

Using technology to improve the plan review process

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CERTIFICATION STATEMENT

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Abstract

Sandy Spring Fire Rescue's (SSFR) plan review process attributed to customer dissatisfaction and environmental and economic waste. This applied research paper assessed methods to revise the plans review process to improve customer satisfaction and decrease environmental and economic waste through the use of emerging technology. Five research questions were developed: (1) What are the satisfaction levels of the SSFR plan review customers? (2) What is the potential value and possible detriments of electronic plans review? (3) What state or federal regulations exist relevant to electronic plan review and storage of public documents? (4) How is electronic plan review being used elsewhere in other agencies? (5) How can electronic plan review be implemented at SSFR? The descriptive research method was used through literature review, survey instruments and interviews. Numerous advantages and some obstacles were discovered as many jurisdictions utilize the emerging technology of electronic plan review. Electronic seals and archiving requirements were analyzed. Electronic plan review was recommended to be implemented in the SSFR to save time, money and economic resources.

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Introduction

Throughout the past century, technology has played an important role in the evolution of the fire service. From the beginnings of fire science through the advanced computer dispatching, computers have played a key role in development of tactics shaping the future for fire departments worldwide. Technology has also shaped the role of the design and construction of buildings. Since the advent of computer aided design, the internet, large screen monitors and the advent of advanced reproduction graphic machines, Authorities Having Jurisdiction (AHJs) have had the ability to receive electronic drawing submittals for review, approval and archiving of the construction documents. No longer does the AHJ have to review drawings sequentially by department and incur the time and expense of mailing marked-up drawing back to the designer. A process that used to take many weeks can be reduced to a matter of days. Electronic plan review challenges the plan review process in place that is currently done with paper and reapplies it in electronic form. This adaptation presents challenges in the legality of using “old school” methodology in the era of advanced technology. This research paper examines the advantages and disadvantages of electronic plan review, potential legal obstacles, how AHJs are currently using electronic plan review and how it may be implemented in the City of Sandy Springs.

The problem is the Sandy Spring Fire Rescue’s plan review process attributes to customer dissatisfaction and environmental and economic waste. The purpose of this applied research paper is to assess methods to revise the plans review process to improve customer satisfaction and decrease environmental and economic waste through the use of emerging technology. The five research questions will be analyzed to determine: (1) What are the

satisfaction levels of the SSFR plan review customers? (2) What is the potential value and possible detriments of electronic plans review to the SSFR? (3) What state or federal regulations exist relevant to electronic plan review and storage of public documents? (4) How is electronic plan review being used elsewhere in other agencies? (5) How can electronic plan review be implemented at SSFR?

The descriptive research method was used through literature review, survey instruments and interviews.

Background and Significance

The City of Sandy Springs was established as a new city in 2005 as a result from taxpayer's dissatisfaction with county government. The new city government has sought to improve all aspects of governance.

On June 21, 2005, 94% of Sandy Spring's residents voted in favor of incorporation of the city. Overnight, the new City of Sandy Springs became the 7th largest municipality Georgia. With a resident population of almost 100,000 people and a workforce population of 350,000, the new government was immediately tasked with forming a new and improved government. To accomplish this, in an unprecedented move, the Mayor and Council voted to privatize all government except for public safety and key administrative staff. The public/private partnership has been a model of innovation that has been adopted on a smaller scale for other new municipal governments, including John's Creek, GA, and Milton, GA.

This innovative thinking led to a culture of dedication, hard work and excellence that has become the norm that is expected by the city government leaders and its citizens.

The Community Development Department was formed to oversee the administration of all Building, Fire Marshal, Land Development and Zoning permits within the city. With a staff of 22 persons, it provides building, zoning, land development review and inspection and code enforcement services.

Initially, the department tracked its projects with Blackbear, a permit tracking software. In 2008, the city switched to a program from SunGard systems called HTE. While the program was more compatible with other city departments such as Finance, it was not compatible with many other programs; consequently HTE was scheduled to be replaced with a new program

called MUNIS. In 2011, the Community Development department first explored the use of electronic plan review. The limitations of interoperability with HTE, combined with a new private contractor that would provide governmental services, the electronic plan review initiative was scrapped. There have been no subsequent plans to revive the electronic plans review initiative.

Throughout all of the software transitions, service levels were expected to maintain or improve. The city established the bench mark of two weeks for an initial review and one week for a re-review, also called a “back check”. In order to expedite review turn-around times, the individual reviewers within Community Development would continue to offer limited plan review services through emails in .pdf format. There is no current initiative to impliment electronic plans review in the City of Sandy Springs.

The apparent customer dissatisfaction is examined in research question 1 in the Results section. Studies on economic waste are analyzed in question 2.

The National Fire Academy, Executive Fire Officer Program Course, *Executive Development*, Executive Development Self Study Guide (2003) identifies the United States Fire Administration, Five Year Operational Objectives, through the refinement of the fire marshal’s office plan review process, which will enhance the ability of the department to respond in a timely manner to emergent issues.

Literature Review

A number of literary resources were utilized in conducting the research. There are a wide variety of perspectives that provide a baseline and guidance for the research of the problem.

In 2003 the American Institute of Architects (AIA) identified the need for state and local governments to use software and hardware for online submittals of construction drawings and electronic review, and tracking and archiving of those plans. In 2004, the AIA commissioned the Alliance for Building Regulatory Affairs in the Digital Age (Alliance), a 44 member private/public partnership to survey state and local governments to see if plans submitted over the internet or CD-ROM were acceptable. On June 8, 2004, the Alliance published the survey (Alliance for Building Regulatory Affairs in the Digital Age, 2001) that compiled input from 17 different state governments and 26 major cities. The findings included:

1. Electronic plans submittal, tracking and plan reviews are in their infancy.
2. A significant number of jurisdictions are exploring e-plans submittal and considering putting such programs in place over the next 1 to 2 years
3. A diverse array of software and hardware programs are being used, including a large number of in-house programs developed and deployed by state and local governments.
4. There are a significant number of barriers to wider use of online plans submittal, tracking and review hardware and software including a lack of:

Laws allowing electronic seals of plans; uniformity in the nation's construction codes; and lack of interoperability among the hardware and software currently available in the marketplace.

5. Jurisdictions making use of such hardware and software have identified the need for these information technology tools to be interoperable and for there to be adequately-sized monitors on which to review the plans.
6. There are significant benefits in savings of time and reduction in errors and unnecessary duplication of effort from online plans submittal, tracking and review programs.

The Alliance also published a White Paper on Best Practices in Electronic Plan Review, Tracking and Storage.(Alliance for Building Regulatory Reform in the Digital Age at Fiatech, 2004, p. 4). The paper lists the following advantages of electronic plan review, submittal and tracking.

1. Speed and ease of submission and review
2. Reduces confusion as to what changes have been made, by whom and when
3. Reduces the number and shortens the resubmission cycles
4. Provides the jurisdiction with a tool to measure productivity of staff and ability to perform plan review from remote locations
5. Speeds inspection processes where coupled with remote field inspection technologies (laptops, PD's etc.)
6. Facilitates mutual aid & speeds disaster response and recovery
7. Prepares jurisdiction for new technologies and processes (building Information Modeling of 3d and 4d designs and SMARTCodes
8. Increases revenues by getting Buildings on tax record faster

These findings were particularly beneficial to developing survey instruments and answering research question no. 2 and developing subsequent discussion and recommendations.

Recognizing importance of technology in the role of fire prevention, in the Fire Protection Handbook (Cote, 2008, p. 89) notes “In recent years, the use of computer technology has helped fire prevention officials handle record keeping and manage fire prevention programs.” Cote further states that “The review of building plans and specifications provides the fire service with its best opportunity to see that fire protection standards are met before construction is completed and the building is occupied.” (89)

Noting the importance of plan review in the fire service as a whole, (Lacey & Vallentine, 2008, p. 3) identifies the “construction document review process is a critical component of the service provided by fire departments and is important not only for the safety of the occupants, but for fire fighter safety and their ability to perform emergency operations at the building. The outcome of the plan review process will impact the building's construction and built-in fire protection features for the life of the building.” They further note that some chiefs of departments question whether plan review is a necessary function in the fire service.

An article in Firehouse magazine succinctly noted, “One of the most significant elements of a comprehensive fire prevention program is the fire department's participation in the construction document review process. The most effective construction document review processes utilizes each of the three basic principles of fire prevention, education, engineering and enforcement.” (“Improving Plan Review,” 2007, p. 1)

Fire Marshal Ed Ruckriegel, noted that electronic blueprints improve inspection effectiveness and efficiency. Whether scanned by department personnel or submitted by design professionals or contractors, the files have almost limitless uses in the fire department. Fire inspections and operations benefit through the use of electronic design drawings.

Electronic files are easy to copy to laptops and field data entry devices. The drawings assist inspectors in making decisions relative to approvals and ensuring the completed project complies with the approved documents. When working in existing buildings, inspectors may use the files to ensure the use and operations of the facility are conducted in accordance with the original approvals.

Blueprint files also serve as a resource for fire operations. Design drawings can be the foundation of preplans. The files can be copied to computers used by special teams like rapid intervention, hazmat, and technical rescue. Command vehicles and mobile command posts can store the electronic files for large scale or complex operations. Operations will find this tool beneficial for many aspects of fire and emergency responses. Fire departments should consider this inexpensive resource for inspections and operations. Implementation of electronic blueprints for inspections should not require funding. With an existing information technology infrastructure and handheld computers or laptops, staff should be able to simply load files on the field device. (Ruckreigel, 2011, p. 1)

The NFPA professional qualification standard for fire inspector and plans examiner (NFPA 1031) spells out specific responsibilities based on the level of certification and training.” This standard further establishes two levels of progression for Plan Examiner I and Plan Examiner II. Section 1.3.15 requires that the “...plan examiner at all levels to maintain records and related documents, so that the information may be retrieved and is filed in accordance with the record keeping policies of the organization.”(NFPA 1031, 2009)

There are numerous State of Georgia laws and regulations that are applicable to construction documents (specifically sealing by a design professional). There are no applicable

Federal laws that apply to signing and sealing construction documents for projects in Georgia (except for structures owned or operated by the US Government). The state of Georgia has stringent requirements for wet signature over a seal on drawings of projects that constitute a potential hazard to public safety. In Georgia, architectural and engineering drawings must bear the written signature of a Georgia licensed architect and /or engineer and in some cases, a licensed interior designer. There are separate and distinct laws for architect, and engineers. For architects the requirements for seals are found in O.C.G.A § 43-4-16.

(b) Plans, specifications, drawings, reports, or other architectural documents issued for the purpose of obtaining a building permit or for other requirements set forth by law shall be sealed by the architect and across the face of the seal shall be affixed the signature of the owner of the seal. The location of the seal on such documents, the identification of the pages which must be sealed, and the form of any title blocks may be established by the board in its rules and regulations.

The purpose for requiring a stamp and a wet seal become more evident in the Georgia for engineers, Georgia Section O.C.G.A. § 43-15-22. The clear intent is to mandate that all work that fall under the law requiring an engineer be performed under the direct supervision of an engineer. Note that this code section does not require a wet signature, only the seal of an engineer.

(b) ...No plans, specifications, plats, or reports shall be stamped with the seal of a registrant unless such registrant has personally performed the engineering or land surveying work involved or, when the registrant has not personally performed the engineering or land surveying work reflected in any plan, specification, plat, or report, such registrant has affixed his or her seal thereto only if such document has been

prepared by an employee or employees under the registrant's direct supervisory control on a daily basis and after the registrant has thoroughly reviewed the work embodied in such document and has satisfied himself or herself completely that such work is adequate.

The specific requirements for a “wet signature” can be found in Georgia regulation §§180-12-.02 Sealing of Documents. (STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS AND LAND SURVEYORS) The State Board of Registration for Professional Engineers and Land Surveyors met on September 14, 2010 to repeal the wet signature requirements, although it is apparent that such requirement has not been codified. (Richardson, 2010, p. 1)

“(5) Seals, signatures, dates, and/or other notations required by this Rule shall be placed on original documents such that the seal, signature, date and/or notations, will be reproduced when copies are made. All dates and signatures shall be hand written. O.C.G.A. 10-12-4 does not apply.”

Paragraph eight specifically prohibits the use of electronic seals for architects. There is no corresponding section in Georgia Law that prohibits electronic seals by engineers; this can be found in the implementing regulations.

(8) Documents that are electronically transmitted shall have the computer- generated seal removed from the original file. All electronically transmitted documents shall have displayed, in lieu of the seal, signature and date, the following statements, “The original of this document was sealed and signed by {registrant’s printed name and registration

number on {date of signature}.” And in bold lettering, “THIS REPRODUCTION IS NOT A CERTIFIED DOCUMENT.”

In Georgia, the regulations signing of drawings for architects are found in section 50-2A-.01 Signing and Sealing Documents as Registered Architect. The rules and regulations are promulgated by the Georgia Secretary of State.

(1) Every holder of a certificate of registration shall secure a SEAL of the design shown below, which shall be imprinted on all documents prepared by the Architect or prepared under his responsible control; or which is a prototypical document for which the Architect of Record is assuming professional responsibility as allowed by this Chapter. The SEAL shall be imprinted on each drawing, imprinted on the cover and index pages identifying all specifications covered by the index pages and imprinted on all other documents of service as well. For all documents of service to be submitted for the purpose of obtaining a building permit or for any other requirement as set forth by law, the architect’s signature shall be original, in permanent blue ink, with the issue date and purpose appropriately identified on the document.

The requirements to enforce the seal are found in Georgia law for Fire Protection and Safety §43-15-27.

“(c) Except as provided in Code Section 25-2-14, it shall be the duty of all public officials charged with the responsibility of enforcing codes related to construction to require compliance with Code Section 43-15-24 before engineering plans, drawings, and specifications are approved by construction. Except as provided in Code Section 25-2-14, no construction which is subject to Code Section 43-15-24 and which requires the service of an engineer shall be built without such approval prior to construction.”

Furthermore the Georgia Law requires approved drawings at the jobsite. Approved drawings must remain on the construction site during construction O.C.G.A., 25-2-14(b)

“A complete set of approved plans and specifications shall be maintained on the construction site, and construction shall proceed in compliance with the minimum fire safety standards under which such plans and specifications were approved. “

The requirements for the International Building Code in O.C.G.A Title 8, Buildings and Housing are silent with respect to electronic seals and approved drawings on the job site.

The Fire Protection and Safety section 25-2-14 requires that plans shall bear the seal and Georgia registration number of the drafting architect or engineer or shall otherwise have the approval of the Commissioner.

For archiving and storage of drawings, the International Fire Code requires retention of the one set of construction documents by the fire code official until final approval of the work covered within (International Fire Code, 2006). However, the Georgia Secretary of State requires that the AHJ provide a record of the planning, administration and implementation of capital construction projects; includes project descriptions and requirements, bid records, plan reviews, project schedules, contract changes, consultant contracts, and budgets to be retained 11 years after completion of project as empowered by the “Georgia Records Act”, Section 50-18-91 ("SOS Retention,"). The more restrictive requirements of GA State regulation apply.

Procedures

This research project utilized the descriptive research methodology to: (1) determine the potential value of electronic plans review to the SSFR, (2) examine the potential possible detriments of electronic plan review to the SSFR, (3) review state or federal regulations that exist relevant to electronic plan review and storage of public documents, (4) determine if electronic plan review is being used in prevention programs of other agencies and (5) consider how electronic plan review can be implemented at SSFR. The procedures employed in this project included literature review, survey of customers and fire prevention programs, and interviews with internal and external staff members in the fire service and building departments, design professionals and vendors.

The literature review encompassed a myriad of resources ranging from the theoretical application of quality control to disciplines outside of the fire service such as the building departments to the pragmatic research within the fire service.

Two survey instruments, entitled Electronic Plan Review (Appendix A) and Customer Service Template (Appendix B), were utilized to gather data on customer service satisfaction and current and future use of electronic plan review by AHJs. The data was assembled from 15 design professionals and 82 members of fire prevention offices and building departments via the use of online survey instruments. The participating departments that chose to identify them were Cherokee County, City of Atlanta, City of Coeur d'Alene Fire Department, City of Marietta Fire Department, City of Rockville, MD, City of Smyrna, City of Tomball, Texas Fire Marshal's Office, Colorado Springs Fire Department, Florissant Valley Fire Protection District, Gwinnett County, Gwinnett County Fire Plan Review, McKinney Fire Department Fire Marshal's Office

McKinney, Texas, Modesto Regional Fire Authority – California, Potato, Idaho Fire Department, San Francisco Fire Dept., Scottsdale Fire Dept. Scottsdale AZ , Strathcona County, Alberta Canada, Union Fire District of South Kingstown, RI, and West County EMS and Fire Protection District St. Louis County, MO.

Interviews were conducted to broaden the results of the survey, guide direction of the research and to provide insight for future possible actions. The interview process used ad-hoc questioning that was loosely based on interview question format in the Interview Questionnaire (Appendix A and B). The interviews were conducted in May 2012, and included Johnny Lawler, AICP, City of Sandy Springs Manager of Building and Land Development, who oversees the permitting process in the City of Sandy Springs; Nathan Ippolito, EIT, Plan Review Engineer, who manages permitting software for the City of Sandy Springs; Daniel Schultheiss, IT Manager for the City of Sandy Springs and Steve Bear, Code Compliance Services, who is a former Fire Marshal and currently owns and operated a permit expediting company in Georgia.

Limitations

There was unanticipated lack of specific resources for electronic plan review, although there was a wealth of research on the merits and procedures of traditional plan review. At the time of publishing, the Federal Emergency Management Agency, United States Fire Administration, National Fire Academy, Learning Resource Center had a total of no reports on electronic plan review. As this is an emerging issue, there were no documents found on specific processes and procedures for electronic review.

Results

To answer research question no. 1 the following procedures was utilized: Surveys. The first question asked: What are the satisfaction levels of the SSFR plan review customers? The customers of SSFR include architects and engineers, contractors and permit expeditors. There is an age old phrase “perception is reality” that applies to gaging public opinion. It matters not what the AHJ perceives the level of its service; it matters solely what the service levels are being perceived by the customer. To measure the satisfaction, a survey instrument (Appendix A) was received by 15 design professions who routinely work with the City of Sandy Springs. A series of eight questions were developed. The results of three of these questions from the Customer Service Template have been published in this research report.

Table 1. Customer satisfaction by departments

Answer Options	Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied	Rating Average
Building	2	10	0	0	1.83
ADA	2	9	1	0	1.92
Fire	8	6	0	0	1.43
Land	2	6	1	1	2.10
Development					
Public Works	1	7	2	0	2.10
Structural	2	6	2	0	2.00
Transportation	2	8	0	0	1.80
Permitting Desk	3	7	1	0	1.82

Table 1 presents data concerning customer satisfaction based on individual departments with construction document review responsibilities in the city of Sandy Springs. The highest ranking is for Fire with an average weighted rating of 1.43 and 51.7% indicating a “very satisfied” level of customer satisfaction. The lowest ranking is a tie between Land Development and Public Works with a weighted value of 2.10 however Land Development was rated by 20% as “very satisfied.” The table indicates that most customers are very satisfied or satisfied with the review departments in Sandy Springs.

Table 2, Plan review turn-around times

Answer Options	Response Percent	Response Count
Extremely long	0.0%	0
Very long	0.0%	0
Moderately long	15.4%	2
Slightly long	7.7%	1
Not at all long	76.9%	10

The question for this table was “How long did you have to wait before a plan review representative at Sandy Springs began to help you?” The data in Table 2 suggests that most people (76.9%) did not experience a long wait time for a plan review representative from Sandy Springs. No customers responded “extremely long” or “very long”. Note that this measure of perception is not quantitative; speed of service does not necessarily measure quality of service.

Table 3. Customer’s plan review experience

Answer Options	Response Percent	Response Count
Much better	28.6%	4
Somewhat better	21.4%	3
Slightly better	14.3%	2
About what was expected	35.7%	5
Slightly worse	0.0%	0
Somewhat worse	0.0%	0
Much worse	0.0%	0

Table 3 tabulated data to the question, “Was your experience with Plan Review at the City of Sandy Springs better than you expected it to be, worse than you expected it to be, or about what you expected it to be?” The data shows that all of the customers had a positive experience. A shortcoming in the survey is the descriptor language used in the survey. While the information is usable and credible, more relevant language would employ a scale from “very good to very bad.”

Question 2

To answer research question no. 2 the following three procedures were utilized literature review, interviews and surveys. The second question asked, what is the potential value and possible detriments of electronic plans review to the SSFR?

Research indicates that there are significant advantages to electronic plan review. A survey instrument, entitled Electronic Plan Review was utilized to gather data on customer current and future use of electronic plan review by AHJs. The data was assembled by 82

members of fire prevention offices and building departments. The results of 12 tables have been reproduced in the remainder of this research paper.

Table 4. Advantages of electronic plan review

Answer Options	Most Important				Least Important	Rating Average	Response Count
Sharing between departments	11	14	7	1	5	2.34	38
Shorten the review process	16	12	7	3	1	2.00	39
Save printing costs	15	12	5	2	6	2.30	40
Electronic archiving	29	11	2	2	0	1.48	44
Improved customer service	20	13	6	2	0	1.76	41
Standardized submittal	11	18	6	2	2	2.13	39
Improved communication with the Design Professional	9	16	9	3	2	2.31	39
GIS synchronization	6	16	8	6	3	2.59	39

The survey question asked was what is the most important attribute of electronic plan review? The results indicate that archiving of documents is the most important and beneficial attribute of electronic plan review. This is especially beneficial in Georgia as the Georgia Secretary of State requires that the AJH provide a record of the planning, administration and implementation of capital construction projects; includes project descriptions and requirements, bid records, plan reviews, project schedules, contract changes, consultant contracts, and budgets to be retained 11 years after completion of project as empowered by the “Georgia Records Act”, Section 50-18-91 ("SOS Retention,").

Nathan Ippolito, Plan Review Engineer, with the City of Sandy Springs observed that the city contract asked for the scanning and archiving of all construction documents received the City between September 2005 and September 2010 with a company called Iron Mountain. The cost for this service was approximately 1 million dollars. The city is currently seeking bids for scanning of large documents. Scanning of large documents ranges in cost from 43-73 cents apiece. The City has about 1,920 construction documents a year that need to be scanned. Moving forward, the city has hired a fulltime member to scan drawings using the City’s HP Designjet T1100PS. This plotter scanner was purchased by the city for about \$12,000.

Robert Wheeler, Building Officer, City of Sandy Springs estimates that 1/3rd of all commercial projects use the 30” x 42” format. The remaining 2/3rd of commercial projects use the 24” x 36” drawing size. Three sets of drawings are required for commercial projects. The average number of drawings in a 24” x 36” construction document set is approximately 35 sheets. The average number of drawings in a 30” x 42” is 100 sheets. In 2011, there were 800 commercial projects reviewed by the City of Sandy Springs.

Reproduction costs for construction documents can be costly. The Diazo Blueprint in Atlanta offers 24” x 36” copies for \$1.50. 30” x 42” copies at \$2.25. The drawings are delivered to the account holder at no additional cost.

Thus, the extrapolated costs are as follows:

Size	Projects	Ratio	Sets	Sheets	Cost	Total
30” x 42”	800	x 1/3	x 3	x 100	x .225	= \$18,000
24” x 36”	800	x 2/3	x 3	x 100	x .150	= \$24,000

There is also the expense of construction document submittal to the permit desk.

Samantha Jackson, Permit Technician II with the City of Sandy Springs estimates the average

time spent in city hall for commercial building permit submittal is about 30 minutes. One hour is assumed for the contractor to travel time to and from city hall, thus the total time spent by the contractor is about 90 minutes. Assuming an hourly wage of \$35.00, this cost is \$52.50.

An emerging trend of the use of permit expeditors has been observed by Jackson. About 50% of all projects are submitted by permit expeditors. The expeditors are hired by a design professional or contractor for their expertise in understanding the permitting requirements and processes. The average cost for these services is about \$150.00 per permit.

Thus the extrapolated personnel expenses are:

Type	Quantity		Ratio		Cost	Total
Contractor	800	x	.50	x	\$32.50	= \$13,000
Expediter	800	x	.50	x	\$625.00	= \$60,000

Thus, electronic archiving can save the design professions and contractors a minimum of \$115,000 collectively per year. The city would save approximately annually in archiving \$10,800 in scanning expenses alone. The survey also indicates the potential to improve customer service the the implementation of electronic plan review.

Electronic plan review does not come without barriers and obstacles. Research indicates that there are substantial barriers to electronic plan review. The results of the Table 5 illustrate some of the reservations and short coming with this new technology.

Table 5. Barriers to electronic review

Answer Options	Response Percent	Response Count
Funds	59.0%	46
Interoperability with current systems	42.3%	33
Electronic seals allowed by law	29.5%	23
Demand by design professionals	7.7%	6
Demand by governmental entity	9.0%	7
Hardware, including large monitors	62.8%	49
Training of staff	47.4%	37
Coordination with other departments	35.9%	28
Software for submittal and review	55.1%	43
Security concerns	24.4%	19
Fear of loss of data	19.2%	15
Lack of hands on use in meetings	21.8%	17
Other (please specify)	7	

Other data suggest problems include (a) due to impractical to review large plans looking at a monitor, (b) documentation of review notes and approval stamps, (c) too small to read and scale, all contractors would have to have capability in field to ever be feasible, (d) availability of electronic plans for submittal from vendor, (e) printing plans on large blue-print size printer (about \$20,000 to purchase) so that large enough detail is clear to the reviewers. While some of this data could have been entered in existing categories, it is worthwhile to note that two of the other responses, (c) and (e) center around legibility of the electronic drawings.

Table 5 indicates that the four most significant obstacles are based on available funds and limitation of technology (hardware and software) and training. Shortcomings in training can

encompass those plan reviewers who are set in their way; they simply will not embrace technology. The limitation on electronic seals is examined further in question 3.

While perceived demand by the AHJ was only 7.7%, the desire for electronic plan review by the design profession is an overwhelming 73.3%. The enthusiasm by local design professionals is illustrated in Table 6

Table 6. Desire for electronic plan review by design professionals

Answer Options	Response Percent	Response Count
Very receptive	73.3%	11
Somewhat receptive	13.3%	2
Not at all, we prefer paper submittals	20.0%	3

Table 4, asked design professionals, “would your firm be receptive to the use of electronic plan review by the City of Sandy Springs?” The vast majority of these architects and engineers said that they would be very receptive to electronic plan review in the City of Sandy Springs while 20% of those prefer the traditional paper plan submittals. Design professions are generally pleased with jurisdictions that utilize electronic plan review.

To answer research question no. 3 the following procedure was utilized, Literature Review. The question was what state or federal regulations exist relevant to electronic plan review and storage of public documents? The answers to this question were found in the body of Federal and State laws and regulations. In Georgia, the State Law requires a wet seal on contract documents for buildings that meet a specified threshold. The impending regulation further states the reason why electronic seals cannot be used. While there is a movement to delete this requirement for engineers, a change in the State Law will need to occur for architects.

Furthermore, sealed drawing must be archived for 11 years and an approved set of drawings must remain at the site. Thus Georgia State Law presents numerous hurdles to electronic plan review, however it is conceivable that separate stages of the submittal, review and archiving process could bypass these requirements.

Question 4.

To answer research question no. 4 the following procedures were utilized: Surveys and Interviews. The survey includes a wide cross section of participating AHJ including the City of San Francisco, City of Atlanta and Gwinnett County, GA. The survey indicates who and to what extent these jurisdictions are using electronic plan review.

Table 7. Overall satisfaction with electronic plan review by jurisdictional entity

Answer Options	Very Satisfied	Satisfied	Somewhat Satisfied	Dissatisfied	N/A	Rating Average
By the Design Professionals	6	9	5	1	22	2.05
By the Governmental Management	7	8	6	2	20	2.13
By the Plan Reviewers	5	8	8	3	20	2.38

The question asked was what is the overall satisfaction level with electronic plan review? This table indicates that the highest overall satisfaction, based on weighted average is by the plan reviewers. This is critical as the successful implementation lies with the plan reviewer who must accept the software and hardware and often must re-invent his or her review process. Ironically, the survey once again indicates moderate supports as perceived by the AHJ.

Table 8. Software

Answer Options	Response Percent	Response Count
Not Applicable	56.8%	25
Accella	15.9%	7
Avolve	2.3%	1
Voloview	0.0%	0
Spacedox	0.0%	0
Ebuilder	0.0%	0
Online Plan Review	2.3%	1
In-house	25.0%	11
Other (please specify)	11	

The survey question asked, What software do you use?

Of the other eleven responses, five noted use of Adobe Acrobat reader in conjunction with electronic tracking software. Other responses included Accella, Projectdocx, Posse and an in-house designed program. Accella and Projectdocx are two categories in the survey. It is unclear why these were overlooked. The data indicates that in-house programming, Accella and Adobe Acrobat reader are the most popular software programs used by the respondents.

Table 9. Changing software

Answer Options	Response Percent	Response Count
No	81.1%	30
Changing software	13.5%	5
Changing hardware	10.8%	4
Eliminating electronic plan review	0.0%	0
Other (please specify)	8	

The question asked, are you planning changes to the electronic plan review system?

Of the eight other responses (a) changing process, (b) broadening scope of reviews, (c) still too early to make that determination, (d) as with any technology (it is necessary) to keep up with current trends and software in order to make it beneficial, (e) pushing for more contractors to use the system, (f) two respondents answered not applicable.

Table 10. Submittal format

Answer Options	Response Percent	Response Count
.pdf	45.5%	20
.dgn or .dwg	11.4%	5
Do not specify format	43.2%	19
Other (please specify)	3	

The question asked, what format do you require? The data shows that the majority of the AHJ's require either the .pdf format or do not require any format at all. Working with design files such

as .dgn or .dwg files can potentially alter layers if the program files are not locked. Hence, many AHJs require the .PDF which the AHJ can mark up, but not modify the content (whether intentionally or unintentionally).

Table 11. Project based limitations

Answer Options	Response Percent	Response Count
Size	64.0%	16
Complexity	60.0%	15
Construction Type	8.0%	2
Occupancy Type	16.0%	4
Other (please specify)	11	

Other comments included (a) download sizes as set forth by IT department, (b) hard copy requested as needed, (c) one reviewer at a time can access the plans, (d) small scale remodels and additions and (e) six respondents answered that there were no restrictions in size or complexity.

The question asked, are there project limitations to electronic plan review based on? Nearly 60% of all AHJs require some limitation on electronic plan review based on size and or complexity. Large, complex projects such as a major hospital have historically not been easy to review with automation.

Table 12, Internal output of drawings.

Answer Options	Response Percent	Response Count
Printed out	33.3%	12
Reviewed electronically	66.7%	24
Archived only	8.3%	3
Transfer to other departments/jurisdictions	8.3%	3
Other (please specify)	6	

Five of the other responses answered (a) not applicable or none, (b) would print only when necessary, and (c) once on-line they will be reviewed electronically.

The question asked, Drawings electronically submitted to the department are. Most AHJ’s review the drawing electronically. Only 8% electronically archive and share between departments. This indicates a need for an interoperable cross-walk.

Table 13. Hard and electronic copies required

Answer Options	Response Percent	Response Count
Yes	16.7%	7
No	54.8%	23
On some projects only	28.6%	12
Other (please specify)	4	

The other comments noted (a) Bldg. Dept. still wants paper for review. Some bigger project would be nice depending on how architect lays out stuff on the plans, (b) hard copy only, until

we get our online program up and running, (c) we will need a jobsite copy for the field and (d) no as we haven't started the electronic process.

The question asked, do you require both electronic and hard copy submittals? The majority of AHF's require only electronic plans to be submitted. Note that if both paper and electronic drawings are submitted simultaneously, for all phases of reviews, the net result will defeat the potential saving in the electronic copy.

Table 14. Mark-up capability

Answer Options	Response Percent	Response Count
Yes	14.3%	6
Yes, and electronic approval stamps	33.3%	14
No	52.4%	22

The question asked do you have "mark-up" capability? Surprisingly, only 52.4% utilize software that allows mark-ups. Such mark ups would duplicate redline comments some plan reviewers make on the drawings. Other mark-up could include electronic approval seals and computer generated plan review comment with code citations. It is unclear what advantage is gained from a program that does not permit mark ups.

Question 5

To answer research question no. 5 the following three procedures were utilized Literature Review, Interviews and Surveys. There are numerous advantages identified in the White Paper on Best Practices in Electronic Plan Submittal (Alliance for Building Regulatory

Reform in the Digital Age at Fiotech, 2004, p. 4). Such advantages would be necessary to present to City leadership prior to implementation. A full cost-benefit analysis must be presented that includes expenses for manpower, training, hardware/software, ecological incentives, and interoperability expenses must be analyzed. Compatibility / interoperability with the City’s new computer tracking system, Munis, must be considered. Customer service must be stressed. It is recommended to reference the data in the following table which highlights the satisfaction level of design professionals (our customers) with electronic plan review.

Table 15. Design Professional’s satisfaction with local AHJs using electronic plan review

Answer Options	Response Percent	Response Count
Extremely satisfied	18.2%	2
Satisfied	45.5%	5
Dissatisfied	27.3%	3
Very dissatisfied	9.1%	1
Other (please specify)	3	

The question asked in Table 5 was, “what is your satisfaction level of working with other AHJs that use electronic plans submittal/review?” The responses indicates about 2/3rds of the design professions are either “satisfied” or “extremely satisfied” with electronic plan review in surrounding jurisdictions. The “other” responses suggest that some firm have not had any experience with jurisdictions that use electronic plan review.

Finally, it was necessary to show current trends by other AHJ’s. Table 16 addresses the current and future use of electronic plan review by AHJs.

Table 16. Electronic plan review through internet use

Answer Options	Response Percent	Response Count
		1
Yes	22.0%	18
No, but we’re considering adding in in the near future (within 1 to 2 years)	22.0%	18
No, but were considering it in the long term future (longer than 2 years)	29.3%	24
No, we have not considered this	29.3%	24

The question asked was does your jurisdiction use an electric plan submittal / review process through the internet? While only 22% of current AHJs are using electronic plan review, over 70% will either be using it or are considering using electronic plan review in the long term future. Note that the survey is deficient because it did not identify the time limit for “long term future.”

Discussion

Based on the results of literature review, surveys and interviews, the following is observed.

The first question asked, what are the satisfaction levels of the SSFR plan review customers? In general, the results from the three tables indicate an acceptable level of satisfaction with the departments that provide construction document review services in Sandy Springs, although there is room for improvement with respect to customer expectation for all departments. Furthermore, the City of Sandy Springs plan review experience is rated as better than about 66% of the surrounding AHJs. It should be noted that this is a status-quo situation, not a situation whereby electronic plan review has been implemented. Thus research did not indicate glaring weakness of turnaround time or customer dissatisfaction which is a classic indicator of need for improvement. The implications to the SSFR would include potential increase in customer service levels.

The second question asked what is the potential value and possible detriments of electronic plans review to the SSFR? The Alliance published a White Paper on Best Practices in Electronic Plan Review, Tracking and Storage.(Alliance for Building Regulatory Reform in the Digital Age at Fiatch, 2004, p. 4). The paper lists the following eight advantages of electronic plan review, submittal and tracking, some of which have not been identified by the survey. It is obvious from the literature review and the survey instrument that there are numerous advantages to electronic plan review. There are also numerous disadvantages such a cost, software and hardware technology, interoperability and training. The implications to the SSFR might be detrimental at first as the city absorbs the initial costs of software, hardware and training. There

is also an anticipated learning curve. In the long run however, electronic plan review can clearly save the city revenue, especially in the drawing archiving phase.

The third question asked what state or federal regulations exist relevant to electronic plan review and storage of public documents? The Georgia State Law specifically prohibits electronic seals on drawings that are required to be prepared on the drawings. It is conceivable that electronic drawings can be transferred through the review and re-review process. Electronic stamps would be provided on the drawings by the city. The drawings would then be printed by the design professional. These drawings would then be scanned for archiving just as they are done currently with an external contract. The original signed drawing would remain at the jobsite as required by Georgia State law. The implications to SSFR are that such a process will save time, money and economic resources if and when the disadvantages can be overcome.

The fourth question asked, how is electronic plan review being used elsewhere in other agencies? The literature review and surveys showed that over 66% of all AHJ were either currently using electronic plan review or will be using it in the long term future (albeit not defined in the survey). The survey indicated preferences and procedures that are worth study by the city for adopting best practices. The implication to SSFR is that the department will be seen as progressively adopting new technologies that ensure the Fire Prevention Bureau will be a continued success.

The fifth question asked how can electronic plan review be implemented at SSFR? The results to the question provided a framework for future implementation by SSFR and the City of Sandy Springs. Such framework is centered around the recommendation in the Alliance's White Paper on Best Practices in Electronic Plan Submittal (Alliance for Building Regulatory Reform in the Digital Age at Fiatch, 2004, p. 4). The implications to SSFR are that an electronic plan

review process will save time, money and economic resources. Table 15 suggests that the private sector is far ahead of the public sector in drawing technology and thus, government is in the role of “catch-up”. It is apparent that the private sector, led by the American Institute of Architects and the Alliance for Building Regulatory Reform in the Digital Age.(Alliance for Building Regulatory Reform in the Digital Age at Fiotech, 2004, p. 2)

Recommendations

It is the recommendation of this author that an electronic plans review process be studied further for implementation in the City of Sandy Springs with the goals to save time, money and economic resources as well as improve customer service. This is based on supporting evidence in the Literature Review, Personal Interviews and Survey Instruments. This proposal appears to be achievable and beneficial to the city and the design professionals, given a commitment to resolve disadvantages and challenges.

Additional research will be required to achieve this goal. Hardware, software, training and implementation costs must be established within the current and future budget cycles. A formal legal opinion from the Georgia Attorney General shall be sought on electronic seals and archiving. A plan of metrics, standards and feedback shall be established to measure and improve the process.

Recommendations for future researchers should be to examine future technologies such as Building Information Modeling that will virtually mandate electronic plan review in the near future. Specific software programs and new hardware should be examined on a continuing basis.

Technology evolves at an exponential rate, thus new applications should be anticipated.

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Appendix A

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1. What is your overall satisfaction with the design review process at the City of Sandy Springs (by department)

	Very Satisfied	Satisfied	Disatisfied	Very Dissatisfied
Building	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ADA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public Works	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Structural	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transportation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Permitting Desk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. How long did you have to wait before a Plan review representative at Sandy Springs began to help you?

- Extremely long
- Very long
- Moderately long
- Slightly long
- Not at all long

3. How eager to help you were the Plan Review representatives at the City of Sandy Springs?

- Extremely eager
- Very eager
- Moderately eager
- Slightly eager
- Not at all eager

4. How knowledgeable were the Plan Review representatives at the City of Sandy Springs?

- Extremely knowledgeable
- Very knowledgeable
- Moderately knowledgeable
- Slightly knowledgeable
- Not at all knowledgeable

5. How clear was the information the technical support representatives at the City of Sandy Springs gave you?

- Extremely clear
- Very clear
- Moderately clear
- Slightly clear
- Not at all clear

6. Was your experience with Plan Review at the City of Sandy Springs better than you expected it to be, worse than you expected it to be, or about what you expected it to be?

- Much better
- Somewhat better
- Slightly better
- About what was expected
- Slightly worse
- Somewhat worse
- Much worse

7. Is your firm using Building Information Modeling (BIM)?

- Yes
- No
- No, but we're considering using it in the next 1-2 years
- No, but were considering using it in the long term?

Other (please specify)

8. Would your firm be receptive to the use of electronic plan review by the City of Sandy Springs?

- Very receptive
- Somewhat receptive
- Not at all, we prefer paper submittals

9. What is your satisfaction level of working with other AHJs that use electronic plans submittal/review?

- Extremely satisfied
- Satisfied
- Disatisfied
- Very disatisfied

Other (please specify)

10. What other jurisdictions that you work with perform electronic plan review?

11. What is the one thing we could do that would most improve our customer satisfaction?

Appendix B

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1. Does your jurisdiction use an electric plan submittal / review process through the internet?

- Yes
- No, but we're considering adding in in the near future (within 1 to 2 years)
- No, but were considering it in the long term future (longer than 2 years)
- No, we have not considered this

2. Barriers to adding electronic plans submittal / review process (potential or encountered)? Check all that apply.

- Funds
- Interoperability with current systems
- Electronic seals allowed by law
- Demand by design professionals
- Demand by governmental entity
- Hardware, including large monitors
- Training of staff
- Coordination with other departments
- Software for submittal and review
- Security concerns
- Fear of loss of data
- Lack of hands on use in meetings

Other (please specify)

If you have not added electronic plan review to your department, please exi...

3. What software do you use?

- Not Applicable
- Accella
- Avolve
- Voloview
- Spacedox
- Ebuilder
- Online Plan Review
- In-house

Other (please specify)

4. What format do you require?

- .pdf
- .dgn or .dwg
- Do not specify format

Other (please specify)

5. Are there project limitations to electronic plan review based on:

- Size
- Complexity
- Construction Type
- Occupancy Type

Other (please specify)

6. Drawings electronically submitted to the department are:

- Printed out
- Reviewed electronically
- Archived only
- Transfer to other departments/jurisdictions

Other (please specify)

7. Do you require both electronic and hard copy submittals?

- Yes
- No
- On some projects only.

Other (please specify)

8. What is the overall satisfaction level with electronic plan review?

	Very Satisfied	Satisfied	Somewhat Satisfied	Disatisfied	N/A
By the Design Professionals	<input type="radio"/>				
By the Governmental Management	<input type="radio"/>				
By the Plan Reviewers	<input type="radio"/>				

9. What is the most important attribute of electronic plan review?

	Most Important				Least Important
Sharing between departments	<input type="radio"/>				
Shorten the review process	<input type="radio"/>				
Save printing costs	<input type="radio"/>				
Electronic archiving	<input type="radio"/>				
Improved customer service	<input type="radio"/>				
Standardized submittal	<input type="radio"/>				
Improved communication with the Design Professional	<input type="radio"/>				
GIS synchroniziation	<input type="radio"/>				

10. Are you planning changes to the electronic plan review system?

- No
- Changing software
- Changing hardware
- Eliminating electronic plan review

Other (please specify)

11. Do you have "mark up" capability?

- Yes
- Yes, and electronic approval stamps
- No

12. Does your jurisdiction require hard copy prints on the jobsite?

- Yes, We use printed copies of approved drawings are required
- No, we use contractor furnished electronic drawings
- No, we use AHJ furnished electronic drawings

13. Optional - Name of Jurisdiction

14. Do you have any comments?

Appendix C

Interview Questionnaire

1. What is your position with the company? What is your academic and professional Background?
2. What do you see as the benefits of implementing electronic plan review in the City of Sandy Springs?
3. What do you see as the potential detriments for implementing electronic plan review in the City of Sandy Springs?
4. How do you think this will affect customer service?
5. What is the long term strategy for archiving of construction documents?
6. How do you feel this initiative will be received by Mayor and Council and the top City leadership?
7. Specific pertinent questions based on the individual's background.