	379,556	969	886	835	807	756	756
87	4254	70290000	Saddle Mountain Unified School District	374,207	1,286	1,337	1,395	1,439	1,436	1,436
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	1,251	1,321	1,298	1,228	1,199	1,199
89	4210	40220000	San Carlos Unified District	369,835	1,514	1,468	1,434	1,488	1,536	1,536
90	4510	150227000	Parker Unified School District	366,028	1,829	1,999	2,016	2,046	2,010	2,010
91	4390	90204000	Pinon Unified District	344,152	1,245	1,323	1,307	1,311	1,272	1,272
92	4208	40201000	Globe Unified District	336,783	1,776	1,623	1,644	1,862	1,885	1,885
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	919	943	940	918	850	850
94	4474	130251000	Chino Valley Unified District	333,773	2,419	2,354	2,335	2,313	2,347	2,345
95	4211	40240000	Miami Unified District	327,598	1,211	1,235	1,201	1,160	1,153	1,153
96	4412	100240000	Baboquivari Unified School District #40	315,281	992	966	1,056	1,082	1,006	998
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	2,157	2,127	2,127	2,145	2,156	2,156
98	4500	140411000	Somerton Elementary District	312,037	2,722	2,725	2,777	2,860	2,861	2,861
99	4265	70421000	Murphy Elementary District	305,100	2,089	2,277	2,222	2,057	2,014	2,014
100	4153	10201000	St Johns Unified District	297,133	859	839	808	804	787	777
101	4408	100213000	Tanque Verde Unified District	280,121	1,664	1,747	1,914	2,003	2,080	2,079
102	4219	50204000	Thatcher Unified District	276,740	1,412	1,501	1,614	1,700	1,729	1,729
103	4230	60218000	Morenci Unified District	273,528	1,187	1,267	1,342	1,352	1,632	1,632
104	4170	20213000	Willcox Unified District	273,508	1,295	1,253	1,196	1,210	1,146	1,146
105	4470	130228000	Camp Verde Unified District	245,725	1,395	1,384	1,425	1,448	1,457	1,457
106	4168	20201000	Tombstone Unified District	231,447	840	875	889	917	866	866
107	4169	20202000	Bisbee Unified District	228,248	771	760	784	797	662	662
108	4159	10227000	Red Mesa Unified District	227,658	1,012	952	724	674	728	727
109	4379	80416000	Mohave Valley Elementary District	220,035	1,758	1,738	1,611	1,525	1,411	1,411
110	4388	90202000	Joseph City Unified District	211,184	503	495	461	401	406	403
111	4261	70407000	Wilson Elementary District	207,691	1,136	1,391	1,181	1,278	1,245	1,245
112	4277	70462000	Union Elementary District	202,597	1,652	1,747	1,773	1,870	2,028	2,028
113	4488	130504000	Mingus Union High School District	198,724	1,203	1,162	1,196	1,220	1,151	1,151
114	79226	20209000	Benson Unified School District	194,192	1,147	1,193	1,123	1,126	1,245	1,238
115	4257	70402000	Riverside Elementary District	192,409	740	894	825	952	927	927
116	4438	110203000	Ray Unified District	191,243	535	541	559	522	493	493
117	4221	50207000	Fort Thomas Unified District	183,357	543	510	565	575	577	577
118	4212	40241000	Hayden-Winkelman Unified District	179,222	364	339	302	293	297	297
119	4440	110215000	Superior Unified School District	171,807	445	461	443	420	408	408
120	4450	110422000	Toltec School District	170,495	1,302	1,203	1,168	1,169	1,189	1,189

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Attenance by District					
					2010 Attendance	2011 Attendance	2012 Attendance	2013 Attendance	2014 Attendance	2015 Attendance
121	4370	80214000	Colorado City Unified District	168,595	384	428	444	481	591	591
122	4392	90206000	Heber-Overgaard Unified District	164,182	494	515	487	480	448	448
123	4448	110411000	Eloy Elementary District	157,960	1,056	1,044	1,019	1,014	971	971
124	4395	90225000	Cedar Unified District	156,043	307	250	187	164	151	148
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	433	374	357	395	425	425
126	4449	110418000	Sacaton Elementary District	148,862	506	464	440	449	502	502
127	4193	30202000	Williams Unified District	146,180	664	621	620	619	618	618
128	4228	60202000	Duncan Unified District	136,458	364	410	364	389	382	381
129	4180	20349000	Palominas Elementary District	129,873	1,424	1,431	1,435	1,398	1,409	1,409
130	4220	50206000	Pima Unified District	119,300	792	713	803	823	848	848
131	4473	130243000	Mayer Unified School District	118,214	432	470	497	561	570	570
132	4447	110405000	Red Rock Elementary District	118,105	317	306	301	343	312	312
133	4506	140550000	Antelope Union High School District	117,018	300	296	284	295	255	255
134	4418	100351000	Altar Valley Elementary District	116,000	969	980	981	941	981	979
135	4238	70224000	Gila Bend Unified District	110,813	440	472	410	408	418	418
136	4409	100215000	Ajo Unified District	107,122	439	449	441	439	428	428
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	310	284	261	238	258	258
138	4369	80208000	Peach Springs Unified District	102,653	225	233	227	230	245	244
139	4468	130220000	Bagdad Unified District	98,396	425	430	453	458	479	479
140	4451	110424000	Stanfield Elementary District	97,461	678	654	599	529	524	524
141	4472	130240000	Seligman Unified District	90,327	133	145	141	144	138	138
142	4173	20221000	St David Unified District	88,586	446	458	429	426	435	435
143	4374	80209000	Littlefield Unified District	82,633	505	513	462	424	459	459
144	4194	30204000	Grand Canyon Unified District	76,786	294	285	310	324	294	294
145	4416	100339000	Continental Elementary District	75,361	712	671	690	755	801	800
146	4481	130326000	Beaver Creek Elementary District	74,916	460	460	480	437	431	425
147	4444	110302000	Oracle Elementary District	72,929	773	721	738	692	695	693
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	222	217	206	213	216	216
149	4462	120520000	Patagonia Union High School District	70,799	70	57	54	61	64	62
150	4275	70449000	Palo Verde Elementary District	66,790	497	447	430	447	455	455
151	4214	40312000	Pine Strawberry Elementary District	66,745	156	182	159	150	173	171
152	4504	140424000	Wellton Elementary District	60,797	342	358	312	272	241	241
153	4190	20522000	Valley Union High School District	59,812	122	103	99	98	86	86
154	4515	150576000	Bicentennial Union High School District	57,537	125	136	131	103	97	97
155	4471	130231000	Ash Fork Joint Unified District	53,260	286	263	232	244	234	234
156	4511	150404000	Quartzsite Elementary District	53,125	239	247	215	233	231	231
157	4502	140416000	Hyder Elementary District	52,656	122	107	102	103	98	98
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	434	479	455	455	469	469
159	4503	140417000	Mohawk Valley Elementary District	47,820	158	151	146	150	144	144
160	4171	20214000	Bowie Unified District	46,243	79	82	70	52	39	38

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Attenance by District					
					2010 Attendance	2011 Attendance	2012 Attendance	2013 Attendance	2014 Attendance	2015 Attendance
161	4172	20218000	San Simon Unified District	45,061	95	89	114	146	137	137
162	4222	50305000	Solomon Elementary District	44,339	249	250	268	280	299	294
163	4213	40305000	Young Elementary District	43,872	60	59	56	33	45	45
164	4160	10306000	Concho Elementary District	41,015	239	232	244	248	205	194
165	4163	10323000	Mcnary Elementary District	39,692	169	154	167	155	169	169
166	4484	130350000	Canon Elementary District	38,230	258	221	205	206	185	185
167	4274	70447000	Arlington Elementary District	36,618	263	275	258	253	260	260
168	4514	150430000	Salome Consolidated Elementary District	36,533	107	100	102	118	120	120
169	4176	20323000	Naco Elementary District	36,034	416	411	383	382	428	428
170	4251	70375000	Morristown Elementary District	33,637	217	190	194	190	175	173
171	4461	120425000	Sonoita Elementary District	31,797	103	103	116	113	113	112
172	4249	70363000	Aguila Elementary District	31,788	216	219	216	220	219	211
173	4186	20422000	Pearce Elementary District	31,322	89	92	107	100	101	101
174	4185	20412000	Elfrida Elementary District	29,737	124	127	114	124	122	122
175	4199	30310000	Maine Consolidated School District	29,567	146	168	134	129	150	149
176	4188	20364000	Pomerene Elementary District	28,867	172	126	151	136	134	134
177	4224	50316000	Bonita Elementary District	27,239	92	93	89	92	89	89
178	4452	110433000	Picacho Elementary District	26,788	226	203	206	195	195	195
179	4479	130317000	Congress Elementary District	26,000	170	166	152	147	158	155
180	4177	20326000	Cochise Elementary District	25,613	86	81	96	91	88	88
181	4512	150419000	Wenden Elementary District	25,590	88	106	119	114	106	106
182	4162	10309000	Vernon Elementary District	24,218	170	179	164	147	166	164
183	4253	70386000	Mobile Elementary District	22,880	21	27	33	23	0	0
184	4234	70199000	Maricopa County Regional District	22,509	411	429	479	530	367	367
185	4459	120328000	Santa Cruz Elementary District	22,461	282	291	256	249	290	287
186	4386	90199000	Navajo County Accommodation District #99	22,178	1	9	11	0	0	0
187	4187	20453000	Ash Creek Elementary District	21,432	44	27	20	19	28	28
188	4250	70371000	Sentinel Elementary District	21,004	30	29	39	32	37	37
189	4485	130352000	Yarnell Elementary District	20,499	69	76	54	47	45	33
190	4371	80303000	Hackberry School District	19,916	35	48	63	79	58	44
191	79379	130199000	Yavapai Accommodation School District	19,116	71	67	79	65	72	72
192	4215	40333000	Tonto Basin Elementary District	16,896	101	94	90	66	72	72
193	4179	20345000	Double Adobe Elementary District	16,164	72	61	55	59	67	62
194	4255	70394000	Paloma School District	15,280	95	84	100	104	117	115
195	4161	10307000	Alpine Elementary District	14,868	64	69	67	68	68	57
196	4380	80322000	Valentine Elementary District	13,430	76	71	70	80	79	72
197	4513	150426000	Bouse Elementary District	13,327	40	42	35	41	30	30
198	4460	120406000	Patagonia Elementary District	12,483	74	78	90	94	86	86
199	4480	130323000	Kirkland Elementary District	10,452	105	96	104	94	97	97
200	4181	20355000	McNeal Elementary District	8,550	82	83	56	66	56	56
201	4478	130315000	Skull Valley Elementary District	8,550	48	48	53	40	42	39
202	4414	100335000	San Fernando Elementary District	7,630	18	12	25	25	26	26
203	4377	80313000	Yucca Elementary District	7,616	25	36	37	44	43	35
204	4482	130335000	Hillside Elementary District	7,229	35	36	30	25	29	29
205	4178	20342000	Apache Elementary District	1,720	10	10	7	0	0	0
206	4231	60322000	Blue Elementary District	1,600	11	5	8	0	19	19

APPENDIX B

PLANT MAINTENANCE AND OPERATIONS SPEND PER DISTRICT

(Arizona Department of Education)

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Spending by District					
					2010 Fac Ops Spend	2011 Fac Ops Spend	2012 Fac Ops Spend	2013 Fac Ops Spend	2014 Fac Ops Spend	2015 Fac Ops Spend
1	4403	100201000	Tucson Unified District	8,968,427	$2,819,336	$347,041	$746,419	$2,220,491	$48,611,656	$25,136,842
2	4235	70204000	Mesa Unified District	8,530,135	$2,732,373	$0	$0	$0	$0	$43,173,127
3	4241	70269000	Paradise Valley Unified District	5,085,048	$0	$1,073,940	$555,897	$0	$54,814,345	$54,323,863
4	4239	70241000	Gilbert Unified District	4,833,949	$0	$0	$0	$12,115	$24,270,502	$19,927,148
5	4242	70280000	Chandler Unified District #80	4,773,688	$0	$0	$0	$575	$26,339,602	$76,347,129
6	4237	70211000	Peoria Unified School District	4,584,353	$1,513	$1,823,708	$349,136	$452,662	$27,588,190	$27,925,652
7	4246	70297000	Deer Valley Unified District	4,447,281	$180,923	$0	$0	$6,791	$30,710,807	$32,638,050
8	4286	70510000	Phoenix Union High School District	4,361,240	$1,679,200	$0	$66,027	$47,717	$34,627,202	$38,190,660
9	4240	70248000	Scottsdale Unified District	4,303,438	$221,547	$166,773	$0	$40,424	$36,747,745	$34,010,329
10	4243	70289000	Dysart Unified District	3,283,430	$2,621,696	$111,389	$100,579	$1,536	$10,373,782	$68,672,316
11	4260	70406000	Washington Elementary School District	2,929,727	$702,099	$254,542	$572,897	$261,976	$16,280,475	$16,112,897
12	4406	100210000	Amphitheater Unified District	2,560,557	$83,930	$0	$0	$0	$13,909,239	$14,122,971
13	4267	70428000	Kyrene Elementary District	2,556,290	$120,849	$105,362	$0	$262,009	$16,126,463	$41,761,241
14	4285	70505000	Glendale Union High School District	2,365,011	$363,168	$403,559	$4,159	$128,711	$16,471,080	$18,466,890
15	4287	70513000	Tempe Union High School District	2,326,820	$0	$47,807	$632,684	$11,667	$7,976,817	$7,791,581
16	4282	70483000	Cartwright Elementary District	2,143,391	$155,253	$27,890	$0	$6,423	$2,092,341	$486,373
17	4407	100212000	Sunnyside Unified District	1,970,356	$0	$948,062	$8,322,566	$1,245,601	$6,885,540	$6,544,671
18	4258	70403000	Tempe School District	1,818,774	$263,493	$209,574	$156,459	$201,952	$25,319,653	$50,922,079
19	4192	30201000	Flagstaff Unified District	1,747,421	$682	$0	$0	$0	$6,515,599	$6,862,554
20	4404	100206000	Marana Unified District	1,717,323	$288,430	$0	$98,626	$135,373	$7,670,006	$8,120,451
21	4248	70260000	Higley Unified School District	1,677,682	$1,668,326	$4,844	$0	$3,528	$8,957,046	$49,253,672
22	4280	70468000	Alhambra Elementary District	1,583,925	$0	$0	$0	$0	$0	$6,695,164
23	79598	80220000	Kingman Unified School District	1,517,377	$875,457	$390,551	$45,510	$40,292	$6,830,282	$6,939,744
24	4279	70466000	Roosevelt Elementary District	1,487,676	$0	$0	$0	$0	$0	$6,076,120
25	4507	140570000	Yuma Union High School District	1,474,177	$0	$250,381	$20,034	$56	$15,761,627	$764,664
26	4271	70440000	Glendale Elementary District	1,441,452	$0	$0	$27,138	$44,651	$4,011,279	$3,123,012
27	4413	100220000	Vail Unified District	1,326,723	$29,765	$110,558	$9,044,254	$8,307,683	$9,931,978	$4,610,085
28	4288	70514000	Tolleson Union High School District	1,310,221	$192,778	$1,156,762	$625,069	$654,204	$26,177	$14,025,812
29	4283	70492000	Pendergast Elementary District	1,261,632	$86,870	$620,454	$0	$252	$5,893,870	$11,467,695
30	4437	110201000	Florence Unified School District	1,249,830	$1,683,666	$346,300	$0	$0	$3,563,781	$3,617,015
31	4256	70401000	Phoenix Elementary District	1,168,665	$0	$0	$0	$18,406	$9,758,325	$9,477,735
32	4281	70479000	Litchfield Elementary District	1,161,345	$2,186,279	$366,043	$456,484	$0	$4,335,263	$5,436,714
33	4499	140401000	Yuma Elementary District	1,098,098	$5,390	$210,110	$122,733	$2	$3,310,459	$266,352
34	4263	70414000	Creighton Elementary District	995,558	$338,077	$82,859	$72,369	$5,306	$3,797,263	$4,535,743
35	4289	70516000	Agua Fria Union High School District	991,777	$32,138	$126,594	$45,313	$62,679	$8,369,771	$26,686,649
36	4158	10224000	Chinle Unified District	975,701	$0	$308,500	$165,526	$1,095,617	$465,963	$0
37	4244	70293000	Cave Creek Unified District	952,246	$52,895	$136,412	$5,016,735	$927,193	$363,465	$15,741,904
38	4284	70501000	Buckeye Union High School District	903,133	$316,333	$2,076	$9,000	$198	$6,163,618	$21,057,090
39	4442	110221000	Coolidge Unified District	901,352	$303,693	$70,591	$568,210	$22,527	$364,667	$3,287,557
40	4446	110404000	Casa Grande Elementary District	896,907	$29,484	$39,059	$153,574	$322,002	$3,805,787	$2,782,661

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Spending by District					
					2010 Fac Ops Spend	2011 Fac Ops Spend	2012 Fac Ops Spend	2013 Fac Ops Spend	2014 Fac Ops Spend	2015 Fac Ops Spend
41	4259	70405000	Isaac Elementary District	876,839	$0	$0	$0	$0	$102,666	$0
42	4175	20268000	Sierra Vista Unified District	856,511	$0	$143,195	$156,478	$0	$0	$103,908
43	4368	80201000	Lake Havasu Unified District	846,080	$33,818	$49,850	$70,060	$0	$5,781,177	$6,919,289
44	4441	110220000	Maricopa Unified School District	837,081	$1,193,475	$1,368,387	$2,561,936	$100,971	$3,978,767	$3,536,687
45	4245	70295000	Queen Creek Unified District	833,228	$166,627	$206,231	$3,011	$73,034	$5,687,025	$13,840,881
46	4469	130222000	Humboldt Unified District	826,072	$33,881	$79,714	$9,866	$159,146	$3,629,325	$3,553,482
47	4411	100230000	Sahuarita Unified District	814,183	$253,322	$16,194,435	$4,873,512	$454,376	$267,257	$5,670,035
48	4410	100216000	Catalina Foothills Unified District	808,947	$8,604	$6,600	$0	$0	$89	$4,077,124
49	4405	100208000	Flowing Wells Unified District	789,539	$170,274	$181,589	$1,549	$318,465	$2,971,568	$2,604,016
50	4443	110243000	Apache Junction Unified District	783,426	$84,825	$451,526	$6,005	$719	$6,799,553	$6,451,203
51	4466	130201000	Prescott Unified District	764,467	$0	$0	$0	$108,039	$451,272	$2,609,881
52	4270	70438000	Madison Elementary District	762,711	$37,181	$0	$0	$92,827	$10,524,128	$11,075,816
53	4272	70444000	Avondale Elementary District	760,287	$15,703	$0	$0	$0	$3,501,392	$3,420,565
54	4457	120201000	Nogales Unified District	750,318	$0	$0	$0	$42,666	$755,355	$660,248
55	4501	140413000	Crane Elementary District	712,076	$135,001	$84,562	$11,671	$2,696	$1,847,931	$2,009,364
56	4276	70459000	Laveen Elementary District	660,163	$86,440	$233,025	$10,372,903	$1,145,594	$2,834,128	$1,982,488
57	4396	90227000	Kayenta Unified District	654,650	$0	$0	$0	$0	$328	$0
58	4445	110244000	J O Combs Unified School District	653,277	$647,216	$553,739	$197,154	$37,776	$2,813,095	$2,154,674
59	4196	30208000	Page Unified District	638,103	$0	$0	$0	$65,146	$2,900,249	$2,706,259
60	4278	70465000	Littleton Elementary District	631,086	$43,828	$478,652	$0	$55,671	$2,939,523	$3,209,939
61	4394	90220000	Whiteriver Unified District	626,577	$0	$0	$0	$0	$1,924,303	$1,969,785
62	4154	10208000	Window Rock Unified District	626,340	$150,597	$111,191	$0	$226,514	$3,585,036	$356,644
63	4453	110502000	Casa Grande Union High School District	603,851	$100,182	$0	$0	$640,686	$3,071,322	$1,429,513
64	4174	20227000	Douglas Unified District	603,041	$47,602	$225,605	$0	$29,109	$692,419	$1,063,601
65	4157	10220000	Ganado Unified School District	587,701	$0	$155,224	$862,752	$108,657	$3,270,129	$393,965
66	4273	70445000	Fowler Elementary District	559,846	$0	$437,866	$12,553	$24,394	$2,437,539	$8,555,610
67	4269	70433000	Buckeye Elementary District	546,169	$534,569	$10,201	$0	$48,132	$1,994,382	$1,705,475
68	4262	70408000	Osborn Elementary District	539,469	$5,652	$0	$0	$0	$6,311,272	$4,522,293
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	$35,460	$21,142	$0	$2,181	$2,684,978	$2,452,656
70	4155	10210000	Round Valley Unified District	530,690	$117,159	$263,749	$0	$31,999	$0	$899,461
71	4505	140432000	Gadsden Elementary District	513,519	$49,217	$11,372	$0	$0	$136,451	$508,553
72	4458	120235000	Santa Cruz Valley Unified District	494,529	$10,211	$177,810	$0	$381,020	$111,248	$713,573
73	4247	70298000	Fountain Hills Unified District	483,159	$0	$1,756,446	$0	$0	$1,200,088	$1,030,000
74	4218	50201000	Safford Unified District	479,116	$25,500	$42,084	$0	$241,972	$1,112,521	$1,088,336
75	4387	90201000	Winslow Unified District	478,581	$40,473	$0	$0	$0	$455,543	$449,316
76	4393	90210000	Show Low Unified District	451,741	$79,272	$0	$0	$0	$670	$43,991
77	4268	70431000	Balsz Elementary District	446,570	$0	$0	$0	$49	$2,968,740	$3,600,070
78	4391	90205000	Snowflake Unified District	428,183	$98,033	$103,877	$0	$12,245	$1,340,339	$4,324,338
79	4236	70209000	Wickenburg Unified District	428,117	$26,522	$4,086	$728	$5,557	$5,876,057	$2,307,762
80	4378	80415000	Bullhead City School District	424,264	$0	$0	$0	$40,423	$24,500	$599,926

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Spending by District					
					2010 Fac Ops Spend	2011 Fac Ops Spend	2012 Fac Ops Spend	2013 Fac Ops Spend	2014 Fac Ops Spend	2015 Fac Ops Spend
81	4381	80502000	Colorado River Union High School District	418,757	$23,652	$0	$5,745	$470,915	$2,347,058	$2,450,336
82	4389	90203000	Holbrook Unified District	412,976	$93,315	$227,321	$0	$0	$324,294	$365,509
83	4209	40210000	Payson Unified District	403,279	$135,693	$0	$773,040	$534,001	$165,888	$2,931,723
84	4264	70417000	Tolleson Elementary District	392,313	$0	$0	$0	$0	$1,971,337	$1,650,163
85	4266	70425000	Liberty Elementary District	380,368	$0	$0	$162,128	$7,399	$1,114,825	$1,738,657
86	4156	10218000	Sanders Unified District	379,556	$0	$225,000	$0	$0	$0	$3,589
87	4254	70290000	Saddle Mountain Unified School District	374,207	$21	$2,960	$0	$37,204	$4,051,589	$41,962
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	$84,914	$9,508	$0	$8,546	$6,474,170	$6,387,047
89	4210	40220000	San Carlos Unified District	369,835	$504,136	$161,579	$0	$0	$712,131	$0
90	4510	150227000	Parker Unified School District	366,028	$0	$20,021	$0	$0	$0	$0
91	4390	90204000	Pinon Unified District	344,152	$0	$75,374	$0	$0	$0	$0
92	4208	40201000	Globe Unified District	336,783	$1,606	$0	$0	$0	$123,908	$867,469
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	$3,473	$48,566	$0	$12,145	$171,337	$8,967
94	4474	130251000	Chino Valley Unified District	333,773	$86,453	$20,804	$0	$312,453	$44,464	$316,547
95	4211	40240000	Miami Unified District	327,598	$5,723	$5,759	$0	$3,625	$58,361	$103,537
96	4412	100240000	Baboquivari Unified School District #40	315,281	$317,283	$163,012	$0	$0	$0	$1,391,960
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	$87,361	$2,406	$0	$15,475	$0	$48,128
98	4500	140411000	Somerton Elementary District	312,037	$4,960	$137,333	$0	$0	$531,960	$526,215
99	4265	70421000	Murphy Elementary District	305,100	$0	$0	$0	$0	$167,772	$1,479,554
100	4153	10201000	St Johns Unified District	297,133	$24,763	$0	$0	$0	$0	$76,831
101	4408	100213000	Tanque Verde Unified District	280,121	$14,093	$642,387	$3,735,537	$48	$101,746	$1,538,907
102	4219	50204000	Thatcher Unified District	276,740	$137,506	$10,140	$0	$26,701	$721,679	$2,103,259
103	4230	60218000	Morenci Unified District	273,528	$42,938	$222,213	$0	$0	$0	$0
104	4170	20213000	Willcox Unified District	273,508	$80,044	$0	$5,000	$15,060	$1,224,837	$1,655,123
105	4470	130228000	Camp Verde Unified District	245,725	$465,859	$154,696	$0	$0	$0	$779,883
106	4168	20201000	Tombstone Unified District	231,447	$64,768	$0	$0	$14,000	$52,447	$495,854
107	4169	20202000	Bisbee Unified District	228,248	$261,927	$8,788	$159,770	$0	$882,145	$25,650
108	4159	10227000	Red Mesa Unified District	227,658	$48,388	$498,472	$0	$0	$3,021	$28,391
109	4379	80416000	Mohave Valley Elementary District	220,035	$4,585	$7,043	$0	$125,311	$1,323,362	$1,460,690
110	4388	90202000	Joseph City Unified District	211,184	$10,586	$49,306	$3,976	$15,406	$706,290	$392,758
111	4261	70407000	Wilson Elementary District	207,691	$174,000	$43,540	$390,108	$0	$472,782	$144,491
112	4277	70462000	Union Elementary District	202,597	$0	$0	$0	$0	$367,675	$359,087
113	4488	130504000	Mingus Union High School District	198,724	$34,887	$0	$0	$0	$1,566,570	$1,568,789
114	79226	20209000	Benson Unified School District	194,192	$3,240	$39,698	$9,946	$5,459	$44,382	$725,388
115	4257	70402000	Riverside Elementary District	192,409	$312,704	$14,750	$0	$961	$6,044,894	$7,023,938
116	4438	110203000	Ray Unified District	191,243	$0	$0	$0	$28	$281,151	$265,701
117	4221	50207000	Fort Thomas Unified District	183,357	$35,064	$50,995	$0	$3,200	$202,654	$0
118	4212	40241000	Hayden-Winkelman Unified District	179,222	$41,428	$11,541	$102,267	$15,055	$1,025,811	$892,501
119	4440	110215000	Superior Unified School District	171,807	$16,112	$3,107	$0	$114,434	$261,301	$249,738
120	4450	110422000	Toltec School District	170,495	$15,198	$0	$89	$0	$1,916,413	$806,624

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Spending by District					
					2010 Fac Ops Spend	2011 Fac Ops Spend	2012 Fac Ops Spend	2013 Fac Ops Spend	2014 Fac Ops Spend	2015 Fac Ops Spend
121	4370	80214000	Colorado City Unified District	168,595	$0	$0	$0	$0	$195,512	$183,570
122	4392	90206000	Heber-Overgaard Unified District	164,182	$0	$1,078	$0	$33,815	$858,400	$855,500
123	4448	110411000	Eloy Elementary District	157,960	$0	$0	$0	$860	$30,238	$118,675
124	4395	90225000	Cedar Unified District	156,043	$0	$0	$0	$146,996	$0	$503,651
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	$195,860	$166,910	$49,649	$216,063	$1,716,940	$1,673,457
126	4449	110418000	Sacaton Elementary District	148,862	$6,178	$41,311	$31,769	$6,287	$40,162	$0
127	4193	30202000	Williams Unified District	146,180	$17,487	$1,330	$1,397,771	$890,615	$477,047	$1,319
128	4228	60202000	Duncan Unified District	136,458	$375,613	$48,335	$0	$96,103	$356,748	$294,500
129	4180	20349000	Palominas Elementary District	129,873	$504	$0	$398,068	$255,102	$0	$0
130	4220	50206000	Pima Unified District	119,300	$5,921	$0	$0	$0	$153,550	$0
131	4473	130243000	Mayer Unified School District	118,214	$0	$0	$0	$5,084	$280,512	$159,775
132	4447	110405000	Red Rock Elementary District	118,105	$208,120	$0	$0	$0	$237,064	$0
133	4506	140550000	Antelope Union High School District	117,018	$27,558	$15,527	$0	$0	$235,943	$228,193
134	4418	100351000	Altar Valley Elementary District	116,000	$10,280	$0	$0	$0	$8,385	$0
135	4238	70224000	Gila Bend Unified District	110,813	$47,735	$32,366	$0	$122,048	$592,368	$724,424
136	4409	100215000	Ajo Unified District	107,122	$72,937	$10,640	$283,813	$3,179	$26,525	$5,344
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	$14,796	$1	$0	$99,500	$43	$0
138	4369	80208000	Peach Springs Unified District	102,653	$37,287	$23,769	$37,025	$16,481	$16,766	$1,408
139	4468	130220000	Bagdad Unified District	98,396	$0	$16,719	$0	$0	$13,903	$0
140	4451	110424000	Stanfield Elementary District	97,461	$0	$0	$0	$0	$154,538	$13
141	4472	130240000	Seligman Unified District	90,327	$2,942	$0	$0	$0	$27,381	$0
142	4173	20221000	St David Unified District	88,586	$0	$14,285	$0	$450,000	$374,939	$340,282
143	4374	80209000	Littlefield Unified District	82,633	$22,403	$0	$0	$3,307	$190,175	$336,613
144	4194	30204000	Grand Canyon Unified District	76,786	$0	$0	$0	$0	$713,385	$50,053
145	4416	100339000	Continental Elementary District	75,361	$0	$0	$0	$0	$7,716	$945,137
146	4481	130326000	Beaver Creek Elementary District	74,916	$8,346	$10,349	$0	$12	$365,655	$409,927
147	4444	110302000	Oracle Elementary District	72,929	$0	$0	$41,800	$65,433	$31,524	$0
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	$0	$0	$20,846	$0	$624	$72,344
149	4462	120520000	Patagonia Union High School District	70,799	$0	$65,475	$2,040	$152,898	$340	$0
150	4275	70449000	Palo Verde Elementary District	66,790	$116,969	$38,800	$0	$219,197	$170,489	$178,377
151	4214	40312000	Pine Strawberry Elementary District	66,745	$12,274	$0	$0	$0	$0	$0
152	4504	140424000	Wellton Elementary District	60,797	$0	$0	$0	$569	$2,053	$0
153	4190	20522000	Valley Union High School District	59,812	$49,153	$16,357	$10,516	$10,153	$32,020	$175,109
154	4515	150576000	Bicentennial Union High School District	57,537	$167,542	$0	$0	$22,918	$1,684	$394,522
155	4471	130231000	Ash Fork Joint Unified District	53,260	$0	$0	$0	$0	$0	$0
156	4511	150404000	Quartzsite Elementary District	53,125	$10,428	$41,970	$0	$19,181	$27,178	$339,398
157	4502	140416000	Hyder Elementary District	52,656	$18,689	$10,480	$20,055	$23,089	$9,065	$263,141
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	$13,886	$0	$111,042	$15	$39,451	$107,038
159	4503	140417000	Mohawk Valley Elementary District	47,820	$0	$1,394	$0	$13,115	$218,292	$602,496
160	4171	20214000	Bowie Unified District	46,243	$12,629	$20,797	$0	$10,198	$41,034	$33,954

#	Entity ID	CTD	Entity Name	GSF	Year-Over-Year Spending by District					
					2010 Fac Ops Spend	2011 Fac Ops Spend	2012 Fac Ops Spend	2013 Fac Ops Spend	2014 Fac Ops Spend	2015 Fac Ops Spend
161	4172	20218000	San Simon Unified District	45,061	$50,441	$920	$0	$0	$9,673	$0
162	4222	50305000	Solomon Elementary District	44,339	$35,293	$8,113	$0	$24,783	$69,631	$14,805
163	4213	40305000	Young Elementary District	43,872	$334,139	$0	$0	$12,095	$92,607	$0
164	4160	10306000	Concho Elementary District	41,015	$0	$0	$0	$0	$102,147	$98,650
165	4163	10323000	Mcnary Elementary District	39,692	$3,588	$3,448	$3,131	$0	$3,411	$18,245
166	4484	130350000	Canon Elementary District	38,230	$11,607	$52,730	$0	$25,233	$12,089	$74,018
167	4274	70447000	Arlington Elementary District	36,618	$0	$0	$0	$0	-$270,101	$821,897
168	4514	150430000	Salome Consolidated Elementary District	36,533	$11,462	$0	$0	$9,894	$1,607	$0
169	4176	20323000	Naco Elementary District	36,034	$114,789	$108,257	$0	$10	$0	$0
170	4251	70375000	Morristown Elementary District	33,637	$0	$0	$0	$0	$65,213	$0
171	4461	120425000	Sonoita Elementary District	31,797	$0	$0	$0	$0	$181	$0
172	4249	70363000	Aguila Elementary District	31,788	$4,131	$0	$0	$400,207	$425,704	$0
173	4186	20422000	Pearce Elementary District	31,322	$0	$0	$0	$0	$943	$0
174	4185	20412000	Elfrida Elementary District	29,737	$0	$191	$0	$2,691	$0	$3,565
175	4199	30310000	Maine Consolidated School District	29,567	$30,823	$3,501	$0	$0	-$1,142	$0
176	4188	20364000	Pomerene Elementary District	28,867	-$560	$0	$0	$0	$34,458	$502,760
177	4224	50316000	Bonita Elementary District	27,239	$9,500	$898	$0	$1,265	$0	$77,271
178	4452	110433000	Picacho Elementary District	26,788	$80	$0	$148,503	$0	$16,179	$12,589
179	4479	130317000	Congress Elementary District	26,000	$177,106	$380	$0	$9,734	$0	$0
180	4177	20326000	Cochise Elementary District	25,613	$5,813	$4,746	$0	$0	$0	$0
181	4512	150419000	Wenden Elementary District	25,590	$13,042	$2,186	$3,079	$0	$0	$0
182	4162	10309000	Vernon Elementary District	24,218	$0	$135,585	$0	$266,606	$0	$28,233
183	4253	70386000	Mobile Elementary District	22,880	$39,562	$5,076	$0	$481,446	$3,809	$96,711
184	4234	70199000	Maricopa County Regional District	22,509	$0	$0	$0	$6,363	$125,772	$0
185	4459	120328000	Santa Cruz Elementary District	22,461	$7,052	$0	$0	$0	$0	$0
186	4386	90199000	Navajo County Accommodation District #99	22,178	$0	$0	$0	$0	$629	$0
187	4187	20453000	Ash Creek Elementary District	21,432	$0	$0	$44,270	$15,195	$708	$0
188	4250	70371000	Sentinel Elementary District	21,004	$0	$0	$0	$3,914	$0	$0
189	4485	130352000	Yarnell Elementary District	20,499	$0	$0	$0	$0	$0	$31,447
190	4371	80303000	Hackberry School District	19,916	$0	$0	$0	$0	$0	$0
191	79379	130199000	Yavapai Accommodation School District	19,116	$0	$616,216	$0	$0	$0	$0
192	4215	40333000	Tonto Basin Elementary District	16,896	$0	$0	$0	$0	$44,380	$87,016
193	4179	20345000	Double Adobe Elementary District	16,164	$0	$20,468	$0	$7,304	$103,003	$0
194	4255	70394000	Paloma School District	15,280	$21,047	$0	$0	$122,880	$170,801	$24,505
195	4161	10307000	Alpine Elementary District	14,868	$25,060	$0	$0	$0	$35,089	$0
196	4380	80322000	Valentine Elementary District	13,430	$0	$0	$0	$13,744	$14,011	$221,389
197	4513	150426000	Bouse Elementary District	13,327	$3,065	$11,374	$22,987	$1,000	$4,470	$0
198	4460	120406000	Patagonia Elementary District	12,483	$47	$0	$0	$0	$1,466	$0
199	4480	130323000	Kirkland Elementary District	10,452	$4,101	$3,804	$3,602	$29,654	$0	$33,587
200	4181	20355000	McNeal Elementary District	8,550	$1,208	$10,678	$113,835	$6,775	$24,057	$0
201	4478	130315000	Skull Valley Elementary District	8,550	$3,773	$22,106	$0	$28,283	$59,775	$8,521
202	4414	100335000	San Fernando Elementary District	7,630	$0	$0	$0	$0	$0	$0
203	4377	80313000	Yucca Elementary District	7,616	$4,760	$14,726	$0	$0	$4,582	$0
204	4482	130335000	Hillside Elementary District	7,229	$0	$10,752	$28,256	$0	$5,440	$0
205	4178	20342000	Apache Elementary District	1,720	$0	$24,498	$4,660	$0	$0	$0
206	4231	60322000	Blue Elementary District	1,600	0	30934	0	0	0	0

APPENDIX C
STANDARDIZED TEST RESULTS PER DISTRICT

(Arizona Department of Education)

#	Entity ID	CTD	Entity Name	GSF	2010 Math	2010 Science	2010 Reading	2010 Writing
1	4403	100201000	Tucson Unified District	8,968,427	32%	42%	50%	46%
2	4235	70204000	Mesa Unified District	8,530,135	52%	60%	64%	53%
3	4241	70269000	Paradise Valley Unified District	5,085,048	57%	67%	73%	70%
4	4239	70241000	Gilbert Unified District	4,833,949	63%	63%	78%	74%
5	4242	70280000	Chandler Unified District #80	4,773,688	63%	71%	73%	71%
6	4237	70211000	Peoria Unified School District	4,584,353	59%	61%	75%	69%
7	4246	70297000	Deer Valley Unified District	4,447,281	55%	61%	76%	67%
8	4286	70510000	Phoenix Union High School District	4,361,240	26%	46%	43%	36%
9	4240	70248000	Scottsdale Unified District	4,303,438	68%	71%	81%	74%
10	4243	70289000	Dysart Unified District	3,283,430	50%	59%	66%	62%
11	4260	70406000	Washington Elementary School District	2,929,727	53%	53%	68%	72%
12	4406	100210000	Amphitheater Unified District	2,560,557	52%	56%	63%	58%
13	4267	70428000	Kyrene Elementary District	2,556,290	78%	80%	88%	86%
14	4285	70505000	Glendale Union High School District	2,365,011	38%	69%	50%	48%
15	4287	70513000	Tempe Union High School District	2,326,820	31%	72%	49%	44%
16	4282	70483000	Cartwright Elementary District	2,143,391	50%	37%	63%	61%
17	4407	100212000	Sunnyside Unified District	1,970,356	34%	40%	55%	48%
18	4258	70403000	Tempe School District	1,818,774	55%	55%	72%	77%
19	4192	30201000	Flagstaff Unified District	1,747,421	48%	51%	62%	61%
20	4404	100206000	Marana Unified District	1,717,323	56%	66%	75%	68%
21	4248	70260000	Higley Unified School District	1,677,682	63%	63%	78%	72%
22	4280	70468000	Alhambra Elementary District	1,583,925	55%	43%	67%	59%
23	79598	80220000	Kingman Unified School District	1,517,377	42%	52%	57%	46%
24	4279	70466000	Roosevelt Elementary District	1,487,676	43%	37%	58%	63%
25	4507	140570000	Yuma Union High School District	1,474,177	26%	20%	34%	29%
26	4271	70440000	Glendale Elementary District	1,441,452	47%	46%	59%	66%
27	4413	100220000	Vail Unified District	1,326,723	74%	82%	90%	81%
28	4288	70514000	Tolleson Union High School District	1,310,221	26%	45%	44%	45%
29	4283	70492000	Pendergast Elementary District	1,261,632	56%	50%	71%	69%
30	4437	110201000	Florence Unified School District	1,249,830	44%	58%	67%	58%
31	4256	70401000	Phoenix Elementary District	1,168,665	43%	38%	61%	56%
32	4281	70479000	Litchfield Elementary District	1,161,345	69%	75%	82%	83%
33	4499	140401000	Yuma Elementary District	1,098,098	50%	47%	67%	64%
34	4263	70414000	Creighton Elementary District	995,558	47%	45%	63%	61%
35	4289	70516000	Agua Fria Union High School District	991,777	40%	37%	65%	58%
36	4158	10224000	Chinle Unified District	975,701	22%	23%	44%	44%
37	4244	70293000	Cave Creek Unified District	952,246	73%	73%	88%	86%
38	4284	70501000	Buckeye Union High School District	903,133	45%	39%	72%	67%
39	4442	110221000	Coolidge Unified District	901,352	36%	38%	59%	55%
40	4446	110404000	Casa Grande Elementary District	896,907	60%	56%	72%	63%
41	4259	70405000	Isaac Elementary District	876,839	46%	42%	57%	62%
42	4175	20268000	Sierra Vista Unified District	856,511	57%	60%	75%	65%
43	4368	80201000	Lake Havasu Unified District	846,080	61%	68%	83%	79%
44	4441	110220000	Maricopa Unified School District	837,081	44%	43%	63%	60%
45	4245	70295000	Queen Creek Unified District	833,228	61%	68%	80%	85%
46	4469	130222000	Humboldt Unified District	826,072	57%	69%	73%	64%
47	4411	100230000	Sahuarita Unified District	814,183	57%	59%	70%	67%
48	4410	100216000	Catalina Foothills Unified District	808,947	83%	73%	93%	91%
49	4405	100208000	Flowing Wells Unified District	789,539	55%	57%	71%	65%
50	4443	110243000	Apache Junction Unified District	783,426	49%	62%	66%	67%
51	4466	130201000	Prescott Unified District	764,467	68%	73%	85%	79%
52	4270	70438000	Madison Elementary District	762,711	71%	74%	82%	74%
53	4272	70444000	Avondale Elementary District	760,287	52%	57%	70%	62%
54	4457	120201000	Nogales Unified District	750,318	49%	31%	65%	60%
55	4501	140413000	Crane Elementary District	712,076	58%	55%	72%	77%
56	4276	70459000	Laveen Elementary District	660,163	55%	47%	68%	63%
57	4396	90227000	Kayenta Unified District	654,650	31%	25%	49%	53%
58	4445	110244000	J O Combs Unified School District	653,277	53%	49%	76%	73%
59	4196	30208000	Page Unified District	638,103	41%	35%	56%	54%
60	4278	70465000	Littleton Elementary District	631,086	47%	49%	63%	59%

#	Entity ID	CTD	Entity Name	GSF	2010 Math	2010 Science	2010 Reading	2010 Writing
61	4394	90220000	Whiteriver Unified District	626,577	20%	18%	39%	38%
62	4154	10208000	Window Rock Unified District	626,340	28%	22%	47%	44%
63	4453	110502000	Casa Grande Union High School District	603,851	23%	44%	44%	39%
64	4174	20227000	Douglas Unified District	603,041	40%	31%	55%	51%
65	4157	10220000	Ganado Unified School District	587,701	31%	28%	51%	50%
66	4273	70445000	Fowler Elementary District	559,846	49%	45%	62%	59%
67	4269	70433000	Buckeye Elementary District	546,169	49%	47%	67%	61%
68	4262	70408000	Osborn Elementary District	539,469	56%	49%	64%	64%
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	57%	55%	76%	69%
70	4155	10210000	Round Valley Unified District	530,690	45%	55%	68%	70%
71	4505	140432000	Gadsden Elementary District	513,519	44%	29%	52%	62%
72	4458	120235000	Santa Cruz Valley Unified District	494,529	46%	41%	61%	48%
73	4247	70298000	Fountain Hills Unified District	483,159	66%	70%	84%	83%
74	4218	50201000	Safford Unified District	479,116	50%	46%	69%	58%
75	4387	90201000	Winslow Unified District	478,581	43%	48%	67%	63%
76	4393	90210000	Show Low Unified District	451,741	53%	57%	74%	63%
77	4268	70431000	Balsz Elementary District	446,570	49%	38%	56%	58%
78	4391	90205000	Snowflake Unified District	428,183	59%	61%	76%	66%
79	4236	70209000	Wickenburg Unified District	428,117	57%	70%	78%	65%
80	4378	80415000	Bullhead City School District	424,264	48%	47%	69%	63%
81	4381	80502000	Colorado River Union High School District	418,757	26%	50%	50%	48%
82	4389	90203000	Holbrook Unified District	412,976	48%	38%	66%	65%
83	4209	40210000	Payson Unified District	403,279	54%	47%	79%	70%
84	4264	70417000	Tolleson Elementary District	392,313	54%	50%	70%	59%
85	4266	70425000	Liberty Elementary District	380,368	60%	64%	76%	74%
86	4156	10218000	Sanders Unified District	379,556	25%	26%	42%	37%
87	4254	70290000	Saddle Mountain Unified School District	374,207	34%	47%	53%	52%
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	61%	65%	78%	75%
89	4210	40220000	San Carlos Unified District	369,835	14%	7%	26%	21%
90	4510	150227000	Parker Unified School District	366,028	40%	37%	60%	54%
91	4390	90204000	Pinon Unified District	344,152	25%	15%	40%	41%
92	4208	40201000	Globe Unified District	336,783	37%	37%	59%	50%
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	48%	41%	76%	66%
94	4474	130251000	Chino Valley Unified District	333,773	51%	56%	76%	61%
95	4211	40240000	Miami Unified District	327,598	41%	44%	68%	48%
96	4412	100240000	Baboquivari Unified School District #40	315,281	15%	11%	33%	25%
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	55%	61%	76%	70%
98	4500	140411000	Somerton Elementary District	312,037	47%	37%	62%	69%
99	4265	70421000	Murphy Elementary District	305,100	45%	34%	61%	50%
100	4153	10201000	St Johns Unified District	297,133	51%	62%	72%	68%
101	4408	100213000	Tanque Verde Unified District	280,121	79%	73%	93%	88%
102	4219	50204000	Thatcher Unified District	276,740	69%	69%	79%	69%
103	4230	60218000	Morenci Unified District	273,528	59%	57%	78%	71%
104	4170	20213000	Willcox Unified District	273,508	41%	34%	55%	54%
105	4470	130228000	Camp Verde Unified District	245,725	47%	41%	68%	62%
106	4168	20201000	Tombstone Unified District	231,447	40%	38%	70%	64%
107	4169	20202000	Bisbee Unified District	228,248	37%	33%	67%	63%
108	4159	10227000	Red Mesa Unified District	227,658	24%	16%	44%	50%
109	4379	80416000	Mohave Valley Elementary District	220,035	50%	53%	69%	71%
110	4388	90202000	Joseph City Unified District	211,184	58%	53%	74%	74%
111	4261	70407000	Wilson Elementary District	207,691	57%	51%	66%	62%
112	4277	70462000	Union Elementary District	202,597	43%	41%	59%	54%
113	4488	130504000	Mingus Union High School District	198,724	35%	38%	66%	52%
114	79226	20209000	Benson Unified School District	194,192	57%	57%	82%	68%
115	4257	70402000	Riverside Elementary District	192,409	40%	32%	61%	59%
116	4438	110203000	Ray Unified District	191,243	56%	46%	74%	64%
117	4221	50207000	Fort Thomas Unified District	183,357	19%	22%	42%	42%
118	4212	40241000	Hayden-Winkelman Unified District	179,222	40%	29%	64%	65%
119	4440	110215000	Superior Unified School District	171,807	38%	36%	68%	46%
120	4450	110422000	Toltec School District	170,495	40%	44%	62%	

#	Entity ID	CTD	Entity Name	GSF	2010 Math	2010 Science	2010 Reading	2010 Writing
121	4370	80214000	Colorado City Unified District	168,595	72%	66%	83%	73%
122	4392	90206000	Heber-Overgaard Unified District	164,182	65%	49%	79%	77%
123	4448	110411000	Eloy Elementary District	157,960	34%	34%	55%	58%
124	4395	90225000	Cedar Unified District	156,043	29%	15%	39%	42%
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	24%	20%	30%	23%
126	4449	110418000	Sacaton Elementary District	148,862	19%	10%	39%	32%
127	4193	30202000	Williams Unified District	146,180	46%	41%	68%	51%
128	4228	60202000	Duncan Unified District	136,458	45%	45%	74%	75%
129	4180	20349000	Palominas Elementary District	129,873				
130	4220	50206000	Pima Unified District	119,300	52%	53%	71%	62%
131	4473	130243000	Mayer Unified School District	118,214	45%	40%	63%	57%
132	4447	110405000	Red Rock Elementary District	118,105	53%	62%	73%	75%
133	4506	140550000	Antelope Union High School District	117,018	33%	16%	59%	57%
134	4418	100351000	Altar Valley Elementary District	116,000	53%	48%	63%	57%
135	4238	70224000	Gila Bend Unified District	110,813	24%	20%	40%	37%
136	4409	100215000	Ajo Unified District	107,122	23%	23%	50%	41%
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	40%	47%	61%	47%
138	4369	80208000	Peach Springs Unified District	102,653	21%	13%	47%	42%
139	4468	130220000	Bagdad Unified District	98,396	48%	49%	72%	72%
140	4451	110424000	Stanfield Elementary District	97,461	51%	44%	60%	63%
141	4472	130240000	Seligman Unified District	90,327	26%	29%	55%	55%
142	4173	20221000	St David Unified District	88,586	64%	63%	78%	73%
143	4374	80209000	Littlefield Unified District	82,633	35%	33%	65%	66%
144	4194	30204000	Grand Canyon Unified District	76,786	43%	57%	67%	54%
145	4416	100339000	Continental Elementary District	75,361	63%	62%	77%	82%
146	4481	130326000	Beaver Creek Elementary District	74,916	49%	48%	65%	58%
147	4444	110302000	Oracle Elementary District	72,929	59%	59%	75%	72%
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	40%	69%	72%	63%
149	4462	120520000	Patagonia Union High School District	70,799	40%	26%	70%	60%
150	4275	70449000	Palo Verde Elementary District	66,790	62%	56%	75%	75%
151	4214	40312000	Pine Strawberry Elementary District	66,745	55%	60%	84%	56%
152	4504	140424000	Wellton Elementary District	60,797	47%	49%	61%	51%
153	4190	20522000	Valley Union High School District	59,812	69%	45%	93%	86%
154	4515	150576000	Bicentennial Union High School District	57,537	58%	45%	69%	56%
155	4471	130231000	Ash Fork Joint Unified District	53,260	34%	39%	64%	37%
156	4511	150404000	Quartzsite Elementary District	53,125	39%	36%	61%	69%
157	4502	140416000	Hyder Elementary District	52,656	62%	48%	57%	69%
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	73%	77%	86%	81%
159	4503	140417000	Mohawk Valley Elementary District	47,820	68%	45%	83%	68%
160	4171	20214000	Bowie Unified District	46,243				
161	4172	20218000	San Simon Unified District	45,061	42%		83%	50%
162	4222	50305000	Solomon Elementary District	44,339	69%	43%	82%	76%
163	4213	40305000	Young Elementary District	43,872				
164	4160	10306000	Concho Elementary District	41,015	60%	70%	77%	
165	4163	10323000	Mcnary Elementary District	39,692	41%	36%	47%	38%
166	4484	130350000	Canon Elementary District	38,230	62%	85%	73%	56%
167	4274	70447000	Arlington Elementary District	36,618	46%	50%	69%	52%
168	4514	150430000	Salome Consolidated Elementary District	36,533	53%	59%	74%	64%
169	4176	20323000	Naco Elementary District	36,034	25%	17%	43%	34%
170	4251	70375000	Morristown Elementary District	33,637	46%	47%	77%	64%
171	4461	120425000	Sonoita Elementary District	31,797	63%	86%	87%	81%
172	4249	70363000	Aguila Elementary District	31,788	57%	22%	60%	50%
173	4186	20422000	Pearce Elementary District	31,322	48%	46%	71%	63%
174	4185	20412000	Elfrida Elementary District	29,737	45%	63%	70%	75%
175	4199	30310000	Maine Consolidated School District	29,567	79%		87%	64%
176	4188	20364000	Pomerene Elementary District	28,867	73%	81%	86%	68%
177	4224	50316000	Bonita Elementary District	27,239	60%	64%	69%	45%
178	4452	110433000	Picacho Elementary District	26,788	54%	35%	63%	73%
179	4479	130317000	Congress Elementary District	26,000	84%	55%	87%	74%
180	4177	20326000	Cochise Elementary District	25,613	68%	91%	78%	83%

#	Entity ID	CTD	Entity Name	GSF	2010 Math	2010 Science	2010 Reading	2010 Writing
181	4512	150419000	Wenden Elementary District	25,590				
182	4162	10309000	Vernon Elementary District	24,218	51%	84%	87%	86%
183	4253	70386000	Mobile Elementary District	22,880				
184	4234	70199000	Maricopa County Regional District	22,509	9%	12%	31%	31%
185	4459	120328000	Santa Cruz Elementary District	22,461	61%	66%	80%	87%
186	4386	90199000	Navajo County Accommodation District #99	22,178				
187	4187	20453000	Ash Creek Elementary District	21,432				
188	4250	70371000	Sentinel Elementary District	21,004				
189	4485	130352000	Yarnell Elementary District	20,499				
190	4371	80303000	Hackberry School District	19,916				
191	79379	130199000	Yavapai Accommodation School District	19,116	14%	11%	62%	52%
192	4215	40333000	Tonto Basin Elementary District	16,896	64%	55%	82%	
193	4179	20345000	Double Adobe Elementary District	16,164	45%	45%	73%	
194	4255	70394000	Paloma School District	15,280	55%		73%	
195	4161	10307000	Alpine Elementary District	14,868				
196	4380	80322000	Valentine Elementary District	13,430	36%		73%	
197	4513	150426000	Bouse Elementary District	13,327				
198	4460	120406000	Patagonia Elementary District	12,483	67%	75%	75%	
199	4480	130323000	Kirkland Elementary District	10,452	49%	53%	59%	
200	4181	20355000	McNeal Elementary District	8,550				
201	4478	130315000	Skull Valley Elementary District	8,550				
202	4414	100335000	San Fernando Elementary District	7,630				
203	4377	80313000	Yucca Elementary District	7,616				
204	4482	130335000	Hillside Elementary District	7,229				
205	4178	20342000	Apache Elementary District	1,720				
206	4231	60322000	Blue Elementary District	1,600				

#	Entity ID	CTD	Entity Name	GSF	2011 Math	2011 Science	2011 Reading	2011 Writing
1	4403	100201000	Tucson Unified District	8,968,427	45%	19%	29%	35%
2	4235	70204000	Mesa Unified District	8,530,135	54%	20%	22%	40%
3	4241	70269000	Paradise Valley Unified District	5,085,048	55%	28%	22%	44%
4	4239	70241000	Gilbert Unified District	4,833,949	61%	23%	21%	44%
5	4242	70280000	Chandler Unified District #80	4,773,688	59%	16%	20%	26%
6	4237	70211000	Peoria Unified School District	4,584,353	53%	27%	26%	44%
7	4246	70297000	Deer Valley Unified District	4,447,281	45%	20%	29%	39%
8	4286	70510000	Phoenix Union High School District	4,361,240	50%	33%	28%	50%
9	4240	70248000	Scottsdale Unified District	4,303,438	62%	28%	21%	44%
10	4243	70289000	Dysart Unified District	3,283,430	41%	16%	30%	37%
11	4260	70406000	Washington Elementary School District	2,929,727	44%	22%	29%	43%
12	4406	100210000	Amphitheater Unified District	2,560,557	49%	18%	26%	38%
13	4267	70428000	Kyrene Elementary District	2,556,290	47%	27%	25%	53%
14	4285	70505000	Glendale Union High School District	2,365,011	61%	30%	23%	39%
15	4287	70513000	Tempe Union High School District	2,326,820	62%	13%	16%	27%
16	4282	70483000	Cartwright Elementary District	2,143,391	65%	22%	18%	34%
17	4407	100212000	Sunnyside Unified District	1,970,356	45%	21%	32%	39%
18	4258	70403000	Tempe School District	1,818,774	68%	23%	14%	37%
19	4192	30201000	Flagstaff Unified District	1,747,421	74%	21%	11%	21%
20	4404	100206000	Marana Unified District	1,717,323	47%	22%	27%	37%
21	4248	70260000	Higley Unified School District	1,677,682	80%	19%	11%	29%
22	4280	70468000	Alhambra Elementary District	1,583,925	64%	23%	17%	33%
23	79598	80220000	Kingman Unified School District	1,517,377				
24	4279	70466000	Roosevelt Elementary District	1,487,676	65%	18%	12%	30%
25	4507	140570000	Yuma Union High School District	1,474,177				
26	4271	70440000	Glendale Elementary District	1,441,452	57%	34%	21%	43%
27	4413	100220000	Vail Unified District	1,326,723	53%	20%	19%	36%
28	4288	70514000	Tolleson Union High School District	1,310,221	85%	6%	4%	12%
29	4283	70492000	Pendergast Elementary District	1,261,632	56%	19%	20%	33%
30	4437	110201000	Florence Unified School District	1,249,830	73%	15%	13%	28%
31	4256	70401000	Phoenix Elementary District	1,168,665	43%	24%	31%	45%
32	4281	70479000	Litchfield Elementary District	1,161,345	67%	15%	16%	32%
33	4499	140401000	Yuma Elementary District	1,098,098				
34	4263	70414000	Creighton Elementary District	995,558	51%	26%	24%	41%
35	4289	70516000	Agua Fria Union High School District	991,777	37%	19%	28%	41%
36	4158	10224000	Chinle Unified District	975,701	58%	20%	17%	34%
37	4244	70293000	Cave Creek Unified District	952,246	47%	18%	28%	31%
38	4284	70501000	Buckeye Union High School District	903,133	60%	17%	15%	26%
39	4442	110221000	Coolidge Unified District	901,352	64%	15%	20%	30%
40	4446	110404000	Casa Grande Elementary District	896,907	49%	25%	23%	39%
41	4259	70405000	Isaac Elementary District	876,839	36%	27%	30%	44%
42	4175	20268000	Sierra Vista Unified District	856,511	67%	22%	16%	35%
43	4368	80201000	Lake Havasu Unified District	846,080	47%	13%	32%	43%
44	4441	110220000	Maricopa Unified School District	837,081	71%	18%	16%	29%
45	4245	70295000	Queen Creek Unified District	833,228	58%	19%	20%	28%
46	4469	130222000	Humboldt Unified District	826,072				
47	4411	100230000	Sahuarita Unified District	814,183	49%	20%	26%	41%
48	4410	100216000	Catalina Foothills Unified District	808,947	38%	24%	35%	40%
49	4405	100208000	Flowing Wells Unified District	789,539	51%	21%	26%	34%
50	4443	110243000	Apache Junction Unified District	783,426	58%	15%	24%	33%
51	4466	130201000	Prescott Unified District	764,467	34%	13%	25%	49%
52	4270	70438000	Madison Elementary District	762,711	60%	27%	21%	44%
53	4272	70444000	Avondale Elementary District	760,287	50%	21%	21%	38%
54	4457	120201000	Nogales Unified District	750,318	46%	19%	27%	33%
55	4501	140413000	Crane Elementary District	712,076				
56	4276	70459000	Laveen Elementary District	660,163	47%	18%	23%	27%
57	4396	90227000	Kayenta Unified District	654,650	61%	19%	17%	31%
58	4445	110244000	J O Combs Unified School District	653,277	62%	20%	24%	36%
59	4196	30208000	Page Unified District	638,103	60%	15%	17%	27%
60	4278	70465000	Littleton Elementary District	631,086	72%	17%	14%	32%

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61	4394	90220000	Whiteriver Unified District	626,577	49%	23%	23%	43%
62	4154	10208000	Window Rock Unified District	626,340	36%	26%	34%	49%
63	4453	110502000	Casa Grande Union High School District	603,851	56%	15%	25%	33%
64	4174	20227000	Douglas Unified District	603,041	61%	27%	21%	42%
65	4157	10220000	Ganado Unified School District	587,701	48%	25%	29%	40%
66	4273	70445000	Fowler Elementary District	559,846	34%	23%	26%	41%
67	4269	70433000	Buckeye Elementary District	546,169	55%	32%	26%	43%
68	4262	70408000	Osborn Elementary District	539,469	50%	27%	23%	42%
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	56%	20%	20%	34%
70	4155	10210000	Round Valley Unified District	530,690	47%	27%	31%	44%
71	4505	140432000	Gadsden Elementary District	513,519				
72	4458	120235000	Santa Cruz Valley Unified District	494,529	49%	18%	23%	40%
73	4247	70298000	Fountain Hills Unified District	483,159	51%	14%	28%	34%
74	4218	50201000	Safford Unified District	479,116	52%	26%	24%	43%
75	4387	90201000	Winslow Unified District	478,581	64%	18%	19%	32%
76	4393	90210000	Show Low Unified District	451,741	60%	17%	18%	28%
77	4268	70431000	Balsz Elementary District	446,570	58%	26%	23%	45%
78	4391	90205000	Snowflake Unified District	428,183	51%	18%	21%	34%
79	4236	70209000	Wickenburg Unified District	428,117	55%	27%	25%	43%
80	4378	80415000	Bullhead City School District	424,264	66%	19%	17%	38%
81	4381	80502000	Colorado River Union High School District	418,757	58%	20%	18%	30%
82	4389	90203000	Holbrook Unified District	412,976	52%	21%	24%	35%
83	4209	40210000	Payson Unified District	403,279	66%	20%	14%	31%
84	4264	70417000	Tolleson Elementary District	392,313	50%	27%	26%	51%
85	4266	70425000	Liberty Elementary District	380,368	61%	19%	19%	39%
86	4156	10218000	Sanders Unified District	379,556	44%	22%	25%	39%
87	4254	70290000	Saddle Mountain Unified School District	374,207	52%	22%	21%	36%
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234				
89	4210	40220000	San Carlos Unified District	369,835	68%	16%	12%	29%
90	4510	150227000	Parker Unified School District	366,028				
91	4390	90204000	Pinon Unified District	344,152	50%	23%	26%	43%
92	4208	40201000	Globe Unified District	336,783	67%	16%	16%	31%
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	51%	18%	28%	41%
94	4474	130251000	Chino Valley Unified District	333,773				
95	4211	40240000	Miami Unified District	327,598	66%	18%	14%	30%
96	4412	100240000	Baboquivari Unified School District #40	315,281	57%	17%	18%	36%
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330				
98	4500	140411000	Somerton Elementary District	312,037				
99	4265	70421000	Murphy Elementary District	305,100	61%	23%	19%	39%
100	4153	10201000	St Johns Unified District	297,133	46%	24%	28%	41%
101	4408	100213000	Tanque Verde Unified District	280,121	45%	23%	27%	38%
102	4219	50204000	Thatcher Unified District	276,740	55%	27%	20%	40%
103	4230	60218000	Morenci Unified District	273,528	75%	17%	13%	28%
104	4170	20213000	Willcox Unified District	273,508	52%	19%	22%	41%
105	4470	130228000	Camp Verde Unified District	245,725				
106	4168	20201000	Tombstone Unified District	231,447	55%	19%	19%	30%
107	4169	20202000	Bisbee Unified District	228,248	50%	22%	23%	36%
108	4159	10227000	Red Mesa Unified District	227,658	55%	18%	17%	34%
109	4379	80416000	Mohave Valley Elementary District	220,035	37%	16%	34%	34%
110	4388	90202000	Joseph City Unified District	211,184	55%	16%	15%	31%
111	4261	70407000	Wilson Elementary District	207,691	21%	13%	40%	44%
112	4277	70462000	Union Elementary District	202,597	42%	18%	23%	38%
113	4488	130504000	Mingus Union High School District	198,724				
114	79226	20209000	Benson Unified School District	194,192				
115	4257	70402000	Riverside Elementary District	192,409	66%	21%	14%	29%
116	4438	110203000	Ray Unified District	191,243	57%	19%	19%	37%
117	4221	50207000	Fort Thomas Unified District	183,357	51%	26%	23%	40%
118	4212	40241000	Hayden-Winkelman Unified District	179,222	48%	32%	30%	46%
119	4440	110215000	Superior Unified School District	171,807	57%	22%	19%	35%
120	4450	110422000	Toltec School District	170,495	56%	18%	20%	33%

#	Entity ID	CTD	Entity Name	GSF	2011 Math	2011 Science	2011 Reading	2011 Writing
121	4370	80214000	Colorado City Unified District	168,595	53%	17%	25%	33%
122	4392	90206000	Heber-Overgaard Unified District	164,182	41%	16%	32%	41%
123	4448	110411000	Eloy Elementary District	157,960	60%	18%	18%	29%
124	4395	90225000	Cedar Unified District	156,043	56%	14%	21%	30%
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	25%	24%	35%	47%
126	4449	110418000	Sacaton Elementary District	148,862	62%	19%	27%	33%
127	4193	30202000	Williams Unified District	146,180	68%	17%	12%	24%
128	4228	60202000	Duncan Unified District	136,458	67%	17%	14%	29%
129	4180	20349000	Palominas Elementary District	129,873	61%	14%	18%	38%
130	4220	50206000	Pima Unified District	119,300	52%	25%	22%	39%
131	4473	130243000	Mayer Unified School District	118,214				
132	4447	110405000	Red Rock Elementary District	118,105	40%	25%	24%	34%
133	4506	140550000	Antelope Union High School District	117,018				
134	4418	100351000	Altar Valley Elementary District	116,000	55%	15%	15%	22%
135	4238	70224000	Gila Bend Unified District	110,813	35%	24%	31%	44%
136	4409	100215000	Ajo Unified District	107,122	47%	20%	27%	41%
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	75%	11%	10%	25%
138	4369	80208000	Peach Springs Unified District	102,653	56%	17%	24%	37%
139	4468	130220000	Bagdad Unified District	98,396				
140	4451	110424000	Stanfield Elementary District	97,461	41%	24%	31%	47%
141	4472	130240000	Seligman Unified District	90,327				
142	4173	20221000	St David Unified District	88,586	61%	28%	24%	41%
143	4374	80209000	Littlefield Unified District	82,633	50%	21%	24%	41%
144	4194	30204000	Grand Canyon Unified District	76,786	75%	16%	11%	27%
145	4416	100339000	Continental Elementary District	75,361	45%	13%	24%	33%
146	4481	130326000	Beaver Creek Elementary District	74,916				
147	4444	110302000	Oracle Elementary District	72,929	49%	23%	20%	29%
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	55%	21%	22%	35%
149	4462	120520000	Patagonia Union High School District	70,799	52%	14%	32%	34%
150	4275	70449000	Palo Verde Elementary District	66,790	27%	21%	36%	41%
151	4214	40312000	Pine Strawberry Elementary District	66,745	56%	30%	21%	41%
152	4504	140424000	Wellton Elementary District	60,797				
153	4190	20522000	Valley Union High School District	59,812	74%	21%	10%	26%
154	4515	150576000	Bicentennial Union High School District	57,537				
155	4471	130231000	Ash Fork Joint Unified District	53,260				
156	4511	150404000	Quartzsite Elementary District	53,125				
157	4502	140416000	Hyder Elementary District	52,656				
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288				
159	4503	140417000	Mohawk Valley Elementary District	47,820				
160	4171	20214000	Bowie Unified District	46,243	55%	18%	21%	38%
161	4172	20218000	San Simon Unified District	45,061	57%	24%	20%	38%
162	4222	50305000	Solomon Elementary District	44,339	62%	25%	21%	33%
163	4213	40305000	Young Elementary District	43,872	46%	30%	26%	45%
164	4160	10306000	Concho Elementary District	41,015	45%	18%	29%	38%
165	4163	10323000	Mcnary Elementary District	39,692	44%	24%	24%	41%
166	4484	130350000	Canon Elementary District	38,230				
167	4274	70447000	Arlington Elementary District	36,618	35%	23%	26%	43%
168	4514	150430000	Salome Consolidated Elementary District	36,533				
169	4176	20323000	Naco Elementary District	36,034	73%	19%	13%	32%
170	4251	70375000	Morristown Elementary District	33,637	61%	25%	20%	35%
171	4461	120425000	Sonoita Elementary District	31,797	46%	20%	27%	34%
172	4249	70363000	Aguila Elementary District	31,788	65%	17%	14%	26%
173	4186	20422000	Pearce Elementary District	31,322	59%	21%	18%	42%
174	4185	20412000	Elfrida Elementary District	29,737	55%	18%	20%	35%
175	4199	30310000	Maine Consolidated School District	29,567	68%	10%	18%	23%
176	4188	20364000	Pomerene Elementary District	28,867	66%	19%	16%	32%
177	4224	50316000	Bonita Elementary District	27,239	53%	30%	25%	42%
178	4452	110433000	Picacho Elementary District	26,788	48%	16%	24%	23%
179	4479	130317000	Congress Elementary District	26,000				
180	4177	20326000	Cochise Elementary District	25,613	74%	19%	13%	30%

#	Entity ID	CTD	Entity Name	GSF	2011 Math	2011 Science	2011 Reading	2011 Writing
181	4512	150419000	Wenden Elementary District	25,590				
182	4162	10309000	Vernon Elementary District	24,218	55%	15%	20%	29%
183	4253	70386000	Mobile Elementary District	22,880	58%	24%	22%	40%
184	4234	70199000	Maricopa County Regional District	22,509	63%	23%	20%	35%
185	4459	120328000	Santa Cruz Elementary District	22,461	27%	20%	37%	40%
186	4386	90199000	Navajo County Accommodation District #99	22,178	63%	24%	19%	38%
187	4187	20453000	Ash Creek Elementary District	21,432	69%	15%	14%	29%
188	4250	70371000	Sentinel Elementary District	21,004	60%	18%	22%	35%
189	4485	130352000	Yarnell Elementary District	20,499				
190	4371	80303000	Hackberry School District	19,916	30%	16%	24%	41%
191	79379	130199000	Yavapai Accommodation School District	19,116				
192	4215	40333000	Tonto Basin Elementary District	16,896	62%	35%	19%	37%
193	4179	20345000	Double Adobe Elementary District	16,164	51%	18%	21%	37%
194	4255	70394000	Paloma School District	15,280	55%	28%	20%	35%
195	4161	10307000	Alpine Elementary District	14,868	58%	25%	21%	42%
196	4380	80322000	Valentine Elementary District	13,430	49%	26%	37%	39%
197	4513	150426000	Bouse Elementary District	13,327				
198	4460	120406000	Patagonia Elementary District	12,483	82%	12%	11%	22%
199	4480	130323000	Kirkland Elementary District	10,452				
200	4181	20355000	McNeal Elementary District	8,550	68%	14%	15%	28%
201	4478	130315000	Skull Valley Elementary District	8,550				
202	4414	100335000	San Fernando Elementary District	7,630	32%	22%	34%	40%
203	4377	80313000	Yucca Elementary District	7,616	45%	32%	23%	46%
204	4482	130335000	Hillside Elementary District	7,229				
205	4178	20342000	Apache Elementary District	1,720	58%	11%	20%	35%
206	4231	60322000	Blue Elementary District	1,600	85%	12%	7%	21%

#	Entity ID	CTD	Entity Name	GSF	2012 Math	2012 Science	2012 Reading	2012 Writing
1	4403	100201000	Tucson Unified District	8,968,427	40%	53%	58%	36%
2	4235	70204000	Mesa Unified District	8,530,135	55%	64%	67%	46%
3	4241	70269000	Paradise Valley Unified District	5,085,048	54%	74%	68%	50%
4	4239	70241000	Gilbert Unified District	4,833,949	66%	68%	79%	64%
5	4242	70280000	Chandler Unified District #80	4,773,688	66%	78%	79%	66%
6	4237	70211000	Peoria Unified School District	4,584,353	61%	69%	77%	59%
7	4246	70297000	Deer Valley Unified District	4,447,281	61%	68%	76%	60%
8	4286	70510000	Phoenix Union High School District	4,361,240	26%	41%	38%	27%
9	4240	70248000	Scottsdale Unified District	4,303,438	65%	74%	79%	64%
10	4243	70289000	Dysart Unified District	3,283,430	52%	63%	71%	52%
11	4260	70406000	Washington Elementary School District	2,929,727	52%	57%	71%	47%
12	4406	100210000	Amphitheater Unified District	2,560,557	57%	61%	72%	53%
13	4267	70428000	Kyrene Elementary District	2,556,290	77%	82%	88%	74%
14	4285	70505000	Glendale Union High School District	2,365,011	33%	72%	46%	46%
15	4287	70513000	Tempe Union High School District	2,326,820	33%	78%	49%	40%
16	4282	70483000	Cartwright Elementary District	2,143,391	56%	44%	68%	35%
17	4407	100212000	Sunnyside Unified District	1,970,356	38%	45%	56%	33%
18	4258	70403000	Tempe School District	1,818,774	58%	58%	75%	51%
19	4192	30201000	Flagstaff Unified District	1,747,421	49%	63%	64%	42%
20	4404	100206000	Marana Unified District	1,717,323	55%	65%	75%	57%
21	4248	70260000	Higley Unified School District	1,677,682	67%	79%	80%	67%
22	4280	70468000	Alhambra Elementary District	1,583,925	54%	52%	67%	36%
23	79598	80220000	Kingman Unified School District	1,517,377	48%	55%	66%	43%
24	4279	70466000	Roosevelt Elementary District	1,487,676	43%	41%	60%	32%
25	4507	140570000	Yuma Union High School District	1,474,177	18%	27%	34%	31%
26	4271	70440000	Glendale Elementary District	1,441,452	50%	55%	65%	40%
27	4413	100220000	Vail Unified District	1,326,723	73%	84%	85%	78%
28	4288	70514000	Tolleson Union High School District	1,310,221	29%	50%	46%	41%
29	4283	70492000	Pendergast Elementary District	1,261,632	59%	51%	74%	50%
30	4437	110201000	Florence Unified School District	1,249,830	49%	63%	65%	42%
31	4256	70401000	Phoenix Elementary District	1,168,665	52%	48%	66%	35%
32	4281	70479000	Litchfield Elementary District	1,161,345	74%	82%	85%	69%
33	4499	140401000	Yuma Elementary District	1,098,098	56%	56%	70%	38%
34	4263	70414000	Creighton Elementary District	995,558	53%	48%	67%	39%
35	4289	70516000	Agua Fria Union High School District	991,777	35%	60%	56%	47%
36	4158	10224000	Chinle Unified District	975,701	27%	27%	49%	24%
37	4244	70293000	Cave Creek Unified District	952,246	70%	75%	80%	69%
38	4284	70501000	Buckeye Union High School District	903,133	36%	46%	69%	48%
39	4442	110221000	Coolidge Unified District	901,352	33%	41%	55%	34%
40	4446	110404000	Casa Grande Elementary District	896,907	63%	59%	74%	42%
41	4259	70405000	Isaac Elementary District	876,839	50%	48%	62%	32%
42	4175	20268000	Sierra Vista Unified District	856,511	61%	70%	79%	67%
43	4368	80201000	Lake Havasu Unified District	846,080	64%	73%	81%	65%
44	4441	110220000	Maricopa Unified School District	837,081	49%	52%	69%	46%
45	4245	70295000	Queen Creek Unified District	833,228	64%	73%	88%	79%
46	4469	130222000	Humboldt Unified District	826,072	58%	76%	72%	51%
47	4411	100230000	Sahuarita Unified District	814,183	55%	63%	73%	59%
48	4410	100216000	Catalina Foothills Unified District	808,947	77%	81%	93%	85%
49	4405	100208000	Flowing Wells Unified District	789,539	56%	59%	76%	57%
50	4443	110243000	Apache Junction Unified District	783,426	50%	64%	66%	47%
51	4466	130201000	Prescott Unified District	764,467	68%	71%	86%	61%
52	4270	70438000	Madison Elementary District	762,711	73%	78%	85%	61%
53	4272	70444000	Avondale Elementary District	760,287	55%	57%	70%	46%
54	4457	120201000	Nogales Unified District	750,318	54%	41%	68%	43%
55	4501	140413000	Crane Elementary District	712,076	63%	62%	75%	49%
56	4276	70459000	Laveen Elementary District	660,163	64%	53%	73%	48%
57	4396	90227000	Kayenta Unified District	654,650	35%	27%	51%	39%
58	4445	110244000	J O Combs Unified School District	653,277	50%	56%	73%	45%
59	4196	30208000	Page Unified District	638,103	45%	39%	53%	36%
60	4278	70465000	Littleton Elementary District	631,086	57%	52%	70%	40%

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61	4394	90220000	Whiteriver Unified District	626,577	25%	28%	52%	28%
62	4154	10208000	Window Rock Unified District	626,340	30%	30%	48%	29%
63	4453	110502000	Casa Grande Union High School District	603,851	35%	54%	38%	32%
64	4174	20227000	Douglas Unified District	603,041	39%	38%	58%	40%
65	4157	10220000	Ganado Unified School District	587,701	33%	40%	58%	35%
66	4273	70445000	Fowler Elementary District	559,846	59%	52%	71%	41%
67	4269	70433000	Buckeye Elementary District	546,169	54%	53%	71%	40%
68	4262	70408000	Osborn Elementary District	539,469	57%	53%	68%	46%
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	56%	61%	74%	49%
70	4155	10210000	Round Valley Unified District	530,690	48%	68%	70%	47%
71	4505	140432000	Gadsden Elementary District	513,519	52%	36%	58%	41%
72	4458	120235000	Santa Cruz Valley Unified District	494,529	52%	49%	66%	40%
73	4247	70298000	Fountain Hills Unified District	483,159	65%	77%	85%	76%
74	4218	50201000	Safford Unified District	479,116	51%	62%	69%	47%
75	4387	90201000	Winslow Unified District	478,581	50%	51%	64%	44%
76	4393	90210000	Show Low Unified District	451,741	54%	70%	77%	47%
77	4268	70431000	Balsz Elementary District	446,570	55%	40%	63%	34%
78	4391	90205000	Snowflake Unified District	428,183	62%	65%	79%	59%
79	4236	70209000	Wickenburg Unified District	428,117	65%	67%	76%	51%
80	4378	80415000	Bullhead City School District	424,264	60%	58%	73%	43%
81	4381	80502000	Colorado River Union High School District	418,757	26%	34%	64%	54%
82	4389	90203000	Holbrook Unified District	412,976	45%	44%	62%	43%
83	4209	40210000	Payson Unified District	403,279	50%	55%	75%	54%
84	4264	70417000	Tolleson Elementary District	392,313	52%	50%	69%	36%
85	4266	70425000	Liberty Elementary District	380,368	61%	69%	80%	57%
86	4156	10218000	Sanders Unified District	379,556	34%	36%	54%	37%
87	4254	70290000	Saddle Mountain Unified School District	374,207	56%	61%	75%	48%
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	53%	65%	76%	64%
89	4210	40220000	San Carlos Unified District	369,835	11%	11%	29%	16%
90	4510	150227000	Parker Unified School District	366,028	40%	38%	57%	37%
91	4390	90204000	Pinon Unified District	344,152	30%	26%	52%	26%
92	4208	40201000	Globe Unified District	336,783	40%	43%	57%	30%
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	53%	49%	70%	48%
94	4474	130251000	Chino Valley Unified District	333,773	58%	59%	77%	55%
95	4211	40240000	Miami Unified District	327,598	45%	56%	62%	34%
96	4412	100240000	Baboquivari Unified School District #40	315,281	19%	18%	41%	19%
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	59%	66%	77%	46%
98	4500	140411000	Somerton Elementary District	312,037	57%	43%	71%	46%
99	4265	70421000	Murphy Elementary District	305,100	48%	34%	62%	29%
100	4153	10201000	St Johns Unified District	297,133	53%	60%	77%	54%
101	4408	100213000	Tanque Verde Unified District	280,121	80%	88%	93%	85%
102	4219	50204000	Thatcher Unified District	276,740	72%	71%	86%	72%
103	4230	60218000	Morenci Unified District	273,528	57%	59%	78%	51%
104	4170	20213000	Willcox Unified District	273,508	41%	37%	62%	37%
105	4470	130228000	Camp Verde Unified District	245,725	48%	50%	68%	36%
106	4168	20201000	Tombstone Unified District	231,447	50%	57%	75%	54%
107	4169	20202000	Bisbee Unified District	228,248	44%	49%	75%	48%
108	4159	10227000	Red Mesa Unified District	227,658	34%	33%	48%	32%
109	4379	80416000	Mohave Valley Elementary District	220,035	54%	57%	72%	43%
110	4388	90202000	Joseph City Unified District	211,184	63%	68%	81%	72%
111	4261	70407000	Wilson Elementary District	207,691	60%	56%	72%	46%
112	4277	70462000	Union Elementary District	202,597	56%	47%	68%	40%
113	4488	130504000	Mingus Union High School District	198,724	35%	68%	51%	44%
114	79226	20209000	Benson Unified School District	194,192	60%	62%	83%	64%
115	4257	70402000	Riverside Elementary District	192,409	42%	40%	61%	30%
116	4438	110203000	Ray Unified District	191,243	51%	61%	74%	50%
117	4221	50207000	Fort Thomas Unified District	183,357	32%	26%	46%	22%
118	4212	40241000	Hayden-Winkelman Unified District	179,222	31%	25%	59%	29%
119	4440	110215000	Superior Unified School District	171,807	35%	27%	66%	32%
120	4450	110422000	Toltec School District	170,495	48%	42%	66%	24%

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121	4370	80214000	Colorado City Unified District	168,595	56%	68%	76%	53%
122	4392	90206000	Heber-Overgaard Unified District	164,182	65%	63%	84%	66%
123	4448	110411000	Eloy Elementary District	157,960	45%	27%	59%	32%
124	4395	90225000	Cedar Unified District	156,043	26%	21%	46%	19%
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	18%	32%	44%	23%
126	4449	110418000	Sacaton Elementary District	148,862	35%	23%	55%	12%
127	4193	30202000	Williams Unified District	146,180	52%	49%	70%	48%
128	4228	60202000	Duncan Unified District	136,458	43%	55%	71%	59%
129	4180	20349000	Palominas Elementary District	129,873	78%	79%	86%	63%
130	4220	50206000	Pima Unified District	119,300	65%	70%	82%	61%
131	4473	130243000	Mayer Unified School District	118,214	45%	45%	65%	39%
132	4447	110405000	Red Rock Elementary District	118,105	59%	82%	78%	49%
133	4506	140550000	Antelope Union High School District	117,018	35%	38%	68%	49%
134	4418	100351000	Altar Valley Elementary District	116,000	56%	55%	69%	31%
135	4238	70224000	Gila Bend Unified District	110,813	27%	27%	56%	35%
136	4409	100215000	Ajo Unified District	107,122	31%	34%	58%	23%
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	49%	49%	66%	42%
138	4369	80208000	Peach Springs Unified District	102,653	22%	15%	45%	22%
139	4468	130220000	Bagdad Unified District	98,396	45%	49%	71%	54%
140	4451	110424000	Stanfield Elementary District	97,461	53%	45%	66%	32%
141	4472	130240000	Seligman Unified District	90,327	42%	32%	68%	45%
142	4173	20221000	St David Unified District	88,586	70%	68%	80%	65%
143	4374	80209000	Littlefield Unified District	82,633	39%	53%	72%	53%
144	4194	30204000	Grand Canyon Unified District	76,786	40%	54%	68%	41%
145	4416	100339000	Continental Elementary District	75,361	66%	60%	79%	57%
146	4481	130326000	Beaver Creek Elementary District	74,916	57%	57%	68%	39%
147	4444	110302000	Oracle Elementary District	72,929	57%	68%	73%	48%
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	54%	51%	79%	74%
149	4462	120520000	Patagonia Union High School District	70,799	53%	50%	89%	67%
150	4275	70449000	Palo Verde Elementary District	66,790	72%	62%	79%	65%
151	4214	40312000	Pine Strawberry Elementary District	66,745	67%	82%	80%	65%
152	4504	140424000	Wellton Elementary District	60,797	56%	43%	71%	37%
153	4190	20522000	Valley Union High School District	59,812	43%	47%	83%	83%
154	4515	150576000	Bicentennial Union High School District	57,537	40%	32%	62%	23%
155	4471	130231000	Ash Fork Joint Unified District	53,260	44%	55%	74%	49%
156	4511	150404000	Quartzsite Elementary District	53,125	53%	58%	67%	34%
157	4502	140416000	Hyder Elementary District	52,656	75%	78%	73%	46%
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	71%	84%	85%	63%
159	4503	140417000	Mohawk Valley Elementary District	47,820	54%	64%	80%	40%
160	4171	20214000	Bowie Unified District	46,243				
161	4172	20218000	San Simon Unified District	45,061	73%	62%	77%	58%
162	4222	50305000	Solomon Elementary District	44,339	74%	65%	78%	51%
163	4213	40305000	Young Elementary District	43,872				
164	4160	10306000	Concho Elementary District	41,015	68%	82%	81%	47%
165	4163	10323000	Mcnary Elementary District	39,692	30%		57%	43%
166	4484	130350000	Canon Elementary District	38,230	57%	58%	76%	41%
167	4274	70447000	Arlington Elementary District	36,618	61%	66%	75%	44%
168	4514	150430000	Salome Consolidated Elementary District	36,533	32%	42%	47%	69%
169	4176	20323000	Naco Elementary District	36,034	27%	14%	41%	23%
170	4251	70375000	Morristown Elementary District	33,637	51%	60%	79%	56%
171	4461	120425000	Sonoita Elementary District	31,797	72%	93%	87%	75%
172	4249	70363000	Aguila Elementary District	31,788	71%	59%	71%	39%
173	4186	20422000	Pearce Elementary District	31,322	35%	92%	64%	26%
174	4185	20412000	Elfrida Elementary District	29,737	45%	80%	74%	53%
175	4199	30310000	Maine Consolidated School District	29,567	72%	73%	86%	66%
176	4188	20364000	Pomerene Elementary District	28,867	70%	84%	83%	66%
177	4224	50316000	Bonita Elementary District	27,239	66%	72%	76%	45%
178	4452	110433000	Picacho Elementary District	26,788	54%	50%	65%	36%
179	4479	130317000	Congress Elementary District	26,000	86%	92%	87%	78%
180	4177	20326000	Cochise Elementary District	25,613	90%		80%	80%

#	Entity ID	CTD	Entity Name	GSF	2012 Math	2012 Science	2012 Reading	2012 Writing
181	4512	150419000	Wenden Elementary District	25,590	33%		66%	22%
182	4162	10309000	Vernon Elementary District	24,218	64%	78%	82%	61%
183	4253	70386000	Mobile Elementary District	22,880				
184	4234	70199000	Maricopa County Regional District	22,509	23%	15%	38%	27%
185	4459	120328000	Santa Cruz Elementary District	22,461	69%	66%	84%	75%
186	4386	90199000	Navajo County Accommodation District #99	22,178				
187	4187	20453000	Ash Creek Elementary District	21,432				
188	4250	70371000	Sentinel Elementary District	21,004				
189	4485	130352000	Yarnell Elementary District	20,499				
190	4371	80303000	Hackberry School District	19,916				
191	79379	130199000	Yavapai Accommodation School District	19,116	20%	43%	91%	64%
192	4215	40333000	Tonto Basin Elementary District	16,896	57%	70%	75%	38%
193	4179	20345000	Double Adobe Elementary District	16,164				
194	4255	70394000	Paloma School District	15,280	29%		67%	54%
195	4161	10307000	Alpine Elementary District	14,868				
196	4380	80322000	Valentine Elementary District	13,430				
197	4513	150426000	Bouse Elementary District	13,327				
198	4460	120406000	Patagonia Elementary District	12,483	50%	60%	80%	
199	4480	130323000	Kirkland Elementary District	10,452	72%		82%	86%
200	4181	20355000	McNeal Elementary District	8,550	62%		85%	54%
201	4478	130315000	Skull Valley Elementary District	8,550				
202	4414	100335000	San Fernando Elementary District	7,630				
203	4377	80313000	Yucca Elementary District	7,616				
204	4482	130335000	Hillside Elementary District	7,229				
205	4178	20342000	Apache Elementary District	1,720				
206	4231	60322000	Blue Elementary District	1,600				

#	Entity ID	CTD	Entity Name	GSF	2013 Math	2013 Science	2013 Reading	2013 Writing
1	4403	100201000	Tucson Unified District	8,968,427	39%	40%	61%	35%
2	4235	70204000	Mesa Unified District	8,530,135	55%	65%	70%	46%
3	4241	70269000	Paradise Valley Unified District	5,085,048	56%	70%	77%	51%
4	4239	70241000	Gilbert Unified District	4,833,949	66%	66%	84%	70%
5	4242	70280000	Chandler Unified District #80	4,773,688	69%	75%	84%	67%
6	4237	70211000	Peoria Unified School District	4,584,353	61%	64%	78%	60%
7	4246	70297000	Deer Valley Unified District	4,447,281	63%	68%	79%	58%
8	4286	70510000	Phoenix Union High School District	4,361,240	24%	35%	38%	26%
9	4240	70248000	Scottsdale Unified District	4,303,438	65%	71%	83%	64%
10	4243	70289000	Dysart Unified District	3,283,430	52%	53%	72%	52%
11	4260	70406000	Washington Elementary School District	2,929,727	52%	53%	72%	43%
12	4406	100210000	Amphitheater Unified District	2,560,557	55%	60%	72%	52%
13	4267	70428000	Kyrene Elementary District	2,556,290	77%	78%	89%	71%
14	4285	70505000	Glendale Union High School District	2,365,011	43%	70%	61%	40%
15	4287	70513000	Tempe Union High School District	2,326,820	33%	74%	53%	43%
16	4282	70483000	Cartwright Elementary District	2,143,391	59%	42%	69%	40%
17	4407	100212000	Sunnyside Unified District	1,970,356	34%	41%	58%	30%
18	4258	70403000	Tempe School District	1,818,774	57%	56%	76%	51%
19	4192	30201000	Flagstaff Unified District	1,747,421	48%	60%	64%	42%
20	4404	100206000	Marana Unified District	1,717,323	59%	61%	78%	54%
21	4248	70260000	Higley Unified School District	1,677,682	68%	69%	87%	68%
22	4280	70468000	Alhambra Elementary District	1,583,925	54%	45%	68%	36%
23	79598	80220000	Kingman Unified School District	1,517,377	47%	48%	64%	41%
24	4279	70466000	Roosevelt Elementary District	1,487,676	42%	37%	61%	31%
25	4507	140570000	Yuma Union High School District	1,474,177	22%	22%	40%	27%
26	4271	70440000	Glendale Elementary District	1,441,452	50%	49%	65%	39%
27	4413	100220000	Vail Unified District	1,326,723	74%	83%	90%	69%
28	4288	70514000	Tolleson Union High School District	1,310,221	28%	45%	57%	47%
29	4283	70492000	Pendergast Elementary District	1,261,632	58%	51%	75%	49%
30	4437	110201000	Florence Unified School District	1,249,830	50%	64%	72%	51%
31	4256	70401000	Phoenix Elementary District	1,168,665	48%	42%	66%	33%
32	4281	70479000	Litchfield Elementary District	1,161,345	76%	79%	87%	66%
33	4499	140401000	Yuma Elementary District	1,098,098	60%	54%	72%	46%
34	4263	70414000	Creighton Elementary District	995,558	53%	45%	65%	38%
35	4289	70516000	Agua Fria Union High School District	991,777	36%	50%	60%	49%
36	4158	10224000	Chinle Unified District	975,701	27%	24%	47%	21%
37	4244	70293000	Cave Creek Unified District	952,246	70%	77%	82%	75%
38	4284	70501000	Buckeye Union High School District	903,133	40%	63%	71%	56%
39	4442	110221000	Coolidge Unified District	901,352	30%	29%	55%	32%
40	4446	110404000	Casa Grande Elementary District	896,907	62%	54%	74%	44%
41	4259	70405000	Isaac Elementary District	876,839	47%	44%	61%	38%
42	4175	20268000	Sierra Vista Unified District	856,511	59%	64%	84%	62%
43	4368	80201000	Lake Havasu Unified District	846,080	65%	69%	85%	57%
44	4441	110220000	Maricopa Unified School District	837,081	47%	53%	67%	42%
45	4245	70295000	Queen Creek Unified District	833,228	70%	74%	87%	76%
46	4469	130222000	Humboldt Unified District	826,072	60%	74%	77%	58%
47	4411	100230000	Sahuarita Unified District	814,183	54%	63%	73%	58%
48	4410	100216000	Catalina Foothills Unified District	808,947	82%	79%	94%	84%
49	4405	100208000	Flowing Wells Unified District	789,539	54%	55%	76%	48%
50	4443	110243000	Apache Junction Unified District	783,426	51%	63%	64%	45%
51	4466	130201000	Prescott Unified District	764,467	64%	72%	86%	57%
52	4270	70438000	Madison Elementary District	762,711	74%	77%	86%	61%
53	4272	70444000	Avondale Elementary District	760,287	53%	52%	71%	47%
54	4457	120201000	Nogales Unified District	750,318	52%	37%	74%	44%
55	4501	140413000	Crane Elementary District	712,076	64%	60%	76%	51%
56	4276	70459000	Laveen Elementary District	660,163	59%	50%	72%	45%
57	4396	90227000	Kayenta Unified District	654,650	37%	27%	59%	36%
58	4445	110244000	J O Combs Unified School District	653,277	56%	54%	74%	51%
59	4196	30208000	Page Unified District	638,103	44%	33%	58%	33%
60	4278	70465000	Littleton Elementary District	631,086	61%	51%	72%	42%

#	Entity ID	CTD	Entity Name	GSF	2013 Math	2013 Science	2013 Reading	2013 Writing
61	4394	90220000	Whiteriver Unified District	626,577	30%	21%	56%	27%
62	4154	10208000	Window Rock Unified District	626,340	30%	31%	52%	29%
63	4453	110502000	Casa Grande Union High School District	603,851	30%	46%	44%	37%
64	4174	20227000	Douglas Unified District	603,041	40%	37%	58%	43%
65	4157	10220000	Ganado Unified School District	587,701	33%	25%	58%	31%
66	4273	70445000	Fowler Elementary District	559,846	56%	45%	71%	36%
67	4269	70433000	Buckeye Elementary District	546,169	56%	54%	70%	36%
68	4262	70408000	Osborn Elementary District	539,469	57%	46%	68%	44%
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	62%	62%	79%	53%
70	4155	10210000	Round Valley Unified District	530,690	58%	55%	72%	41%
71	4505	140432000	Gadsden Elementary District	513,519	55%	35%	61%	48%
72	4458	120235000	Santa Cruz Valley Unified District	494,529	54%	44%	71%	47%
73	4247	70298000	Fountain Hills Unified District	483,159	64%	69%	88%	69%
74	4218	50201000	Safford Unified District	479,116	54%	56%	71%	42%
75	4387	90201000	Winslow Unified District	478,581	48%	45%	72%	44%
76	4393	90210000	Show Low Unified District	451,741	53%	72%	72%	47%
77	4268	70431000	Balsz Elementary District	446,570	57%	41%	64%	36%
78	4391	90205000	Snowflake Unified District	428,183	67%	64%	83%	65%
79	4236	70209000	Wickenburg Unified District	428,117	62%	53%	79%	54%
80	4378	80415000	Bullhead City School District	424,264	63%	65%	75%	46%
81	4381	80502000	Colorado River Union High School District	418,757	32%	40%	54%	41%
82	4389	90203000	Holbrook Unified District	412,976	52%	40%	68%	34%
83	4209	40210000	Payson Unified District	403,279	53%	62%	72%	46%
84	4264	70417000	Tolleson Elementary District	392,313	52%	47%	69%	39%
85	4266	70425000	Liberty Elementary District	380,368	63%	67%	79%	55%
86	4156	10218000	Sanders Unified District	379,556	30%	22%	46%	23%
87	4254	70290000	Saddle Mountain Unified School District	374,207	54%	47%	72%	45%
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	56%	62%	76%	62%
89	4210	40220000	San Carlos Unified District	369,835	15%	11%	29%	15%
90	4510	150227000	Parker Unified School District	366,028	47%	38%	60%	29%
91	4390	90204000	Pinon Unified District	344,152	33%	20%	52%	27%
92	4208	40201000	Globe Unified District	336,783	36%	40%	57%	39%
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	54%	46%	77%	50%
94	4474	130251000	Chino Valley Unified District	333,773	57%	54%	77%	55%
95	4211	40240000	Miami Unified District	327,598	43%	50%	65%	38%
96	4412	100240000	Baboquivari Unified School District #40	315,281	20%	15%	46%	19%
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	57%	65%	77%	42%
98	4500	140411000	Somerton Elementary District	312,037	59%	38%	71%	40%
99	4265	70421000	Murphy Elementary District	305,100	46%	30%	62%	30%
100	4153	10201000	St Johns Unified District	297,133	63%	65%	85%	63%
101	4408	100213000	Tanque Verde Unified District	280,121	80%	84%	94%	84%
102	4219	50204000	Thatcher Unified District	276,740	69%	68%	89%	71%
103	4230	60218000	Morenci Unified District	273,528	67%	52%	84%	58%
104	4170	20213000	Willcox Unified District	273,508	49%	41%	66%	34%
105	4470	130228000	Camp Verde Unified District	245,725	51%	51%	74%	42%
106	4168	20201000	Tombstone Unified District	231,447	56%	56%	83%	52%
107	4169	20202000	Bisbee Unified District	228,248	42%	47%	75%	43%
108	4159	10227000	Red Mesa Unified District	227,658	34%	23%	52%	24%
109	4379	80416000	Mohave Valley Elementary District	220,035	63%	59%	78%	51%
110	4388	90202000	Joseph City Unified District	211,184	64%	51%	83%	59%
111	4261	70407000	Wilson Elementary District	207,691	62%	53%	73%	43%
112	4277	70462000	Union Elementary District	202,597	52%	39%	68%	45%
113	4488	130504000	Mingus Union High School District	198,724	37%	74%	52%	41%
114	79226	20209000	Benson Unified School District	194,192	71%	60%	87%	58%
115	4257	70402000	Riverside Elementary District	192,409	48%	34%	62%	41%
116	4438	110203000	Ray Unified District	191,243	49%	66%	79%	39%
117	4221	50207000	Fort Thomas Unified District	183,357	40%	20%	57%	25%
118	4212	40241000	Hayden-Winkelman Unified District	179,222	31%	27%	61%	33%
119	4440	110215000	Superior Unified School District	171,807	43%	30%	71%	48%
120	4450	110422000	Toltec School District	170,495	47%	38%	65%	26%

#	Entity ID	CTD	Entity Name	GSF	2013 Math	2013 Science	2013 Reading	2013 Writing
121	4370	80214000	Colorado City Unified District	168,595	63%	61%	79%	44%
122	4392	90206000	Heber-Overgaard Unified District	164,182	67%	59%	84%	60%
123	4448	110411000	Eloy Elementary District	157,960	46%	28%	62%	24%
124	4395	90225000	Cedar Unified District	156,043	22%	11%	35%	13%
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	26%	23%	57%	35%
126	4449	110418000	Sacaton Elementary District	148,862	41%	21%	57%	23%
127	4193	30202000	Williams Unified District	146,180	47%	51%	70%	55%
128	4228	60202000	Duncan Unified District	136,458	48%	48%	70%	58%
129	4180	20349000	Palominas Elementary District	129,873	78%	83%	87%	56%
130	4220	50206000	Pima Unified District	119,300	62%	62%	80%	62%
131	4473	130243000	Mayer Unified School District	118,214	44%	50%	64%	37%
132	4447	110405000	Red Rock Elementary District	118,105	61%	85%	79%	43%
133	4506	140550000	Antelope Union High School District	117,018	33%	23%	73%	39%
134	4418	100351000	Altar Valley Elementary District	116,000	57%	51%	70%	25%
135	4238	70224000	Gila Bend Unified District	110,813	31%	23%	52%	28%
136	4409	100215000	Ajo Unified District	107,122	46%	38%	65%	37%
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	47%	55%	72%	31%
138	4369	80208000	Peach Springs Unified District	102,653	11%	12%	35%	22%
139	4468	130220000	Bagdad Unified District	98,396	50%	55%	79%	39%
140	4451	110424000	Stanfield Elementary District	97,461	50%	31%	62%	31%
141	4472	130240000	Seligman Unified District	90,327	56%	44%	81%	48%
142	4173	20221000	St David Unified District	88,586	70%	82%	85%	53%
143	4374	80209000	Littlefield Unified District	82,633	41%	35%	67%	45%
144	4194	30204000	Grand Canyon Unified District	76,786	51%	62%	68%	51%
145	4416	100339000	Continental Elementary District	75,361	68%	73%	81%	55%
146	4481	130326000	Beaver Creek Elementary District	74,916	54%	57%	70%	33%
147	4444	110302000	Oracle Elementary District	72,929	49%	66%	73%	36%
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	60%	47%	78%	63%
149	4462	120520000	Patagonia Union High School District	70,799	60%	37%	85%	65%
150	4275	70449000	Palo Verde Elementary District	66,790	69%	69%	80%	68%
151	4214	40312000	Pine Strawberry Elementary District	66,745	56%	85%	82%	62%
152	4504	140424000	Wellton Elementary District	60,797	60%	46%	72%	25%
153	4190	20522000	Valley Union High School District	59,812	67%	53%	80%	79%
154	4515	150576000	Bicentennial Union High School District	57,537	49%	43%	76%	52%
155	4471	130231000	Ash Fork Joint Unified District	53,260	65%	54%	83%	49%
156	4511	150404000	Quartzsite Elementary District	53,125	45%	41%	63%	31%
157	4502	140416000	Hyder Elementary District	52,656	87%	70%	82%	47%
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	72%	75%	85%	56%
159	4503	140417000	Mohawk Valley Elementary District	47,820	48%	34%	74%	38%
160	4171	20214000	Bowie Unified District	46,243				
161	4172	20218000	San Simon Unified District	45,061	77%		87%	52%
162	4222	50305000	Solomon Elementary District	44,339	72%	74%	86%	60%
163	4213	40305000	Young Elementary District	43,872				
164	4160	10306000	Concho Elementary District	41,015	63%	71%	83%	41%
165	4163	10323000	Mcnary Elementary District	39,692	32%	32%	64%	18%
166	4484	130350000	Canon Elementary District	38,230	41%	60%	71%	34%
167	4274	70447000	Arlington Elementary District	36,618	53%	45%	76%	48%
168	4514	150430000	Salome Consolidated Elementary District	36,533	17%		42%	33%
169	4176	20323000	Naco Elementary District	36,034	40%	39%	49%	17%
170	4251	70375000	Morristown Elementary District	33,637	55%	54%	74%	48%
171	4461	120425000	Sonoita Elementary District	31,797	67%	92%	86%	71%
172	4249	70363000	Aguila Elementary District	31,788	74%	70%	85%	78%
173	4186	20422000	Pearce Elementary District	31,322	47%		80%	14%
174	4185	20412000	Elfrida Elementary District	29,737	62%	61%	76%	53%
175	4199	30310000	Maine Consolidated School District	29,567	69%	88%	67%	66%
176	4188	20364000	Pomerene Elementary District	28,867	63%	72%	83%	64%
177	4224	50316000	Bonita Elementary District	27,239	59%	74%	83%	64%
178	4452	110433000	Picacho Elementary District	26,788	43%	34%	54%	28%
179	4479	130317000	Congress Elementary District	26,000	78%	91%	90%	66%
180	4177	20326000	Cochise Elementary District	25,613	62%		77%	62%

#	Entity ID	CTD	Entity Name	GSF	2013 Math	2013 Science	2013 Reading	2013 Writing
181	4512	150419000	Wenden Elementary District	25,590	50%	54%	70%	28%
182	4162	10309000	Vernon Elementary District	24,218	58%		76%	57%
183	4253	70386000	Mobile Elementary District	22,880				
184	4234	70199000	Maricopa County Regional District	22,509	6%	8%	29%	29%
185	4459	120328000	Santa Cruz Elementary District	22,461	71%	67%	87%	76%
186	4386	90199000	Navajo County Accommodation District #99	22,178				
187	4187	20453000	Ash Creek Elementary District	21,432				
188	4250	70371000	Sentinel Elementary District	21,004				
189	4485	130352000	Yarnell Elementary District	20,499				
190	4371	80303000	Hackberry School District	19,916				
191	79379	130199000	Yavapai Accommodation School District	19,116	9%		64%	36%
192	4215	40333000	Tonto Basin Elementary District	16,896	36%	36%	45%	
193	4179	20345000	Double Adobe Elementary District	16,164				
194	4255	70394000	Paloma School District	15,280	27%		82%	18%
195	4161	10307000	Alpine Elementary District	14,868				
196	4380	80322000	Valentine Elementary District	13,430				
197	4513	150426000	Bouse Elementary District	13,327				
198	4460	120406000	Patagonia Elementary District	12,483	59%	80%	80%	53%
199	4480	130323000	Kirkland Elementary District	10,452				
200	4181	20355000	McNeal Elementary District	8,550				
201	4478	130315000	Skull Valley Elementary District	8,550				
202	4414	100335000	San Fernando Elementary District	7,630				
203	4377	80313000	Yucca Elementary District	7,616				
204	4482	130335000	Hillside Elementary District	7,229				
205	4178	20342000	Apache Elementary District	1,720				
206	4231	60322000	Blue Elementary District	1,600				

#	Entity ID	CTD	Entity Name	GSF	2014 Math	2014 Science	2014 Reading	2014 Writing
1	4403	100201000	Tucson Unified District	8,968,427	40%	45%	56%	33%
2	4235	70204000	Mesa Unified District	8,530,135	53%	63%	73%	49%
3	4241	70269000	Paradise Valley Unified District	5,085,048	56%	67%	76%	53%
4	4239	70241000	Gilbert Unified District	4,833,949	68%	67%	86%	70%
5	4242	70280000	Chandler Unified District #80	4,773,688	68%	76%	83%	70%
6	4237	70211000	Peoria Unified School District	4,584,353	62%	63%	80%	60%
7	4246	70297000	Deer Valley Unified District	4,447,281	63%	69%	80%	62%
8	4286	70510000	Phoenix Union High School District	4,361,240	21%	33%	46%	37%
9	4240	70248000	Scottsdale Unified District	4,303,438	63%	69%	82%	63%
10	4243	70289000	Dysart Unified District	3,283,430	59%	55%	78%	56%
11	4260	70406000	Washington Elementary School District	2,929,727	53%	50%	72%	43%
12	4406	100210000	Amphitheater Unified District	2,560,557	52%	60%	70%	47%
13	4267	70428000	Kyrene Elementary District	2,556,290	77%	77%	88%	66%
14	4285	70505000	Glendale Union High School District	2,365,011	43%	71%	70%	50%
15	4287	70513000	Tempe Union High School District	2,326,820	33%	74%	66%	49%
16	4282	70483000	Cartwright Elementary District	2,143,391	57%	37%	69%	37%
17	4407	100212000	Sunnyside Unified District	1,970,356	35%	39%	56%	36%
18	4258	70403000	Tempe School District	1,818,774	56%	52%	76%	49%
19	4192	30201000	Flagstaff Unified District	1,747,421	48%	59%	66%	47%
20	4404	100206000	Marana Unified District	1,717,323	53%	60%	80%	58%
21	4248	70260000	Higley Unified School District	1,677,682	73%	74%	93%	74%
22	4280	70468000	Alhambra Elementary District	1,583,925	52%	43%	66%	33%
23	79598	80220000	Kingman Unified School District	1,517,377	44%	48%	63%	39%
24	4279	70466000	Roosevelt Elementary District	1,487,676	42%	33%	60%	31%
25	4507	140570000	Yuma Union High School District	1,474,177	24%	16%	45%	27%
26	4271	70440000	Glendale Elementary District	1,441,452	47%	47%	65%	39%
27	4413	100220000	Vail Unified District	1,326,723	73%	83%	90%	71%
28	4288	70514000	Tolleson Union High School District	1,310,221	32%	44%	62%	49%
29	4283	70492000	Pendergast Elementary District	1,261,632	56%	49%	75%	45%
30	4437	110201000	Florence Unified School District	1,249,830	53%	61%	74%	53%
31	4256	70401000	Phoenix Elementary District	1,168,665	47%	38%	64%	33%
32	4281	70479000	Litchfield Elementary District	1,161,345	76%	78%	86%	67%
33	4499	140401000	Yuma Elementary District	1,098,098	57%	52%	72%	42%
34	4263	70414000	Creighton Elementary District	995,558	49%	40%	63%	37%
35	4289	70516000	Agua Fria Union High School District	991,777	39%	46%	65%	52%
36	4158	10224000	Chinle Unified District	975,701	25%	26%	54%	27%
37	4244	70293000	Cave Creek Unified District	952,246	71%	72%	90%	79%
38	4284	70501000	Buckeye Union High School District	903,133	40%	48%	69%	54%
39	4442	110221000	Coolidge Unified District	901,352	31%	30%	53%	33%
40	4446	110404000	Casa Grande Elementary District	896,907	58%	49%	73%	44%
41	4259	70405000	Isaac Elementary District	876,839	42%	40%	59%	33%
42	4175	20268000	Sierra Vista Unified District	856,511	63%	61%	83%	59%
43	4368	80201000	Lake Havasu Unified District	846,080	62%	68%	87%	62%
44	4441	110220000	Maricopa Unified School District	837,081	50%	56%	70%	48%
45	4245	70295000	Queen Creek Unified District	833,228	68%	74%	85%	71%
46	4469	130222000	Humboldt Unified District	826,072	56%	67%	73%	49%
47	4411	100230000	Sahuarita Unified District	814,183	58%	61%	76%	57%
48	4410	100216000	Catalina Foothills Unified District	808,947	78%	80%	94%	81%
49	4405	100208000	Flowing Wells Unified District	789,539	57%	54%	77%	55%
50	4443	110243000	Apache Junction Unified District	783,426	49%	59%	65%	47%
51	4466	130201000	Prescott Unified District	764,467	62%	70%	80%	62%
52	4270	70438000	Madison Elementary District	762,711	73%	75%	86%	65%
53	4272	70444000	Avondale Elementary District	760,287	51%	49%	71%	43%
54	4457	120201000	Nogales Unified District	750,318	60%	35%	76%	54%
55	4501	140413000	Crane Elementary District	712,076	66%	60%	77%	49%
56	4276	70459000	Laveen Elementary District	660,163	60%	51%	75%	48%
57	4396	90227000	Kayenta Unified District	654,650	39%	26%	59%	34%
58	4445	110244000	J O Combs Unified School District	653,277	50%	51%	78%	56%
59	4196	30208000	Page Unified District	638,103	41%	38%	59%	34%
60	4278	70465000	Littleton Elementary District	631,086	55%	54%	71%	38%

#	Entity ID	CTD	Entity Name	GSF	2014 Math	2014 Science	2014 Reading	2014 Writing
61	4394	90220000	Whiteriver Unified District	626,577	29%	17%	55%	30%
62	4154	10208000	Window Rock Unified District	626,340	29%	20%	55%	29%
63	4453	110502000	Casa Grande Union High School District	603,851	21%	31%	42%	35%
64	4174	20227000	Douglas Unified District	603,041	38%	34%	60%	46%
65	4157	10220000	Ganado Unified School District	587,701	32%	26%	55%	33%
66	4273	70445000	Fowler Elementary District	559,846	54%	44%	69%	36%
67	4269	70433000	Buckeye Elementary District	546,169	57%	55%	73%	39%
68	4262	70408000	Osborn Elementary District	539,469	63%	49%	71%	44%
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	56%	56%	80%	53%
70	4155	10210000	Round Valley Unified District	530,690	61%	54%	76%	51%
71	4505	140432000	Gadsden Elementary District	513,519	57%	34%	63%	45%
72	4458	120235000	Santa Cruz Valley Unified District	494,529	51%	48%	70%	49%
73	4247	70298000	Fountain Hills Unified District	483,159	69%	68%	85%	74%
74	4218	50201000	Safford Unified District	479,116	55%	53%	78%	46%
75	4387	90201000	Winslow Unified District	478,581	43%	38%	69%	47%
76	4393	90210000	Show Low Unified District	451,741	62%	71%	82%	51%
77	4268	70431000	Balsz Elementary District	446,570	49%	36%	62%	28%
78	4391	90205000	Snowflake Unified District	428,183	68%	66%	83%	63%
79	4236	70209000	Wickenburg Unified District	428,117	52%	53%	76%	52%
80	4378	80415000	Bullhead City School District	424,264	64%	64%	76%	44%
81	4381	80502000	Colorado River Union High School District	418,757	29%	37%	44%	46%
82	4389	90203000	Holbrook Unified District	412,976	53%	46%	75%	44%
83	4209	40210000	Payson Unified District	403,279	52%	51%	78%	59%
84	4264	70417000	Tolleson Elementary District	392,313	52%	39%	71%	37%
85	4266	70425000	Liberty Elementary District	380,368	60%	62%	79%	50%
86	4156	10218000	Sanders Unified District	379,556	28%	13%	51%	23%
87	4254	70290000	Saddle Mountain Unified School District	374,207	60%	44%	72%	51%
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	51%	58%	78%	62%
89	4210	40220000	San Carlos Unified District	369,835	12%	9%	35%	13%
90	4510	150227000	Parker Unified School District	366,028	41%	38%	70%	37%
91	4390	90204000	Pinon Unified District	344,152	40%	18%	57%	29%
92	4208	40201000	Globe Unified District	336,783	34%	35%	61%	28%
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	54%	40%	75%	53%
94	4474	130251000	Chino Valley Unified District	333,773	60%	50%	82%	51%
95	4211	40240000	Miami Unified District	327,598	42%	43%	71%	44%
96	4412	100240000	Baboquivari Unified School District #40	315,281	24%	14%	50%	20%
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	58%	61%	76%	44%
98	4500	140411000	Somerton Elementary District	312,037	54%	35%	69%	41%
99	4265	70421000	Murphy Elementary District	305,100	47%	38%	66%	27%
100	4153	10201000	St Johns Unified District	297,133	70%	66%	82%	60%
101	4408	100213000	Tanque Verde Unified District	280,121	84%	85%	93%	85%
102	4219	50204000	Thatcher Unified District	276,740	70%	67%	88%	69%
103	4230	60218000	Morenci Unified District	273,528	71%	55%	85%	56%
104	4170	20213000	Willcox Unified District	273,508	52%	45%	66%	31%
105	4470	130228000	Camp Verde Unified District	245,725	52%	50%	77%	42%
106	4168	20201000	Tombstone Unified District	231,447	58%	46%	82%	57%
107	4169	20202000	Bisbee Unified District	228,248	41%	51%	68%	37%
108	4159	10227000	Red Mesa Unified District	227,658	36%	20%	58%	31%
109	4379	80416000	Mohave Valley Elementary District	220,035	62%	66%	77%	41%
110	4388	90202000	Joseph City Unified District	211,184	72%	70%	81%	63%
111	4261	70407000	Wilson Elementary District	207,691	57%	48%	75%	42%
112	4277	70462000	Union Elementary District	202,597	47%	33%	66%	43%
113	4488	130504000	Mingus Union High School District	198,724	41%	66%	79%	62%
114	79226	20209000	Benson Unified School District	194,192	68%	65%	88%	58%
115	4257	70402000	Riverside Elementary District	192,409	57%	45%	70%	37%
116	4438	110203000	Ray Unified District	191,243	46%	51%	72%	40%
117	4221	50207000	Fort Thomas Unified District	183,357	54%	25%	65%	33%
118	4212	40241000	Hayden-Winkelman Unified District	179,222	37%	21%	63%	31%
119	4440	110215000	Superior Unified School District	171,807	36%	18%	64%	37%
120	4450	110422000	Toltec School District	170,495	46%	40%	68%	33%

#	Entity ID	CTD	Entity Name	GSF	2014 Math	2014 Science	2014 Reading	2014 Writing
121	4370	80214000	Colorado City Unified District	168,595	56%	53%	75%	39%
122	4392	90206000	Heber-Overgaard Unified District	164,182	71%	60%	86%	68%
123	4448	110411000	Eloy Elementary District	157,960	44%	25%	62%	25%
124	4395	90225000	Cedar Unified District	156,043	26%	10%	44%	13%
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	28%	5%	66%	41%
126	4449	110418000	Sacaton Elementary District	148,862	40%	23%	61%	20%
127	4193	30202000	Williams Unified District	146,180	42%	46%	66%	45%
128	4228	60202000	Duncan Unified District	136,458	46%	45%	73%	52%
129	4180	20349000	Palominas Elementary District	129,873	72%	76%	87%	59%
130	4220	50206000	Pima Unified District	119,300	52%	59%	78%	60%
131	4473	130243000	Mayer Unified School District	118,214	36%	40%	70%	44%
132	4447	110405000	Red Rock Elementary District	118,105	69%	79%	80%	50%
133	4506	140550000	Antelope Union High School District	117,018	33%	22%	72%	37%
134	4418	100351000	Altar Valley Elementary District	116,000	49%	50%	74%	32%
135	4238	70224000	Gila Bend Unified District	110,813	32%	25%	60%	28%
136	4409	100215000	Ajo Unified District	107,122	51%	54%	72%	46%
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	56%	44%	74%	47%
138	4369	80208000	Peach Springs Unified District	102,653	26%	33%	43%	21%
139	4468	130220000	Bagdad Unified District	98,396	56%	60%	85%	44%
140	4451	110424000	Stanfield Elementary District	97,461	47%	44%	59%	26%
141	4472	130240000	Seligman Unified District	90,327	56%	41%	73%	51%
142	4173	20221000	St David Unified District	88,586	75%	76%	89%	65%
143	4374	80209000	Littlefield Unified District	82,633	46%	44%	67%	50%
144	4194	30204000	Grand Canyon Unified District	76,786	52%	57%	69%	57%
145	4416	100339000	Continental Elementary District	75,361	53%	71%	78%	60%
146	4481	130326000	Beaver Creek Elementary District	74,916	46%	60%	69%	34%
147	4444	110302000	Oracle Elementary District	72,929	48%	55%	67%	37%
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	57%	47%	73%	67%
149	4462	120520000	Patagonia Union High School District	70,799	81%	56%	88%	81%
150	4275	70449000	Palo Verde Elementary District	66,790	58%	47%	70%	61%
151	4214	40312000	Pine Strawberry Elementary District	66,745	55%	70%	81%	55%
152	4504	140424000	Wellton Elementary District	60,797	60%	51%	62%	41%
153	4190	20522000	Valley Union High School District	59,812	61%	48%		84%
154	4515	150576000	Bicentennial Union High School District	57,537	68%		81%	65%
155	4471	130231000	Ash Fork Joint Unified District	53,260	70%	47%	78%	42%
156	4511	150404000	Quartzsite Elementary District	53,125	35%	64%	59%	29%
157	4502	140416000	Hyder Elementary District	52,656	71%		85%	70%
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	69%	75%	84%	68%
159	4503	140417000	Mohawk Valley Elementary District	47,820	38%	46%	64%	30%
160	4171	20214000	Bowie Unified District	46,243				
161	4172	20218000	San Simon Unified District	45,061	55%	42%	81%	45%
162	4222	50305000	Solomon Elementary District	44,339	74%	53%	73%	73%
163	4213	40305000	Young Elementary District	43,872				
164	4160	10306000	Concho Elementary District	41,015	66%	51%	81%	46%
165	4163	10323000	Mcnary Elementary District	39,692	25%	22%	51%	17%
166	4484	130350000	Canon Elementary District	38,230	58%	53%	81%	57%
167	4274	70447000	Arlington Elementary District	36,618	71%	67%	84%	53%
168	4514	150430000	Salome Consolidated Elementary District	36,533	32%		57%	36%
169	4176	20323000	Naco Elementary District	36,034	37%	21%	48%	9%
170	4251	70375000	Morristown Elementary District	33,637	61%	57%	84%	59%
171	4461	120425000	Sonoita Elementary District	31,797	53%	71%	83%	77%
172	4249	70363000	Aguila Elementary District	31,788	63%	60%	76%	64%
173	4186	20422000	Pearce Elementary District	31,322	32%		74%	36%
174	4185	20412000	Elfrida Elementary District	29,737	56%	77%	75%	37%
175	4199	30310000	Maine Consolidated School District	29,567	76%	76%	87%	58%
176	4188	20364000	Pomerene Elementary District	28,867	69%	71%	88%	43%
177	4224	50316000	Bonita Elementary District	27,239	61%		78%	65%
178	4452	110433000	Picacho Elementary District	26,788	39%	50%	58%	26%
179	4479	130317000	Congress Elementary District	26,000	83%	67%	89%	77%
180	4177	20326000	Cochise Elementary District	25,613	50%		92%	64%

#	Entity ID	CTD	Entity Name	GSF	2014 Math	2014 Science	2014 Reading	2014 Writing
181	4512	150419000	Wenden Elementary District	25,590	43%	64%	79%	
182	4162	10309000	Vernon Elementary District	24,218	45%	57%	85%	40%
183	4253	70386000	Mobile Elementary District	22,880				
184	4234	70199000	Maricopa County Regional District	22,509	8%	11%	32%	22%
185	4459	120328000	Santa Cruz Elementary District	22,461	68%	68%	85%	66%
186	4386	90199000	Navajo County Accommodation District #99	22,178				
187	4187	20453000	Ash Creek Elementary District	21,432				
188	4250	70371000	Sentinel Elementary District	21,004				
189	4485	130352000	Yarnell Elementary District	20,499				
190	4371	80303000	Hackberry School District	19,916				
191	79379	130199000	Yavapai Accommodation School District	19,116	20%	15%	61%	28%
192	4215	40333000	Tonto Basin Elementary District	16,896				
193	4179	20345000	Double Adobe Elementary District	16,164				
194	4255	70394000	Paloma School District	15,280	41%	27%	55%	91%
195	4161	10307000	Alpine Elementary District	14,868				
196	4380	80322000	Valentine Elementary District	13,430	33%		58%	
197	4513	150426000	Bouse Elementary District	13,327				
198	4460	120406000	Patagonia Elementary District	12,483	48%	50%	71%	40%
199	4480	130323000	Kirkland Elementary District	10,452				
200	4181	20355000	McNeal Elementary District	8,550				
201	4478	130315000	Skull Valley Elementary District	8,550				
202	4414	100335000	San Fernando Elementary District	7,630				
203	4377	80313000	Yucca Elementary District	7,616				
204	4482	130335000	Hillside Elementary District	7,229				
205	4178	20342000	Apache Elementary District	1,720				
206	4231	60322000	Blue Elementary District	1,600				

#	Entity ID	CTD	Entity Name	GSF	2015 Math	2015 Science	2015 Reading
1	4403	100201000	Tucson Unified District	8,968,427	25%	36%	28%
2	4235	70204000	Mesa Unified District	8,530,135	38%		33%
3	4241	70269000	Paradise Valley Unified District	5,085,048	39%	61%	42%
4	4239	70241000	Gilbert Unified District	4,833,949	51%		49%
5	4242	70280000	Chandler Unified District #80	4,773,688	53%	73%	52%
6	4237	70211000	Peoria Unified School District	4,584,353	40%		41%
7	4246	70297000	Deer Valley Unified District	4,447,281	44%	64%	44%
8	4286	70510000	Phoenix Union High School District	4,361,240	23%	25%	20%
9	4240	70248000	Scottsdale Unified District	4,303,438	47%	62%	48%
10	4243	70289000	Dysart Unified District	3,283,430	29%	47%	31%
11	4260	70406000	Washington Elementary School District	2,929,727	29%	54%	32%
12	4406	100210000	Amphitheater Unified District	2,560,557	36%	50%	38%
13	4267	70428000	Kyrene Elementary District	2,556,290	54%	76%	51%
14	4285	70505000	Glendale Union High School District	2,365,011	29%	68%	28%
15	4287	70513000	Tempe Union High School District	2,326,820	30%	71%	32%
16	4282	70483000	Cartwright Elementary District	2,143,391	24%	42%	18%
17	4407	100212000	Sunnyside Unified District	1,970,356	16%	33%	16%
18	4258	70403000	Tempe School District	1,818,774	32%	51%	31%
19	4192	30201000	Flagstaff Unified District	1,747,421	30%		25%
20	4404	100206000	Marana Unified District	1,717,323	36%	62%	38%
21	4248	70260000	Higley Unified School District	1,677,682	54%	78%	51%
22	4280	70468000	Alhambra Elementary District	1,583,925	26%	44%	19%
23	79598	80220000	Kingman Unified School District	1,517,377	27%	39%	24%
24	4279	70466000	Roosevelt Elementary District	1,487,676	20%	34%	17%
25	4507	140570000	Yuma Union High School District	1,474,177	15%	16%	20%
26	4271	70440000	Glendale Elementary District	1,441,452	22%	44%	18%
27	4413	100220000	Vail Unified District	1,326,723	58%	81%	49%
28	4288	70514000	Tolleson Union High School District	1,310,221	9%	28%	16%
29	4283	70492000	Pendergast Elementary District	1,261,632	29%	43%	31%
30	4437	110201000	Florence Unified School District	1,249,830	29%	46%	29%
31	4256	70401000	Phoenix Elementary District	1,168,665	21%	39%	21%
32	4281	70479000	Litchfield Elementary District	1,161,345	48%	75%	49%
33	4499	140401000	Yuma Elementary District	1,098,098	33%	50%	25%
34	4263	70414000	Creighton Elementary District	995,558	24%	31%	21%
35	4289	70516000	Agua Fria Union High School District	991,777	23%	36%	26%
36	4158	10224000	Chinle Unified District	975,701	15%		9%
37	4244	70293000	Cave Creek Unified District	952,246	58%	75%	56%
38	4284	70501000	Buckeye Union High School District	903,133	26%	51%	19%
39	4442	110221000	Coolidge Unified District	901,352	10%	23%	11%
40	4446	110404000	Casa Grande Elementary District	896,907	31%	47%	27%
41	4259	70405000	Isaac Elementary District	876,839	16%	35%	15%
42	4175	20268000	Sierra Vista Unified District	856,511	43%		40%
43	4368	80201000	Lake Havasu Unified District	846,080	41%	60%	37%
44	4441	110220000	Maricopa Unified School District	837,081	27%	50%	27%
45	4245	70295000	Queen Creek Unified District	833,228	44%	74%	39%
46	4469	130222000	Humboldt Unified District	826,072	31%	60%	36%
47	4411	100230000	Sahuarita Unified District	814,183	36%	52%	35%
48	4410	100216000	Catalina Foothills Unified District	808,947	63%	76%	63%
49	4405	100208000	Flowing Wells Unified District	789,539	30%	48%	31%
50	4443	110243000	Apache Junction Unified District	783,426	28%	46%	27%
51	4466	130201000	Prescott Unified District	764,467	37%	63%	36%
52	4270	70438000	Madison Elementary District	762,711	49%	76%	48%
53	4272	70444000	Avondale Elementary District	760,287	23%	50%	25%
54	4457	120201000	Nogales Unified District	750,318	27%	31%	24%
55	4501	140413000	Crane Elementary District	712,076	43%	62%	36%
56	4276	70459000	Laveen Elementary District	660,163	32%	51%	27%
57	4396	90227000	Kayenta Unified District	654,650	12%	21%	11%
58	4445	110244000	J O Combs Unified School District	653,277	31%	41%	30%
59	4196	30208000	Page Unified District	638,103	18%		15%
60	4278	70465000	Littleton Elementary District	631,086	25%	44%	19%

#	Entity ID	CTD	Entity Name	GSF	2015 Math	2015 Science	2015 Reading
61	4394	90220000	Whiteriver Unified District	626,577	10%	11%	7%
62	4154	10208000	Window Rock Unified District	626,340	9%		11%
63	4453	110502000	Casa Grande Union High School District	603,851	16%	49%	22%
64	4174	20227000	Douglas Unified District	603,041	21%		23%
65	4157	10220000	Ganado Unified School District	587,701	10%		8%
66	4273	70445000	Fowler Elementary District	559,846	29%	37%	23%
67	4269	70433000	Buckeye Elementary District	546,169	27%	49%	28%
68	4262	70408000	Osborn Elementary District	539,469	33%	49%	21%
69	4397	90232000	Blue Ridge Unified School District No. 32	532,157	40%	54%	36%
70	4155	10210000	Round Valley Unified District	530,690	38%		29%
71	4505	140432000	Gadsden Elementary District	513,519	25%	32%	25%
72	4458	120235000	Santa Cruz Valley Unified District	494,529	30%	42%	26%
73	4247	70298000	Fountain Hills Unified District	483,159	43%	62%	40%
74	4218	50201000	Safford Unified District	479,116	28%	49%	25%
75	4387	90201000	Winslow Unified District	478,581	22%	35%	19%
76	4393	90210000	Show Low Unified District	451,741	27%	62%	30%
77	4268	70431000	Balsz Elementary District	446,570	25%	34%	14%
78	4391	90205000	Snowflake Unified District	428,183	52%	70%	46%
79	4236	70209000	Wickenburg Unified District	428,117	36%	49%	27%
80	4378	80415000	Bullhead City School District	424,264	37%	63%	25%
81	4381	80502000	Colorado River Union High School District	418,757	12%	42%	19%
82	4389	90203000	Holbrook Unified District	412,976	25%	37%	20%
83	4209	40210000	Payson Unified District	403,279	29%	44%	29%
84	4264	70417000	Tolleson Elementary District	392,313	29%	46%	25%
85	4266	70425000	Liberty Elementary District	380,368	35%	62%	38%
86	4156	10218000	Sanders Unified District	379,556	10%		5%
87	4254	70290000	Saddle Mountain Unified School District	374,207	32%	35%	20%
88	4467	130209000	Sedona-Oak Creek JUSD #9	372,234	32%	55%	37%
89	4210	40220000	San Carlos Unified District	369,835	6%	9%	2%
90	4510	150227000	Parker Unified School District	366,028	21%	35%	16%
91	4390	90204000	Pinon Unified District	344,152	17%	17%	10%
92	4208	40201000	Globe Unified District	336,783	16%	37%	12%
93	4439	110208000	Mammoth-San Manuel Unified District	335,849	19%	33%	24%
94	4474	130251000	Chino Valley Unified District	333,773	30%	53%	33%
95	4211	40240000	Miami Unified District	327,598	17%	37%	17%
96	4412	100240000	Baboquivari Unified School District #40	315,281	8%	12%	7%
97	4487	130406000	Cottonwood-Oak Creek Elementary District	312,330	31%	59%	31%
98	4500	140411000	Somerton Elementary District	312,037	20%	37%	17%
99	4265	70421000	Murphy Elementary District	305,100	14%	28%	15%
100	4153	10201000	St Johns Unified District	297,133	37%		36%
101	4408	100213000	Tanque Verde Unified District	280,121	54%	76%	52%
102	4219	50204000	Thatcher Unified District	276,740	41%	64%	44%
103	4230	60218000	Morenci Unified District	273,528	37%	63%	29%
104	4170	20213000	Willcox Unified District	273,508	24%		19%
105	4470	130228000	Camp Verde Unified District	245,725	23%	53%	20%
106	4168	20201000	Tombstone Unified District	231,447	25%		26%
107	4169	20202000	Bisbee Unified District	228,248	14%		15%
108	4159	10227000	Red Mesa Unified District	227,658	10%		10%
109	4379	80416000	Mohave Valley Elementary District	220,035	33%	49%	24%
110	4388	90202000	Joseph City Unified District	211,184	32%	51%	32%
111	4261	70407000	Wilson Elementary District	207,691	25%	48%	23%
112	4277	70462000	Union Elementary District	202,597	23%	30%	23%
113	4488	130504000	Mingus Union High School District	198,724	21%	61%	22%
114	79226	20209000	Benson Unified School District	194,192	41%	57%	41%
115	4257	70402000	Riverside Elementary District	192,409	25%	44%	23%
116	4438	110203000	Ray Unified District	191,243	13%	60%	18%
117	4221	50207000	Fort Thomas Unified District	183,357	16%	18%	12%
118	4212	40241000	Hayden-Winkelman Unified District	179,222	10%	28%	15%
119	4440	110215000	Superior Unified School District	171,807	9%	16%	8%
120	4450	110422000	Toltec School District	170,495	19%	40%	19%

#	Entity ID	CTD	Entity Name	GSF	2015 Math	2015 Science	2015 Reading
121	4370	80214000	Colorado City Unified District	168,595	40%	70%	33%
122	4392	90206000	Heber-Overgaard Unified District	164,182	38%	72%	32%
123	4448	110411000	Eloy Elementary District	157,960	17%	30%	12%
124	4395	90225000	Cedar Unified District	156,043	16%	28%	12%
125	4454	110540000	Santa Cruz Valley Union High School District	151,633	7%	14%	16%
126	4449	110418000	Sacaton Elementary District	148,862	18%	21%	13%
127	4193	30202000	Williams Unified District	146,180	13%	40%	16%
128	4228	60202000	Duncan Unified District	136,458	20%	44%	20%
129	4180	20349000	Palominas Elementary District	129,873	45%		40%
130	4220	50206000	Pima Unified District	119,300	27%	59%	36%
131	4473	130243000	Mayer Unified School District	118,214	11%	45%	13%
132	4447	110405000	Red Rock Elementary District	118,105	30%	70%	35%
133	4506	140550000	Antelope Union High School District	117,018	8%	14%	10%
134	4418	100351000	Altar Valley Elementary District	116,000	22%	39%	19%
135	4238	70224000	Gila Bend Unified District	110,813	7%	25%	12%
136	4409	100215000	Ajo Unified District	107,122	25%	39%	25%
137	4195	30206000	Fredonia-Moccasin Unified District	106,127	24%	53%	25%
138	4369	80208000	Peach Springs Unified District	102,653	5%	19%	6%
139	4468	130220000	Bagdad Unified District	98,396	20%	39%	19%
140	4451	110424000	Stanfield Elementary District	97,461	20%	25%	11%
141	4472	130240000	Seligman Unified District	90,327	15%	55%	16%
142	4173	20221000	St David Unified District	88,586	34%		49%
143	4374	80209000	Littlefield Unified District	82,633	23%	47%	21%
144	4194	30204000	Grand Canyon Unified District	76,786	20%	52%	29%
145	4416	100339000	Continental Elementary District	75,361	37%	59%	38%
146	4481	130326000	Beaver Creek Elementary District	74,916	15%	52%	14%
147	4444	110302000	Oracle Elementary District	72,929	26%	49%	20%
148	4435	110100000	Mary C O'Brien Accommodation District	72,051	25%	37%	33%
149	4462	120520000	Patagonia Union High School District	70,799	46%	58%	38%
150	4275	70449000	Palo Verde Elementary District	66,790	36%	58%	31%
151	4214	40312000	Pine Strawberry Elementary District	66,745	37%	75%	31%
152	4504	140424000	Wellton Elementary District	60,797	25%	47%	15%
153	4190	20522000	Valley Union High School District	59,812	23%	39%	26%
154	4515	150576000	Bicentennial Union High School District	57,537	21%	36%	23%
155	4471	130231000	Ash Fork Joint Unified District	53,260	49%	84%	42%
156	4511	150404000	Quartzsite Elementary District	53,125	16%	34%	26%
157	4502	140416000	Hyder Elementary District	52,656	53%	76%	33%
158	4486	130403000	Clarkdale-Jerome Elementary District	48,288	41%	73%	39%
159	4503	140417000	Mohawk Valley Elementary District	47,820	11%	24%	8%
160	4171	20214000	Bowie Unified District	46,243	4%		
161	4172	20218000	San Simon Unified District	45,061	28%	68%	29%
162	4222	50305000	Solomon Elementary District	44,339	36%	64%	39%
163	4213	40305000	Young Elementary District	43,872	34%		46%
164	4160	10306000	Concho Elementary District	41,015	33%		27%
165	4163	10323000	Mcnary Elementary District	39,692	12%		11%
166	4484	130350000	Canon Elementary District	38,230	36%	75%	42%
167	4274	70447000	Arlington Elementary District	36,618	22%	34%	16%
168	4514	150430000	Salome Consolidated Elementary District	36,533	15%	13%	11%
169	4176	20323000	Naco Elementary District	36,034	7%	19%	12%
170	4251	70375000	Morristown Elementary District	33,637	24%	63%	30%
171	4461	120425000	Sonoita Elementary District	31,797	42%		48%
172	4249	70363000	Aguila Elementary District	31,788	20%	47%	19%
173	4186	20422000	Pearce Elementary District	31,322	29%	53%	24%
174	4185	20412000	Elfrida Elementary District	29,737	21%	70%	28%
175	4199	30310000	Maine Consolidated School District	29,567	28%	83%	33%
176	4188	20364000	Pomerene Elementary District	28,867	37%		32%
177	4224	50316000	Bonita Elementary District	27,239	36%		37%
178	4452	110433000	Picacho Elementary District	26,788	11%	44%	13%
179	4479	130317000	Congress Elementary District	26,000	77%	83%	66%
180	4177	20326000	Cochise Elementary District	25,613	46%		48%

#	Entity ID	CTD	Entity Name	GSF	2015 Math	2015 Science	2015 Reading
181	4512	150419000	Wenden Elementary District	25,590	18%	36%	15%
182	4162	10309000	Vernon Elementary District	24,218	17%	50%	19%
183	4253	70386000	Mobile Elementary District	22,880			
184	4234	70199000	Maricopa County Regional District	22,509	3%	13%	3%
185	4459	120328000	Santa Cruz Elementary District	22,461	40%	63%	42%
186	4386	90199000	Navajo County Accommodation District #99	22,178			
187	4187	20453000	Ash Creek Elementary District	21,432	5%		19%
188	4250	70371000	Sentinel Elementary District	21,004	43%		35%
189	4485	130352000	Yarnell Elementary District	20,499	41%		44%
190	4371	80303000	Hackberry School District	19,916	56%		63%
191	79379	130199000	Yavapai Accommodation School District	19,116	3%	17%	10%
192	4215	40333000	Tonto Basin Elementary District	16,896	32%		45%
193	4179	20345000	Double Adobe Elementary District	16,164	13%		21%
194	4255	70394000	Paloma School District	15,280	13%		17%
195	4161	10307000	Alpine Elementary District	14,868	62%		57%
196	4380	80322000	Valentine Elementary District	13,430	7%	23%	10%
197	4513	150426000	Bouse Elementary District	13,327	21%		25%
198	4460	120406000	Patagonia Elementary District	12,483	31%	36%	32%
199	4480	130323000	Kirkland Elementary District	10,452	33%		33%
200	4181	20355000	McNeal Elementary District	8,550	16%		13%
201	4478	130315000	Skull Valley Elementary District	8,550	50%		57%
202	4414	100335000	San Fernando Elementary District	7,630			
203	4377	80313000	Yucca Elementary District	7,616	42%		33%
204	4482	130335000	Hillside Elementary District	7,229	11%		21%
205	4178	20342000	Apache Elementary District	1,720			
206	4231	60322000	Blue Elementary District	1,600	15%		33%

APPENDIX D

DISTRICT QUESTIONNAIRE AND STRUCTURED INTERVIEW

Qualitative Analysis of Facility Management Strategy

Please take a few minutes to fill out this survey regarding your experience.

General Information

Please provide your title, and the district and or school you support:

Title: _____

District / School: _____

Years with the District: _____ years

To better understand the Districts real estate portfolio, please provide the following:

Approx. annual Facility Operations (Facility Operations) budget: $_____ USD.

Approx. Total Gross Sq. Ft: _____ GSF; Approx. Total Acreage: _____

- Academic Buildings: _____ %
- Administration Buildings: _____ %
- General Purpose Buildings: _____ %
- Average Age of Buildings: _____ years

How many years of professional experience do you have in this role:

☐ <5 years ☐ 5 - 10 years ☐ 10 – 15 years ☐ >15 years experience

Do you hold a degree or professional certificate in Facilities Management:

☐ Yes ☐ No List Certificate(s): _____

Are you an active member of either the Building Owners and Managers Association (BOMA), the Association of Physical Plant Administrators (APPA,) and/or the International Facilities Management Association (IFMA)? Please check all that may apply:

☐ BOMA ☐ APPA ☐ IFMA

Other: _____

FACILITIES MANAGEMENT QUESTIONNAIRE:

Do you currently use or have previously used a Building Management System (BMS) or Computerized Maintenance Management System (CMMS), if so please provide the application(s):

☐ Yes ☐ No Application(s): _____

If Yes, please rate your experience working with BMS / CMMS:

No Experience ☐ ☐ ☐ ☐ ☐ Very Experienced

Please rate your perceived value the BMS / CMMS brings to your role at the district:

No Value ☐ ☐ ☐ ☐ ☐ Very High Value

Do you currently use or have previously have used an Energy Management System (EMS), if so please provide the application(s):

☐ Yes ☐ No Application(s): _____

If Yes, please rate your experience working with an EMS:

No Experience ☐ ☐ ☐ ☐ ☐ Very Experienced

Please rate your perceived value the EMS brings to your role at the district:

No Value ☐ ☐ ☐ ☐ ☐ Very High Value

Do you currently perform regular ***preventative*** maintenance on building systems? If so, please circle the maintained systems:

☐ Yes ☐ No

HVAC Roof Elevator. Mechanical. Electrical. Water Treatment

Other:_____

Do you currently perform regular ***predictive*** maintenance on building systems? If so, please circle the maintained systems:

☐ Yes ☐ No

HVAC Roof Elevator Mechanical Electrical Water Treatment

Other:_____

Do you utilize a ***run-to-fail*** option on building systems? If so, please circle the maintained systems:

☐ Yes ☐ No

HVAC Roof Elevator Mechanical Electrical Water Treatment

Other:_____

INTERVIEW

This is a semi-structured anonymous interview in accordance with IRB Study 00005522 approval and consent form. For the purpose of this interview we will be focusing on Plant Maintenance and Operations, Uniform System of Financial Records (USFR) Cost Code 2600. For the purpose of this interview the terms Plant Maintenance and Operations and Facility Maintenance and Operations (FacOps) are understood to be equivalent terms.

- Walk me through a typical day in the life of a district Facility Director? A site Facility Manager?
- How is the work prioritized on a daily basis?
- For you, as the senior Facilities Director within the district, what does success look like? Please define success in terms of how you are measured, how the department is measured, and how you would measure success.

OPERATIONS AND ORGANIZATION

1. Please describe the Plant Maintenance and Operations organization structure?
2. Are Facility Managers assigned to each school? If not, what is the determinate used in placing a Facility Manager at a school?
3. Are mobile technicians utilized by the district? If yes, please explain their role?
    a. Are Mobile technicians shared by districts?
4. At what frequency are rounds and readings conducted and by whom?
5. Does the district have a budget for on-going training and or certification of Facility Managers?
6. How are Facility Managers used by a school? For example, are Facility Managers responsible for custodial work, traffic coordination, etc. at the school they are assigned?

PERFORMANCE

1. How are you measuring success and conversely measuring potential stress in the system?
    a. For Example: The State Auditor General measures financial "stress" levels specific to Plant Maintenance and Operations in terms of Cost per Gross Square foot and Cost per Student, are you in agreement with these metrics of success? Please explain your position.
2. Are additional Key Performance Metrics (KPI's) or equivalent measures of performance specific to Plant Maintenance and Operations used at a district or school level? If so, please explain the metric(s).
3. Are there any requirements by the district regarding the implementation and or development of "best known methods" or similar performance evaluations? If so, please define the districts approach to evolving industry standards?
4. Does the district utilize benchmarking data as published by BOMA, or an equivalent source, as a metric of facility performance?
    a. Does the district partner with neighboring districts in terms of sharing processes / procedures, leveraging third party spend, utilizing building system expertise?
5. When prioritizing work, is potential influence on academic achievement accounted? Are facility performance metrics tied to academic performance at the district? If so, please explain?
6. Are you aware of studies linking the performance of building systems to student academic success? If so, have steps been taken to replicate the spend?

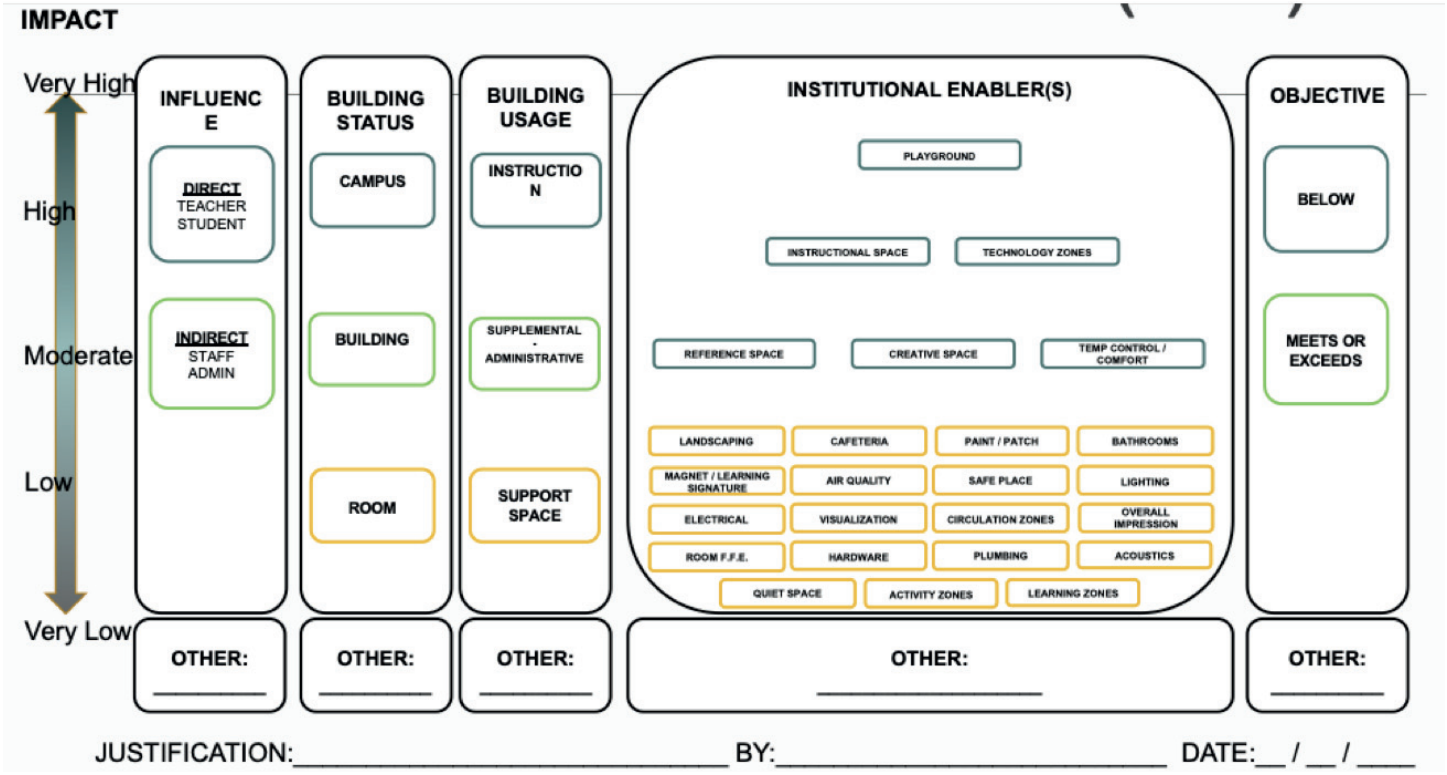
BUDGETING

1. Please describe the process by which you establish the annual Plant Maintenance and Operations Budget? For example, is the budget developed Top Down, Bottom Up, Zero Baseline or similar?
    a. Who or which department(s) participates in the Facilities budgeting process?
    b. Are you, as the senior Facilities Director, a contributing member in the districts budgeting process?
2. Please speak to the districts approach to defining and proliferating Capital Expense requirements?
    a. Is there a Capital Expense threshold and if so what is that threshold?
    b. Is there written process and or procedure in place at the schools regarding Capital Expense?
3. Are purchase cards (PCards) used by the district?
    a. If yes, are PCards issued for the purpose of facility maintenance held by the Principle's office, the schools site Facility Manager, or are PCards held at the district level?
    b. How often are PCards purchases reconciled?
4. Please walk me through which Building Systems are outsourced to third party facility maintenance providers and why?
    a. What percentage of plant maintenance and operations is currently outsourced?
    b. What is the preferred method for procuring such services PCard, Purchase Orders, or Service Contract(s)?
    c. Does the District and or Schools within the district utilize "open" purchase orders?
    d. Are service contracts for outsourced services established and managed at a district level or at the school level
    e. Are contractor certificates of insurance on file with the district
5. Are Utility spends captured in USFR Cost Code 2600? If so, is would you please walk me through how to identify that spend?

APPENDIX E

INITIAL DECISION SUPPORT TOOL

(Beauregard and Ayer, 2019)


IMPACT
Very High
High
Moderate
Low
Very Low
INFLUENCE
DIRECT
TEACHER
STUDENT
INDIRECT
STAFF
ADMIN
BUILDING STATUS
CAMPUS
BUILDING
ROOM
BUILDING USAGE
INSTRUCTION
SUPPLEMENTAL - ADMINISTRATIVE
SUPPORT SPACE
INSTITUTIONAL ENABLER(S)
PLAYGROUND
INSTRUCTIONAL SPACE
TECHNOLOGY ZONES
REFERENCE SPACE
CREATIVE SPACE
TEMP CONTROL / COMFORT
LANDSCAPING
CAFETERIA
PAINT / PATCH
BATHROOMS
MAGNET / LEARNING SIGNATURE
AIR QUALITY
SAFE PLACE
LIGHTING
ELECTRICAL
VISUALIZATION
CIRCULATION ZONES
OVERALL IMPRESSION
ROOM F.F.E.
HARDWARE
PLUMBING
ACOUSTICS
QUIET SPACE
ACTIVITY ZONES
LEARNING ZONES
OBJECTIVE
BELOW
MEETS OR EXCEEDS
OTHER: _____
OTHER: _____
OTHER: _____
OTHER: _____
OTHER: _____
JUSTIFICATION:_____ BY:_____ DATE:__ / __ / ____

APPENDIX F

FOCUS GROUP CONSENT FORM AND SCRIPT

Consent Form

Purpose

You are invited to participate in a study conducted by the Ira A. Fulton School of Sustainable Engineering and the Built Environment at Arizona State University under the supervision of Professor Steven K. Ayer, Ph.D. The purpose of this study is to evaluate a proposed facility maintenance and operations decision-support tool for use in prioritizing routine maintenance of K-12 educational infrastructure. Specifically, we want to understand the relevance and professional application of the proposed tool. We will use this information to support ongoing research in the field of facility maintenance and operations and subsequent publication purposes.

Procedures

If you participate in this study, you will be in a group of approximately seven to nine facility maintenance professionals. There will be a facilitator who will ask questions and facilitate the discussion, and a note-taker to write down the ideas expressed within the group. If you volunteer to participate in this focus group, you will be asked some questions relating to your experience managing facility operations to include the prioritization of routine work orders. These questions will help the researchers to better understand the process by which work is prioritized to include the practical application of the decision-support tool.

The focus group will be audio recorded, with your written consent. Please let the group facilitator know if you do not want to participate in the audio recording. You may elect to change your mind after the focus group has started. Should you elect to terminate your participation in the focus group at any time, please declare your intent to the group facilitator.

If you have any questions concerning the research, please contact the primary investigator Professor Steven K. Ayer, Ph.D. at Sayer@asu.edu or at (480) 965-0557. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Your participation is voluntary. You may withdraw from this study at any time without penalty.

Benefits and Risks

Your participation may benefit you, your facility maintenance colleagues, and K-12 academic Facility Directors by helping to improve the prioritization of routine work orders in accordance with established academic enablers. No risks greater than those experienced in ordinary conversations are anticipated.

Confidentiality

Anonymous data from this study will be analyzed by researchers in the School of Sustainable Engineering and the Built Environment and shared with Arizona State University. No individual participant will be identified or linked to the results. Study records, including this consent form signed by you, may be inspected by the administrators. The results of this study may be presented to Arizona State University representatives; however, your identity will not be disclosed. All information obtained in this study will be kept strictly confidential. All materials will be stored in a secure location within the academic department and access to files will be restricted to paid research staff.

Consent

By signing this consent form, you are indicating that you fully understand the above information and agree to participate in this focus group.

Participant's Signature: _____ Date:_____

Printed Name: _____

Focus Group Script

Welcome and thank you for your participation in this study. The purpose of this gathering is to solicit your experience regarding how facility maintenance and operations can better serve institutional performance through the management and operations of facilities. Specifically, we want to influence the way routine work is prioritized, aligned with the strategic objectives of the parent organization or institution. Learnings from this focus group will be used to modify a proposed decision-support tool to better support to K-12 academic Facility Directors. We recognize you bring a level of expertise that will help us understand how to further developed and improve upon our proposed decision-support tool, which is why you have been asked to participate in this study.

Let me introduce myself. I am Michael Beauregard, a graduate research Ph.D. candidate at ASU and I will be moderating today's discussion. The format we are using is a focus group. A focus group is a conversation that focuses on specific questions in a safe and confidential environment. I will guide the conversation by asking questions that each of you can respond to. There are no right or wrong answers to these questions. Just be honest. If you wish, you can also respond to each other's comments, like you would in an ordinary conversation. It is my job to make sure that everyone here gets to participate and that we stay on track. ASU Assistant Professor Steven K. Ayer, Ph.D. is here to record and summarize your comments.

Before we begin, I want to let you know two things. First, the information we learn today will be compiled into a final report for publication purposes. That report will include a summary of your comments and recommendations. It will be shared with the research team and the dissertation committee. Secondly, you do not have to answer any questions that you do not feel comfortable with. This focus group today is anonymous and confidential. "Anonymous" means that we will not be using your names and you will not be identified as an individual in our report of this project. "Confidential" means that what we say in this room should not be repeated outside of this room. If you would prefer to not answer any questions or discuss any topics that are brought up during this session, you may decline to respond at any time. private.

As you can see, we will be audio recording this focus group. The recording will only be used to make sure our notes are correct and will not be heard by anyone outside of this project.

With that, let's begin with an overview and introductions.

- 5 minutes: Facilitator introduces a TMA work order, speaking to the various aspects of a completed work order
- 5 minutes: Facilitator walks the focus group through the prioritization of that work order utilizing the decision-support tool.

Each of you will be provided 5 work orders selected at random. Each work order includes a decision-support tool for reference. Additionally, your package contains an enlarged decision-support tool. Please take 10 minutes to prioritize the work orders, numbering them from 1 to 5. Work order number 1 represents the work order with the highest priority. Once complete, please stack your documents and raise your hand notifying the facilitator you are complete.

Focus Group Questions

Questions and Probes:

1. Q: Was the tool user friendly? Was the tool intuitive? Please explain?
    a. P: What of subjectivity, did the tool provide an opportunity to force a specific result?
    b. P: Was the time required to understand the process, complete an assessment reasonable?
2. Q: Briefly explain if the categories accurately capture facility infrastructure?
    a. P: Specific to education?
    b. P: What confidence would you have that the five categories identified in the decision-support tool apply to other, non-educational, institutional facility portfolio's?
3. Q: If this decision protocol is applied, what are the consequences and or potential negative impacts you envision?
    a. P: What is your primary concern?
    b. P: Have you considered constrained resources? Would this tool create a real or perceived addition to the work?
4. Q: In your own words, would the tool effectively address and align with the concerns or operations of a facility?
    a. P: Would the tool add value, or perhaps not, please explain?
    b. P: Would the tool provide functional direction?

Closing Questions:

5. Q: If you could make a recommendation on whether or how to proceed with the development of this proposed decision-support tool what would you say?
6. The purpose of this was to explore your feelings and opinions on the use and practical application of the proposed decision support tool.
    a. Q: Is there anything we failed to address or consider in the development of the proposed tool? Please explain
    b. Q: Is there anything you would like to add that we didn't get an opportunity to address?

I see our time has come to an end. Thank you so much for sharing your insight and useful information with us.

APPENDIX G

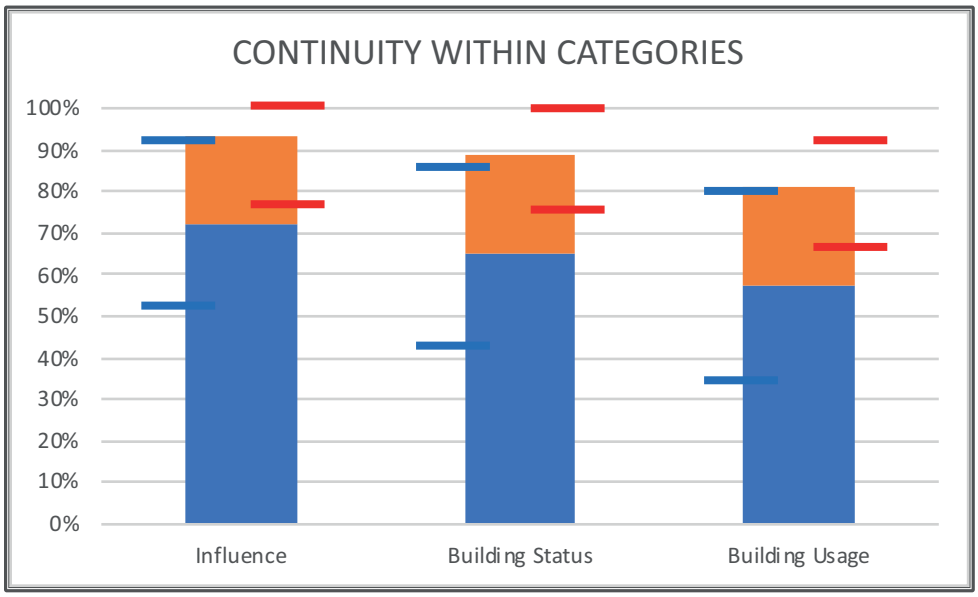
RESULTS OF FOCUS GROUP

GENERAL OBSERVATIONS: Decision Categories: Influence, Building Status & Usage

- Opportunity to improve findings based on the initial data
- Observed relative consistency in the selection of variables defining each of the first three categories
    - Influence 72% (4 variables, two choices)
    - Status 65% (three choices)
    - Usage 57% (4 variables, three choices)

LEARNINGS TO DATE:

- 5 work orders resulted in a split assessment regarding influence and 5 work orders regarding building usage.
- Variables with two or more reasonable definitions may lead to ambiguity; i.e., Teacher / student or supplemental / administrative
- Clarification between a literal read of a work order and an interpretive read of that same work order

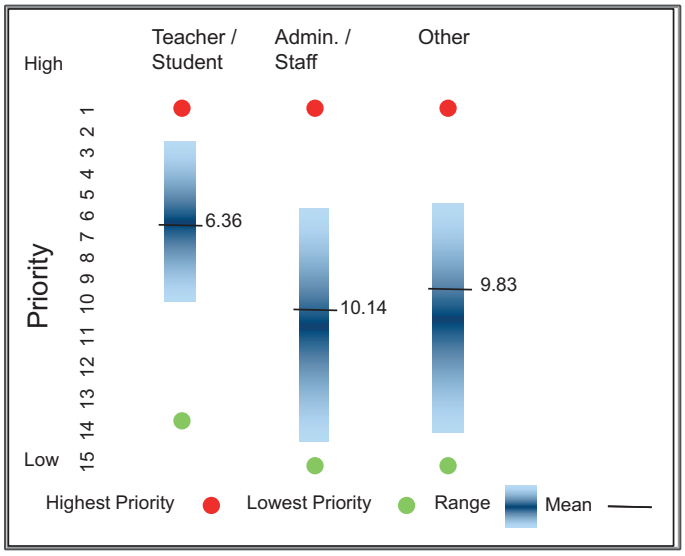


OBSERVATIONS: INFUENCE

- Teacher / student related work orders take clear priority
- 5 of 30 work orders prioritizations split equally between teacher / student and admin. / staff
    - This split is equally present in *building usage*
- Expected to see greater differentiation between admin. / staff and “other”
- Unclear if participant defined ”other” as a summation of teacher / student and admin. / staff or if ”other” is being defined as something more

LEARNINGS TO DATE:

- Students are not submitting work orders, therefore the designation of student in the variable may be misunderstood
- Admin at a district level differs from admin at a school; schools may have the ability to prioritize and close out a work order internally, without the aid of the district facility management staff

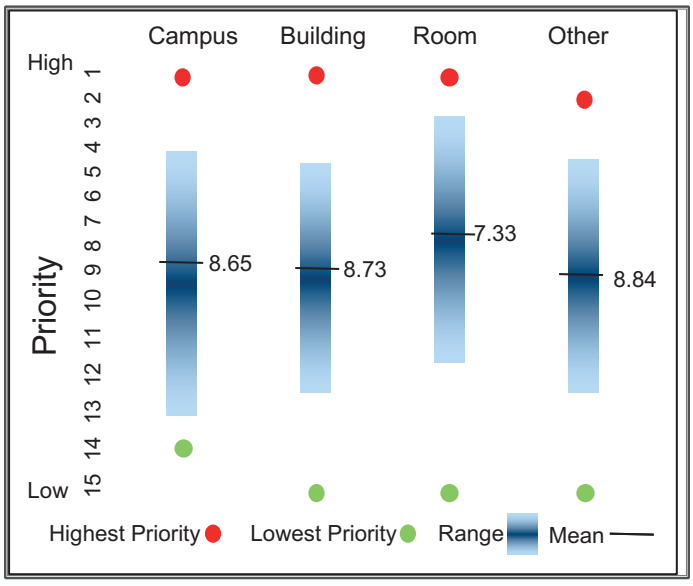


OBSERVATION: BUILDING STATUS

- Room may be artificially high given the relation to teacher / student and instructional space
- 3 of 30 work orders prioritizations split equally between variables, lowering the perceived rate of consistency
- Campus has the largest standard deviation at 4.38
    - Given the definition and higher weight assigned to campus one would expect to see a tighter standard deviation.
- Unclear if participant defined ”other” as a summation of the variables or if ”other” is being defined as something more

LEARNINGS TO DATE:

- Variation in the definition of the decision factors



VARIATION IN THE READING OF THE OF A WORK ORDER

Work Order #	OP-192027	**Request Date**	09/25/2017 11:55
Location ID	Grey H.S. GND – PRKG LOT	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Channel drain behind kitchen falling apart, can we have it repaired/replaced	**Total Hours**	
Priority Description	Routine	**Total Cost**	0

Item Description	Item Number	Item Type	Task Code	Task Description
Parking Lot-PRKG Lot	GHSGND-PRKG LOT	Area	PL11020	Inspection

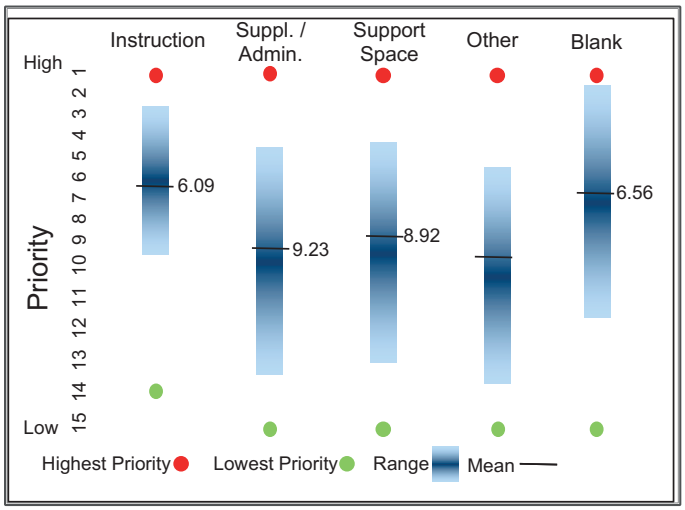
Work Order	Participant	Group	C1	C2	C3	C4-A	C4-B	C4-C
192027	3998	A-1	Staff/Admin	Room	Support Space	Plumbing		
192027	5433	B-1	Staff/Admin	Other	Supplemental - Administrative	Cafeteria	Plumbing	
192027	9313	B-1	Other	Other	Support Space	Plumbing		
192027	8804	B-1	Teacher/Student	Building	Support Space	Cafeteria	Air Quality	Plumbing
192027	5100	A-1	Other	Building	Support Space	Cafeteria		
192027	5326	A-1	Staff/Admin	Room	Support Space	Plumbing		
192027	5196	A-1	Other	Building	Other	Plumbing		

OBSERVATIONS: BUILDING USAGE

- 16 of the 176 work orders do not utilize the building usage category
- Supplemental / administration space was intended to be secondary to instruction
- Results would indicate a relative equal weight within this category, instruction excluded
- Again, it is unclear if participant defined ”other” as a summation of the variables or if ”other” is being defined as something more

LEARNINGS TO DATE:

- Items that impact the classroom are perceived to be of the highest priority
- Variations in the category, specific to a work order, would suggest there is ambiguity in the understanding of the terminology

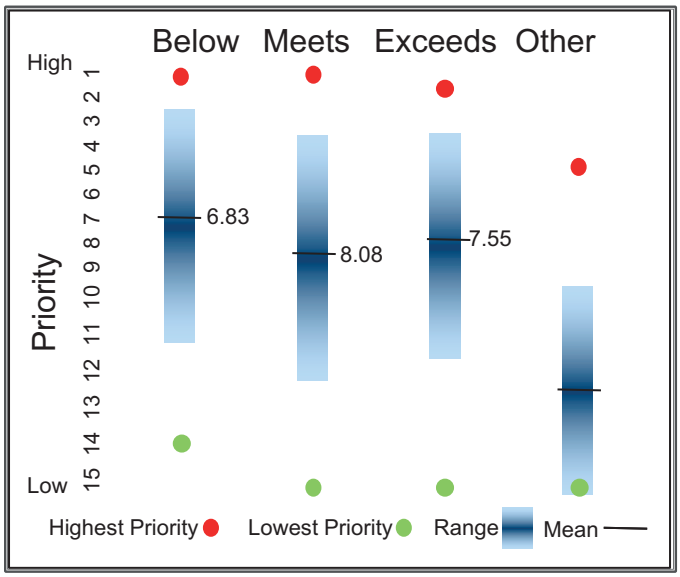


OBSERVATIONS: ACADEMIC ENABLERS

- Two of the participants elected not to categorize the school as instructed
- 3% of work orders identified as out of scope
- 10% when including participant 5196 who identified 10 work orders as out of scope
- Only 1 work order deemed “emergency”
- Mean priority of 2.8 for the 5 work orders identified as “critical”

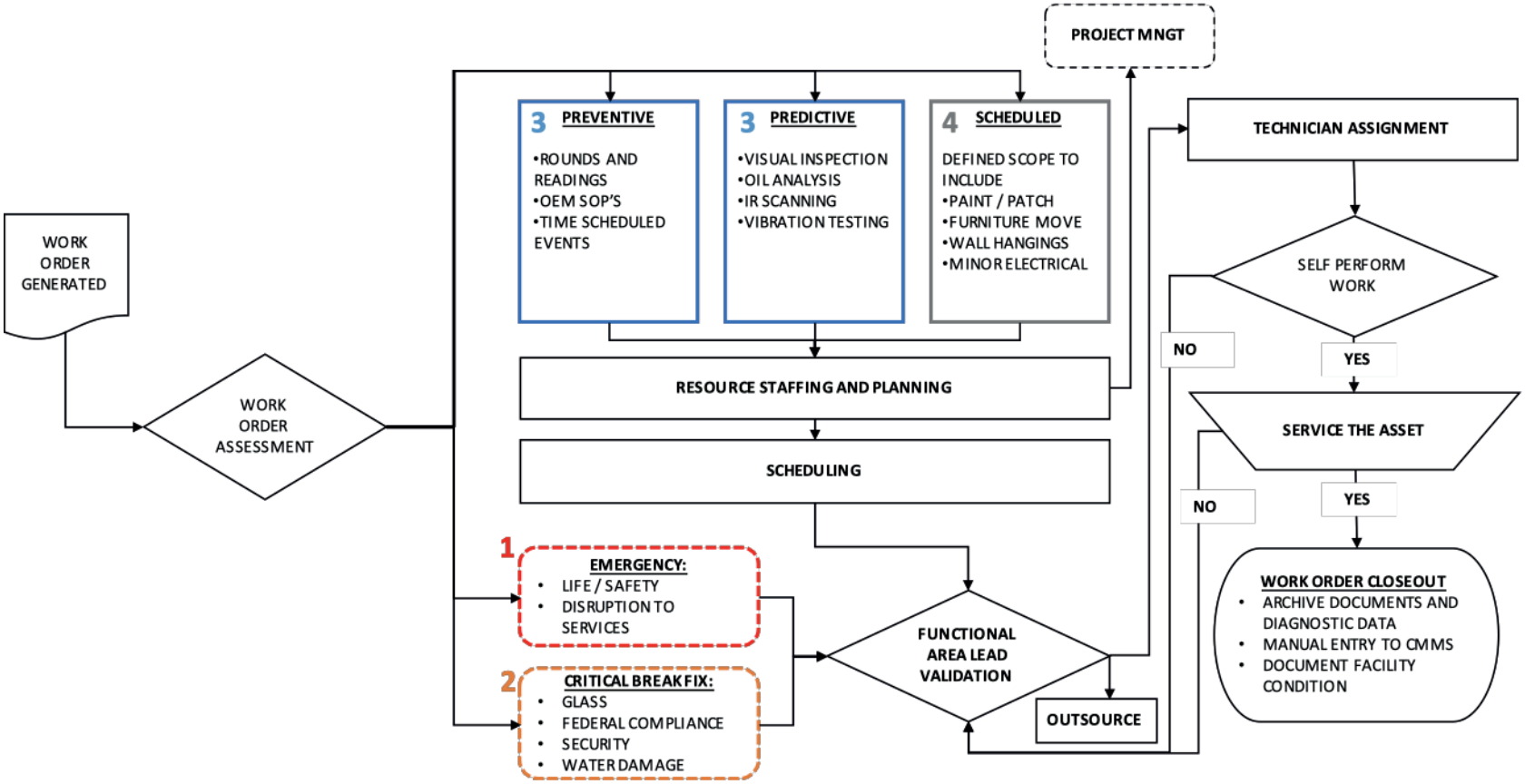
LEARNINGS TO DATE:

- Budget mandates all work orders are corrective
- Emergency repairs are prioritized external to the CMMS system
- Observation of ”meets” influences a slightly lower priority than ”exceeds”



APPENDIX H

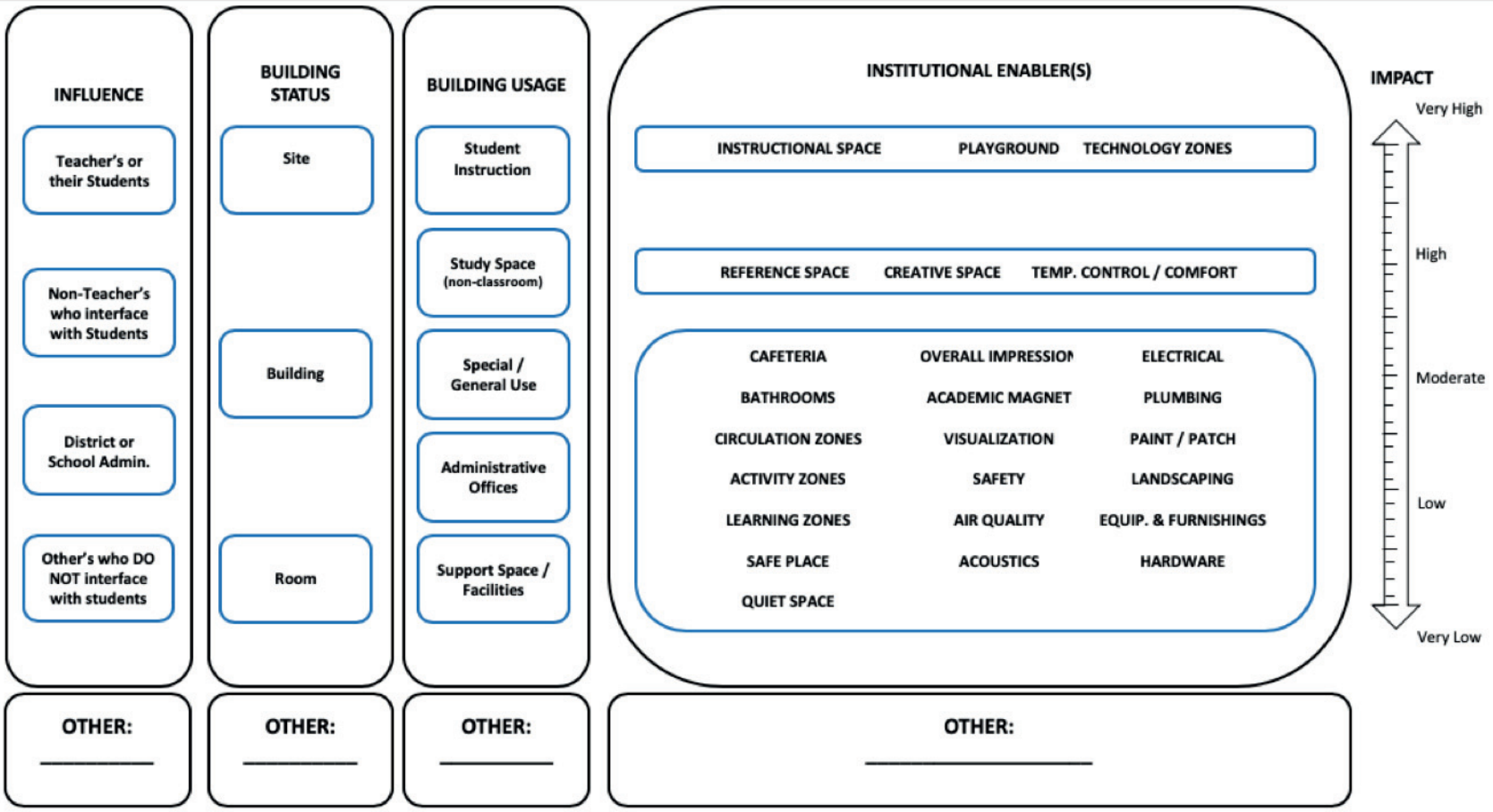
WORK ORDER FLOW DIAGRAM


PROJECT MNGT
WORK ORDER GENERATED
WORK ORDER ASSESSMENT
3 PREVENTIVE
•ROUNDS AND READINGS
•OEM SOP'S
•TIME SCHEDULED EVENTS
3 PREDICTIVE
•VISUAL INSPECTION
•OIL ANALYSIS
•IR SCANNING
•VIBRATION TESTING
4 SCHEDULED
DEFINED SCOPE TO INCLUDE
•PAINT / PATCH
•FURNITURE MOVE
•WALL HANGINGS
•MINOR ELECTRICAL
RESOURCE STAFFING AND PLANNING
SCHEDULING
1
EMERGENCY:
• LIFE / SAFETY
• DISRUPTION TO SERVICES
2
CRITICAL BREAKFIX:
• GLASS
• FEDERAL COMPLIANCE
• SECURITY
• WATER DAMAGE
FUNCTIONAL AREA LEAD VALIDATION
OUTSOURCE
TECHNICIAN ASSIGNMENT
SELF PERFORM WORK
NO
YES
SERVICE THE ASSET
NO
YES
WORK ORDER CLOSEOUT
• ARCHIVE DOCUMENTS AND DIAGNOSTIC DATA
• MANUAL ENTRY TO CMMS
• DOCUMENT FACILITY CONDITION

APPENDIX I

DECISION SUPPORT TOOL

(Adapted from Beauregard and Ayer, 2019)


INFLUENCE
Teacher's or their Students
Non-Teacher's who interface with Students
District or School Admin.
Other's who DO NOT interface with students
BUILDING STATUS
Site
Building
Room
BUILDING USAGE
Student Instruction
Study Space (non-classroom)
Special / General Use
Administrative Offices
Support Space / Facilities
INSTITUTIONAL ENABLER(S)
INSTRUCTIONAL SPACE
PLAYGROUND
TECHNOLOGY ZONES
REFERENCE SPACE
CREATIVE SPACE
TEMP. CONTROL / COMFORT
CAFETERIA
OVERALL IMPRESSION
ELECTRICAL
BATHROOMS
ACADEMIC MAGNET
PLUMBING
CIRCULATION ZONES
VISUALIZATION
PAINT / PATCH
ACTIVITY ZONES
SAFETY
LANDSCAPING
LEARNING ZONES
AIR QUALITY
EQUIP. & FURNISHINGS
SAFE PLACE
ACOUSTICS
HARDWARE
QUIET SPACE
IMPACT
Very High
High
Moderate
Low
Very Low
OTHER: _____
OTHER: _____
OTHER: _____
OTHER: _____
JUSTIFICATION:_____ BY:_____ DATE:__ / __ / ____

APPENDIX J

INSTITUTIONAL REVIEW BOARD CONSENT FORM

Purpose

You are invited to participate in a study conducted by the Ira A. Fulton School of Sustainable Engineering and the Built Environment at Arizona State University under the supervision of Professor Steven K. Ayer, Ph.D.. The purpose of this study is to evaluate a proposed facility maintenance and operations decision-support tool for use in prioritizing routine maintenance of K-12 educational infrastructure. Specifically, we want to understand the extent to which this tool enables consistent decision-making. We will use this information to support ongoing research in the field of facility maintenance and operations and subsequent publications.

Procedures

If you participate in this study, you will be in a group of several other individuals. There will be a facilitator who will ask questions and facilitate the activity. If you volunteer to participate in this activity, you will be asked to complete a pre and post-activity questionnaire relating to your experience managing facility operations and prioritizing routine work orders (if you have any) as well as your assessment of the decision-support tool provided. Your responses will help the researchers to understand better how work is prioritized to support practical application of the decision support tool.

You may elect to change your mind after the activity has started and stop participation. Should you choose to terminate your participation in the activity at any time, please declare your intent to the facilitator.

If you have any questions concerning the research, please contact the primary investigator Professor Steven K. Ayer, Ph.D. at Sayer@asu.edu or at (480) 965-0557. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Your participation is voluntary. You may withdraw from this study at any time without penalty.

Benefits and Risks

Your participation may benefit you, your facility maintenance colleagues, and K-12 academic Facility Directors by helping to improve the prioritization of routine work orders in accordance with established academic enablers. No risks greater than those experienced in ordinary conversations are anticipated.

Confidentiality

Anonymous data from this study will be analyzed by researchers in the School of Sustainable Engineering and the Built Environment and shared with Arizona State University. No individual participant will be identified or linked to the results. Study records, including this consent form signed by you, may be inspected by the administrators. The results of this study may be presented in publications, but your identity will not be

disclosed. All information obtained in this study will be kept strictly confidential. All materials will be stored in a secure location within the academic department and access to files will be restricted to paid research staff.

Consent

By signing this consent form, you are indicating that you fully understand the above information and agree to participate in this study.

Participant's
Signature: _____ Date:_____

Printed Name: _____

APPENDIX K

EXPERIENCE OF PARTICIPATING FACILITY ADMINISTRATORS

	Participant #	Experience	Functional Area	Experience Prioritizing Work Orders
1	4653	>15 Years	OTHER	YES
2	9824	>15 Years	OPERATIONS	YES
3	8992	>15 Years	OPERATIONS	YES
4	3462	>15 Years	OPERATIONS	YES
5	8077	>15 Years	DIRECTOR	YES
6	9424	>15 Years	OPERATIONS	YES
7	4136	>15 Years	DIRECTOR	YES
8	7862	>15 Years	OTHER	YES
9	2884	>15 Years	OPERATIONS	YES
10	2600	>15 Years	CUSTODIAL	YES
11	2648	>15 Years	OPERATIONS	YES
12	4670	>15 Years	OTHER	
13	2622	>15 Years	OPERATIONS	YES
14	6625	>15 Years	OPERATIONS	YES
15	2139	10 - 15 Years	CUSTODIAL	YES
16	1669	10 - 15 Years	OPERATIONS	
17	6733	10 - 15 Years	OTHER	YES
18	2056	10 - 15 Years	OTHER	YES
19	2425	10 - 15 Years	OPERATIONS	YES
20	1659	5 - 10 Years	CUSTODIAL	YES
21	9310	5 - 10 Years	OTHER	YES
22	3737	5 - 10 Years	TECHNICAL SERVICE	YES
23	9146	5 - 10 Years	OTHER	YES
24	8730	5 - 10 Years	OPERATIONS	YES
25	6413	Less than 5 Years	OPERATIONS	YES
26	5921	Less than 5 Years	DIRECTOR	NO
27	5291	Less than 5 Years	OPERATIONS	YES
28	3101	Less than 5 Years	OPERATIONS	YES
29	3113	Less than 5 Years	OTHER	YES
30	3466	Less than 5 Years	TECHNICAL SERVICE	YES
31	3665	Less than 5 Years	OTHER	YES

APPENDIX L

RESULTS OF THE PRE AND POST ACTIVITY QUESTIONNAIRE

Paired Questions:

1. To what extent do you believe your current organization's prioritization of work supports the goals of the district?
2. To what extent do you believe your organization's process of prioritizing work is consistent?

3. To what extent do you believe your organization's current process of prioritizing work is easily understood?

5. To what extent are you familiar with the strategic objectives of the school district?

6. How well does the process of prioritizing work orders align with the strategic objectives of the district?

7. How likely do you believe the current process of prioritizing work enables improved educational outcomes?

8. To what extent do you agree the physical condition of a school relates to academic outcomes?

Residual Post-Activity Questions:

4. Is there ever a need to document the justification of prioritizing one work order over another?

9. To what extent do you believe the variables within each category accurately capture the facility portfolio of the academic district?

10. To what extent would you be willing to use this tool for prioritizing routine maintenance in the future?

11. To what extent do you agree with the suggested content of the proposed decision support tool?

12. To what extent would you be willing to require new hires use the decision support tool for the prioritization of routine work?

13. To what extent do you believe the decision support tool would likely offer the Facility Maintenance department value by supporting evidence-based justifications for higher FM budget requests?

Pre-Activity Questionnaire Results									
Participant # and Question		1	2	3	4	5	6	7	8
1	4653	5	4	4	YES	5	4	4	5
2	9824	5	5	4	YES	5	5	5	5
3	8992	3	1	2	YES	5	1	4	4
4	3462	4	4	4	YES	5	3	3	4
5	8077	3	3	2	YES	4	3	3	5
6	9424	4	4	3	YES	4	3	3	4
7	4136	5	4	2	NO	4	4	5	5
8	7862	4	3	3	YES	5	4	4	5
9	2884	4	4	3	YES	4	4	4	4
10	2600	4	2	4	YES	3	3	4	4
11	2648	4	4	5	NO	2	3	4	5
12	4670	4	3	3	NO	4	4	4	4
13	2622	4	4	3	NO	4	4	4	5
14	6625	5	4	4	YES	5	4	4	4
15	2139	4	2	3	NO	4	3	3	5
16	1669	4	4	4	NO	4	4	4	5
17	6733	4	4	4	YES	4	4	4	5
18	2056	5	4	2	YES	5	4	5	4
19	2425	4	2	4	YES	3	4	4	5
20	1659	4	2	3	NO	4	3	3	5
21	9310	5	3	2	YES	4	4	4	5
22	3737	4	1	1	NO	4	3	3	1
23	9146	2	3	3	NO	3	3	3	4
24	8730	4	4	4	NO	4	4	4	5
25	6413	4	4	4	NO	4	4	4	5
26	5921	2	2	2	YES	4	2	4	4
27	5291	3	2	3	YES	4	3	2	5
28	3101	5	4	4	YES	4	4	4	2
29	3113	4	4	2	YES	5	4	3	3
30	3466	5	5	5	YES	5	5	5	5
31	3665	2	2	1	YES	3	3	2	5
	Mean	3.9677	3.2581	3.129	64% Yes	4.0968	3.5484	3.7419	4.3871
	Median	4	4	3	36% No	4	4	4	5
	Standard Deviation	0.8608	1.0767	1.0393		0.7342	0.7967	0.7606	0.9394

		Post-Activity Questionnaire Results												
Participant # and Question		1	2	3	5	6	7	8	9	10	11	12	13	14
1	4653	5	5	4	4	5	5	5	4	5	5	5	5	5
2	9824	5	5	4	5	5	5	4	5	5	4	4	5	5
3	8992	2	1	2	1	4	4	4	3	4	4	4	3	4
4	3462	4	3	3	3	3	4	5	4	4	4	4	3	4
5	8077	4	3	3	3	3	5	5	4	4	5	5	5	5
6	9424	3	4	4	4	4	4	4	4	4	4	4	4	4
7	4136	4	4	3	4	3	4	4	4	4	5	5	4	4
8	7862	4	3	3	4	5	5	3	4	4	4	4	3	4
9	2884	3	4	3	4	3	4	3	4	4	4	0	0	0
10	2600	3	2	2	3	3	3	3	3	3	3	3	3	3
11	2648	3	3	4	4	3	4	3	3	3	3	3	3	3
12	4670	2	3	2	3	2	4	3	4	4	4	3	3	3
13	2622	4	4	4	3	4	5	5	5	4	5	5	5	4
14	6625	4	4	4	4	4	4	5	5	4	5	4	5	4
15	2139	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1669	4	4	4	4	4	4	4	4	4	4	4	3	3
17	6733	4	4	4	4	4	5	4	4	4	3	4	3	3
18	2056	0	0	0	0	0	0	0	0	0	0	0	0	0
19	2425	4	4	3	3	4	4	4	4	3	4	4	4	4
20	1659	3	2	2	3	3	5	3	4	4	4	4	4	4
21	9310	5	3	2	4	4	3	5	5	4	5	4	5	5
22	3737	4	1	3	4	3	3	4	4	3	4	4	5	3
23	9146	2	4	3	5	4	4	5	4	4	5	5	4	5
24	8730	0	0	0	0	0	0	0	0	0	0	0	0	0
25	6413	4	2	4	2	3	5	2	3	2	5	4	5	4
26	5921	4	3	3	3	3	5	3	4	4	4	4	4	4
27	5291	3	2	2	2	2	4	5	4	4	4	4	4	4
28	3101	5	4	4	4	5	3	4	4	4	3	4	5	4
29	3113	4	3	2	4	3	3	4	4	4	4	4	4	4
30	3466	2	5	4	5	4	4	3	2	2	2	2	1	2
31	3665	2	1	1	3	2	4	4	4	2	3	3	4	5
Mean		3.2258	2.9032	2.7742	3.1935	3.1935	3.7419	3.5484	3.5484	3.3548	3.6452	3.4516	3.4194	3.4194
Median		4	3	3	4	3	4	4	4	4	4	4	4	4
Standard Deviation		1.3845	1.4448	1.2368	1.3541	1.33	1.3905	1.4105	1.3159	1.3087	1.4039	1.4775	1.6019	1.4978
		0.036	0.036	0.412	0.006	0.373	0.332	0.006						
P-Value		-0.742	-0.355	-0.355	-0.903	-0.355	0	-0.839						

APPENDIX M

μ WORK ORDER RANK PER ACTIVITY AND FUNCTIONAL AREA

Functional Area	μ R1 Ranking	μ R2:Comprehensive Ranking	μ R2:Impact Ranking	μ Pairwise Ranking
Electrical	**7**	**9**	**8**	**9**
Work Order 1	1	7	4	9
2	7	7	8	6
3	13	12	13	11
4	3	7	4	6
5	6	9	8	10
6	12	11	11	11
F.L.S.	**5**	**7**	**7**	**8**
1	4	5	6	10
2	6	8	9	8
Geneneral Maintenance	**9**	**9**	**9**	**8**
1	8	14	15	14
2	7	9	9	11
3	13	8	9	6
4	12	5	6	3
5	4	8	8	8
6	8	11	12	12
7	11	9	10	8
8	8	11	11	10
9	9	10	10	7
10	9	8	8	9
11	5	5	4	6
12	9	8	8	5
I.T.	**8**	**4**	**4**	**4**
1	8	4	4	4
Mechanical	**5**	**4**	**4**	**3**
1	6	4	4	3
2	3	4	3	2
3	5	4	4	3
4	7	6	5	4
Plumbing	**11**	**10**	**10**	**11**
1	12	10	9	11
2	9	10	10	11
3	9	8	9	10
4	12	10	10	10
5	14	11	11	12

APPENDIX N

ACTIVITY WORK ORDERS AND PRIORITIZATION RESULTS

Work Order #	OP-190023	**Request Date**	09/22/2017
Location ID	Purple Elem. – Elec. Closet	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Switchgear in elect. Closet shows signs of arching	**Total Hours**	2
Priority Description	Routine Maintenance	**Total Cost**	

Item Description	Item Number	Item Type	Task Code	Task Description
Elec. Closet	Purple Elem.	Elec. Closet	EL4300	Inspect and test switchgear - Electrical

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Electrical	OP-190023		3	3	2
Electrical	OP-190023		8	2	1
Electrical	OP-190023		7	7	8
Electrical	OP-190023			1	4
Electrical	OP-190023		1	1	9
Electrical	OP-190023		10	6	9
Electrical	OP-190023		11		12
Electrical	OP-190023		11	11	13
Electrical	OP-190023		8	6	13
Electrical	OP-190023		2	1	14
Electrical	OP-190023		12		12
Electrical	OP-190023		9	1	9
Electrical	OP-190023		1	2	15
Electrical	OP-190023	2			
Electrical	OP-190023	1			
Electrical	OP-190023		2	1	
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	5			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	2			
Electrical	OP-190023	3			
Electrical	OP-190023	1			
Electrical	OP-190023	1			
Electrical	OP-190023	1			

Work Order #	OP-191874	**Request Date**	09/20/2017 08:20
Location ID	Brown Elem. - 101	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	There is a GFI outlet on the smaller sink that only one of the outlets is working. Can this be looked at?	**Total Hours**	1.0
Priority Description	Routine	**Total Cost**	29.09

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom/Preschool 101	Brown Elem. - 101	Area	EL4005	Repair/Replace Switches or Receptacles

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Electrical	OP-191874		2		1
Electrical	OP-191874		7		2
Electrical	OP-191874		5	8	2
Electrical	OP-191874		5	5	2
Electrical	OP-191874		4	4	5
Electrical	OP-191874		7	8	7
Electrical	OP-191874		6	6	6
Electrical	OP-191874		8	9	4
Electrical	OP-191874		6	9	5
Electrical	OP-191874		10	11	8
Electrical	OP-191874		5	5	8
Electrical	OP-191874		9	10	14
Electrical	OP-191874		11	10	14
Electrical	OP-191874	13			
Electrical	OP-191874	2			
Electrical	OP-191874		6	6	
Electrical	OP-191874	8			
Electrical	OP-191874	7			
Electrical	OP-191874	7			
Electrical	OP-191874	11			
Electrical	OP-191874	6			
Electrical	OP-191874	2			
Electrical	OP-191874	6			
Electrical	OP-191874	4			
Electrical	OP-191874	8			
Electrical	OP-191874	12			
Electrical	OP-191874	11			
Electrical	OP-191874	10			
Electrical	OP-191874	9			
Electrical	OP-191874	5			
Electrical	OP-191874	5			

Work Order #	OP-191886	**Request Date**	09/20/2017 12:04
Location ID	Grey H.S. - GROUNDS	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Can we get a quote to see what it would take to run electricity up to top of visitors side bleachers?	**Total Hours**	2.5
Priority Description	Routine	**Total Cost**	72.73

Item Description	Item Number	Item Type	Task Code	Task Description
Grounds - GROUNDS	Grey H.S. - GROUNDS	Area	EL4015	Install/Replace elect. wiring

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Electrical	OP-191886		15	13	7
Electrical	OP-191886		8		8
Electrical	OP-191886		8	8	10
Electrical	OP-191886		13		9
Electrical	OP-191886		13	14	11
Electrical	OP-191886		15	15	8
Electrical	OP-191886		14		12
Electrical	OP-191886		6	14	11
Electrical	OP-191886		13	13	14
Electrical	OP-191886		13	13	10
Electrical	OP-191886		13	13	11
Electrical	OP-191886		14	13	15
Electrical	OP-191886		11	14	15
Electrical	OP-191886	14			
Electrical	OP-191886	15			
Electrical	OP-191886		9	9	
Electrical	OP-191886	15			
Electrical	OP-191886	10			
Electrical	OP-191886	14			
Electrical	OP-191886	15			
Electrical	OP-191886	12			
Electrical	OP-191886	13			
Electrical	OP-191886	5			
Electrical	OP-191886	15			
Electrical	OP-191886	12			
Electrical	OP-191886	15			
Electrical	OP-191886	15			
Electrical	OP-191886	14			
Electrical	OP-191886	15			
Electrical	OP-191886	9			
Electrical	OP-191886	13			

Work Order #	OP-191910	**Request Date**	09/20/2017 15:19
Location ID	Orange M.S. - 121	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	The light switch it's broken and it's doing short circuit. Thanks.	**Total Hours**	1.5
Priority Description	Routine	**Total Cost**	43.64

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom/Vacant 121	Orange M.S. - 121	Area	EL4005	Repair/Replace Switches or Recepticles

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Electrical	OP-191910		1	1	1
Electrical	OP-191910		8	7	4
Electrical	OP-191910		2	2	3
Electrical	OP-191910		4	3	3
Electrical	OP-191910		2	1	1
Electrical	OP-191910		3	2	3
Electrical	OP-191910		4	8	4
Electrical	OP-191910		3	2	6
Electrical	OP-191910			2	6
Electrical	OP-191910		12	3	8
Electrical	OP-191910		14		14
Electrical	OP-191910		15		14
Electrical	OP-191910		15	13	15
Electrical	OP-191910	1			
Electrical	OP-191910	3			
Electrical	OP-191910		4	2	
Electrical	OP-191910	3			
Electrical	OP-191910	4			
Electrical	OP-191910	3			
Electrical	OP-191910	2			
Electrical	OP-191910	2			
Electrical	OP-191910	1			
Electrical	OP-191910	2			
Electrical	OP-191910	2			
Electrical	OP-191910	3			
Electrical	OP-191910	3			
Electrical	OP-191910	1			
Electrical	OP-191910	7			
Electrical	OP-191910	2			
Electrical	OP-191910	6			
Electrical	OP-191910	4			

Work Order #	OP-191913	**Request Date**	09/20/2017 15:26
Location ID	Orange M.S. - RR	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	The light in restroom next to room 108 it's not on. Lightbulb was replaced but still off probably the ballast it's damage. Thanks	**Total Hours**	2.0
Priority Description	Routine	**Total Cost**	58.18

Item Description	Item Number	Item Type	Task Code	Task Description
Boy's Restroom	Orange M.S. - RR	Area	EL4000	Repair/Replace Lights

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Electrical	OP-191913		12		7
Electrical	OP-191913		11	9	9
Electrical	OP-191913		10	10	12
Electrical	OP-191913		6	4	9
Electrical	OP-191913		9	8	10
Electrical	OP-191913		13	12	10
Electrical	OP-191913		4	4	10
Electrical	OP-191913		10	10	10
Electrical	OP-191913		11		10
Electrical	OP-191913		7	7	11
Electrical	OP-191913		12	11	12
Electrical	OP-191913		8	11	12
Electrical	OP-191913	6			
Electrical	OP-191913	6			
Electrical	OP-191913		7	5	
Electrical	OP-191913	11			
Electrical	OP-191913	8			
Electrical	OP-191913	6			
Electrical	OP-191913	7			
Electrical	OP-191913	3			
Electrical	OP-191913	3			
Electrical	OP-191913	3			
Electrical	OP-191913	3			
Electrical	OP-191913	9			
Electrical	OP-191913		2	6	
Electrical	OP-191913	13			
Electrical	OP-191913	6			
Electrical	OP-191913	6			
Electrical	OP-191913	4			
Electrical	OP-191913	7			
Electrical	OP-191913	6			

Work Order #	OP-196576	**Request Date**	09/22/2018
Location ID	ADMIN. OFFICES	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Check Outlet in Office 318	**Total Hours**	1
Priority Description		**Total Cost**	

Item Description	Item Number	Item Type	Task Code	Task Description
electrical	Admin Offices - 318	318	EL6576	Check electrical outlet on wall

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Electrical	OP-196576		13	13	6
Electrical	OP-196576		9	9	7
Electrical	OP-196576		15	15	11
Electrical	OP-196576		6	6	11
Electrical	OP-196576		11	11	10
Electrical	OP-196576		8	8	7
Electrical	OP-196576		6	6	9
Electrical	OP-196576		6	10	12
Electrical	OP-196576		14	14	12
Electrical	OP-196576		10	10	
Electrical	OP-196576		15	15	15
Electrical	OP-196576		14	14	9
Electrical	OP-196576		15	15	13
Electrical	OP-196576		11	11	12
Electrical	OP-196576		14		13
Electrical	OP-196576		15	12	14
Electrical	OP-196576		13	6	14
Electrical	OP-196576	15			
Electrical	OP-196576	7			
Electrical	OP-196576	15			
Electrical	OP-196576	13			
Electrical	OP-196576	13			
Electrical	OP-196576	6			
Electrical	OP-196576	13			
Electrical	OP-196576	13			
Electrical	OP-196576	11			
Electrical	OP-196576	10			
Electrical	OP-196576	11			
Electrical	OP-196576	14			
Electrical	OP-196576	14			
Electrical	OP-196576	8			

Work Order #	OP-192025	**Request Date**	09/25/2017 09:20
Location ID	Blue H.S. -FLDHOUSE	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Football stadium: Fire Sprinkler system under bleachers is leading water on South end at coupling. Need repaired	**Total Hours**	2.00
Priority Description	Routine	**Total Cost**	62.28

Item Description	Item Number	Item Type	Task Code	Task Description
Field House	Blue H.S. - FLDHOUSE	Area	PL11025	Fire Sprinkler Water Line

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Fire Life Safety	OP-192025		5	5	6
Fire Life Safety	OP-192025		4	7	6
Fire Life Safety	OP-192025		6	6	8
Fire Life Safety	OP-192025		4	4	9
Fire Life Safety	OP-192025		1	1	7
Fire Life Safety	OP-192025		5	5	9
Fire Life Safety	OP-192025		1	1	11
Fire Life Safety	OP-192025		9	8	10
Fire Life Safety	OP-192025		8	8	8
Fire Life Safety	OP-192025		13	13	13
Fire Life Safety	OP-192025		9	9	11
Fire Life Safety	OP-192025		1	1	12
Fire Life Safety	OP-192025		4	4	10
Fire Life Safety	OP-192025		3	11	10
Fire Life Safety	OP-192025		11	11	13
Fire Life Safety	OP-192025	8			
Fire Life Safety	OP-192025	4			
Fire Life Safety	OP-192025	3			
Fire Life Safety	OP-192025	1			
Fire Life Safety	OP-192025		1	1	
Fire Life Safety	OP-192025	1			
Fire Life Safety	OP-192025	4			
Fire Life Safety	OP-192025	1			
Fire Life Safety	OP-192025	6			
Fire Life Safety	OP-192025	2			
Fire Life Safety	OP-192025	8			
Fire Life Safety	OP-192025	4			
Fire Life Safety	OP-192025	2			
Fire Life Safety	OP-192025		6		
Fire Life Safety	OP-192025	1			
Fire Life Safety	OP-192025	10			

Work Order #	OP-193957	**Request Date**	11/20/2017 08:38
Location ID	Blue H.S. - GROUNDS	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Can we get the stadium area cleaned up and the field groomed today or tomorrow, we are host some state championship football games this weekend	**Total Hours**	2.0
Priority Description	Routine	**Total Cost**	44.12

Item Description	Item Number	Item Type	Task Code	Task Description
Grounds - GROUNDS	Blue H.S. - GROUNDS	Area	GR5001	Athletic Grounds Field Prep

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Fire Life Safety	OP-193957		2	2	2
Fire Life Safety	OP-193957		3	7	5
Fire Life Safety	OP-193957		13	13	1
Fire Life Safety	OP-193957		12	15	6
Fire Life Safety	OP-193957		9	9	5
Fire Life Safety	OP-193957		8		6
Fire Life Safety	OP-193957		5	3	8
Fire Life Safety	OP-193957		13	12	11
Fire Life Safety	OP-193957		8	8	6
Fire Life Safety	OP-193957		6	6	8
Fire Life Safety	OP-193957		10	10	6
Fire Life Safety	OP-193957		7	7	10
Fire Life Safety	OP-193957		3	4	8
Fire Life Safety	OP-193957		10	9	13
Fire Life Safety	OP-193957		5	12	13
Fire Life Safety	OP-193957		12	13	12
Fire Life Safety	OP-193957	3			
Fire Life Safety	OP-193957	2			
Fire Life Safety	OP-193957	2			
Fire Life Safety	OP-193957	9			
Fire Life Safety	OP-193957		7	7	
Fire Life Safety	OP-193957	9			
Fire Life Safety	OP-193957	1			
Fire Life Safety	OP-193957	2			
Fire Life Safety	OP-193957	11			
Fire Life Safety	OP-193957	4			
Fire Life Safety	OP-193957	6			
Fire Life Safety	OP-193957	3			
Fire Life Safety	OP-193957	13			
Fire Life Safety	OP-193957	6			
Fire Life Safety	OP-193957	7			

Work Order #	OP-191867	**Request Date**	09/20/2017 09:16
Location ID	Purple Elem. - MPRM	**Completion Date**	
WO Type Description	Corrective Maintenance		
Request	Check outlet in MPR	**Total Hours**	1.0
Priority Description	Routine	**Total Cost**	29.09

Item Description	Item Number	Item Type	Task Code	Task Description
Multipurpose/Multipurpose Room - MP	Purple Elem. - MPRM	Area	EL4005	Repair/Replace Switches or Recepticles

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-191867		15		13
General Maintenance	OP-191867		15	15	15
General Maintenance	OP-191867		14	14	13
General Maintenance	OP-191867		13	14	13
General Maintenance	OP-191867		14	14	15
General Maintenance	OP-191867		14	15	14
General Maintenance	OP-191867		15		13
General Maintenance	OP-191867		12	14	14
General Maintenance	OP-191867		14		15
General Maintenance	OP-191867		15	15	14
General Maintenance	OP-191867		13	15	15
General Maintenance	OP-191867		14	15	12
General Maintenance	OP-191867		14	14	14
General Maintenance	OP-191867	5			
General Maintenance	OP-191867	8			
General Maintenance	OP-191867		15	15	
General Maintenance	OP-191867	6			
General Maintenance	OP-191867	5			
General Maintenance	OP-191867	11			
General Maintenance	OP-191867	14			
General Maintenance	OP-191867	11			
General Maintenance	OP-191867	10			
General Maintenance	OP-191867	8			
General Maintenance	OP-191867	5			
General Maintenance	OP-191867	11			
General Maintenance	OP-191867	9			
General Maintenance	OP-191867	7			
General Maintenance	OP-191867	12			
General Maintenance	OP-191867	3			
General Maintenance	OP-191867	8			
General Maintenance	OP-191867	7			

Work Order #	OP-191956	**Request Date**	09/21/2017 15:11
Location ID	Red M.S. - ENT	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Trim on the outside is bubbling and needs to be replaced. Multiple water leaks	**Total Hours**	31.0
Priority Description	Routine	**Total Cost**	2746.45

Item Description	Item Number	Item Type	Task Code	Task Description
Entire Area - ENT	Red M.S. - ENT	Area	GM17000	General Maintenance

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-191956		4	3	2
General Maintenance	OP-191956		5	6	6
General Maintenance	OP-191956		10		8
General Maintenance	OP-191956		8	9	10
General Maintenance	OP-191956		3	3	9
General Maintenance	OP-191956		13	12	12
General Maintenance	OP-191956		12	12	12
General Maintenance	OP-191956		13		11
General Maintenance	OP-191956		12	11	12
General Maintenance	OP-191956		10		13
General Maintenance	OP-191956		14	12	13
General Maintenance	OP-191956		3	15	15
General Maintenance	OP-191956		10	10	14
General Maintenance	OP-191956	4			
General Maintenance	OP-191956	5			
General Maintenance	OP-191956		8	8	
General Maintenance	OP-191956	4			
General Maintenance	OP-191956	2			
General Maintenance	OP-191956	4			
General Maintenance	OP-191956	5			
General Maintenance	OP-191956	4			
General Maintenance	OP-191956	11			
General Maintenance	OP-191956	15			
General Maintenance	OP-191956	14			
General Maintenance	OP-191956	5			
General Maintenance	OP-191956	8			
General Maintenance	OP-191956	9			
General Maintenance	OP-191956	5			
General Maintenance	OP-191956	5			
General Maintenance	OP-191956	10			
General Maintenance	OP-191956	8			

Work Order #	OP-191963	**Request Date**	09/22/2017 11:21
Location ID	Grey H.S. - 112	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Can we get 6 ceiling tiles replaced in room 1112 and 3 replaced in room 1114?	**Total Hours**	1.5
Priority Description	Routine	**Total Cost**	61.64

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom	Grey H.S. - 112	Area	GM17000	General Maintenance

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-191963		6	8	3
General Maintenance	OP-191963		4	4	5
General Maintenance	OP-191963		1		3
General Maintenance	OP-191963		11		2
General Maintenance	OP-191963		2	3	2
General Maintenance	OP-191963		3	7	6
General Maintenance	OP-191963		12	13	4
General Maintenance	OP-191963		9	10	6
General Maintenance	OP-191963		6		4
General Maintenance	OP-191963		7	9	7
General Maintenance	OP-191963		12	7	6
General Maintenance	OP-191963		11	11	13
General Maintenance	OP-191963		11	12	11
General Maintenance	OP-191963	11			
General Maintenance	OP-191963	14			
General Maintenance	OP-191963		10	10	
General Maintenance	OP-191963	12			
General Maintenance	OP-191963	13			
General Maintenance	OP-191963	13			
General Maintenance	OP-191963	12			
General Maintenance	OP-191963	10			
General Maintenance	OP-191963	14			
General Maintenance	OP-191963	14			
General Maintenance	OP-191963	13			
General Maintenance	OP-191963	13			
General Maintenance	OP-191963	14			
General Maintenance	OP-191963	10			
General Maintenance	OP-191963	13			
General Maintenance	OP-191963	13			
General Maintenance	OP-191963	14			
General Maintenance	OP-191963	15			

Work Order #	OP-191965	**Request Date**	09/22/2017 11:03
Location ID	Grey H.S. - 1114	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Can we get a projector screen relocated from 7001 to 1114?	**Total Hours**	1.0
Priority Description	Routine	**Total Cost**	29.09

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom	Grey H.S. - 1114	Area	CM17000	General Maintenance

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-191965		7	8	1
General Maintenance	OP-191965		1	1	1
General Maintenance	OP-191965		1	1	1
General Maintenance	OP-191965		1	1	1
General Maintenance	OP-191965		2	2	2
General Maintenance	OP-191965		5	5	4
General Maintenance	OP-191965		4		4
General Maintenance	OP-191965		1		2
General Maintenance	OP-191965		1	5	7
General Maintenance	OP-191965		3	7	2
General Maintenance	OP-191965		10	11	2
General Maintenance	OP-191965		6	6	3
General Maintenance	OP-191965		10	6	7
General Maintenance	OP-191965	7			
General Maintenance	OP-191965	13			
General Maintenance	OP-191965		14	14	
General Maintenance	OP-191965	7			
General Maintenance	OP-191965	15			
General Maintenance	OP-191965	12			
General Maintenance	OP-191965	13			
General Maintenance	OP-191965	9			
General Maintenance	OP-191965	15			
General Maintenance	OP-191965	13			
General Maintenance	OP-191965	10			
General Maintenance	OP-191965	14			
General Maintenance	OP-191965	11			
General Maintenance	OP-191965	12			
General Maintenance	OP-191965	8			
General Maintenance	OP-191965	14			
General Maintenance	OP-191965	13			
General Maintenance	OP-191965	12			

Work Order #	OP-192256	**Request Date**	09/29/2017 06:21
Location ID	Blue H.S. - ENT	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	We got tagged last night on East side of building 5 and I don't have either color to paint over the damage, it's not profane just vandalized, can we get some help from the painters, please.	**Total Hours**	8.5
Priority Description	Routine	**Total Cost**	311.17

Item Description	Item Number	Item Type	Task Code	Task Description
Entire Area	Blue H.S. - ENT	Area	PA9020	Remove Graffiti

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-192256		13	12	5
General Maintenance	OP-192256		8	8	6
General Maintenance	OP-192256		1	1	5
General Maintenance	OP-192256		14	14	4
General Maintenance	OP-192256		5	5	5
General Maintenance	OP-192256		7	6	7
General Maintenance	OP-192256		1		9
General Maintenance	OP-192256		5	5	5
General Maintenance	OP-192256		5	5	6
General Maintenance	OP-192256		8	3	7
General Maintenance	OP-192256		9	13	11
General Maintenance	OP-192256		7	7	15
General Maintenance	OP-192256		14	14	13
General Maintenance	OP-192256		2	2	
General Maintenance	OP-192256		4	8	8
General Maintenance	OP-192256		12	12	15
General Maintenance	OP-192256		14	14	14
General Maintenance	OP-192256	1			
General Maintenance	OP-192256	1			
General Maintenance	OP-192256	6			
General Maintenance	OP-192256	2			
General Maintenance	OP-192256	14			
General Maintenance	OP-192256	2			
General Maintenance	OP-192256	4			
General Maintenance	OP-192256	7			
General Maintenance	OP-192256	3			
General Maintenance	OP-192256	1			
General Maintenance	OP-192256	2			
General Maintenance	OP-192256	3			
General Maintenance	OP-192256	5			
General Maintenance	OP-192256	9			

Work Order #	OP-192261	**Request Date**	09/29/2017
Location ID	Purple Elem. - Office	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	(staff workroom) key hole tumbler seems to be malfunctioning to door entering staff workroom key gets stuck	**Total Hours**	2.0
Priority Description	Routine	**Total Cost**	58.18

Item Description	Item Number	Item Type	Task Code	Task Description
Office/Administrative - Office	Purple Elem. - OFFICE	Area	LK8000	Repair/Replace Existing Locks

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-192261		6	8	7
General Maintenance	OP-192261		4		10
General Maintenance	OP-192261		15	13	10
General Maintenance	OP-192261		15	15	11
General Maintenance	OP-192261		13	12	13
General Maintenance	OP-192261		14	14	14
General Maintenance	OP-192261		12	10	12
General Maintenance	OP-192261		13		11
General Maintenance	OP-192261		8	8	12
General Maintenance	OP-192261		14	10	13
General Maintenance	OP-192261		9	12	13
General Maintenance	OP-192261		15	15	15
General Maintenance	OP-192261		7		15
General Maintenance	OP-192261	8			
General Maintenance	OP-192261	7			
General Maintenance	OP-192261		11	13	
General Maintenance	OP-192261	5			
General Maintenance	OP-192261	14			
General Maintenance	OP-192261	5			
General Maintenance	OP-192261	3			
General Maintenance	OP-192261	5			
General Maintenance	OP-192261	8			
General Maintenance	OP-192261	4			
General Maintenance	OP-192261	7			
General Maintenance	OP-192261	15			
General Maintenance	OP-192261	10			
General Maintenance	OP-192261	14			
General Maintenance	OP-192261	9			
General Maintenance	OP-192261	8			
General Maintenance	OP-192261	11			
General Maintenance	OP-192261	10			

Work Order #	OP-192302	**Request Date**	10/02/2017 07:06
Location ID	Orange M.S.	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Can we get a larger crosswalk area painted on the West side where the students pass to and from the portables, maybe a large crosshatch area between the 2 driveways.	**Total Hours**	13
Priority Description	Routine	**Total Cost**	438.01

Item Description	Item Number	Item Type	Task Code	Task Description
Entire Area	Orange M.S.	Area	PA9000	Paint/Patch Existing Facilities

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-192302		12		1
General Maintenance	OP-192302		2		7
General Maintenance	OP-192302		4	4	5
General Maintenance	OP-192302		9	12	7
General Maintenance	OP-192302		6	6	8
General Maintenance	OP-192302		5		6
General Maintenance	OP-192302		15	5	8
General Maintenance	OP-192302		9	9	11
General Maintenance	OP-192302		10	13	9
General Maintenance	OP-192302		10	15	11
General Maintenance	OP-192302		11	11	11
General Maintenance	OP-192302		7	9	10
General Maintenance	OP-192302		15	14	13
General Maintenance	OP-192302	15			
General Maintenance	OP-192302	12			
General Maintenance	OP-192302		5	7	
General Maintenance	OP-192302	13			
General Maintenance	OP-192302	9			
General Maintenance	OP-192302	10			
General Maintenance	OP-192302	9			
General Maintenance	OP-192302	8			
General Maintenance	OP-192302	9			
General Maintenance	OP-192302	12			
General Maintenance	OP-192302	11			
General Maintenance	OP-192302	10			
General Maintenance	OP-192302	4			
General Maintenance	OP-192302	13			
General Maintenance	OP-192302	15			
General Maintenance	OP-192302	11			
General Maintenance	OP-192302	12			
General Maintenance	OP-192302	14			

Work Order #	OP-192313	**Request Date**	10/02/2017 12:26
Location ID	District Office - 501	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Wood railing/counter on pony wall is loose and needs repaired. Located at reception area of professional development in Bld F. See Receptionist in area.	**Total Hours**	2.0
Priority Description	Routine	**Total Cost**	71.66

Item Description	Item Number	Item Type	Task Code	Task Description
District Administration Center	District Office - 501	Facility	CAR1015	General Carpentry Repair

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-192313		15	12	3
General Maintenance	OP-192313		10	10	8
General Maintenance	OP-192313		8	8	8
General Maintenance	OP-192313		15	13	10
General Maintenance	OP-192313		6	6	5
General Maintenance	OP-192313		15		11
General Maintenance	OP-192313		14	14	14
General Maintenance	OP-192313		7	11	11
General Maintenance	OP-192313		12	12	8
General Maintenance	OP-192313		15	15	11
General Maintenance	OP-192313		12	12	
General Maintenance	OP-192313		5	5	8
General Maintenance	OP-192313		14	15	13
General Maintenance	OP-192313		15	13	9
General Maintenance	OP-192313		15	15	11
General Maintenance	OP-192313		13	13	15
General Maintenance	OP-192313		3	7	10
General Maintenance	OP-192313	4			
General Maintenance	OP-192313	15			
General Maintenance	OP-192313	9			
General Maintenance	OP-192313	4			
General Maintenance	OP-192313	7			
General Maintenance	OP-192313	8			
General Maintenance	OP-192313	5			
General Maintenance	OP-192313	5			
General Maintenance	OP-192313	7			
General Maintenance	OP-192313	9			
General Maintenance	OP-192313	14			
General Maintenance	OP-192313	12			
General Maintenance	OP-192313	11			
General Maintenance	OP-192313	2			

Work Order #	OP-192355	**Request Date**	10/03/2017 11:29
Location ID	Pink M.S. - GROUNDS	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	I need to get a soccer goal welded one of the bars welds broke	**Total Hours**	2.5
Priority Description	Routine	**Total Cost**	75.15

Item Description	Item Number	Item Type	Task Code	Task Description
Grounds-GROUNDS	Pink M.S. - GROUNDS	Area	WE13000	General Welding

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-192355		11	8	3
General Maintenance	OP-192355		15	15	1
General Maintenance	OP-192355		14	14	2
General Maintenance	OP-192355		5	4	3
General Maintenance	OP-192355		8	11	3
General Maintenance	OP-192355		1	1	5
General Maintenance	OP-192355		2	8	5
General Maintenance	OP-192355		13		8
General Maintenance	OP-192355		6	6	6
General Maintenance	OP-192355		5	5	7
General Maintenance	OP-192355		13	14	8
General Maintenance	OP-192355		10	10	10
General Maintenance	OP-192355		15	15	14
General Maintenance	OP-192355		14	12	12
General Maintenance	OP-192355		6	7	13
General Maintenance	OP-192355		14	14	15
General Maintenance	OP-192355	11			
General Maintenance	OP-192355	14			
General Maintenance	OP-192355	10			
General Maintenance	OP-192355	3			
General Maintenance	OP-192355		11	11	
General Maintenance	OP-192355	6			
General Maintenance	OP-192355	7			
General Maintenance	OP-192355	12			
General Maintenance	OP-192355	14			
General Maintenance	OP-192355	9			
General Maintenance	OP-192355	7			
General Maintenance	OP-192355	12			
General Maintenance	OP-192355	11			
General Maintenance	OP-192355	9			
General Maintenance	OP-192355	6			

Work Order #	OP-193226	**Request Date**	09/24/2017
Location ID	Pink M.S. - 404	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Student Cafeteria or Kitchen has a bad odor	**Total Hours**	2
Priority Description	Routine Maintenance	**Total Cost**	

Item Description	Item Number	Item Type	Task Code	Task Description
Cafeteria	Pink M.S. - 404	404 GM	GM4300	Determine the source of the smell, correct as needed

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-193226		13	13	9
General Maintenance	OP-193226		5	5	6
General Maintenance	OP-193226		9		5
General Maintenance	OP-193226		9	9	9
General Maintenance	OP-193226		8	8	8
General Maintenance	OP-193226		7	7	10
General Maintenance	OP-193226		8	7	9
General Maintenance	OP-193226		7	10	10
General Maintenance	OP-193226		9	4	11
General Maintenance	OP-193226		6	6	6
General Maintenance	OP-193226		6	6	12
General Maintenance	OP-193226		9		9
General Maintenance	OP-193226		8		15
General Maintenance	OP-193226	12			
General Maintenance	OP-193226	11			
General Maintenance	OP-193226		13	12	
General Maintenance	OP-193226	14			
General Maintenance	OP-193226	12			
General Maintenance	OP-193226	8			
General Maintenance	OP-193226	8			
General Maintenance	OP-193226	15			
General Maintenance	OP-193226	7			
General Maintenance	OP-193226	11			
General Maintenance	OP-193226	12			
General Maintenance	OP-193226	6			
General Maintenance	OP-193226	5			
General Maintenance	OP-193226	5			
General Maintenance	OP-193226	1			
General Maintenance	OP-193226	7			
General Maintenance	OP-193226	3			
General Maintenance	OP-193226	9			

Work Order #	OP-195389	**Request Date**	09/24/2017
Location ID	White Elem. - GRNDS	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Playground Swing foundation has separated, needs replacement	**Total Hours**	3
Priority Description	Routine	**Total Cost**	TBD

Item Description	Item Number	Item Type	Task Code	Task Description
Playground	White Elem. - GRNDS	GRNDS	GM1700	Replace Playground Swing Set foundation

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-195389		1	2	1
General Maintenance	OP-195389		5		1
General Maintenance	OP-195389		6	5	4
General Maintenance	OP-195389		3	3	3
General Maintenance	OP-195389		3	4	5
General Maintenance	OP-195389		2	3	2
General Maintenance	OP-195389		4	3	5
General Maintenance	OP-195389		7	1	8
General Maintenance	OP-195389		5	5	5
General Maintenance	OP-195389		5	5	7
General Maintenance	OP-195389		5	5	7
General Maintenance	OP-195389		9		11
General Maintenance	OP-195389		3	3	14
General Maintenance	OP-195389	3			
General Maintenance	OP-195389	4			
General Maintenance	OP-195389		14	11	
General Maintenance	OP-195389	9			
General Maintenance	OP-195389	3			
General Maintenance	OP-195389	2			
General Maintenance	OP-195389	4			
General Maintenance	OP-195389	13			
General Maintenance	OP-195389	4			
General Maintenance	OP-195389	7			
General Maintenance	OP-195389	8			
General Maintenance	OP-195389	2			
General Maintenance	OP-195389	2			
General Maintenance	OP-195389	3			
General Maintenance	OP-195389	2			
General Maintenance	OP-195389	6			
General Maintenance	OP-195389	4			
General Maintenance	OP-195389	3			

Work Order #	OP-196342	**Request Date**	09/22/2017
Location ID	Red M.S. – 301C	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Replace ceiling tiles in classroom 301C; Re-Paint the wall damaged by monsoon rains (Water Stain)	**Total Hours**	2
Priority Description	Routine Maintenance	**Total Cost**	

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom	Red M.S. – 301C	301C	GM1700	Paint / Patch

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
General Maintenance	OP-196342		2	1	1
General Maintenance	OP-196342		11	4	3
General Maintenance	OP-196342		3		5
General Maintenance	OP-196342		5	5	6
General Maintenance	OP-196342		6	9	4
General Maintenance	OP-196342		7	7	3
General Maintenance	OP-196342		7		5
General Maintenance	OP-196342		12	12	7
General Maintenance	OP-196342		10	10	8
General Maintenance	OP-196342		7	11	5
General Maintenance	OP-196342		11	12	5
General Maintenance	OP-196342		12	11	8
General Maintenance	OP-196342		10		9
General Maintenance	OP-196342	10			
General Maintenance	OP-196342	9			
General Maintenance	OP-196342		3	4	
General Maintenance	OP-196342	10			
General Maintenance	OP-196342	11			
General Maintenance	OP-196342	15			
General Maintenance	OP-196342	6			
General Maintenance	OP-196342	14			
General Maintenance	OP-196342	6			
General Maintenance	OP-196342	9			
General Maintenance	OP-196342	6			
General Maintenance	OP-196342	7			
General Maintenance	OP-196342	7			
General Maintenance	OP-196342	8			
General Maintenance	OP-196342	11			
General Maintenance	OP-196342	12			
General Maintenance	OP-196342	2			
General Maintenance	OP-196342	11			

Work Order #	OP-197664	**Request Date**	09/22/2017
Location ID	Brown Elem. 215B	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Internet connection is cutting out repeatedly during class	**Total Hours**	1
Priority Description	Routine Maintenance	**Total Cost**	

Item Description	Item Number	Item Type	Task Code	Task Description
Comp. Lab 215B	Brown Elem. – 215B	IT	IT3400	IT – inspect internet connectivity, router/wifi

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Information Technology	OP-197664		2	2	2
Information Technology	OP-197664		3	3	3
Information Technology	OP-197664		5	2	1
Information Technology	OP-197664		2	6	5
Information Technology	OP-197664		1	7	4
Information Technology	OP-197664		6		6
Information Technology	OP-197664		9	9	4
Information Technology	OP-197664		1	2	6
Information Technology	OP-197664		4	4	4
Information Technology	OP-197664		4	4	3
Information Technology	OP-197664		4	4	3
Information Technology	OP-197664		3		3
Information Technology	OP-197664		8		7
Information Technology	OP-197664	9			
Information Technology	OP-197664	10			
Information Technology	OP-197664		1	3	
Information Technology	OP-197664	2			
Information Technology	OP-197664	6			
Information Technology	OP-197664	9			
Information Technology	OP-197664	10			
Information Technology	OP-197664	7			
Information Technology	OP-197664	12			
Information Technology	OP-197664	10			
Information Technology	OP-197664	9			
Information Technology	OP-197664	4			
Information Technology	OP-197664	6			
Information Technology	OP-197664	4			
Information Technology	OP-197664	4			
Information Technology	OP-197664	10			
Information Technology	OP-197664	15			
Information Technology	OP-197664	2			

Work Order #	OP-192049	**Request Date**	09/26/2017 06:44
Location ID	Red M.S. - 316A	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	300-bld, room 316 a/c is not working room got really warm yesterday!	**Total Hours**	3.0
Priority Description	Routine	**Total Cost**	93.42

Item Description	Item Number	Item Type	Task Code	Task Description
Office 316A	Red M.S. - 316A	Area	HV6000	Room Temperature Problems

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Mechanical	OP-192049		3	3	2
Mechanical	OP-192049		4	6	1
Mechanical	OP-192049		1	1	1
Mechanical	OP-192049		2	2	1
Mechanical	OP-192049		5	1	2
Mechanical	OP-192049		6	2	1
Mechanical	OP-192049		2	2	1
Mechanical	OP-192049		3	3	1
Mechanical	OP-192049		2	3	1
Mechanical	OP-192049		2	2	1
Mechanical	OP-192049		2	2	5
Mechanical	OP-192049		4		3
Mechanical	OP-192049		1	2	4
Mechanical	OP-192049		10	10	1
Mechanical	OP-192049		11	11	11
Mechanical	OP-192049		9	9	9
Mechanical	OP-192049	9			
Mechanical	OP-192049	6			
Mechanical	OP-192049	5			
Mechanical	OP-192049	7			
Mechanical	OP-192049		5	5	
Mechanical	OP-192049	3			
Mechanical	OP-192049	10			
Mechanical	OP-192049	7			
Mechanical	OP-192049	3			
Mechanical	OP-192049	10			
Mechanical	OP-192049	3			
Mechanical	OP-192049	9			
Mechanical	OP-192049	6			
Mechanical	OP-192049	3			
Mechanical	OP-192049	3			

Work Order #	OP-192052	**Request Date**	09/26/2017 08:16
Location ID	Purple Elem. - R1	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	When A/C kicks on, it makes a really load noise, teacher says that kids can barely hear in the room. Could I get it checked out please. Thank You	**Total Hours**	2.5
Priority Description	Routine	**Total Cost**	77.85

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom/Special Ed	Purple Elem. - R1	Area	HV6040	Inspection

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Mechanical	OP-192052		7	6	1
Mechanical	OP-192052		1	5	1
Mechanical	OP-192052		2	4	2
Mechanical	OP-192052		4	2	2
Mechanical	OP-192052		2	1	2
Mechanical	OP-192052		6	1	2
Mechanical	OP-192052		1	1	2
Mechanical	OP-192052		7		2
Mechanical	OP-192052		3	3	4
Mechanical	OP-192052		4	4	4
Mechanical	OP-192052		6	4	2
Mechanical	OP-192052		2	2	3
Mechanical	OP-192052		4	4	3
Mechanical	OP-192052		3	3	3
Mechanical	OP-192052		1	1	2
Mechanical	OP-192052		7	7	2
Mechanical	OP-192052	6			
Mechanical	OP-192052	8			
Mechanical	OP-192052	1			
Mechanical	OP-192052	6			
Mechanical	OP-192052		3	3	
Mechanical	OP-192052	4			
Mechanical	OP-192052	3			
Mechanical	OP-192052	6			
Mechanical	OP-192052	1			
Mechanical	OP-192052	1			
Mechanical	OP-192052	4			
Mechanical	OP-192052	1			
Mechanical	OP-192052	1			
Mechanical	OP-192052	4			
Mechanical	OP-192052	1			

Work Order #	OP-192054	**Request Date**	09/26/2017 10:09
Location ID	White Elem. - 111	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Room 111 is having problems cooling down, its hot most of the day, thanks	**Total Hours**	3.25
Priority Description	Routine	**Total Cost**	101.21

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom	White Elem. - 111	Area	HV6000	Room Temperature Problems

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Mechanical	OP-192054		2	3	3
Mechanical	OP-192054		4	4	2
Mechanical	OP-192054		2	2	3
Mechanical	OP-192054		6	2	3
Mechanical	OP-192054		4	4	1
Mechanical	OP-192054		1	1	2
Mechanical	OP-192054		1	2	3
Mechanical	OP-192054		5		1
Mechanical	OP-192054		2	1	1
Mechanical	OP-192054		6	6	6
Mechanical	OP-192054		5	3	4
Mechanical	OP-192054		2	2	3
Mechanical	OP-192054		1	3	4
Mechanical	OP-192054		8	7	4
Mechanical	OP-192054		4	5	4
Mechanical	OP-192054		4	4	
Mechanical	OP-192054		9	9	11
Mechanical	OP-192054	10			
Mechanical	OP-192054	5			
Mechanical	OP-192054	4			
Mechanical	OP-192054	5			
Mechanical	OP-192054	2			
Mechanical	OP-192054	5			
Mechanical	OP-192054	8			
Mechanical	OP-192054	2			
Mechanical	OP-192054	8			
Mechanical	OP-192054	5			
Mechanical	OP-192054	5			
Mechanical	OP-192054	4			
Mechanical	OP-192054	2			
Mechanical	OP-192054	4			

Work Order #	OP-192151	**Request Date**	09/26/2017 10:24
Location ID	Green H.S. - 114	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Heat is on in the room	**Total Hours**	3.0
Priority Description	Routine	**Total Cost**	260.18

Item Description	Item Number	Item Type	Task Code	Task Description
Classroom / 4th grade - 114	Green H.S. - 114	Area	HV6000	Room Temperature Problems

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Mechanical	OP-192151		1	1	3
Mechanical	OP-192151		9	9	4
Mechanical	OP-192151		4	6	4
Mechanical	OP-192151		7	4	3
Mechanical	OP-192151		3	3	3
Mechanical	OP-192151		1	1	2
Mechanical	OP-192151		4	4	4
Mechanical	OP-192151		5	5	4
Mechanical	OP-192151		5	5	4
Mechanical	OP-192151		5	5	4
Mechanical	OP-192151		3		4
Mechanical	OP-192151		7	5	5
Mechanical	OP-192151		3	3	5
Mechanical	OP-192151		6	2	7
Mechanical	OP-192151		14	15	4
Mechanical	OP-192151		6	6	7
Mechanical	OP-192151	14			
Mechanical	OP-192151	3			
Mechanical	OP-192151	12			
Mechanical	OP-192151	12			
Mechanical	OP-192151		13	13	
Mechanical	OP-192151	5			
Mechanical	OP-192151	3			
Mechanical	OP-192151	9			
Mechanical	OP-192151	4			
Mechanical	OP-192151	6			
Mechanical	OP-192151	2			
Mechanical	OP-192151	10			
Mechanical	OP-192151	5			
Mechanical	OP-192151	7			
Mechanical	OP-192151	5			

Work Order #	OP-192027	**Request Date**	09/25/2017 11:55
Location ID	Grey H.S. GND – PRKG LOT	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Channel drain behind kitchen falling apart, can we have it repaired/replaced	**Total Hours**	
Priority Description	Routine	**Total Cost**	0

Item Description	Item Number	Item Type	Task Code	Task Description
Parking Lot-PRKG Lot	GHSGND-PRKG LOT	Area	PL11020	Inspection

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Plumbing	OP-192027		12	5	5
Plumbing	OP-192027		11	6	6
Plumbing	OP-192027		9	9	9
Plumbing	OP-192027		7	7	8
Plumbing	OP-192027		10	8	9
Plumbing	OP-192027		8	8	13
Plumbing	OP-192027		11	11	12
Plumbing	OP-192027		2	2	10
Plumbing	OP-192027		11	11	12
Plumbing	OP-192027		15	15	9
Plumbing	OP-192027		7	7	9
Plumbing	OP-192027		11	11	12
Plumbing	OP-192027		12		14
Plumbing	OP-192027		14	14	14
Plumbing	OP-192027		7	7	15
Plumbing	OP-192027		15	15	15
Plumbing	OP-192027	2			
Plumbing	OP-192027	13			
Plumbing	OP-192027	14			
Plumbing	OP-192027	14			
Plumbing	OP-192027		8	8	
Plumbing	OP-192027	12			
Plumbing	OP-192027	14			
Plumbing	OP-192027	14			
Plumbing	OP-192027	12			
Plumbing	OP-192027	15			
Plumbing	OP-192027	13			
Plumbing	OP-192027	6			
Plumbing	OP-192027	10			
Plumbing	OP-192027	10			
Plumbing	OP-192027	14			

Work Order #	OP-192028	**Request Date**	09/25/2017 11:58
Location ID	Grey H.S. 1004-STANDA	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Drinking fountains broken at home side concession stands. Can we have them repaired?	**Total Hours**	2.5
Priority Description	Routine	**Total Cost**	99.85

Item Description	Item Number	Item Type	Task Code	Task Description
Concession Stand A	Grey H.S. -STANDA	Area	PL11020	Inspection

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Plumbing	OP-192028		9		5
Plumbing	OP-192028		10	10	8
Plumbing	OP-192028		12	12	7
Plumbing	OP-192028		3	6	7
Plumbing	OP-192028		8	9	5
Plumbing	OP-192028		4	11	10
Plumbing	OP-192028		14	14	10
Plumbing	OP-192028		4	4	15
Plumbing	OP-192028		9	9	8
Plumbing	OP-192028		10	10	14
Plumbing	OP-192028		12	13	15
Plumbing	OP-192028		10	9	11
Plumbing	OP-192028		13	14	12
Plumbing	OP-192028		12	12	14
Plumbing	OP-192028		13	13	15
Plumbing	OP-192028		13	12	13
Plumbing	OP-192028		9	9	
Plumbing	OP-192028	7			
Plumbing	OP-192028	11			
Plumbing	OP-192028	7			
Plumbing	OP-192028	11			
Plumbing	OP-192028	10			
Plumbing	OP-192028	11			
Plumbing	OP-192028	3			
Plumbing	OP-192028	8			
Plumbing	OP-192028	12			
Plumbing	OP-192028	11			
Plumbing	OP-192028	7			
Plumbing	OP-192028	9			
Plumbing	OP-192028	12			
Plumbing	OP-192028	12			

Work Order #	OP-192029	**Request Date**	09/25/2017 13:12
Location ID	Blue H.S. - 2SC	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	The flush valve in the men's restroom in the teacher's lounge is not working, it's one of those dual flush type with the green handle	**Total Hours**	1.5
Priority Description	Routine	**Total Cost**	46.71

Item Description	Item Number	Item Type	Task Code	Task Description
Men's Restroom	Blue H.S. - 2SC	Area	PL11020	Inspection

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Plumbing	OP-192029		2		7
Plumbing	OP-192029		7	7	7
Plumbing	OP-192029		15	15	7
Plumbing	OP-192029		8	7	6
Plumbing	OP-192029		13	13	10
Plumbing	OP-192029		8	8	7
Plumbing	OP-192029		12	12	9
Plumbing	OP-192029		3	3	12
Plumbing	OP-192029		13	10	10
Plumbing	OP-192029		3	3	13
Plumbing	OP-192029		3	5	13
Plumbing	OP-192029		3	3	14
Plumbing	OP-192029		12	12	13
Plumbing	OP-192029		11	11	11
Plumbing	OP-192029		13	13	11
Plumbing	OP-192029		12	12	14
Plumbing	OP-192029	5			
Plumbing	OP-192029	10			
Plumbing	OP-192029	8			
Plumbing	OP-192029	8			
Plumbing	OP-192029		6	6	
Plumbing	OP-192029	8			
Plumbing	OP-192029	13			
Plumbing	OP-192029	11			
Plumbing	OP-192029	10			
Plumbing	OP-192029	5			
Plumbing	OP-192029	12			
Plumbing	OP-192029	8			
Plumbing	OP-192029	8			
Plumbing	OP-192029	8			
Plumbing	OP-192029	11			

Work Order #	OP-192050	**Request Date**	09/26/2017 07:48
Location ID	White Elem. -ENT SITE	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	South drinking fountain is vibrating and making a loud noise also, May also have the same issue as the other fountain.	**Total Hours**	0.50
Priority Description	Routine	**Total Cost**	15.57

Item Description	Item Number	Item Type	Task Code	Task Description
Entire Area-ENT SITE	White Elem. -ENT SITE	Area	HV6040	Inspection

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Plumbing	OP-192050		3	4	5
Plumbing	OP-192050		9	9	9
Plumbing	OP-192050		9	8	8
Plumbing	OP-192050		10		10
Plumbing	OP-192050		10	10	6
Plumbing	OP-192050		7	7	6
Plumbing	OP-192050		7	7	14
Plumbing	OP-192050		12	13	13
Plumbing	OP-192050		11	11	7
Plumbing	OP-192050		8	8	9
Plumbing	OP-192050		8	8	12
Plumbing	OP-192050		9	10	7
Plumbing	OP-192050		11	11	11
Plumbing	OP-192050		11	9	15
Plumbing	OP-192050		9	9	12
Plumbing	OP-192050		15	15	14
Plumbing	OP-192050	13			
Plumbing	OP-192050	9			
Plumbing	OP-192050	13			
Plumbing	OP-192050	10			
Plumbing	OP-192050		14	14	
Plumbing	OP-192050	15			
Plumbing	OP-192050	12			
Plumbing	OP-192050	10			
Plumbing	OP-192050	9			
Plumbing	OP-192050	13			
Plumbing	OP-192050	15			
Plumbing	OP-192050	15			
Plumbing	OP-192050	7			
Plumbing	OP-192050	13			
Plumbing	OP-192050	13			

Work Order #	OP-192144	**Request Date**	09/25/2017 09:58
Location ID	Green H.S. GRN-ENT AREA	**Completion Date**	
WO Type	Corrective Maintenance		
Description			
Request	Need the storm drain cleaned.	**Total Hours**	2.00
Priority Description	Routine	**Total Cost**	62.28

Item Description	Item Number	Item Type	Task Code	Task Description
Entire Area-ENT AREA	GRNHS GRN-ENT AREA	Area	PL11015	General Plumbing Repair

Functional Area	Work Order	R1	R2:Comprehensive Ranking	R2:Impact Ranking	Pairwise Comparison Ranking
Plumbing	OP-192144		9	9	9
Plumbing	OP-192144		12	12	10
Plumbing	OP-192144		10	10	12
Plumbing	OP-192144		10	10	9
Plumbing	OP-192144		10	10	6
Plumbing	OP-192144		11		12
Plumbing	OP-192144		12	12	14
Plumbing	OP-192144		12	14	12
Plumbing	OP-192144		10	10	14
Plumbing	OP-192144		4	4	13
Plumbing	OP-192144		10	10	10
Plumbing	OP-192144		11	14	15
Plumbing	OP-192144		14	14	15
Plumbing	OP-192144		13	13	15
Plumbing	OP-192144		8	11	14
Plumbing	OP-192144		14	13	15
Plumbing	OP-192144	12			
Plumbing	OP-192144	12			
Plumbing	OP-192144	11			
Plumbing	OP-192144	15			
Plumbing	OP-192144		15	15	
Plumbing	OP-192144	11			
Plumbing	OP-192144	15			
Plumbing	OP-192144	15			
Plumbing	OP-192144	15			
Plumbing	OP-192144	14			
Plumbing	OP-192144	14			
Plumbing	OP-192144	13			
Plumbing	OP-192144	15			
Plumbing	OP-192144	15			
Plumbing	OP-192144	15			