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## Editorial Policy

The primary purpose of the JTM is to publish managerial and policy articles that are relevant to academics, policymakers, and practitioners in the transportation, logistics and supply chain fields. Acceptable articles could include conceptual, theoretical, legal, case, and applied research that contributes to better understanding and management of transportation and logistics. Saying that, our policy requires that articles be of interest to both academics and practitioners, and that they specifically address the managerial or policy implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to transportation and logistics activities, or to related policy matters, would be inappropriate for the *JTM*. Articles related to any and all types of organizations, and of local to global scope, will be considered for publication.

Acceptable topics for submission include, but are not limited to, broad logistics topics, logistics and transportation related legal issues, carrier management, shipper management of transportation functions, modal and intermodal transportation, international transportation issues, transportation safety, marketing of transportation services, transportation operations, domestic and international transportation policy, transportation economics, customer service, and the changing technology of transportation. Articles from related areas, such as third party logistics, purchasing and materials management, and supply chain management, are acceptable as long as they are related to transportation and logistics activities.

Submissions from practitioners, attorneys or policymakers, co-authoring with academicians, are particularly encouraged in order to increase the interaction between groups. Authors considering the submission of an article to the *JTM* are encouraged to contact the editor for help in determining relevance of the topic and material.

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**Publishing Data**

**Manuscripts.** Submit manuscripts to the editor by email attachment at taylorjohn@wayne.edu. Manuscripts should be no longer than 30 double-spaced pages and 7000 words. Guidelines for manuscript submission and publication can be found in the back of this issue.

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*Revised March 15, 2013*

# From the Editor…

Welcome to the Winter, 2015 issue of the Journal of Transportation Management! This issue, being Vol. 25, No. 2 completes the 25th Anniversary of the Journal. This Silvery Anniversary is major milestone in the history of the Journal and a tribute to the previous Editors and Authors of the Journal. We look forward to another even better 25 years.

This issue of the *Journal* contains an article on a logistics executive in residence course, an article on highway construction delays claim analysis, an article on the impact of freight traffic on school walking decisions in urban environments, and an article on the auto industry's MMOG/LE self-assessment processes for improving supply chain delivery performance.

The first article is an excellent overview of the issues involved in starting a Logistics Executive in Residence course. Both the anecdotal and statistical evidence suggests that the Executive in Residence course increases interaction and improves learning with majors. The second article discusses highway construction efficiency, a topic which is critical to highway users such as the trucking industry given today's era of shortages in funding, and given the need for major re-investments in the highway system. The analysis shows clearly that a standardized process for delay claim analysis would improve highway construction contracting. The third manuscript presents findings from a study of urban neighborhoods in a major southeastern city, including those that are adjacent to freight corridors. The paper examines the impact of actual and perceived freight activity on school pedestrian safety. The fourth article introduces readers to a relatively new self-assessment tool for measuring the readiness and effectiveness of supplier materials management and logistics processes in the automotive industry. The authors address the various strengths and weaknesses of the MMOG/LE model, and make several recommendations on how the system and processes for managing it could be improved.

At the *Journal*, we are continuing to make a number of changes that will improve the visibility of JTM, and improve its position in the supply chain publishing world. These include registering and updating journal information with several publishing guides, placing the journal content with the EBSCO, Gale and JSTOR databases faculty have access to, and placing abstracts of all past journal articles on an open area of the DNA Journal webpage. www.deltanualpha.org

I look forward to hearing from you our readers with questions, comments and article submissions. The submission guidelines are included at the end of this issue's articles and I encourage both academics and practitioners to consider submitting an article to the Journal. Also included in this issue is a subscription form and I hope you will subscribe personally, and/or encourage your libraries to subscribe.

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# A NEW APPROACH TO SPEAKER RELEVENCE USING A LOGISTICS EXECUTIVE IN RESIDENCE COURSE

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## ABSTRACT

This article addresses a new method to bring real world relevance into the Logistics, Transportation and Supply Chain Management classroom. A different type of Executive in Residence course focuses on using multiple industry speakers to provide a unique learning environment for today's Millennial majors. While the majority of the paper is a thought based overview, a statistical analysis of student responses was used to compare various types of relevant courses. A simple comparison of various appropriate items was examined to identify if the Executive in Residence course increased learning. Both the anecdotal and statistical evidence suggests that the Executive in Residence course increases interaction and improves learning with majors. It highlights a non-traditional type of approach to incorporating executives into the curriculum and results in a more robust learning environment. The inclusion of active executives also creates a number of practical benefits for the practitioners, students, faculty and university.

## INTRODUCTION

Understanding the absorption of knowledge is a complex exercise and the different approaches in which people learn vary as widely as any individual human characteristic. These processes have been studied for many years by people intent on explaining, predicting and manipulating the ways in which people learn (Potter and Maccaro, 2000). One of the most important objectives of an institution of higher learning is the ability to effectively convey knowledge to the largest group of students possible. Students experience a variety of approaches employed by instructors designed to balance theoretical learning and practical application. In business education, the challenge of providing opportunities for undergraduate students to learn how to apply the concepts of their discipline has been discussed in the literature for more than forty years (Achenreiner and Hein, 2010).

One of the key drivers of this research is that business education has been admonished by practitioners for not training students with the specific knowledge and skills necessary to become practicing business professionals (Beeby and Jones, 1997; Cannon and Sheth, 1994; Byrne, 1992). There are a number of factors that make bridging the gap between theory and practice a challenge for business schools. One of the most glaring is the lack of business experience by an increasing number of academics (Conant et al., 1988). However a study conducted by Conant et al. (1988) notes that students had a higher regard for teachers that possessed real world perspective.

One approach to bridging the gap between theory and practice is to bring business professionals into the classroom. This brings a broader perspective and understanding of current relevant business practices to the students. One method is to hire recently retired practitioners

into an Executive in Residence (EiR) position. The EiR then complements the traditional university faculty. An EiR course allows business practitioners to meet with students and provide undergraduates with examples of "real-world" practitioner experiences in a university setting (Johnston, 2004). However, this is only one method to bring EiR onto campus to interact with students.

This article will examine a different type of Logistics and Transportation EiR course and attempt to evaluate the effectiveness of this unique approach. The overall goal is to present academics and executives a new model to improve the overall education of Logistics, Transportation and/or Supply Chain Management students. After this introduction, there is a review of the appropriate literature and a discussion of the methodology to evaluate the course effectiveness. Also, there is a discussion of the perceived strengths and weaknesses of the new EiR type class. Furthermore, there is an overview of the course mechanics to allow other academics to replicate or modify the course at their location. Finally, the article addresses some key conclusions and future research opportunities.

## LITERATURE REVIEW

### Theory of Learning

Learning is commonly defined as a process that brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views (Illeris, 2004; Ormrod, 1995). An active process, learning builds knowledge and skills through practice within a supportive group or community (Kim, 2000). Most human behavior is learned through observing others behaviors and using new knowledge to guide action (Bandura, 1977).

The theory of learning addresses three philosophical views. First, a behaviorist view focuses on the objectively observable aspects of learning (Skinner, 1953). Second, a cognitive view looks beyond behavior to explain brain-based learning (Mandler, 2002). Finally, there is a constructivist view where the learner actively constructs or builds new ideas or concepts (Driver et al., 1994). Behaviorism dominated the educational landscape twenty-five years ago, while the foremost learning theory today is constructivism (Boghossian, 2006).

Social constructivist learning theory suggests that collaboration between students and others outside the university community is essential for effective learning (Hodgkinson-Williams et al., 2008). The theory focuses on the learning that occurs within a social context and how both environmental and cognitive factors interact to influence human learning and behavior (Bandura, 1977). The interdependence of social and individual processes helps to facilitate co-construction of knowledge (Palincsar, 1998). This is especially true of millennial learners, who have been described in the literature as being both socially and team oriented (Howe and Strauss, 2000). Millennials, born between 1981 and 1999, are described as children who grew up central to their parents' sense of purpose. Their parents have often sheltered them, which tends to extend adolescence and delay their development of independence (Price, 2009). Millennial students who do not see the benefit in learning the material presented may become apathetic (Haytko, 2006; Kothari et al., 1993).

A part of constructivist learning, the theory of action learning, can be explained as a process for the development of managers using a live issue or problem in the learner's workplace as the primary vehicle for learning (Pedler,1997). Active learning is based on the theory that learning is a dynamic, social construction. Growth occurs where one's world view is challenged in an environment which links theory, action and reflection. Instructors should design and structure courses that encourage students to exercise their knowledge formation capabilities (Crawford, 1996; Doolittle and Hicks, 2003). The EiR course is a type of active

learning that motivates students to learn by applying course content ,and providing students with relationship building opportunities in the classroom that contribute to their future career's success (Borges et al., 2010). The next section highlights the importance of active learning with Millennial students.

**Pedagogy**

Since the Theory of Learning highlights the challenges of teaching Millennial students, and the value of active learning, it is important to identify the pedagogical aspects that could support the use of executives in the classroom. The educational psychology literature has explored the ways in which students acquire, retain and retrieve information. This defines the individual's learning style (Claxton and Murrell, 1987; Schmeck, 1988). Students learn in a number of different ways; by seeing and hearing; reflecting and acting; reasoning logically and intuitively; memorizing and visualizing (Felder and Henriques, 1995).

In addition to addressing students' learning styles, understanding the student's characteristics help teachers maximize the students' learning and appropriately prepare them for their future careers (Sojka and Fish, 2008). Millennial students for example, are characterized by their immense need for affiliation, and as a result, they are great team/group participants with tighter peer bonds and greater needs to achieve and succeed (Borges et al., 2010). Due to a strong desire to achieve, Millennial students continuously expect new challenges, and they also require more attention and feedback. High-achievers expect to gather significant experiences and skills that guarantee them future jobs (Matulich et al., 2008).

Regardless of the materials that academics teach, educators are faced with the challenge of how best to design a given course (Kennett-Hensel et al., 2010). "Effective teaching requires inputs and processes to ensure that activities provide relevance and contribute to desired outcomes for students" according to Metrejean et al (2002).

The pedagogical method involving guest speakers from logistics, transportation and supply chain organizations in the course helps to addresses Millennial students desire for affiliation and job placement.

Practitioner speakers bring real-life learning experiences, inspire and orient logistics majors into various logistics and transportation careers and increase credibility of the course materials (Metrejean et al., 2002; Eveleth and Baker-Eveleth, 2009; Fawcett and Fawcett, 2011). Davis and Snyder (2009) observed that students consider their education to be a relevant if it includes guest speakers. Furthermore, Davis (1993) suggests that guest speakers with relevant or practical expertise are good alternatives to traditional lectures. Lowman (1995) suggests using alternate class formats, such as a guest speaker, can enrich learning experiences and reinforce knowledge concepts in the classroom (Davis, 1993; Lowman, 1995; Eveleth and Baker-Eveleth, 2009; Rutner, 2004).

Therefore, the literature identifies the challenges presented by Millennial students and their expectations for new challenges and material. Furthermore, they require more "experiences" and relevance. This leads to a potential solution of using practitioners as guest speakers to better meet the expectations of Millennials.

**COURSE HISTORY AND DEVELOPMENT**

The concept of executive faculty is not new (Achenreiner and Hein, 2010). Mentioned in a 1969 Business Horizons article, executive in residence programs date back to the early 1970's (Wellemeyer, 1983). AACSB defines Executives in Residence as permanent additions to business school faculty with most having the rights, privileges and voting power of traditional faculty but without traditional research demands (Achenreiner and Hein, 2010).

According to Schrader and Thomas (2004) almost half of the AACSB schools have some type of traditional EiR course or program. For the purpose of this article, a "traditional" EiR

course is a full semester's class taught by a practitioner, often recently retired. Therefore, students can experience a number of approaches employed by instructors to balance theoretical learning and practical application (Achenreiner and Hein, 2010). The intent of this type of EiR course is to bring business practitioners into a university campus classroom in an effort to provide students with a "real-world" perspective, including practitioner experiences (Johnston, 2004). In sum, the traditional EiR teaching model basically focuses on a "permanent" faculty addition.

Johnson (2004) clearly states that students, instructors, and the university all benefit from the input of practitioners. The main benefit of any EiR course is the real world experience and examples that a practitioner brings into the classroom (Achenreiner and Hein, 2010). Other benefits include a stronger connection with the business community, introduction of students to potential employers, and the ability for students to learn current business practices (Schrader and Thomas, 2004, Gutterridge, 2007). Many of these benefit areas strongly align with the learning styles and personality traits of Millennial students identified previously (Matulich et al., 2008). Table 1 summarizes both the benefits and costs of a traditional EiR type of course.

Clearly, there are many good reasons to consider a traditional EiR course(s). Many of the key strengths particularly align with the expectations and needs of Millennial students, however, it is

**TABLE 1:**
**BENEFITS AND COSTS OF A TRADITIONAL EiR COURSE**

| | Benefits | Costs |
|---|---|---|
| Student | Learn what employers want in new graduates<br>Access a network for potential job opportunities<br><br>Learn to match expectations to reality in the real world<br><br>Be entertained by speakers | Time spent in class, doing research, meeting practitioner<br><br>Credit-hour costs(no additional cost if full-time students) |
| Instructor | Learn current business practice to use as examples of teaching<br><br>Learn current career advice to give students | Time spent for class, coordinating visits, evaluating assignments, time in class<br><br>Time spent getting a course added to the college catalog (one time) |
| College | Provide practitioner input to students in the business curriculum<br><br>Contribution to achieving college mission and objectives<br><br>Potential new "friends" of the college | Cost of meals<br><br>Cost of faculty time |
| Practitioner | An attentive audience of students<br><br>A chance to help others with his or her experiences<br><br>Introduction to potential employees<br>Association with the business school<br><br>Recommendations about course requirements competencies | Time and travel costs |

(Johnston, 2004)

not a "magic bullet" that solves all challenges. The table identifies a number of significant disadvantages as well. In addition to the items in the table, other challenges to an EiR class include the executive's longevity, availability, pedagogical skill, and ability to relate to Millenials. Incorporating practitioners that not only bring real-world experience to the classroom but are also engaging, familiar with the course content and learning objectives and versed in effective pedagogy is challenging (Fawcett and Fawcett, 2011). The net result is that traditional EiR class evaluations, and especially those that are often taught sporadically, often trend to extreme ends of the teaching spectrum.

## COURSE STRUCTURE, REQUIREMENTS AND GOALS

### Background

To attempt to garner the benefits of a traditional EiR course and simultaneously reduce the typical challenges, Georgia Southern University faculty developed a modified EiR approach. To differentiate between the modified and the traditional, the University's faculty approach is more of a speaker-based EiR course. The authors would love to take credit for the initial design of this process; however, like many successful teaching innovations, a very similar course was taught at the University of Tennessee in both the Marketing and Logistics/ Transportation programs. The Georgia Southern University faculty borrowed the basic elements of the course, but modified them to meet the needs of its students. One goal of this article is to allow other programs to evaluate whether the speaker-based EiR course format would benefit their students.

Over the last ten years, the speaker-based EiR course developed from a random, "special topics" course into a scheduled elective for the Logistics and Transportation majors. Due to the University's rules, the first two times the class was taught, it was as a special topics class without a unique catalogue prefix and course number. Although the evaluation of the course was very subjective, it was clear that it was both a strong learning experience and very popular with the students. Due to the initial successes, the course was then formalized through the curriculum development process into its current form of LOGT 4233 – Logistics Executive in Residence. The goal of the Faculty is to teach it once a year in the spring semester as an elective to graduating seniors. However, due to faculty constraints, it has been taught approximately every other year. Georgia Southern's catalog description follows:

> "Logistics Executive in Residence (LOGT 4233) - A capstone, integrative, case course in logistics and transportation strategy. Students participate in an Executive in Residence program that provides interaction with top-level logistics and transportation executives."

### Course Structure

The structure of the class is very different from a traditional EiR course. A traditional EiR course would usually be built around a typical topic: principles of transportation or logistics, carrier management, logistics information systems/ERP, etc. The speaker-based EiR model attempts to maximize the knowledge of the EiR professionals and not focus on typical topics. Note that the term professionals with an "S" is used. The key is that the speaker-based EiR class incorporates a series of practitioners throughout the semester. According to Fawcett and Fawcett (2011) students believe that effectively involved guest speakers provide excellent validation for key concepts, theories and tools being taught in class. The goal of the class is to bring in approximately twelve executive speakers each semester. This number has been identified as fitting both the length of the semester while allowing a broad coverage of topics across the logistics discipline. An example syllabus in Appendix A provides a typical list of speakers (note: specific individuals' names were removed, but company

types were inserted to highlight the diversity of executive experiences.) As the syllabus highlights, the course spends the most time on the key element of the interaction between the students and the executives. Therefore, twelve weeks of the class are dedicated to the executives. The goal is to maximize the exchange between the students and executives.

The mechanics of the course are fairly straight forward and will become very familiar to the students across the semester since it is repeated for twelve weeks. It is recommended that a Tuesday and Thursday schedule be used for the class. On Tuesdays, students are preparing for the speaker that will present on Thursday. Two student groups will make fifteen minute presentations on two related topics. One group will review basic industry information that is germane to the speaker's field or industry. The second group will present background information on the speaker's career and company. For example, if the speaker is from BNSF, the first group would provide a review of the railroad industry. The second group would talk about the speaker's career and specifically address the BNSF railroad. The purpose of this is twofold. First, it provides a review to all the students to ensure they represent themselves well when the speaker is in the class. Secondly, it frees the speaker of the burden of providing a lot of background information during Thursday's class and allows he or she more time to focus on whatever topic he or she chooses. Frankly, the speakers' time is very valuable and anything that the professor can do to maximize that time is critical. The remaining time in class on Tuesday is used to cover administrative materials, critique previous student presentations and cover current logistics and transportation topics.

The second class in the week is on Thursdays and is primarily for the executive. The entire class period is dedicated to whatever topic the speaker chooses. Usually, they will pick a topic that is related to their current position or discuss a topic that is critical to their company. However, some speakers have gone "off topic" and spoken about leadership, skills for new hires, or presented case studies. Regardless of the topic, the breadth of speakers will ensure a great learning experience based on materials from across the supply chain. Furthermore, most speakers will use some form of PowerPoint, but not all. Again the format is not important; the message to the students will be the critical item. The final event immediately follows class on Thursday. The speaker, professor and the related student group(s) will go to an early dinner. This gives the executive a chance to interact with students in a small group setting. It also allows for very interesting and free flowing discussions with topics ranging from current logistic trends to stories about exotic business dinners around the world. Regardless, it is one of the best learning opportunities for majors.

**Specified and Implied Professor Tasks**

There are a number of necessary tasks required of the professor to ensure a successful course. While the points noted below are more reflective of the rural setting of Georgia Southern, schools in more urban areas may have a far easier time using the model discussed here. In either case, first and foremost, the faculty must identify and schedule approximately twelve available executive speakers. Executives are likely to have very busy schedules. Especially in non-urban settings,steps must be taken to minimize the burden placed on the executives with regard to things such as time and travel costs. One approach is to prioritize the speakers by distance. Normally, the speaker that has to travel the farthest is given their choice of dates. In the event of unforeseen circumstances, it is wise to have a local, thirteenth speaker that can fill in on short notice. Also, there are some politically sensitive considerations about the make-up of the speakers. It is strongly suggested that the speakers come from a cross-section of race, gender and industry. The faculty has had some success in mirroring the demographics of the university in the speakers. This seems to have a positive impact on the students as well.

Another implied task for the faculty is to secure adequate funding. There are two financial costs to the course. The largest is the twelve dinners. The second significant cost is for token speaker gifts. The total cost of both is approximately $2,000 a semester. At the University, Georgia state funds cannot be used for either of these items. Fortunately, a logistics and transportation company, which chooses to remain anonymous, has agreed to fund these costs each year. However, this could be an excellent opportunity to promote themselves to students while funding the "fill in the company name" Executive Speaker Series.

A final specified task is the course structure during the non-speaker weeks. There is not a "best" answer for these weeks. Often the faculty uses them to familiarize the students with the process since it is a very different structure than the traditional lecture format Millennials are used to. Another task is to bring the Career Services representative to class to help students understand the resume and interview process on campus. This works well since the vast majority of students are seniors within one or two semesters of graduation. Finally, exams can be put into some of this time, but that would usually only be one day of a week which creates scheduling problems with the Tuesday/Thursday process during the majority of the weeks.

**Hidden Goals**

At Georgia Southern, there are a disproportionate number of first generation college students when compared to many other universities logistics and transportation programs.. Therefore, one of the goals of the entire faculty is to "polish" the students as they prepare to go into industry. This includes helping them interact with industry professionals. The Logistics EiR course is an excellent vehicle to help educate the students on some of the more subtle aspects of business etiquette. To accomplish this, one requirement of the student groups is to interview the executive before he/she comes to campus. Obviously, an implied task for the professor is to follow up behind the scenes to ensure the executive is comfortable with the process.

Additional tasks are included to meet other course goals. The students are also required to coordinate everything with the executive including time and location of the class, parking passes and any additional requirements. This is to help them learn all the logistics of planning a simple visit. The next goal is addressed during the student presentations. The students are required to make their presentations (Tuesday's class) in formal business attire. This affords the faculty an opportunity to critique the clothing they will wear to interviews. Again, the class helps to address the "polish" as a hidden goal. There are a number of other hidden benefits, but many may be specific to the demographics of the University.

**Professor Learning Points**

To conclude the speaker-based EiR course development and structure, there are a number of learning points that the faculty have identified over the years. First, the two day a week schedule is critical for success. Furthermore, the Tuesday/Thursday schedule is more popular with the speakers than a Monday/Wednesday schedule. This allows some executives the opportunity to turn the visit into a three day weekend for tourist possibilities, or in the case of an urban university, for conducting additional business. The class time that has worked the best is from about 3:30-5:00pm. Although late in the afternoon, this allows the group to proceed immediately to an early dinner. Many of the speakers will travel after dinner, especially if they are visiting a more remote or rural area. So, a later class time can create potential travel issues for some speakers.

Another issue is the exam schedule. More frequent exams work better. If the professor only gives a mid-term and final, there may not be enough responses discussing each speaker (see example exam in Appendix B.) There are two solutions: require the group that presents about a speaker to write about that speaker

(therefore a minimum of 10% of the students will cover every speaker on the exams), and/or give three or four examples which will reduce the number of speakers to choose among for each exam. Finally, the professor is likely to find that most of the speakers very much enjoy the process and are willing to come year after year. Therefore, it is likely that the professor will only have to replace two speakers each year due to job changes, retirements or for other reasons.

The Logistics EiR course structure appears to meet the goals of the faculty. Also, executive feedback continues to be very positive. Furthermore, the willingness of practitioners to continue to travel half way across the country on their own time and money provides solid and positive, but anecdotal, evidence of the benefits they perceive. Finally, the students have been very positive in their comments. However, a better analysis was required to validate the success of the Logistics EiR course.

## COURSE EVALUATION AND METHODOLOGY

As with any course evaluation, the challenge is to assess the learning and benefits for a student using various measures. To improve upon typical university in-class questionnaires, both student course evaluations along with student course achievement were considered for analysis. As with most universities, student course evaluations at Georgia Southern serve as the primary tool for formative and summative evaluations of faculty teaching and course comparison. The student course evaluation contains twenty-three questions intended to assess student perceptions of the course, including elements relating to faculty. This data was collected for both multiple sections of the Logistics Executive in Residence class as well as numerous other courses for comparison. To move beyond the traditional university course evaluation as the only data for consideration, student grades were collected for comparison as well. The second set of data was used to provide additional verification of any outcomes. Since grades serve as the measure for student achievement at the University, it provides another solid method to evaluate the effectiveness of the course.

To gather a representative and testable set of data, both student course evaluations and overall course grades were used from four different logistics courses taught at Georgia Southern for the years 2001 through 2011. The three additional courses are part of the core and major degree requirements for the Bachelor of Business Administration with a major in Logistics. These courses include Business Logistics, International Logistics, and Principles of Transportation. The fourth course was the Logistics EiR course (note: data included both the special topics version and permanent iterations of the class). To improve consistency and minimize variation, evaluations and grades for the all the courses were collected from only one faculty member. A total of 517 student evaluations were collected, all of which were usable. The sample was fairly evenly split in terms of number of evaluations per course. Table 2 provides a summary of the demographic data of the student respondents.

**TABLE 2**
**RESPONDENT DEMOGRAPHICS**

| | |
|---|---|
| Number of students' evaluations 2001-2011 | 517 |
| **Evaluations completed** | |
| Principles of Transportation | 19% |
| Business Logistics | 28% |
| International Logistics | 32% |
| Executive in Residence | 21% |
| **Student's major** | |
| BBA Logistics | 76% |
| Other majors | 24% |
| **Student's classification** | |
| Junior | 47% |
| Seniors | 53% |

**TABLE 3**
**COURSE EVALUATION QUESTIONS**

| Questions | Courses | | | | | | |
|---|---|---|---|---|---|---|---|
| | EiR | Business Logistics | Sig. | Princ. of Trans | Sig. | Int'l Logistics | Sig. |
| To what degree where you intellectually challenged in this course? | 3.29 | 3.63 | .006** | 3.82 | .000** | 4.11 | .000** |
| How much did you learn in this course? | 4.03 | 3.77 | .024* | 4.14 | .338 | 4.13 | .343 |
| The instructor's encouragement to class participation, discussion, or questions was? | 4.59 | 4.41 | .071 | 4.38 | .038* | 4.36 | .006** |
| Overall, how would you rate this instructor? | 4.63 | 4.33 | .001** | 4.44 | .043* | 4.34 | .002** |
| * - Sig. p-value<.05; ** - Sig. p-value<.01 | | | Likert Scales of 5 is the best and 1 is the lowest | | | | |

## FINDINGS – ANALYSIS OF STUDENT REPSONSES AND ACHIEVEMENT

Using student responses from the student course evaluations, an independent sample t-test was conducted to compare the mean responses. Answers to the relevant questions on the evaluations for the Logistics EiR course were compared to answers on the evaluations from each of the core logistics courses. The questions used for comparison are detailed in Table 3.

A review and analysis of the relevant questions from the course evaluations proved thought-provoking. Of particular interest was the idea that students did not feel as though they were as intellectually challenged in the Logistics EiR course versus other logistics courses. The students' perception was that they did not need to work as hard in the EiR course as they did in other logistics courses. This is a key finding and should be viewed as a positive given that Millenials respond more to an active learning environment and less to a traditional learning environment involving memorization. The class increases the level of interaction and active learning when compared to a traditional logistics course. Additionally, when compared to the students learning of the basic concepts in a traditional course format (i.e., a principles course), the logistics EiR course provides for a greater diversity of subject matter related to real world situations. This may contribute to the students perception of lack of intellectual challenge. As documented in the following paragraphs, the overall impact of the guest speaker EiR model appears to be higher levels of learning when compared to other classes without the "traditional" effort on the part of the student.

In addition to the opinions provided by the students in the course evaluations, course grading and assessment was also considered for analysis. Table 4 details the mean grades for each of the courses used in this study by comparing the overall average grade by course to the overall average grade in Logistics EiR (Note: an "A" equaled a 4, "B" = 3, … "F" = 0.)

Interestingly, although the level of learning appears to be greater than that of other logistics courses, students also attained higher levels of achievement in the EiR course. As an upper-level undergraduate course, the logistics EiR course is very "MBA like" in its course requirements and assessment of student

**TABLE 4**
**COMPARISON OF COURSE GRADES**

| Course. | Mean | N | Std. Dev. | F. | Sig. |
|---|---|---|---|---|---|
| Principles of Transportation | 2.48 | 238 | 1.03 | 4.03 | 0.000* |
| Business Logistics | 2.51 | 338 | 0.97 | 38.18 | 0.000* |
| International Logistics | 2.75 | 324 | 0.82 | 8.86 | 0.003* |
| Logistics Executive in Residence | 3.33 | 123 | 0.49 | | |
| * - Sig. p-value<.05; ** - Sig. p-value<.01 | | | | | |

achievement. In addition to in-class quizzes and assignments, the examinations in the course are essay examinations requiring critical thinking skills rather than the multiple choice type examinations provided in other courses. Students are also required to give formal, 15 to 20 minute group presentations as a part of the logistics EiR course. When compared to other classes, the length and depth of the presentation requirements is much greater than other logistics courses.

In addition to a review of student responses to the relevant questions on the course evaluations and student achievement, the authors reviewed the written comments provided by students regarding the course. While there were not enough comments to perform a detailed qualitative analysis, there were enough responses to highlight both strengths and weaknesses of the guest speaker EiR course model. Table 5 provides a number of positive and negative comments representative of student observations about the EiR course.

The comments provided additional support that the speakers provided a unique and positive learning experience for the students. Even the "worst" speaker did a great job of helping to recognize the opportunities and challenges that

**TABLE 5**
**REPRESENTATIVE STUDENT COMMENTS**

| | |
|---|---|
| **Positive Comments: What did you like best about this instructor/course?** | 83% |
| "Learned a lot. Speakers were helpful" | |
| "Instructor cares about the students' futures and he is there if questions need to be asked" | |
| "Instructor is a good mentor" | |
| "Instructor helps students learn more about logistics and enjoy it at the same time" | |
| "Great course" | |
| "Speakers coming in and talking about real life situations" | |
| "Very intellectual course. Showed a lot of insight about what to expect in the Logistics world" | |
| "The executives that came to our class" | |
| "Learn a lot about my major, a lot more about the business world and the real world. Instructor did a great job scheduling speakers" | |
| "The speakers and their information" | |
| "Speakers" | |
| "Guest speakers and practice in presenting" | |
| "Guest speakers were phenomenal" | |
| "Great opportunity to get the feel for real world applications of things I have learned in other logistics classes" | |
| "The chance to interact with other logistics professionals" | |
| "The speakers were very interesting and I learned a lot by listening to them" | |
| "I like the enthusiasm of the instructor and the subject matter of the course" | |
| "I enjoyed listening to knowledgeable people in the industry" | |
| "Excellent course to expose students to various aspects of the transportation industry" | |
| "Well organized and great to take right before you head out" | |
| "The experimental learning got so much from this course, I am still getting stuff out of it" | |
| "Learned from people in the industry that have tremendous experience" | |
| "I liked that there was so much real word application" | |
| "Everything in the class was great. I am very glad I took this course and was able to meet and learn from all the Executives" | |
| "Instructor is interesting and great teacher. He has worked to bring is some of the most successful people in the industry. One of the best part of the class is when he does current affairs" | |
| "In enjoyed most of the speakers" | |
| "The whole class was interesting. Hearing from executives is priceless. Recommended course" | |
| **Negative Comments: How could this instructor/course be improved?** | 17% |
| "Easier exams (they are brutal)" | |
| "By providing more real world" | |
| "Time of day" | |
| "Grade only on presentations, no tests" | |
| "I would suggest a final exam only. No midterm" | |
| "More discussion on current affairs" | |
| "Have more tests, closer together" | |
| "Unnecessarily harsh on many occasions" | |

new logistics managers will face. The comments support the basic concept of having a class centered around logistics executives. Furthermore, most of the negative comments are based on the difficulty of exams and presentations and are more pedagogy issues about the mechanics and not the value of the speakers. Ironically, the comments about difficulty contradict some of the findings about the "easy" nature of the course.

## CONCLUSIONS AND IMPLICATIONS

This study provides insight into the guest-speaker model of a Logistics EiR course. Any EiR model of learning potentially increases students' preparation for the job market and increases the acceptance and understanding of the course material (Eveleth and Baker-Eveleth, 2009.) The speaker-based EiR presents a different type of approach from the traditional one in which an executive teaches an entire course. There are some unique strengths and weaknesses to this model when compared to Johnston's findings (2004, summarized in Table 1.) In addition to Johnston's key concepts, the study identified a number of additional points. Some of the strengths of the speaker-based EiR class include a diversity of people, topics and experiences. For instance, the small group interactions, over dinner, helps learning as well. Another benefit is the branding of the university by including so many different companies on campus. One speaker actually interviewed over twenty of his customers about "what to say to the students." The "free" advertising is invaluable for the school and the company. Finally, it can serve as an early interview filter

**TABLE 6**
**BENEFITS AND COSTS OF A SPEAKER BASED EiR COURSE**

| | Benefits | Costs |
|---|---|---|
| Student | Learn what employers want in new graduates and access a network for potential job opportunities<br><br>Learn to match expectations to real world reality<br><br>*Broad range of speakers and topics* | Time spent in class, doing research, meeting practitioner<br><br>Credit-hour costs(no additional cost if full-time students) |
| Instructor | Learn current business practice to use as examples of teaching<br><br>Learn current career advice to give students | ***Time spent for class, coordinating visits, evaluating assignments, time in class***<br><br>Time spent getting a course added to the college catalog (one time) |
| College | ***Provide practitioner input to students in the business curriculum***<br><br>Contribution to achieving college mission and objectives<br><br>Potential new "friends" of the college<br>*Potential source for placement of graduates*<br>*Potential source of additional funding/resources* | Cost of meals<br><br>*Costs of gifts*<br><br>Cost of faculty time *(much lower in a speaker based vs traditional executive in resident type of class)* |
| Practitioner | An attentive audience of students<br><br>A chance to help others with his or her experiences<br><br>Introduction to potential employees<br>Association with the business school<br><br>*Input to course/curriculum* | Time and travel costs<br><br>*Class preparation* |

(Adapted from Johnston, 2004)

by potential employers. Some companies can use this as a method to improve their access to future employees. Table 6 incorporates both the Johnson conclusions (previously in Table 1) and this study's findings into one overall table. New items are italicized and items that are strongly reinforced by the speaker based EiR class are in bold.

As with any new concept, there are some challenges with this type of class. The scheduling of twelve successful executives can be difficult. There can also be a significant cost for incidentals to the university (e.g., gifts, meals, etc.) and travel for the speakers. There is a significant time commitment for both the faculty member, in course preparation before the semester which includes the organizational activities necessary to schedule the executives participating in the course, and to the executives, who must commit to travel necessary to participate. Finally, there is a potential risk in having students interact with senior executives. According to the professor, there is generally at least one faux pas per semester from the students. Fortunately, the executives are prepared and have taken it with a sense of humor to this point.

The net result is a course that has proven to be very successful and popular at Georgia Southern University. While it is not a perfect course, it provides a different learning experience that seems to resonate with Millennial learners and the executives that participate. The hope of the authors is that other universities will consider whether a similar model can be applied to improve the learning of their Millennial students and increase practitioner involvement at their institution.

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## APPENDIX A
## LOGISTICS EXECUTIVE IN RESIDENCE PARTIAL SYLLABUS

STATEMENT OF OBJECTIVES AND SCOPE

This semester's topic will be executive viewpoints in the field of logistics. The growth of logistics throughout industry has led to an equivalent growth in the professional opportunities for logistics managers. These new leaders in industry have unique insights into various logistics and transportation issues. The simple purpose of the course is to help students identify not only the current issues of the industry, but also gather various viewpoints about the topics.

The students will be expected to challenge themselves and the executives to broaden their understanding and critical thinking skills in logistics. Approximately once a week, an executive will speak with the students on a topic of his or her choice. The goal is to allow a broad collection of issues to be presented by and to the students. Both the executive and the class members should benefit from the interaction within the classroom and other outside settings.

The ultimate goal is to help students to become better informed about the "real world" of logistics and transportation. This, in turn, should continue to prepare the students to perform as entry level managers and analysts for shippers and carriers.

GRADING POLICIES

As mentioned previously, each exam, assignment, etc. has a point value. Based on the values of these assignments, final course grades will be based on the following minimum standards.

| Item | Points | Total |
|---|---|---|
| 2 Exams | 100 each | 200 |
| 2 Presentations | 100 each | 200 |
| Attend/Assign | | 200 |
| Participation | | 200 |
| Total | Possible | 800 |

| Grade | Points | Percent |
|---|---|---|
| A | 720 and over | 90% |
| B | 640-719 | 80% |
| C | 560-639 | 70% |
| D | 480-559 | 60% |
| F | Under 480 | |

STRUCTURE OF COURSE

This course meets twice a week throughout the semester. The principal types of classroom activities include the following:

- Class discussions of current and related topics;
- In class assignments, examples, and projects;
- Examinations to provide feedback and positive reinforcement regarding the level of knowledge and insight which is being gained throughout the course; and
- Group presentations on specific company topics.

The examinations that will be given this semester:

- The exams will be Exams #1, and #2 will count equally towards the final course grade.
- Both exams will be 3-4 short essay questions.
- The examinations are ***TENTATIVELY*** scheduled as listed in the schedule.

Also, there will be various assignments during the quarter. Most of these will be either short and specific assignments (i.e., look up something on the Internet), or be part of the preparation for the coming speaker.
A group project will be required. It will consist of teams of 2-3 students working together to analyze a logistics company. The group will be required to prepare a 15 minute presentation in class discussing their findings. More details will be covered in class and on the web site.

Finally, class participation will be required. This will include both discussions in class and keeping current on logistics literature. Also, required questions each week for the speakers is part of the presentation grade. These will be used as the basis for increasing interaction with speakers. There are a number of points to keep in mind about participation. This class has a unique approach to participation. The grade will be made up of three parts: attendance, questions, and traditional participation in class.

Attendance will be required in every class. All students will be allowed to miss two classes for ANY reason. **AFTER THAT, EACH MISSED CLASS WILL COST ONE LETTER GRADE**. Finally, the professor will evaluate the students' discussion in class on current topics and with speakers.

**Course Outline – Spring Semester, 2011**

| Day | Date | Section and Topics | General Field | Group | Assign |
|---|---|---|---|---|---|
| T | 1/18 | Course Overview & Organization (R&CT) Readings & Current Topics | | | |
| R | 1/20 | Career Planning – Career Services | | | Résumé |
| T | 1/25 | Student Presentations and R&CT | | 1,10 | 1 |
| R | 1/27 | Speaker #1 – Class 1 Railroad | CS in RR | | |
| T | 2/1 | Student Presentations and R&CT | | 2,11 | |
| R | 2/3 | Speaker #2 – Large Private Logistics | Private Fleet | | |
| T | 2/8 | Student Presentations and R&CT | Customs | 3,12 | |
| R | 2/10 | Speaker #3 – Custom Brokerage | Broker | | |
| T | 2/15 | Student Presentations and R&CT | | 4,1 | |
| R | 2/17 | Speaker #4 – Large Specialty Retailer | Retail SCM | | |
| T | 2/22 | Student Presentations and R&CT | | 5,2 | |
| R | 2/24 | Speaker #5 – Large Retailer | Distribution | | |
| T | 3/1 | Student Presentations and R&CT | | 6,3 | |
| R | 3/3 | Speaker #6 – Army Logistics General | Leadership | | |
| T | 3/8 | R&CT and Review for Exam | | | |
| R | 3/10 | *** EXAM 1 *** | | | |
| T | 3/22 | Student Presentations and R&CT | | 7,4 | |
| R | 3/24 | Speaker #7 – Mgt Recruiting Firm | HRM in Log | | |
| T | 3/29 | Student Presentations and R&CT | | 8,5 | |
| R | 3/31 | Speaker #8 – 2000 Olympics Logistics | Int'l | | |
| T | 4/5 | Student Presentations and R&CT | | 9,6 | |
| R | 4/7 | Speaker #9 – Class 1 LTL Firm | Motor | | |
| T | 4/12 | Student Presentations and R&CT | | 10,7 | |
| R | 4/14 | Speaker #10 – Major 3PL | 3PL | | |
| T | 4/19 | Student Presentations and R&CT | | 11,8 | |
| R | 4/21 | Speaker #11 – Large Automotive | Intermodal | | |
| T | 4/26 | Student Presentations and R&CT | | 12,9 | |
| R | 4/28 | Speaker #12 – Smaller Consulting | Entrepreneur | | |
| T | 5/3 | R&CT – Fill In Week for Speaker | | | |
| R | 5/5 | Hand out Take Home Exam | Last Class | | |
| | 5/10 | ** EXAM PERIOD – 5:30pm ** | TURN-IN | | |

## APPENDIX B
## SAMPLE EXAM FOR LOGISTICS EXECUTIVE IN RESIDENCE

LOGT 4233 – Logistics Executive-in-Residence Mid-Term Examination

**PRINT NAME:_____ Last 4:_____**

READ THESE DIRECTIONS CAREFULLY: This is a take home examination that is due at the start of class on the assigned date. It MUST be type written and follow these basic requirements: Font 12 point Times New Roman, single spaced with a blank line between paragraphs, approximately one page per answer. Each answer should be about 600 words. You will type the speaker's name centered at the top of the page for each answer.

You will turn in both a hard copy and electronic file. For the hard copy make sure it has your name hand written on the BACK – not on the front. Each speaker will be on his own page (i.e., each answer on a new page). For the electronic copy create TWO files (one for each answer). Name the files as follows: SPEAKER LAST NAME_YOUR LAST NAME.docx. Make sure you name is not on the answers in the files. Bring the files on a USB/Flash drive when you hand in the hard copy.

Grammar and thought will both be graded. Therefore, proof read your answers and think about what you are trying to say. Do not "fill" a bunch a space recapping what the speaker said. Concentrate your efforts on why this it was important, how it will affect you, etc.

Essay Questions:
For TWO of the speakers answer the following question. For speaker X, what was the most interesting or important point to you and **WHY**? How will you try to apply something from his/her presentation in your business or personal life? What one thing would you like to have heard from the speaker that he/she did not cover?

See below for an example:

Mr. John H. Smith – The Joy Luck Company

Mr Smith visited us on xxx date and covered a number of key topics. The most important point that I got was xxxxxxxxxxxx xxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Another key point that I will be able to apply in my own life is xxxxxxxxxxxx xxxxxxxxx xxxxxxxx
xxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxx xxxxxxxxxx
Based on the material, the one thing I wished we could have learned more about was xxxxxx
xxxxxx xxxxxxxxx xxxxxxxx xxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxx
In conclusion, Mr. Smith was a great speaker because xxxxxxxxxxxxxxxxx xxxxxxxxxxxxx xxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

# STANDARDIZATION OF HIGHWAY CONSTRUCTION DELAY CLAIM ANALYSIS – A HIGHWAY BRIDGE CASE STUDY

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## ABSTRACT

Highway construction efficiency is critical to highway users such as the trucking industry given today's era of shortages in funding, and given the need for major re-investments in the highway system. One topic that can add to project costs relates to delays and how contractors are reimbursed for such delays. Delays are common in construction, especially in complex heavy highway and other infrastructure projects, and the claims they generate have negative effects on project schedules and costs. In spite of this, the analysis of claims is hindered due to the variety of methods and analysis techniques in use and lack of standardization in the incorporation of delay claim analysis methods in construction contracts. This paper reviews different methods for delay claim analysis and outlines their advantages and disadvantages. A case study of a bridge project is used to demonstrate the potential for manipulation by using different methods for the same delay case. The analysis shows clearly that a standardized process for delay claim analysis would improve highway construction contracting. Research needs to create a standardized process are outlined.

## INTRODUCTION

Highway construction effectiveness and efficiency is very important to highway users, including both commercial and personal users, given today's era of shortages in funding, and given the need for major re-investments in the highway system. One topic that can add to project costs relates to delays and how contractors are reimbursed for such delays. This article addresses some of the issues related to delays analysis and how these delays are evaluated. The method of analysis can affect how much reimbursement contractors receive.

Delays are common in highway construction projects, especially in heavy civil and infrastructure construction and rehabilitation projects (Thomas, Hester, Hunter & Logan, 1985; Aibinu & Jagboro, 2002; Assaf & Al-Hejji, 2006; Haseeb, Xinhai-Lu, Bibi, Maloof-ud-Dyian & Rabbani, 2011). The resulting claims impose costs on all contractual parties and can create a poor image for the construction industry (Kaliba, Muya & Mumba, 2009). Claims are notably serious for the heavy construction industry, especially for roads and bridges because of their public ownership, complexity and size. This is why state transportation agencies stress timely completion of projects,given major impacts on the economy, public welfare, and safety (Ellis & Thomas, 2002).

The analysis of delays and schedule exceptions is important to explain the factors causing them, especially the magnitude, impact and significance of the variations between the baseline and operating schedules (Majerowicz, 2001; Arcuri, & Hildreth, 2007; Henschel & Hildreth, 2007). Tools for analyzing schedule impacts and use of the critical path method (CPM) for analysis are needed to analyze delay claims. This paper reviews current methods and provides a case study to identify and explain the differences between analytical and forensic

techniques. The following case study is realistic, but is based on a hypothetical situation to protect sensitive information and to facilitate the use of the information required for the comparison of methods. The results of the analysis and case study are used to provide a recommended process for standardization of delay analysis methods. The methods examined include the As-planned vs. As-built method, Impact As-planned, Collapsed As-built, Time Impact Analysis and Schedule window Analysis.

## DELAY-BASED CLAIMS IN ROAD AND BRIDGE CONSTRUCTION PROJECTS

### Origins of Delay Claims

Delay claims originate from several sources during the various phases of construction projects. The origins of delay claims could be changes, disruptions, and uncoordinated accelerations, among others that also result in added time and cost on projects. In general, delays can be a direct or indirect result of the following:

- Design Changes: Any additions, deletions or revisions to the project scope that affect the project cost or schedule (Ibbs, Wong & Kwak, 2001). Other changes and definitions are in the literature (Lee, 2007; Hanna, Camlic, Peterson & Nordheim, 2002; Schwartzkopf, 2004; FHWA, 2001).
- Disruptions: actions or events that affect a party (e.g. contractor) from executing all or part of the planned work and which negatively affect productivity (McDonald & Zack, 2004). Other definitions are mentioned in Finke, 2000; Meyer, 1994; Hanna, Lotfallah & Lee, 2002.
- Acceleration: having more work to perform in the same project time period or having to perform the same work in a shorter project time (Thomas, 2000). Acceleration is usually a root cause for other claim sources, such as overtime, over-manning and congestion, and shift work. Acceleration techniques usually are accompanied by added costs and higher accident rates.
- Weather: delays caused by weather can affect not only schedules but also productivity due to worker inability to work in such extreme conditions as high and low air temperature, wind, humidity, air movement, and heat radiation (Hancher & Abd-Elkhalek, 1998).

### Types of Delays

Schedule delay types have been classified in several ways. Most writers classify them according to responsibility and compensability as in four categories: excusable, non-excusable, compensable, and concurrent delays (Kraiem & Diekman, 1987; Trauner, 2009; Zack, 2000; Zack, 2006). Brief definitions follow:

- Excusable Delays: Delays attributable to unforeseen events that are beyond the any party's control without any fault or negligence e.g. floods, strikes, government regulations, or in some cases it is differing site conditions. Recovery from these delays varies between granting time extensions and offering some compensation. Most of the industry is leaning towards time extensions only.
- Non-excusable Delays: Delays attributable and caused by the actions, inactions, or fault of the contractor, their subcontractors, or their suppliers. These delays do not entitle the contractor to a time extension or any compensable recovery for delay damages. These force the contractor to use voluntary enforced acceleration to make up the schedule and upon failure to make the schedule, they grant the project owner any contractually-enforced liquidated damages.
- Compensable Delays: Primarily owner-caused delays. These delays are attributable to the owner or any of the owner's agents or third parties by

contract and include failure to furnish the site on time, incomplete drawings, faulty design or specifications, and others. These delays entitle the contractor to a time extension in addition to monetary compensation for delay damages.

- Concurrent Delays: the most complex type of delay, involving situations where two or more types of the delays occur simultaneously. These can be complex to resolve in terms of recovery, damages, or absolute remedies. One approach is a concurrent delay remedy matrix, where any delay concurrent with an excusable delay is remedied by a time extension, while any compensable delay concurrent with a non-excusable delay is remedied by either time extension or apportionment of the delay (Kraiem & Diekmann, 1987).

**Delay Costs**

After causality and liability of a claim have been established, the claim is quantified, which creates a process that can be complex and tedious because of the many parameters involved as discussed earlier. These costs should be identified for future quantification and can be identified partially as (Cushman, Carter, Gorman & Coppi, 2001; Schwartzkopf et al., 1992):

- Direct Costs – represented in labor, equipment and material costs.
- Indirect Costs – represented in site overhead (SOH) (Lankenau,2003; Ibbs & Nguyen,2007a), home office overhead (HOO) (Darbyshire, 1982; Zack,2001) and other indirect costs such as bond and insurance costs, lost profit, interest and attorney fees, and claim preparation costs. These costs are situational and some are excluded as non-enforceable in public work contracts (TXDOT, 2009).

**Schedule and Critical Path Method (CPM) Delay Analysis Techniques**

CPM is the most widely used method of scheduling, and other schedule analysis techniques and tools have been developed to evaluate the magnitude, impact and significance of the variation between the baseline and current operating schedules or to quantify the effect of delays or change impacts on a project schedule (Majerowicz, 2001; Arcuri, & Hildreth, 2007; Henschel & Hildreth, 2007). Each method will be explained briefly:

- As-Planned vs. As-Built Method (AP vs. AB)*:* Also known as “total time method” or “net impact method”. Basically, the AP vs. AB method compares the as-built schedule to the as-planned one where the difference between the two schedules is considered as recoverable delays. It is an inexpensive, simple and easy method to use. (Alkass, Mazerolle & Harris, 1995; Stumpf, 2000). An advanced version of this method is called “modified total time” (Nguyen, 2007; Stumpf, 2000).
- Impacted As-planned Methods (IA*P):* Also known as “what-if” or “adjusted-baseline”, this method addresses delay responsibility by using the original CPM as-planned schedule and inserts the delays by parties that impacted the schedule (Trauner, 2009; Nguyen, 2007).
- Collapsed As-built Method (CAB*):* This method is also known as “what-if”, “but for” or “adjusted-baseline” Method. In contrast to the IAP method, it tends to prepare a detailed as-built schedule including all known delay events, then removes the delay of a party and illustrates how the schedule would have progressed but for that delay or delays (Lovejoy, 2004).
- Schedule Window Analysis*:* Also known as “snapshot method” or “contemporaneous period analysis.” In contrast to the other methods that analyze the whole schedule, the name “snapshot”

refers to analysis of specific periods within the schedule. The method uses the as-planned schedule as its baseline and divides the total project duration into smaller time period "windows" that specify major milestones, significant modifications in the critical paths or major delays and revisions. Then it analyzes the delays in each window successively within the critical paths in the schedule and accounts for their variation throughout the analysis (Hegazy & Zhang, 2005). Variations include modified Window analysis, delay analysis using delay selection and daily window delay analysis (Kao & Yang, 2009). Courts, boards, practitioners, and research scholars have agreed that the window analysis is one of the best available options (Hegazy & Zhang, 2005; Ibbs & Nguyen, 2007b; Kartam, 1999; Stumpf, 2000).

- Time Impact Analysis (TIA*):* Time Impact Analysis yields the most reliable analysis results (Arditi & Pattanakitchamroon, 2006; Nguyen, 2007). It can be considered an advancement of the window analysis method where the difference is that the TIA focuses on a specific delay or delay activity in contrast to the focus on time periods or a snapshot of the schedule in the window analysis method (Alkass, Mazerolle & Harris, 1996). This method works by using the as-planned schedule, and updates it in real time as soon as any delay, change or disruption calls for a schedule impact analysis. This is accompanied with analysis of CPM network changes and variations when the event occurs. These variations can be a critical path shift, float consumption, or new interrelations where all impacts are analyzed, revised, and reflected in the as-built schedule (Arcuri & Hildreth, 2007). One of the major benefits of this method is that it provides a disciplined basis for the contract parties to keep an updated project schedule (Wickwire, Driscoll, Hurlbut & Hillman, 2003).

Other methods and techniques for schedule analysis have been developed such as computerized delay claim analysis (CDCA) (Alkass et al., 1995) and a number of others (Shi, Cheung & Arditi, 2001; Oliveros & Fayek, 2005; Ibbs & Nguyen, 2007b; Nguyen & Ibbs, 2008; Hegazy & Zhang, 2005; Mbabazi, Hegazy, & Saccomanno, 2005).

**Productivity Loss Analysis Methods**

As discussed previously, productivity losses may be claimed as a result of change orders, added work, acceleration, disruption, changed conditions and owner-caused delays. Methods for estimating lost productivity are available in forms such as project-specific studies, project comparison studies, specialty industry studies, general industry studies, cost basis, and productivity impact on schedule (AACE, 2004). The most widely used methods are:

- Simple Calculating Techniques: These include the "Total Cost Method" (Jones, 2001; Burke, 1991), the "Modified-Total Cost Method" (Silverberg, 2003) and the "Jury Verdict Method" (Caplicki III, 2003).
- Detailed Calculating Techniques*:* These include the "Baseline Method" (Barrie & Paulson, 1992; Abdulmalak et al., 2002), the "Actual Method"/"Segregated Cost Method"/ "Discrete Cost Method" (Schwartzkopf &McNamara, 2001) and the "Measured Mile Analysis Method," *a*lso known as "Modified Baseline Method" or "Estimated Cost Method" (Finke, 1998; Guevara, 2013).

Other methods for productivity analysis have been used such as the Factor-Based method and the Disruption Distribution method (Abdul-Malak et al., 2002; Kallo, 1996; Kasen & Oblas, 1996; Finke 1998).

In addition to the above methods, modeling and simulation techniques can be used to increase

the efficiency and capability of claim analysis and productivity losses specifically. They enable a focus on individual activities and can simulate resources involved and the sequence of activities to provide a realistic and holistic approach to claim analysis (AbouRizk & Dozzi, 1993; AbouRizk, Manavazhi & Dozzi, 1997; Luo & Najafi, 2007).

## HIGHWAY BRIDGE CASE-STUDY

### Purpose and Scope

The purpose of this case study is to identify and explain the differences between the analytical and forensic techniques for analysis of delay-based claims. It demonstrates different delay claims analysis techniques, their differences, and their advantages and disadvantages. It identifies the susceptibility of results to be manipulated by using different forensic scheduling techniques. This investigation shows the need to standardize the process so that it cannot be abused or manipulated.

The goals of the case study are:

- To identify the differences between the methods and results used to analyze delay claim costs.
- To determine the outcomes from different methods to demonstrate the advantages and pitfalls of the methods and their suitability in different situations.
- To expose the susceptibility of the results of delay analysis to be manipulated using different techniques for the same delays.
- To help establish a standardized delay claim analysis technique based on best practices to avoid most pitfalls and obtain robust results.

The case study setting is for construction of a small pre-cast bridge in Boston, Massachusetts where the main parties are the owner (Massachusetts Department of Transportation or MassDOT) and an anonymous contractor. As it was formulated, the writers studied whether data from an actual case could be used, but a study of many road and bridge projects showed how difficult it is to obtain the level of data required (Hashem Mehany, 2014).

The bridge is 350 feet in length and 60 feet in width. It has two roadway lanes and sidewalks on both sides for a total area of 21,000 square feet (1,950 square meters). The project scope consists of precast abutments, steel beams and precast slab decks topped by pavement. The scope also includes excavation, backfilling and grading along with limited landscaping. Other obligatory preconstruction activities also include storm water protection, water control measures, and signage and shoring systems. Demolition of sub and super structures and repair of an underground drainage structure are also required. Utility relocation is not in the scope for the bridge contractor and is the responsibility of the owner to coordinate and complete. The total project consists of 73 different activities that were divided into 3 milestone activities, 31 preconstruction activities, 1 utility relocation activity and 38 construction activities.

### Project Schedule and Cost

The total project cost was originally estimated at $3,348,851, including the construction and preconstruction activities. A number of activities were equally divided between two phases. The project schedule had a start date of May 12, 2013 and finish date of November 4, 2013 with a project planned duration of 176 days on a 7 days/week project calendar.

There was a projected increase in labor wages and materials costs around November 9, 2013, which should not affect the project if it was completed on time

### Case Study – Analysis and Results

The schedule delays were taken into account in the as-built schedule with a duration of 191 days finishing by November 19, 2013 which pushed

the project into the escalation period for wages and materials. Also, it pushed the schedule into a more uncertain period of weather conditions. Now, using methodologies of schedule analysis that were highlighted earlier, the analysis will illustrate the differences, advantages and pitfalls in the different methods and techniques as well as to outline some associated costs. Primavera P6 software has been used for all the scheduling processes during the case study analysis. Figure 1 shows the logic of the claim case study and the interaction of its cost and schedule constituents.

The right side of Figure 1 lists the 5 different schedule delay analysis techniques that were used for the case study along with the involvement of acceleration and disruption due to the delays in the project and their effect on productivity. The left side is studying the associated direct and indirect costs with all their elements affected by the delays and based on the results of the schedule delay analysis along with the productivity loss costs.

### Schedule Delays Scenario

In the schedule delays scenario, several delays occurred during project construction and pushed the finish date to November 19, 2013 which stretched the project duration from 176 to 191 days. Table 1 outlines a summary of the 6 delays that happened during the project.

Table 1 classifies each delay according to the activity's Primavera software P6 ID and its duration in the original schedule. Then it states each activity's predecessor activities according to the schedule and the delay for each activity. The last two columns show the delay type and party responsible.

## CLAIMS CALCULATION AND EVALUATION

The claims calculation and evaluation are divided into two separate but dependent / correlated parts: the forensic schedule analysis which proves the time that qualifies as entitled

**FIGURE 1**
**CASE STUDY METHODOLOGIES LAYOUT**

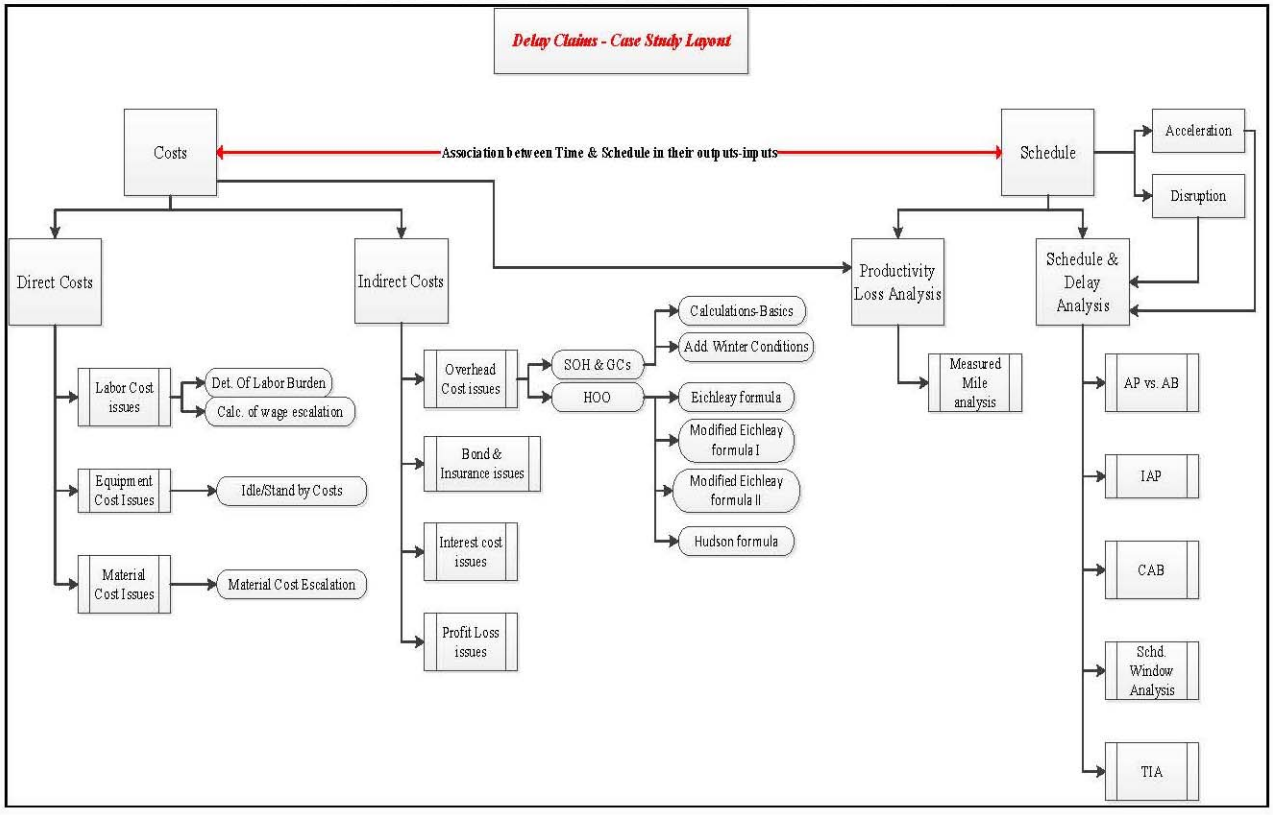


**TABLE 1**
**DELAYS ENCOUNTERED IN THE PROJECT PER ACTIVITY**

| P6 Activ. ID | Activity Name | Orig .dur. | Predec essors | Delay Time (days) | New dur. | Delay Type | Responsible Party |
|---|---|---|---|---|---|---|---|
| U120 | Utility Relocation | 67 | NTP | 22 | 89 | Utility Conflicts | Owner |
| P670 | Review & Approve - Precast Deck Shop Dwgs. | 30 | P660 | 7 | 37 | Late Approval/Defective Specs | Owner |
| P680 | Fabrication & Delivery - Precast Deck | 55 | P670 | 5 | 60 | Late Delivery | Contractor |
| C815 | Set & Grout Precast Abutments - P2SA SB | 5 | C805 | 5 | 10 | Unavailable Equipment | Contractor |
| C320 | Backfill & Grade - P2SC SB RDWY | 12 | C200 | 3 | 15 | Weather Conditions - Excusable | Excusable |
| C525 | Install Steel Beams - P1SB NB | 7 | P610, P480, C515 | 2 | 9 | Crane Position - Owner Disruption | Owner |

delay duration and the pricing components of this delay accordingly.

The schedule delays will be analyzed according to several different analytical methods that included 1) As-Planned (AP) Vs. As-Built (AB) analytical method; 2) Impacted As-Planned (IAP) analytical method; 3) Collapsed As-Built Method (CAB) analytical method; 4) Schedule Window Analysis (SWA) analytical method; 5) Time Impact Analysis (TIA) analytical method

**AP vs. AB Schedule Analysis – Net Impact Method**

By Using the As-planned and As-Built schedules, the total delay duration entitled was calculated as in the following: Total Entitled delay duration = AB schedule duration – AP schedule duration = 191 days- 176 days; Therefore, the total delay duration entitled is ***15 days***.

**Impacted As-planned (IAP) Schedule Analysis – What-If or "Adjusted AP"**

The results for the IAP method is calculated using the AB schedule which includes all the delays and an AP-schedule which includes only the contractor's delays which arrives at 181 days. From the results of the two schedules, the total delay duration entitled is calculated as in the following:
Total Entitled delay duration = AB schedule duration – IAP schedule duration (including only contractor's delays) = 191 days – 181 days; Therefore, the total delay duration entitled is ***10 days***.

**Collapsed As-Built (CAB) Schedule Analysis – But For or "Adjusted Baseline"**

The result of this analytical method is evaluated through different schedules as in 1) AB-schedule; 2) AP schedule; 3) CAB- But for Owner delays: where all owner delays are excluded to; 4) CAB-But for Owner and

excusable delays: where all owner and excusable delays are excluded.

After all the above schedules are created, the delay duration entitled is calculated according to the following simple equations:

- AB = AP + Contractor Delays + Owner Delays + Time extension; *Solve for Contractor's delay*
- Owner Delays = AB – But for Owner's delays
- Time Extension = But for Owner's delays – But for Owner & Excusable delays
- Total delay duration Entitled = AB – AP-Contractor's delay

After creating both schedules the entitlement calculations can be calculated with the equations available as in the following:

- Owner Delays = AB – But for Owner's delays = 191 – 184 = 7 days
- Time Extension = But for Owner's delays - But for Owner & excusable delays = 184 – 181 = 3 days.
- AB = AP + Contractor Delays + Owner Delays + Time Extension
- 191 = 176 + Solve X + 7 + 3
- Solving for (X), Contractor's delay = 5 days
- Therefore, Total Delay duration entitled = AB – AP – Contractor's delays = 191 – 176 – 5 = ***10 days.***

**Schedule Window Analysis**

A window schedule analysis was completed by taking several snapshots to analyze specific time periods within the schedule that have major delays as shown in Figure 2.

Each window was analyzed and assessed accordingly, and then the delay effects from all windows were summed up to come up with the total delay duration entitled. All the windows are based on each other to model the cumulative, contemporaneous effect of the schedule sequence and the cumulative effect is demonstrated as shown in Figure 3.

The results of the analysis are presented Figure 3 shows the original as-planned schedule, the analysis per each window and its cumulative results for each later window and finally, it shows the total as-built schedule with all the different window delay effects plugged in its overall duration.

**Time Impact Analysis**

Time impact analysis is a method that works using the as-planned schedule and updates it instantly as soon as any delay, change or disruption calls for a schedule impact analysis, in a very active real-time manner. As was previously explained in detail, the TIA is one of the most reliable and accurate methods which takes into account the effect of each impact happening in the project as an individual activity. In this case, all the six delays will be analyzed for their impacts along with their cumulative effect and summarized as shown in Table 2.

The overall entitled compensable delays are the sum of the analysis of the final results from all those impacts. In this case, the compensable delays are 12 days and three days of weather-excusable delays.

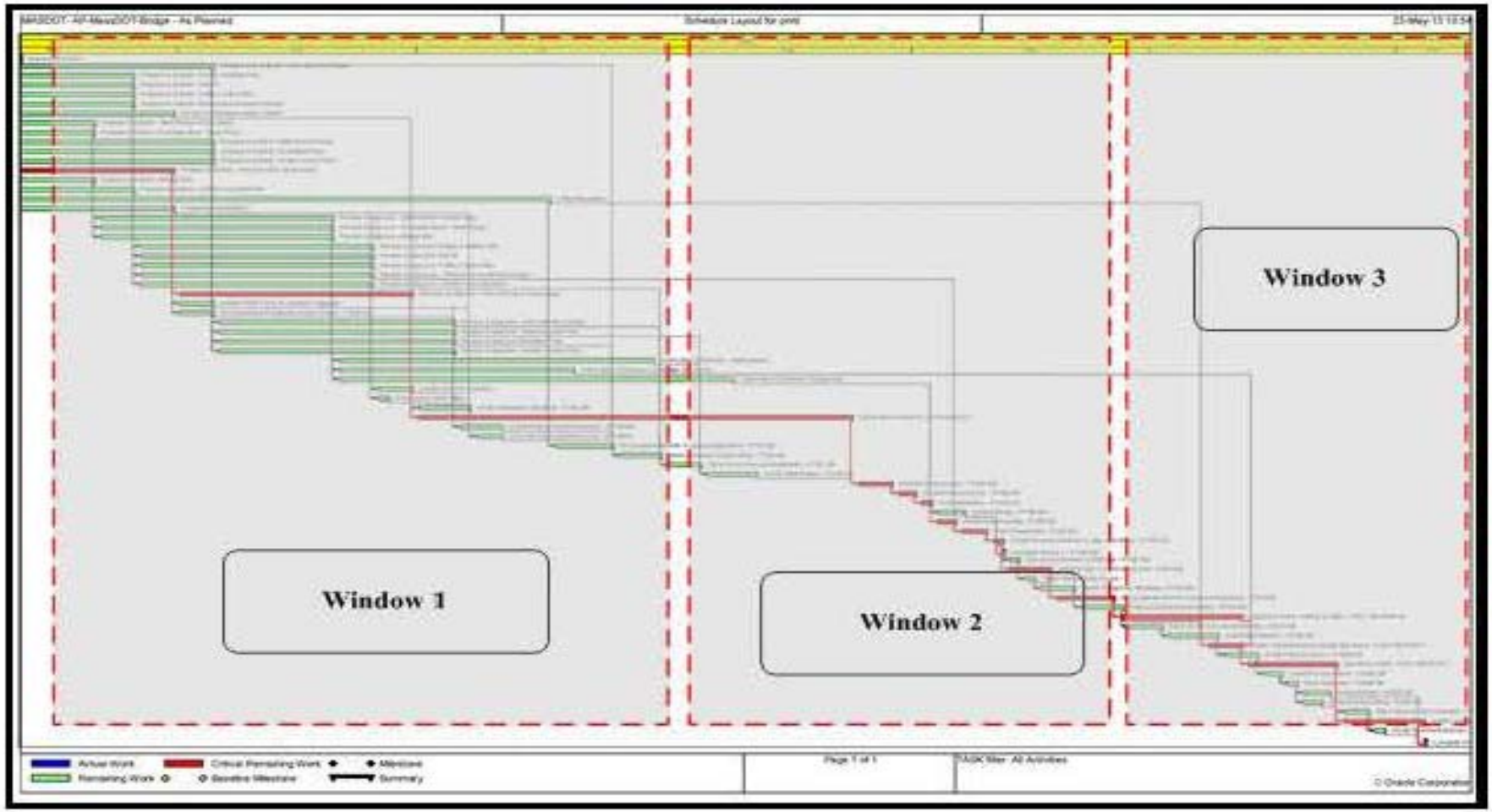
**Summary of Schedule Analysis**

All the results from the previous five types of schedule analysis were summarized and tabulated in Table 3.

Table 3 describes each technique's time entitlement duration, along with every aspect of the delay according to causality and compensability. However, the net impact method and the IAP do not have the ability to separate delays according to these parameters since they just adjust total duration and they do not anticipate concurrency and responsibility of delays.

# Figure 2

## WINDOWS SNAPSHOTS DISPLAYED ON THE AP SCHEDULE



## Figure 3

**SUMMARY OF THE WINDOW ANALYSIS RESULTS**

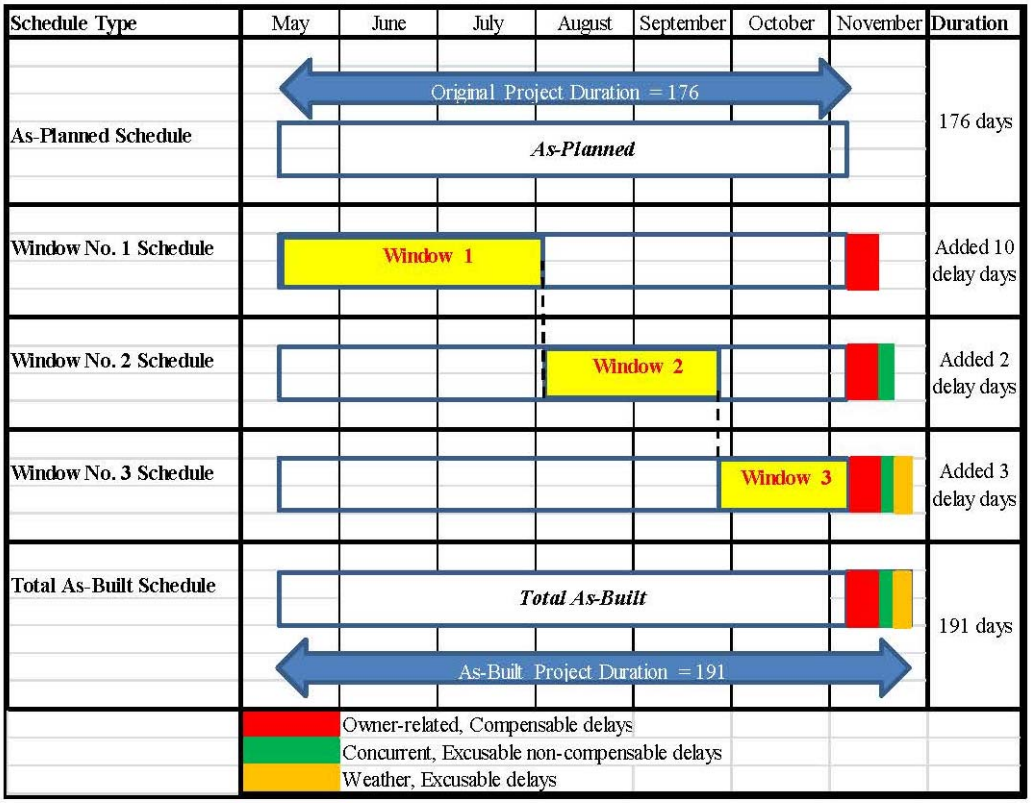



**TABLE 2**

**SUMMARY OF TIME IMPACT ANALYSIS (TIA) METHOD**

| Impacts No. | delay duration (days) | Change in C.P | Responsibility | Preliminary status |
|---|---|---|---|---|
| After Impact #1 analysis | 5 | N | Owner | Compensable |
| After Impact #2 analysis | 5 | Y | Owner | Compensable |
| After Impact #3&4 analysis | 2 | N | Owner | Compensable |
| After Impact #5 analysis | 0 | N | None | |
| After Impact #6 analysis | 3 | N | Weather | Excusable |
| ***Total Delay duration Entitled*** = | 12 | days | | |

**TABLE 3**
**DEMONSTRATION OF THE OVERALL RESULTS OF THE DIFFERENT SCHEDULE RESULTS FROM THE DIFFERENT SCHEDULING TECHNIQUES USED IN THE CASE STUDY**

| Schedule Analysis Techniques | Time entitlement | Compensable Owner-Caused | Inexcusable Contractor Caused | Excusable |
|---|---|---|---|---|
| AP vs. AB - Net Impact Method | 15 | N/A | N/A | N/A |
| IAP, What If, Adjusted AP | 10 | N/A | N/A | N/A |
| CAB, But For, Adjusted Baseline | 10 | 10 | 0 | 5 (2 concurrent, 3 Weather) |
| Window Schedule Analysis | 10 | 10 | 0 | 5 (2 concurrent, 3 Weather) |
| Time Impact Analysis | 12 | 12 | 0 | 3 (Weather) |

**TABLE 4**
**SUMMARY OF THE TOTAL COSTS RELATED TO THE DELAY CLAIMS IN THE CASE STUDY**

| Cost Item type | Delay Costs Associated |
|---|---|
| Labor Costs | $ 864 |
| Equipment Costs | $ 18,748 |
| Material Costs | $ 6,400 |
| Add. SOH / General Conditions | $ 19,449 |
| Add. SOH - Winter Conditions | $ 9,862 |
| Additional (HOO) | $ 15,000 |
| Lost Productivity Costs | $ 1,158 |
| **Total delay claim costs** | ***$ 71,481*** |

From the different results represented in Table 3, it is very obvious that different methods can yield different results within the same case. That is because some of them do not account for certain parameters as concurrency, delay responsibility, or the sequence that the delays occur in within the construction process. This is simple yet very strong evidence of how variable the claim analysis can be, and there is a critical need for standardization of schedule delay analysis approaches within the delay claim management process. There is also a need to stick with the current best practice technique represented in the TIA.

**Cost Analysis Results - Summary**

All the results from the cost analysis associated with the entitled delay were summarized and tabulated in Table 4. According to Table 4, the total cost associated with the delay-entitled claim is $71,481.

## DISCUSSION AND CONCLUSION

The paper provides an original contribution by applying diverse methods of delay claim analysis to a case study, and thereby bolstering the case for standardized delay claim analysis as a part of

road construction contracts. Such a system of standardized delay claim analysis is important to ongoing efforts to increase the effectiveness and efficiency of highway and other construction projects. Highway funding is in very short supply currently, and both federal and state regulations and/or processes need to be followed so as to assure maximum return for available dollars. The proposed approaches can help with this overall goal. For the trucking industry, and other highway users, efficiency of construction projects is very important given the large backlog of needed projects.

The paper also identified the common negative time and cost effect of delays in road and bridge projects and showed the difficulty in analyzing and resolving delay claims due to the variety of methods in use. In achieving the goals for the case study, the paper listed the most common delay claim analysis techniques and methods along with their outcomes, advantages and pitfalls as follows:
*As-Planned vs. As-Built Methods (AP vs. AB):* Although it is a very inexpensive, simple and easy method to use, the biggest pitfall is that it is not very practical regarding the allocation of the delay. This is due to the fact that it is overestimating the duration of the delay considering it is all from one party.

*Impacted As-planned Methods (IAP):* This method is considerably better than (AP vs. AB) but it still has several deficiencies represented in the following:

- The impacted schedule is not contemporaneous enough and does not show the project activities as they occur
- The decision for placing the impacts into the schedule is greatly subjective which can lead to more disputable analysis rather than solving the delay analysis.
- The method does not reflect the dynamic nature of construction projects and the critical path dynamics of change during the project.

*Collapsed As-built Method (CAB):* As one of the most accepted by the industry, it has the ability to address the concurrent delay issues. It also has several weaknesses since it is based on the CPM network and on as-built information that can be tweaked and manipulated to a predetermined conclusion.

*Schedule Window Analysis (SWA):* the main strength of this method was its ability to utilize contemporaneous information to account for the dynamic variation of the critical activities and the critical paths which can reflect the actual status of work in the as-built schedule and assess each period for delay, its cause and responsibility. And can also deal with concurrency effectively. However, there are still some points of weaknesses to this method represented in the following:

- The as-built schedule is still dealing after the fact and can still be subjected to errors and omissions that hinder accurate delay analysis.
- The window span being in the form of weeks or months, the focus is on the critical paths that exist at the end of the window time. Thus, the technique does not consider the fluctuations that occur in the critical paths as events evolve on site. As a consequence, the technique loses sensitivity to the time at which the owner/ contractor causes project delays within the window. Also, it loses sensitivity to the events of speeding up or slowdowns within the window.
- The delay representation of existing software systems makes the application and automation of the windows technique a very difficult task.

*Time Impact Analysis (TIA):* This method is widely considered the most reliable where it is an advancement of the SWA by focusing on a specific delay or the affected activities instead of a wider window that can miss some of the dynamics that evolved during that window as pointed out above. The main drawback of this method is the efforts

required to keep a real-time accurate schedule along with all the records accompanying that schedule.

Based on the results from all of these techniques and methods of delay claim analysis, TIA is the recommended proactive method of choice. This is due to its ability to use the AP schedule and its real-time updates which captures the delays and its consequences represented in the schedule impact analysis in a real-time proactive manner. It also captures and deals with the real-time CPM network changes and variations when the event occurs as in the critical path changes, float consumption and delays concurrency. In short, it is considered the most proactive method and it calls on the contractual parties to keep an updated real-time schedule as part of the project conditions which limits the disputes and provides a good predictive tool to avoid further delays and impacts on the project cost and schedule.

It was also concluded that the measured mile analysis was one of the most reliable methods for calculating the lost productivity cost. Therefore it was used to come up with the costs for this study. This is because the measured mile analysis considers only the actual effect of the alleged impact and thereby eliminates disputes over the validity of cost estimates, or factors that may have impacted productivity due to no fault of the owner. However, its greatest challenge is to accurately identify the suitable un-impacted period in which the work being performed was sufficiently similar to that work performed in the impacted period.

Mostly, after all the methods were applied in the case study, they yielded different results for the same case. That is because some of them do not account for certain parameters as concurrency, delay responsibility, or the sequence that the delays occur in, within the construction process and other issues that have been pointed above. Thus, the case study of the bridge construction project showed the potential for manipulation by using different techniques for the same delay case within the same project condition.

This is simple yet very strong evidence of how manipulative the claim analysis can be since one party can manipulate the delay claims by using an advantageous scheduling method for the most compensation or entitlement. Therefore, there is a desperate need for standardization of the schedule delay analysis within the delay claim management process to limit the ability of any manipulation by any of the contractual parties. This should also limit future disputes for time and cost entitlements. Accordingly, there is a need to use the best practice techniques represented in the TIA since it has been proven to be the most proactive method that can accurately appropriate delays entitlement, limit the analysis disputes and even forecasts potential future impacts or delays.

There is a clear need for standardization of the methods of delay claim analysis. The standardization process should be included and developed into the projects specification books and enforced contractually. This standardized delay claim management system should be able to detect and document delays as soon as they happen in real-time using TIA or similar techniques. It should also include the following details:

- Detailed scheduled specifications
- Establish schedule evaluation standards
- Define unanticipated weather conditions
- Identify clearly the agreed-upon standard method for schedule analysis during the project
- Identify the requirements and inputs for that method
- Other specific issues such as float ownership.

A claim management system that includes such components should mitigate delay claims and disputes during a project as well as predict and enhance future project performance.

## FUTURE RESEARCH

To address the issues represented in this paper and affirmed in the case study, future research should point toward a system and set of best practices for delay claim management to be used by owners and contractors as a fair and proactive process that minimizes disputes. The system should also be amenable to standardization. This research should establish a practical approach that will work at the lowest level with simple approaches. The management system should include selection of a method such as the recommended (TIA) to standardize the process and prevent manipulation by any party in the contract. Then, it should proceed with the requirements to implement that method of delay analysis along with related issues and schedule specifications in project specification books.

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# IMPACT OF FREIGHT TRAFFIC ON SCHOOL WALKING DECISIONS IN URBAN ENVIRONMENTS

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## ABSTRACT

In light of the decline in social acceptance of walking and biking to school, there is a critical need to examine issues impacting school transportation decisions and to identify strategies to promote healthier behavior. In urban areas with high volume freight corridors, factors affecting school walking decisions can be complicated by increased truck and rail traffic. This paper presents findings from a study of urban neighborhoods in a major southeastern city, including those that are adjacent to freight corridors. Perceptions of neighborhood residents are compared in the context of existing infrastructure and network characteristics (urban vs. urban freight-centric). The results provide insight into factors influencing school transportation decisions in urban environments, and highlight discrepancies between perceptions and actual issues relevant to child pedestrian safety.

## INTRODUCTION

Thirty years ago, nearly half of all school-aged children walked or rode bikes to school (FHWA, 2008), but in recent years, this practice has declined significantly, with currently less than 15% of children walking or riding bikes to school (Safe Routes to School National Partnership, 2010). Encouragement of active transportation is essential for promoting healthy lifestyles, and particularly for establishing healthy habits in children. However, because of the decline in social acceptance of walking and biking to school, there is a critical need to examine issues impacting school transportation decisions and to identify strategies to shift behavior in a healthier direction. With support from disciplines such as engineering, marketing, and public health, there is a growing synergy for initiatives that will help make walking and bike riding to school safer, healthier, and more popular. One avenue for multidisciplinary collaboration in support of active transportation to school is through the National Safe Routes to Schools (SRTS) program, originally funded from 2005-2012 under the federal *Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users Act (SAFETEA-LU).* The goal of the SRTS program is to provide support and funding for changes to communities through the 5 E's (Engineering, Enforcement, Encouragement, Education, and Evaluation) to make walking and bicycling to school a safe and more popular activity. The program was administered through state DOTs through a designated SRTS program coordinator. The new Moving Ahead for Progress in the 21st Century Act (MAP-21), for highway and broader transportation funding, includes SRTS program eligibility through the Transportation Alternatives Program funding mechanism. States have the option of continuing SRTS initiatives through MAP-21, but are not required to have a state SRTS coordinator.

In 2010, the National Center for Safe Routes to School reported key statistics on why parents do or do not allow their children to walk to school (National Center for Safe Routes to School, 2010). These findings were based on more than

130,000 parent surveys from elementary and middle schools from 47 states for the years 2007-2009. Results were segmented by students who do walk/bike to school versus those who do not. For both groups, distance was reported as the most significant barrier to walking/biking to school (52% walkers, 62% non-walkers). Parents whose children walked also indicated intersection and crossing safety (44%), weather (41%), and sidewalks (38%) as influential factors. For children who were not allowed to walk, traffic speeds (55%), traffic volumes (55%), intersection and crossing safety (47%) and weather (44%) were significant deterrents.

There are considerable gaps in the school walking related literature related to impact and implications for urban areas with significant minority populations. Urban areas arguably provide more suitable settings for active transportation to school given increased land use densities (which decrease walk distances) and the grid design more typical of urban street networks (which improves connectivity). In addition, promoting active transportation among minority populations (particularly African-American) is of particular importance due to the more significant health risks (obesity, hypertension, diabetes, and associated conditions) faced by these groups (Cole and Fox, 2008; NHLBI, 2012; ADA, 2014; OMH, 2014). However, urban corridors may also contain significant rail and truck traffic, which may influence parent and student attitudes toward active transport to school, and increase community safety concerns.

The primary objective of this research is to examine factors influencing school walking decisions in urban settings for schools adjacent to rail and truck corridors. This study was conducted in urban neighborhoods in a major southeast city in the United States. Findings from this study are used to identify differences in perspectives of residents of urban areas adjacent to rail and truck corridors versus those from comparable urban areas not adjacent to rail and truck corridors. It is expected that the results can be used to develop effective messages and strategies for improving the safety and health of urban students through active transportation to school efforts. Moreover, the study identifies community safety concerns related to traffic and walking patterns near rail/truck corridors. As such, this research has potential critical implications for future funding of research that would specifically address these safety and health issues. This paper first presents relevant literature, outlines the pilot study methodology, highlights preliminary findings, and finally describes future research.

## LITERATURE REVIEW

The benefits of and barriers to active school transportation are numerous, particularly for child pedestrians. School-aged children rarely make the decision about travel to school on their own; thus parental attitudes and perceptions are important to understand and address for changes in behavior to occur. The following sections briefly outline relevant literature related to both benefits and barriers to walking and biking to school. This literature review, along with the experience of the research team, helped guide the construction of the survey instrument developed for this project.

### Benefits of Active Transportation

About one-third (31.7%) of American children aged 2-19 (about 25 million) are now overweight or obese (Ogden, et al., 2010), substantially increasing their risk of developing diabetes, cardiovascular disease, hypertension, and other chronic illnesses. One of three children born in 2000 is expected to develop diabetes during his/her lifetime (CDC, 2012). Certain racial and ethnic groups (African American and Latino) are genetically predisposed for diabetes, and the high prevalence of obesity in these groups exacerbate this increased risk. In fact, rates of childhood obesity are highest among non-Hispanic black girls and Hispanic boys (Anderson and Whitaker, 2019).

Childhood obesity also has psychosocial consequences due to stigmatization. Obese children are reported to have low self-esteem and are more likely than non-obese children to feel sad, lonely, and nervous (Strauss, 2000). Obesity also has adverse economic consequences for our health system. Nearly $150 billion is spent annually to treat obesity-related medical conditions (Finkelstein, et al., 2009), while the direct medical costs of childhood obesity alone are estimated at $3 billion per year (Trasande and Chatterjee, 2009). Further, it is well established that obesity and overweight significantly threaten the health and well-being of children and families, and physical inactiv-ity is a primary cause. Currently, less than half of American children and adolescents get the recommended 60 minutes of daily physical activity (CDC, 2004; Haskell et al., 2007; Troiano, et al., 2008).

Public health officials recognize the potential of low-cost methods that increase children's physical activity, such as walking and biking to school, in reducing the epidemic of obesity. Research confirms the health benefits of walking or biking to school. A six-state study of more than 1500 middle school-age girls found that those who reported walking before and after school had 13.7 more minutes of total physically activity than those who did not (Saksvig, et al., 2007). Moreover, cardiovascular fitness is improved for children who walk or bicycle to school compared to children who do not actively commute to school (Davison, et al., 2008).

Beyond the physical health benefits, recent studies have also shown cognitive benefits to walking and biking to school. A 2011 study revealed significant links between active transportation and cognitive function in children (Martinez-Gomez, 2011). Physical activity has also been shown to be a positive factor in influencing concentration, memory and classroom behavior (Trudea and Shephard, 2008). Another study showed that children who commuted one or more days in the week were most likely to achieve the MVPA criterion (Moderate-to-Vigorous Physical Activity; 60+ mins/day × 5) (Daly-Smith, 2010). MVPA was found to be the type of activity that has the greatest positive effect on cognitive performance (Active Bodies, Active Minds, 2010).

Active transportation has other public health benefits, such as reducing carbon monoxide, nitrogen oxide, and greenhouse gas emissions (EPA, 2006). These harmful pollutants from cars and trucks exacerbate asthma and cause respiratory illnesses. Research has shown that schools which facilitate walking and biking have significantly better air quality, although cause and affect may be unclear. A 13% increase in walking/biking leads to at least a 15% reduction in dangerous vehicle emissions. (EPA, 2003). Additionally, if 100 children at a single school switch to walking or bicycling for a year, more than 35,000 pounds of harmful emissions will be eliminated and nearly 12,000 hours of physical activity will be generated by the group (National Center for Safe Routes to School, 2013).

**Barriers to Walking/Bicycling to School**

In 2009, just 13% of students rode a bike or walked to school, down from 44% in 1969 (*3*), and this decrease in active commuting corresponds to the growing increase in childhood obesity. Similarly, school bus ridership has also declined, as more students report coming to school by personal vehicle than other methods (National Center for Safe Routes to School, 2010). One study reported three key barriers that prevented parents from allowing their children to walk or bicycle to school: distance to school, traffic-related danger, and weather (Martin and Carlson, 2004). In the same survey, 12% of parents referred to safety issues, while 6% of parents also indicated school policies prohibiting walking and biking to school as the reason their children did not walk or bike to school.

Bike and pedestrian safety are already a critical concern. Statistics from the Centers for Disease Control and Prevention (CDC) show that for

children 15 years and younger, pedestrian injury is the third leading cause of death by unintentional injury (CDC, 2002). In addition, children account for a significant portion of all traffic deaths (25-30%), with nearly 3,900 children 15 years and younger killed while walking (Transportation for America, 2014).

For urban environments, additional considerations such as higher traffic volumes and greater presence of freight traffic may increase pedestrian risk, yet frequently such areas have reduced block lengths and better connectivity, which can be more conducive to active transportation. There is limited research focusing specifically on urban inner-city schools. In 2011, a study conducted on such schools found that children living in low socioeconomic neighborhoods were exposed to greater hazards on their walk to school, yet were more likely to walk (Rossen, et al., 2011). Another study indicated that for urban inner-city communities, more focus should be placed on increasing safety rather than impacting mode choice, as high numbers of walkers typically already exist for schools in these communities (von Hagen, et al., 2009). A 2012 study investigating factors affecting school walking decisions in urban environments found that crime and animals were the key barriers to active transportation, while family mobility (length of time living in a neighborhood) and previous walking behaviors were positively correlated with active transportation (Royne, et al., 2012).

A 2013 study conducted on safety and school travel in Toronto found that high volume traffic at intersections played a significant role in mode choice decisions (Larsen, et al., 2013). There is little research, however, related to the impact of high freight volumes on child pedestrian safety and mode choice. The same 2013 study did explore vehicle mix in assessing active transportation and included a 'vehicle fleet index' in a regression model for predicting mode choice for school trips (Larsen, et al., 2013). The study found that vehicle mix did not influence mode choice. The schools participating in the study were selected to include a range of built environments and income levels, but freight-centric areas were not specifically targeted. Thus, for urban areas where high volume freight corridors are in close proximity to schools, it is particularly important to determine the impact, both perceived and actual, on child pedestrian safety, as very little research is available to inform infrastructure improvement decisions and education initiatives.

The following sections detail a pilot study conducted for a central urban community within a major metropolitan area to help determine the influence that heavy freight traffic (both truck and rail) has on the decision to walk or bike to school and the impact on safety. The study utilizes a multidisciplinary perspective, representing collaboration among engineering, public health, and marketing professionals.

## METHODOLOGY

This research was conducted in two phases to obtain feedback from urban residents on perceived differences in walkability and safety across freight-centric (FC) vs. nonfreight-centric neighborhoods. Phase 1 of this project involved the development and online administration of a survey instrument to gauge perceptions regarding children's walk/bike trips to school in urban environments. Phase 2 utilized a focus group to elicit more detailed responses regarding mode choice decisions in the journey to school.

### Phase 1: Survey

Based on the national Safe Routes to School questionnaire, we developed a seventeen-item survey instrument consisting of questions related to neighborhood identity, family characteristics, frequency of walk/bike trips of children in the neighborhood, perceptions regarding safety for walk/bike activity, perceptions regarding benefits of walk/bike activity, and perceptions regarding barriers to walk/bike activity. Additional freight-oriented topics were also assessed. The survey was administered in an

online format through neighborhood associations.

Neighborhoods located within the central urban communities of the major metropolitan area were specifically targeted to participate, and association leaders were asked to distribute the survey to residents of their neighborhoods. Participants were asked to indicate the neighborhood in which they live so that survey responses could be coded based upon presence or absence of significant freight corridors. Presence of significant freight corridors was determined based upon multiple arterials with high freight volumes, rail lines, and warehouse/ trucking companies located within the neighborhood boundaries. The presence of such corridors/facilities within neighborhood boundaries defines a freight-centric neighborhood for this study.

A total of 104 individuals completed the survey, including the focus group members who completed surveys prior to the start of the focus group. However, it is important to note that not all response categories add up to 104 responses, because participants were not required to answer every question. Therefore, the total number of responses for each item is reported for each individual result.

**Phase 2: Focus Group**

To obtain greater insight into factors influencing school walk decisions, a focus group was conducted in conjunction with a local community organization after the initial online survey event. The community organization helped with recruiting urban participants for the focus group, and provided an established venue for community meetings. Twenty-two urban residents participated in the focus group. Participants were first asked to complete the project survey before any discussion began. The participants were then shown a brief informational video regarding the Safe Routes to School program, followed by a brief presentation by project team members regarding the focus of the project. The participants then engaged in a discussion of perceived benefits of active transportation to school along with barriers. All discussions were transcribed to ensure accuracy of data and for potential input into additional research on the topic.

## RESULTS

**Phase I: Survey**

Neighborhood Identity

Survey participants were asked to identify the neighborhood in which they lived and how long they had lived in their current neighborhood, because previous research has suggested that this may be an influential factor in active transportation decisions (Royne, et al., 2012). Of the 104 respondents, 83 lived in urban neighborhoods that are not significantly impacted by freight, while 21 lived within freight-centric neighborhoods. For the freight-centric (FC) neighborhoods (n=21), 40% (8) of the respondents reported living in the neighborhood for more than 7 years, 30% (6) between 4 and 7 years, and 30% (6) between 1 and 3 years. For the nonfreight-centric neighborhoods, 51% (39) of responding residents (n=76 for this item) have lived in these communities for more than 7 years, 17% (13) between 4 and 7 years, 22% (17) between 1 and 3 years, and 9% (7) for less than one year.

Family Characteristics

Family characteristics (number of children, number of schools children have attended, and walk/bike behaviors) were requested on the survey. Of responding residents of NF neighborhoods (n=63), 53% (33) reported having at least one child, while 47% (30) indicated they do not have any children. For FC neighborhoods, 39% (5) of respondents (13) reported having at least one child, while 61% (8) indicated they do not have any children. In addition, 50% (2) of responding FC participants with children (n=4) indicated that their children have walked or biked to school, while NF respondents (n=29) reported 38% (11) had

allowed their children to walk or bike to school. Table 1 summarizes responses related to participants' perceptions of appropriate ages for children to walk or bike to school. While the reported average safe age for children to walk or bike to school is slightly higher for the FC group for all responses, there is no statistically significant difference ($p > .05$) between the values in any category.

Frequency of Walk/Bike Trips
In Neighborhood
In terms of walk/bike trips in the neighborhoods of the survey participants, 71% (58) of NF participants (n=81) reported seeing children walking to or from school, and 40% (32) reported seeing children biking to or from school in their neighborhoods. For FC participants (n=20), 80% (15) of respondents indicated they see children walking, and 35% (7) reported seeing children biking to or from school in their neighborhoods.

Neighborhood Safety Perceptions
The statement "Children's walk to school in my neighborhood would be safer if:" and a list of factors thought to be influential to child pedestrian safety (based on literature review and research team experience) was included in the survey to assess perceptions of participants regarding the safety of their neighborhood for active transportation to school. Participants were asked to rate how strongly they agreed (or disagreed) with the statement for these factors. The items were rated on a Likert scale, where 1 indicated strongly disagree, and 5 indicated strongly agree. Results are presented in Table 2. The results are presented by FC and NF groupings, with average response (ì), standard deviation (s), t-statistic (using a one-tailed test of hypothesis $H_o$: $ì_{FC} - ì_{NF} > 0$), and p-value for the t-test reported.

All of the mean responses from the FC group were equal to or greater than that of the NF group. Only three factors were significantly different at a statistical level. These factors included walking with parents or other adults, increasing the number of crossing guards, and additional parent or police volunteers along walk routes. The top five factors based on mean scores for the FC participants are highlighted in Table 2. Note that there are actually six factors shaded for the NF group, as there were multiple factors with the same mean response such that five distinct factors could not be identified. The ranked scores are very consistent between the two groups. The presence of trucks and rail crossings along the walk route was rated among the lowest concern for both the FC and NF groups.

Neighborhood Barriers to Walking/Biking
Survey participants were asked to indicate how concerned they are about a series of safety issues near schools in their neighborhood. The items were rated on a Likert scale (1 = no concern, and 5 = extreme concern). The average response,

**TABLE 1**
**SCHOOL AND TRANSPORTATION CHARACTERISTICS OF FAMILIES IN FC AND NF NEIGHBORHOODS**

| Survey Item | FC | NF |
|---|---|---|
| | Average Response | Average Response |
| At what age do you think it is safe for a girl to walk to school? (years) | 10.7 (n=18, s=2.5) | 9.7 (n=68, s=2.4) |
| At what age do you think it is safe for a boy to walk to school? (years) | 10.3 (n=18, s=2.4) | 9.4 (n=68, s=1.9) |
| At what age do you think it is safe for a girl to bike to school? (years) | 10.7 (n=18, s=2.3) | 10.5 (n=69, s=2.1) |
| At what age do you think it is safe for a boy to bike to school? (years) | 10.3 (n=18, s=2.2) | 10.2 (n=69, s=1.7) |

**TABLE 2**
**FACTORS IMPORTANT FOR CHILD PEDESTRIAN SAFETY IN FC AND NF NEIGHBORHOODS**

| Survey Item | FC | NF | t-stat | p-value |
|---|---|---|---|---|
| | Average Response, $\mu_{FC}$ (std. dev.) n=19 | Average Response, $\mu_{NF}$ (std. dev.) n=76 | | |
| She or he walked with other kids | 4.3 (s=0.6) | 4.1 (s=1.0) | 0.78 | 0.21 |
| She or he walked with a parent or other adult | 4.7 (s=0.5) | 4.1 (s=1.0) | 4.17 | 0.00004* |
| Schools provided walking route maps to parents and kids | 4.0 (s=0.9) | 3.8 (s=1.1) | 0.96 | 0.17 |
| Schools provided more walking safety training for kids | 4.3 (s=0.6) | 4.1 (s=0.9) | 1.01 | 0.16 |
| More crossing guards were present | 4.2 (s=0.7) | 3.6 (s=1.1) | 2.96 | 0.002* |
| There were continuous sidewalks from my neighborhood to school | 4.0 (s=1.1) | 4.0 (s=1.0) | 0.05 | 0.48 |
| There were fewer cars where kids walk to school | 3.8 (s=0.8) | 3.8 (s=1.0) | 0.20 | 0.42 |
| Vehicle speeds were lower along the routes to school | 4.2 (s=0.8) | 4.0 (s=1.1) | 0.69 | 0.24 |
| There was better street lighting along walk routes to school | 3.6 (s=0.8) | 3.3 (s=1.1) | 1.02 | 0.16 |
| Kids lived closer to the school | 3.7 (s=0.7) | 3.5 (s=1.0) | 1.02 | 0.16 |
| There were fewer trucks | 3.5 (s=0.9) | 3.4 (s=1.0) | 0.49 | 0.31 |
| There were fewer rail crossings required | 3.3 (s=1.0) | 3.1 (s=0.9) | 0.82 | 0.21 |
| There were more crosswalks | 4.4 (s=0.8) | 4.1 (s=0.9) | 1.13 | 0.13 |
| There were more parent volunteers or police officers along walk routes to school | 4.4 (s=0.8) | 4.0 (s=0.9) | 1.76 | 0.04* |

standard deviation, t-statistic (using a one-tailed test of hypothesis $H_o$: $ì_{FC} - ì_{NF} > 0$), and corresponding p-value for the t-test are presented in Table 3 for each item.

The responses from participants living in FC neighborhoods had a higher mean for all items than the corresponding responses from participants living in NF neighborhoods. The differences were significant for the following factors: stray dogs/animals, crime, fights/ bullying, railroad crossings/trains, illegal drugs, abandoned houses, gang activity, trash/junk/trees on the sidewalk, and lack of crossing guards. It is interesting to note that neither presence of railroad crossings/trains nor large trucks were ranked at a particularly high level of concern by either group. The top five rated factors are highlighted in Table 3 for each group. Fast cars, busy intersections, and missing/hard to see crosswalks were in the top 5 of both groups. FC participants also included missing/broken sidewalks and trash/junk/trees on the sidewalks, while NF participants rated heavy traffic and lack of bike lanes as higher priority concerns.

Benefits of Walking/Biking

Survey participants were also asked to indicate how strongly they agreed with a series of statements about the benefits of walking/biking to school. The results are reported in aggregate (Figure 1), as there is no relevance to the type of neighborhood in which the respondent lives (FC or NF). A total of 94 participants responded to this survey item. While most participants recognized the potential health benefits of active

**TABLE 3**
**RELATIVE LEVEL OF CONCERN FOR SAFETY FACTORS IN URBAN NEIGHBORHOODS**

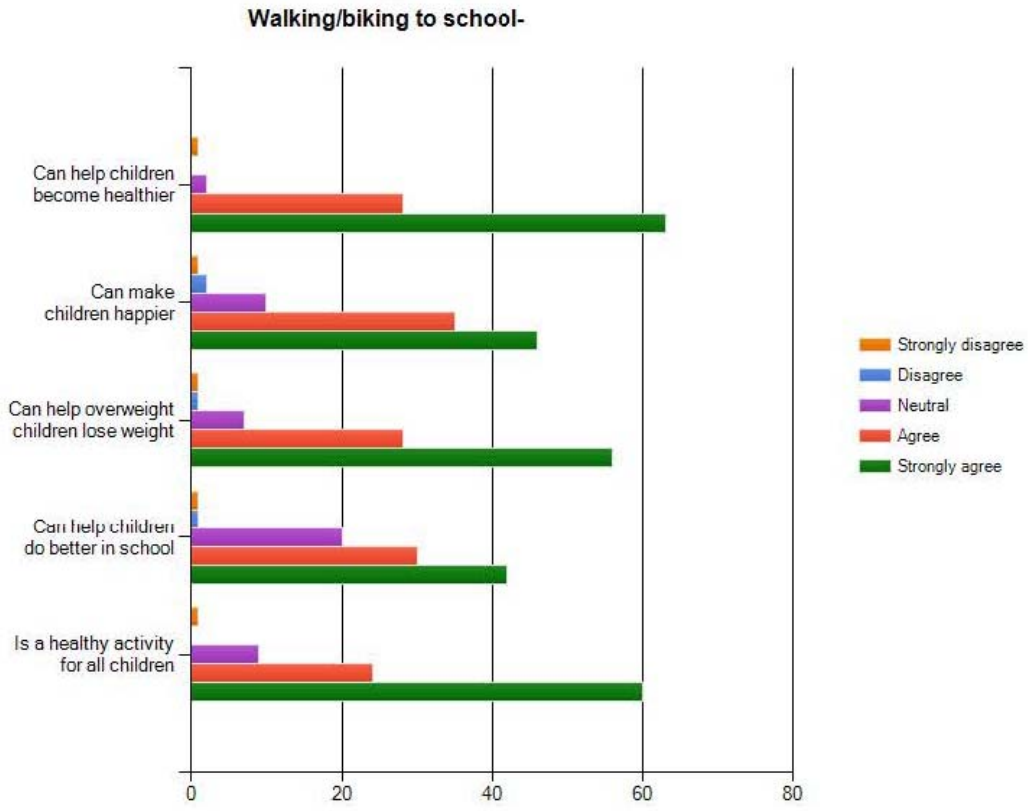
| Survey Item | FC | NF | t-stat | p-value |
|---|---|---|---|---|
| | Average Response, $\mu_{FC}$ (std. dev.) n=19 | Average Response, $\mu_{NF}$ (std. dev.) n=74 | | |
| Stray dogs/animals | 3.5 (s=1.2) | 2.8 (s=1.4) | 2.3 | 0.01* |
| Crime | 4.1 (s=1.1) | 3.5 (s=1.3) | 1.9 | 0.03* |
| Fights/bullying | 3.7 (s=1.2) | 3.3 (s=1.4) | 1.3 | 0.10* |
| Fast cars | 4.3 (s=0.7) | 4.0 (s=1.0) | 1.1 | 0.14 |
| Large trucks | 3.7 (s=0.9) | 3.4 (s=1.3) | 1.0 | 0.15 |
| Railroad crossings/trains | 3.2 (s=1.1) | 2.4 (s=1.4) | 2.6 | 0.006* |
| Child predators | 3.5 (s=1.2) | 3.2 (s=1.3) | 1.0 | 0.15 |
| Missing/broken sidewalks | 4.3 (s=0.9) | 3.6 (s=1.4) | 2.5 | 0.008 |
| Busy intersections | 4.3 (s=0.7) | 4.2 (s=1.0) | 0.6 | 0.28 |
| Missing/hard to see cross walks | 4.1 (s=0.8) | 3.8 (s=1.3) | 1.1 | 0.13 |
| Illegal drugs | 3.6 (s=1.3) | 2.9 (s=1.5) | 2.1 | 0.02* |
| Abandoned house | 3.9 (s=1.2) | 3.0 (s=1.6) | 2.7 | 0.005* |
| Gang activity | 3.7 (s=1.2) | 3.0 (s=1.6) | 1.7 | 0.04* |
| Trash/junk/trees on the sidewalks | 4.1 (s=0.9) | 3.3 (s=1.4) | 3.0 | 0.002* |
| Heavy traffic | 4.0 (s=0.9) | 3.8 (s=1.2) | 0.9 | 0.20 |
| No bike lanes | 4.0 (s=0.9) | 3.8 (s=1.4) | 0.8 | 0.21 |
| No crossing guards | 4.1 (s=0.8) | 3.2 (s=1.4) | 3.6 | 0.0002* |

transportation, 21% (20) were unsure whether active transportation could help children do better in school.

**Phase 2: Focus Group**

The focus group provided insight into additional barriers to walking and bicycling to schools. The research team highlighted examples of potential safety issues for child pedestrians in urban areas to elicit discussion. Some barriers that were discussed include distance, railroads, school traffic queuing, lack of crossing guards, the weight of children's backpacks, and concern with freight trucks on residential roadways. The presence of freight trucks on residential roadways was attributed to local truck drivers' bringing their trucks home despite ordinances prohibiting this, as well as zoning rules that allow industry adjacent to residential areas. Focus group participants repeatedly noted railroads that do not provide an at-grade crossing location for pedestrians except at the roadway and railroad intersection. There are no pedestrian facilities at these intersections, which forces the pedestrians into the roadway. Another important barrier identified is the weight of children's backpacks. This is also supported in the literature, as indicated by the U.S. Consumer Product and Safety Commission which estimates that, "…more than 7,000 emergency room visits in 2001 resulted from injuries related to backpacks and book bags; half of these injuries occurred in children 5 to 14 years old-the age of elementary and middle-school students" (U.S. Consumer Product Safety Commission, 2001). The focus group also discussed possible stakeholders to help identify and diminish safety concerns (including the barriers that were introduced during the focus group). These stakeholders include the School Board, Parent Teacher Associations (PTA's), the students, rail

**FIGURE 1**
**PARTICIPANT RATINGS OF POTENTIAL BENEFITS OF WALKING/BIKING TO SCHOOL**




and trucking companies, and local law enforcement.

## DISCUSSION, CONCLUSIONS AND FUTURE RESEARCH

Results of this pilot study provide valuable insight into important areas for further exploration. For example, the number of respondents who reported seeing children walk or bike to school in their neighborhoods was similar for both groups, suggesting that the presence of significant freight activity is not necessarily a deterrent to active transportation. However, the fact that the freight centric group was more concerned with railroad crossings/ trains does indicate that this issue is present in those areas. Future research should explore this issue in more detail and with a larger sample.

With regard to perceived impact on safety, increasing the presence of adults (either parents, chaperones, or crossing guards) along walk routes as well as having other children to walk with were rated highly by both FC and NF respondents. While the ratings differ from what is frequently seen in the literature, this may be due to the fact that our survey participants were not necessarily parents of school-age children (and the low response rate to these survey items). More insight into differences for urban communities should be examined in future research with a sample of school children and their parents.

Perhaps the most important finding of this pilot study is that neither the FC nor NF groups rated the presence of truck traffic or rail corridors highly in terms of being a barrier to walking or negatively impacting child pedestrian safety. In

fact, freight activity (both rail and truck) was of least concern to survey respondents in both FC and NFC communities. Even within the focus group, the research team had to specifically raise the issue and point to examples of safety concerns to elicit discussion regarding freight traffic. This is a significant issue because site visits to urban schools within the metropolitan area studied found numerous examples of safety issues and "close-call" situations with child pedestrians and freight activity. Overall, however, because of the relatively small sample size, conclusions should be carefully considered. But this research provides insights and can guide future studies. This points to the importance of additional research so that this apparent discrepancy can be further investigated and appropriate recommendations for safety improvements/practices and education can be made given the high number of child pedestrians in the FC communities.

Urban schools, particularly within inner-city areas, are likely to have children walking or biking to or from school due to socio-economic factors limiting the availability of personal vehicles. In addition, street networks in these environments are often well connected with shorter block lengths, and may be more conducive to promoting active transportation than in suburban or rural communities. The potential for a significant positive impact on health, academic performance, air quality, and congestion by increasing the number of children using active transportation points to the importance of research to understand existing barriers (both perceived and actual). For urban environments, the presence of significant freight activity can further complicate the approach to safe walk and bike routes, and its significance may not be fully understood by children and parents.

Hence, future research must investigate both stakeholder perceptions and current traffic data for a selected group of study and control urban elementary schools. Infrastructure and traffic data (including vehicle mix) should be collected at all schools included in this research, in addition to survey data from students, parents, teachers/administrators, and freight industry professionals. Such data can then be analyzed to determine if gaps in alignment exist between stakeholder groups as well as between stakeholder perceptions and existing conditions. The ultimate goal of this line of research is to identify perceived versus actual safety issues and to outline strategies for increasing safety and prominence of active transport to school in urban settings.

**Accomplishments**
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# MMOG/LE: IMPROVING SUPPLY CHAIN DELIVERY PERFORMANCE THROUGH BUYER-SUPPLIER COLLABORATION

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## ABSTRACT

This article introduces readers to a relatively new self-assessment tool for measuring the readiness and effectiveness of supplier materials management and logistics processes in the automotive industry. The tool, the Material Management Operating Guidelines/Logistics Evaluation (MMOG/LE), was developed by the Automotive Industry Action Group (AIAG), and Odette International – a European alliance of automotive companies. The article begins with an introduction to the topic of quality and materials management assessment systems. The author's then report on what they learned about MMOG/LE based on a review of the system and other comparable systems, and based on interviews with OEM's and tier 1 and 2 auto suppliers that use the system. The article begins with a description of what the MMOG/LE system is, and how it works. The article then has a section comparing MMOG/LE and ISO/TS16949, and then another section comparing MMOG/LE and the SCOR model. The authors then address and comment on various strengths and weaknesses of the MMOG/LE model. Finally, the authors make several recommendations on how the system and processes for managing it could be improved. Overall, the authors find that MMOG/LE is an effective system for improving materials management and logistics performance.

## INTRODUCTION

Over the past 20 years, supply chain excellence has become a key dimension of successful business competitiveness. A supply chain can create sustainable competitive advantage for a firm by reducing cost, enhancing product quality, ensuring on-time delivery and/or producing innovations. As a result, business and the academe have strived to develop theories, practices and guidelines that can assist companies in improving their supply chain performance.

Supply Chain Management performance guidelines have evolved from a number of performance evaluation programs developed for business and finance. A range of tools have been developed to facilitate improved business performance, such as the Balanced Scorecard (Kaplan and Norton, 1996) and Activity Based Costing (Kaplan, 1983). Also, during the 1980's and 1990's, several programs were developed to promote business performance standards of organizations. Most notably, among these programs, are the ISO standards. ISO 9000 — arguably the most widely recognized of the ISO standards – addresses quality issues. The automobile manufacturing industry, recognizing its unique environment, particularly the reliance on suppliers in terms of number of parts, volume of business, and complexity of purchased components, developed a "technical supplement" to ISO 9000, known as TS -16949, specific to the automotive industry.

Consequently, beginning in the 1990s, programs were developed to address supply chain performance. The best known of these is the Supply Chain Operations Reference (SCOR) system (SCOR, 2010), a 976 page document that covers the broad spectrum of supply chain management. SCOR provides a resource for identifying problems and developing solutions

across an organization's supply chain. However, like in the quality arena, where the automotive industry developed a specific program in TS-16949, there was recognition of a similar need in the supply chain domain. In response, a supply chain related model was developed specifically for the automotive industry. This model is called MMOG/LE — Materials Management Operating Guideline / Logistics Evaluation (AIAG, 2010; Odette, 2010). The development and introduction of MMOG/LE and SCOR emphasize the importance of an effective and efficient material flow process in ensuring supply chain reliability and responsiveness in today's uncertain world.

The Material Management Operating Guidelines / Logistic Evaluation (MMOG/LE) is a jointly developed supply chain self-assessment program that focuses exclusively on supply chain delivery performance. It was developed by the Automotive Industry Action Group (AIAG), a United States based alliance of automotive manufacturers and suppliers), and Odette International, a European alliance of automotive companies. MMOG/LE provides organizations a thorough assessment of their material management and logistics processes, from strategic planning issues, to production planning, to lower tier supplier relations, to customer relations. It is widely utilized by original equipment manufacturers (OEMs) in the vehicle manufacturing industry for suppliers to self-assess their logistics and material management processes. There also is a growing emphasis on Tier 1 suppliers using MMOG/LE with their suppliers (Tier 2). These often are somewhat smaller suppliers that may be especially in need of process support. MMOG/LE guides the establishment of formal processes in supply chain material flows, which enhances supply chain reliability and responsiveness.

Beyond helping suppliers to improve supply chain delivery performance, MMOG/LE is also an instrument that has the potential to encourage buyer-supplier collaboration, which has been widely shown to be a key to realize supply chain excellence. A paradox exists in the business relationships between a buying company and its suppliers. On one hand, buyer-supplier open communication would enhance the efficiency, connectivity and long term profitability of both firms. On the other hand, a buying company and its suppliers are independent companies whose stakeholders expect quick and high short-term profits – which may require actions detrimental to the other side. Such emphasis on short-term financial performance can mitigate the establishment of a collaborative atmosphere that supports efficiency, connectivity, and long term profitability of supply chain partners. The common expectation of a buyer is high quality and on-time delivery at the lowest cost. Because of its reliance on the supplier, the buyer organization often wants to monitor supplier processes to make sure they are reliable. However, suppliers often believe that if they are delivering products as agreed upon, they do not require "oversight" by the buyer.

To help mitigate this paradox, MMOG/LE is designed in a way that encourages buyer-supplier interactions for a common purpose: on-time and reliable deliveries to maximize profits for both sides. Long term profitability can be attained most likely when two distinct "successful" companies act like one company. Key business relationship elements are facilitated: product exchange, financial transactions, quality improvement, and product development. The more that distrust and opaque understanding with your supply chain partner is converted to trust and transparency, the more likely the relationship will lead to long term profitability for both parties.

To introduce MMOG/LE to supply chain researchers and practitioners, we answer the following questions in this study: (1) what is MMOG/LE, (2) differences between MMOG/LE and other major supply chain performance evaluation tools, (3) strengths and weakness of MMOG/LE and (4) recommendations for improving MMOG/LE. We conducted our analysis by using two sources of information:

- MMOG/LE documents including the program itself, training programs, and journal articles (Estampe, et al. 2013).
- Interviews with two (2) automotive original equipment manufacturers (OEMs), ten (10) suppliers in the auto industry, and two (2) ERP provider organizations.

## WHAT IS MMOG/LE AND HOW DOES IT WORK?

MMOG/LE means different things to different people. But following are two views by automotive industry executives:

- A continuous improvement tool that establishes processes for enhancing the quality of the material flow and delivery systems.(Automotive Industry OEM Executive)
- A self-audit tool that helps identify problems in the current processes and establishes new processes to improve delivery performance to satisfy customer demand. (Automotive Industry Tier 1 Supplier Executive)

The authors see MMOG/LE as an assessment program where the user *self-evaluates* the logistics and material management capabilities of an operating facility. It can assure that all necessary processes are documented and in place for on-time delivery by 1) identifying weaknesses in the out-bound distribution system, 2) ensuring that appropriate materials scheduling is in place, and 3) reducing the likelihood of production shutdowns. MMOG/LE provides evidence for an organization's customers, or for internal purposes, that appropriate EDI capabilities are in place for customers and suppliers, inventory control processes are in place, appropriate freight planning (inbound and outbound) is in place, and that production and capacity planning procedures and capabilities are in place. With grading and gap analysis capability, MMOG/LE can facilitate continuous improvement analysis and benchmarking best practices. A total of 206 questions, covered in six chapters, provide detailed analysis of the materials management and logistics functions. After completing the program, the company has a useful, comprehensive, and complete picture of those functions. MMOG/LE does not, however, recommend the specific tasks that an organization uses to satisfy the requirements.

In order to complete the MMOG/LE survey, the questions, or criteria, are each answered in one of three ways: Compliant, Not Compliant, or Not Applicable. In order for an item to be designated as Not Applicable (N/A), the organization's customer must approve the N/A designation (see MMOG/LE Introduction and Instructions). Each guideline item is weighted at either one, two, or three points (designated F1, F2, or F3 items, respectively), depending on how critical that item is. After all the items have been scored, grades on the overall MMOG/LE assessment can be either an "A", a "B," or a "C"; with an "A" grade only being possible if if the following three requirements are met:

- 90% or higher score out of all possible applicable points
- Compliance on all F3 criteria
- Non-compliance on fewer than six F2 criteria

A "B" grade is obtained if all above state F3 criteria are met, with the following exceptions:

- More than six, but no more than twelve F2 criteria are violated
- At least 80% but less than 90% out of the possible applicable points allowed.

If an "A," or "B" grade is not received, then a "C" grade is assigned.

### Assessment Question Categories

As noted earlier, there are three categories of questions – F1, F2 and F3. This section explains each of these types of questions and provides

examples. We start with the F3 category, as it includes the most critical types of questions. F3 items (35 questions) are those policies and procedures that are fundamental to the organizations ability to serve the customer in the short term – failure to comply create immediate risk of interruption of delivery or create significant cost to the organization (MMOG/LE, 2009). All F3 criteria must be met to achieve an A or B grade (i.e. failure to meet any single F3 criteria results in a "C" score). Examples of F3 questions in the program are:

- Example 1. (From Strategy and Improvement Chapter) There shall be a process in place to identify and, where appropriate, manage bottleneck processes within the supply chain to maximize output while ensuring production and delivery to the customer are not compromised.
- Example 2. (From Customer Interface Chapter) The organization shall have a process in place to develop and define labeling and packaging solutions for standard and back-up packaging, including pack size, in conjunction with all involved parties and before the start of production
- Example 3. (From Production and Product Control Chapter) There shall be a process in place that satisfies customer, industry, government and/or internationally mandated traceability standards, including reporting requirements, for all affected parts (e.g. Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act, Federal Motor Vehicle Safety Standard (FIVES), End of Life Vehicle (ELVA)).

F2 questions (75) are those policies and procedures that are significant to the materials management and logistics goals and performance of the organization. If an F2 criterion is disregarded, the organizations performance and customer service may be severely impacted (MMOG/LE, 2009). Examples of F2 items are as follows:

- Example 1. (Strategy and Improvement) Production batch/lot size is evaluated on a regular basis and is adjusted accordingly in support of lean objectives.
- Example 2. (Customer Interface) There is a process in place to validate the packaging and labeling solution with all involved parties. The process includes a formal sign-off with the customer for the packaging and labeling solution.
- Example 3. (Production and Product Control) There is a process in place to ensure that lot, partial lot, and/or serial traceability is managed according to customer, industry, government, and/or international standards. This may involve traceability of individual part/pallet/ batches for all stages of inventory (finished goods, WIP, raw material).

F1 questions (96) demonstrate overall control and completeness of the material management and logistics policies. Failure to comply with the F1 criteria can be detrimental to the long term successful operations and success of the organization (MMOG/LE, 2009). F1 criteria contribute one point to the overall MMOG/LE score. There is no requirement on the specific number of F1 criteria that must be completed satisfactorily, however, if the overall score of the MMOG/LE assessment is below 90%, a "B" score is assigned. If less than 75% of criteria are satisfactory, then a "C" score is assigned. Examples of F1 criteria include:

- Example 1. (Strategy and Improvement) Cycle counts are used to measure and improve the accuracy of perpetual inventory records, reducing the need for inventory adjustments and/or physical inventory counts.

- Example 2. (Customer Interface) All applicable manufacturing, storage, and shipping processes are considered when developing the customer packaging solution.

- Example 3. (Production and Product Control) Collecting, recording, and tracking of lot, partial lot, and/or serial traceability data are automated (e.g. bar coding, RFID).

Of course the concept here is that the urgency for satisfactory implementation is highest for F3 criteria. The criticality of the items declines as you move to the F2 category and then the F1 category. MMOG/LE is a system that focuses on improving performance by establishing basic processes and assuring that important materials and logistics management processes are developed and implemented. It is a program that integrates activities of both OEMs and suppliers to ensure smooth material flow.

## MMOG/LE AND ISO/ TS16949: SIMILARITIES AND DIFFERENCES

The key similarity between MMOG/LE and ISO/ TS 16949 is that both programs include a checklist for process criteria. Neither program makes assurances that quality is achieved in either the product, service or delivery realms, but they do assure that processes are in place that can lead quality and service goals being achieved. There are two primary differences between the two programs: First, ISO/TS 16949 addresses processes to maintain and improve product quality. MMOG/LE addresses processes for material management and logistics. Second, ISO/TS 16949 criteria are checked by independent, third party auditors in order to certify the organization. MMOG/LE is primarily a self-assessment, where no certification is attained.

ISO/TS 16949 criteria comprise ISO 9000 quality standards with additional criteria targeted specifically for the automotive industry. The standard was developed by the International Automotive Task Force (IATF) with the Japanese Automotive Manufacturers Association (JAMA) and ISO Technical Committee 176 to facilitate suppliers compliance to military, national, and consumer standards (Franceschini, et al. 2011). There are 267 criteria in the ISO/ TS16949 document. While there is some overlap between MMOG/LE and ISO/TS16949, MMOG/LE is intended to complement ISO/ TS16949. Again, ISO/TS16949 is focused on product quality, while MMOG/LE concentrates on the accuracy and reliability of material management and logistics processes. The ISO/ TS 16949 introduction states that:

- The adoption of a quality management system should be a strategic decision of an organization. The design and implementation of an organization's quality management system is influenced by:

a) its organizational environment, changes in that environment, and the risks associated with that environment,

b) its varying needs,

c) its particular objectives,

d) the products it provides,

e) the processes it employs,

f) its size and organizational structure. (ISO Technical Specification, 2009)

The focus of MMOG/LE is spelled out clearly in the program introduction:

- Materials Planning and Logistics (MP&L) is the process of managing the procurement, movement, and storage of materials, parts, and finished goods (and the related information flows) throughout the organization through the timely and cost-effective fulfillment of orders.

> This assessment tool has been produced to assist organizations in developing and implementing world class MP&L processes (MMOG/LE Introduction and Instructions).

To further examine differences between the two programs, we conducted a key word search to identify the most popular words used in each program. Table 1 below shows terminology that demonstrates the difference in emphasis between MMOG/LE and ISO/TS16949, with an emphasis on the most widely used words in MMOG/LE.

There is clearly a distinction in emphasis between the two programs. MMOG/LE emphasizes processes related to inventory, shipping, transport, material, and logistics. ISO/TS 16949 emphasizes quality, validation, specification, and conformance. What terms are common between both programs? Terms we found in common were "delivery" and "resource". One term that we found commonly used that should be introduced more frequently in both programs was "safety."

The specific term strategy (or strategic) is raised only once in the ISO/TS16949 2009 document. It covers the implications of quality initiatives as a strategic initiative. Strategy is more explicitly detailed in MMOG/LE —the first section is dedicated to Strategy and Vision. Several F1 and F2 criteria relate specifically to strategic plans and planning.

Strategy-related Criteria included in the MMOG/LE program include:

- A documented strategy is in place for delivery of the MP&L vision.
- The MP&L vision and strategy is a fundamental part of the organization's overall business objectives, including

**TABLE 1**
**KEY WORD SEARCH OF MMOG/LE AND ISO/TS16949**
**NUMBER OF TIMES EACH TERM IS USED BY EACH SYSTEM**

**MOST USED WORDS IN MMOG/LE WITH TS16949 COMPARISON**

| Term | MMOG/LE | ISO/TS16949 |
|---|---|---|
| Strategy (Strategic) | 15 | 1 |
| Inventory | 34 | 3 |
| Capacity | 20 | 0 |
| Ship (shipping, shipment) | 45 | 4 |
| Transport | 30 | 1 |
| Material | 72 | 16 |
| Logistic | 18 | 1 |

**MOST USED WORDS IN ISO/TS16949 WITH MMOG/LE COMAPRISON**

| Term | ISO/TS16949 | MMOG/LE |
|---|---|---|
| Realization (new product) | 26 | 4 |
| specification | 30 | 4 |
| quality | 198 | 10 |
| conform | 76 | 1 |
| Design | 86 | 4 |
| audit | 33 | 3 |
| purchase | 26 | 9 |
| Validate (invalidate, validation) | 25 | 4 |

customer requirements and continual improvement.

- The MP&L vision and strategy are communicated to and understood by all employees within the organization.
- Objectives are documented, specific, measurable, achievable, realistic, timely and consistent with the organization's MP&L strategy.
- Training objectives are clearly defined within the MP&L strategy, understood by all employees concerned, and monitored by management.

The number of questions regarding articulated strategy, vision, and communications in the MMOG/LE document confirm their importance. However, the lack of F3 designations for vision and strategic planning subordinate the urgency within the MP&L framework.

ISO/ TS 16949 offers much less coverage of Inventory and Material Management Requirements

ISO/TS16949 does state the following:

- The organization shall use an inventory management system to optimize inventory turns over time and assure stock rotation, such as "first-in-first-out" (FIFO). Obsolete product shall be controlled in a similar manner to nonconforming product. Plant layouts shall optimize material travel, handling and value-added use of floor space, and shall facilitate synchronous material flow (ISO/TS 16929).

But in MMOG, there is extensive consideration for inventory control. For instance, in the Material Management Chapter (5), there is a complete section on Inventory. Within that chapter there are F3 requirements such as the following:

- Operational parameters (e.g. transport time, lead times, inventory levels, packaging) and internal production requirements (e.g. supplier constraints, scrap rates, set-up times) shall be integrated into the production planning system.
- The organization shall use all customer's business systems as required (e.g. inventory management, container management, capacity planning, supplier portals). A structured problem solving process is in place to determine root cause and prevent the recurrence of any problems within the supply chain (e.g. material, delivery, logistics, systems).

The differences in the treatment of inventory demonstrate the emphases of the two programs.

## SCOR AND MMOG/LE: SIMILARITIES AND DIFFERENCES

The Supply Chain Reference Model (SCOR) is produced by the Supply Chain Council and was introduced in 1996. Now in its 11th version, SCOR is designed to address five SCM challenges: superior customer service, cost control, planning and risk management, supplier/ partner relationship management, and talent (Huan, Sheoran, and Wang, 2004). It is intended to have a broader focus than individual project management. SCOR does this by introducing a common language and set of metrics that can be applied across SC functions and by integrating business strategy with SC design. SCOR explicitly excludes the sales and marketing, research and development, information technology, and quality functions. The SCOR model is developed around four interrelated concepts: performance metrics, SC processes, practices (emerging, best and standard), and employee skills and training (Huan, Sheoran and Wang, 2004).

The performance metrics are organized into five core performance attributes: reliability (e.g., on-time, right quality, right quantity),

responsiveness (e.g., cycle time), agility (e.g., flexibility and adaptability), costs (e.g., cost of goods sold, SCM costs), and assets (e.g., cash-to-cash cycle time, return on fixed assets). Within these five core areas, specific metrics are placed at one of four levels. Level 1 attributes are strategic in nature and are tied to overall business strategy. Level 2 metrics are seen as diagnostic of Level 1 measures, while Level 3 measures are diagnostic of those at Level 2. Thus, the organization of the metrics is designed to facilitate root-cause analysis. Level 4 metrics are not specified and should be developed by the individual firm, if appropriate.

SCOR processes are also organized hierarchically. There are five Level 1 processes: Plan (strategic planning within SC), Source (ordering and receipt of goods), Make (conversion of materials, which is viewed as broader than production and includes…), Delivery (to customers), and Return (reverse flow related activities excluding repair and remanufacturing which are included in Make). Again, Level 2 processes are nested under the various Level 1 processes and are classified into three types: planning, execution, and enabling (e.g, managing information or relationships). Level 3 processes are subsumed under Level 2 processes, so as to support root-cause analysis as with the performance metrics. At each level, linkages of processes to appropriate performance metrics are provided.

SCOR describes numerous practices which are categorized into emerging (not yet well established and thus higher risk), best (established in some industries and thus moderate risk), and standard (widely employed and thus moderate to low risk). A practice is defined as a unique way to configure a process or set of processes. Uniqueness can be in automation, technology, personnel skills, sequencing of processes or the method of connecting them. Each of the practices discussed are tied to particular processes and metrics. SCOR also provides discussion of best practices specifically for managing risk and environmental performance.

Lastly, the SCOR model discusses employee skills and training using a skills management framework. An extensive list of specific skills is included and each is related to particular processes. Training, experience, and aptitudes are suggested as a means to develop each skill.

Both the five SCM challenges that motivate the SCOR model as well as the list of five Level 1 (strategic) processes clearly suggest that SCOR has a broader focus than MMOG/LE. SCOR's greater breadth is reflected in its industry perspective, its business process perspective, and in the detail it provides. At the industry level, the greater breadth of SCOR is not surprising in that MMOG/LE is designed specifically for the auto industry, while SCOR is presented as applicable to all businesses including those in the service and retail sectors. The Level 1 processes in SCOR cover both the Sourcing and Return areas. It also considers engineering-to-order (as part of the Make group of processes) and the planning and selection of transportation providers (as part of the Delivery group of process). These functions are either absent from or substantially limited in MMOG/LE. Again, this is likely due to MMOG/LE's focus on the auto industry. In particular, its focus is on parts suppliers who deliver parts on an ongoing (JIT) basis. Parts are produced following previously agreed to specifications (often engineered by the buyer or OEM) and following contracts that are generally the length of a model run which is 3 years or more. Deliveries are often made daily using transportation providers selected by the OEM. The fact that MMOG/LE does not consider the Return function is somewhat surprising in light of the occasional need for rework of parts in the auto supply chain. Finally, the detail provided by SCOR is substantially greater than that in MMOG/LE. SCOR provides an extensive set of metrics and their linkages to specific processes, a feature largely absent from MMOG/LE. The SCOR user is given some latitude in the selection of the metrics used to

assess the performance of a particular process. However, the recommended metrics are quite specific. In this sense, SCOR can be seen as more proscriptive than MMOG/LE in pointing to a certain approach for measuring each process. Clearly, this has both advantages and disadvantages.

Two of the five core performance attributes of the SCOR model deserve separate discussion because they highlight another important difference between SCOR and MMOG/LE. These are agility and costs, which are not emphasized in MMOG/LE. Much of the focus of the agility component in SCOR is on risk management and includes value-at-risk metrics. It encourages those responsible for the supply chain to consider 'what if' scenarios that potentially threaten supply chain performance. MMOG/LE would benefit from a greater emphasis in this area. There is also no direct assessment of cost factors in MMOG/LE, which would be of obvious value to firms in the automotive supply chain.

Perhaps the most significant difference between the two models is the implied need for integration of processes. As the name implies, SCOR is designed as a reference source for companies interested in enhancing particular aspects of their supply chain operations. It is not intended that it be implemented in its entirety all at once; nor does it suggest an overall metric of supply chain performance. In contrast, MMOG/LE requires comprehensive adoption and yields an overall score and letter rating. Thus, with SCOR the user decides which processes to prioritize for improvement. With MMOG/LE the priorities are imposed by the weights given to each process. Of course, the supplier that is following a customer orientation may see the priorities in MMOG/LE as appropriate since the weightings come from the OEM customers.

This last point leads us to suggest that the two models can best be seen as complementary rather than as competing alternatives. MMOG/LE addresses the customer's priorities and SCOR provides guidance as to the metrics, practices, and employee skills that are most useful for addressing the priority processes.

## MMOG/LE STRENGTHES AND WEAKNESSES

### MMOG/LE Strengths

The earlier mentioned interviews with OEMs and Tier 1 suppliers reported strengths and weaknesses of MMOG/LE. A consistent theme about the strengths of MMOG/LE relates to the comprehensive coverage of material management and logistical criteria and principles. Interview respondents uniformly stated that the survey content was appropriate and useful. Detailed strengths of MMOG/LE as articulated by the respondents were:

- Focus on EDI, Planning, and Customer Communication
- It provides thoughtful guidelines to best practices
- Encourages vendor EDI.
- More detail on material and logistic processes than ISO/TS 16949.
- Helpful in improving processes and helpful in looking for improvements — helps in solving problems
- It forces discipline. It focuses on detail, yet is comprehensive.
- It identifies weaknesses and gaps.
- It provides guidelines on what to be done to be world class — can be used as a competitive differentiator.
- Helps to be compliant with customer… to do business better with customer.

One of the key strengths of MMOG/LE is simply the fact that OEM's require it. For instance one interview with a small tier 1 supplier describes a management reluctant to acquire electronic data

interchange technology (EDI) for communications between themselves and the OEM customer. The OEM requirements for the supplier to complete MMOG helped persuade management to make the necessary investment in the technology. The implementation of EDI resulted in improved data accuracy, delivery performance, and improved inventory levels.

Another benefit of MMOG relates to improvements in the accuracy of records and improved responsiveness to customers. Specific Tier 1 supplier remarks about improvements that were made as a result of MMOG/LE include the following:

- More accurate information moving between supplier and customer.
- Improved data accuracy
- Reduced Inventory levels
- Improved contingency planning
- Improved customer support
- Reduced order lead time and premium freight
- Improved supplier assessment score in customer evaluations
- Improved monitoring of containers

In conclusion, supplier interviews revealed a number of benefits related to use of MMOG?LE.

**MMOG/LE Weaknesses**

While MMOG/LE can be implemented independently by an organization to assess its material management and logistics processes, the vast majority of times it is recommended, or even mandated, by a customer. That said, a key criticism of MMOG/LE is not with the program, but on how it is managed by the customer organization. Respondents reported that customers require them to submit the program reports, but then do not provide timely feedback or any feedback at all. Also, respondents reported that suppliers are not held accountable for poor scores, therefore suppliers are slow to institute improvements. Established companies with reputations for quality reported that they were required to document what they had long had in place. To summarize, respondents find that weaknesses apply to the management of MMOG/LE, and not to the program itself.

One example of poor management of the whole MMOG/LE process relates to a supplier that reported that his organization had complied with all MMOG/LE guidelines without actually conducting the necessary assessment. The customer organization apparently accepted this assessment until a surge in demand caught the supplier by surprise, unable to respond. When the customer's evaluators arrived to ascertain the problem, they discovered that the supplier's employees had neglected to perform the assessment – merely submitting the evaluation as 100% in compliance. That finding resulted in employee turnover at the supplier organization. This example demonstrates one of the key weaknesses with MMOG/LE – the lack of customer follow-up on suppliers self-reported results.

**MMOG/LE RECOMMENDATIONS**

Unanimously, tier 1 suppliers and OEMs agreed that the MMOG/LE standards are important for Material Planning and Logistic success. That does not suggest, however, that improvement cannot be made. Recommendations for future implementation include the following:

- The most common criticism of MMOG/LE is not about the program itself, but how it is implemented by OEMs. OEMs should adopt a hands-on approach through intensive communication with suppliers to encourage implementation and offer feedback. There should be prompt response to questions and prompt acknowledgement that the MMOG/LE

assessment has been received. OEMs can provide a priority list for improvements for suppliers to pursue based upon the assessments Gap-Analysis.

- Continuing with the theme that there should be more of a partnership between buyers and suppliers, OEMs should allow suppliers to discuss the "circumstances" related to non-compliance on individual factors. Unique circumstances and special situations may satisfactorily explain non-compliance and allow for an adjusted score that would make the supplier compliant overall at a higher level.

- A particularly valuable use of MMOG/LE is to provide startup businesses, and smaller tier 1 and tier 2 organizations with guidelines for implementing materials management and logistic best practices. As such it is recommended that there should be a:

    - Focus on promoting MMOG/LE with newly created, or smaller organizations.

    - Focus on highlighting how MMOG/LE is different from other supplier evaluation programs, such as SCOR.

- A common misconception about MMOG/LE among suppliers is that it is primarily about installing information systems. It would be beneficial to highlight the emphasis on improving processes.

  Develop a common clearinghouse for suppliers to submit their MMOG/LE results to– preferably at AIAG Headquarters. This could eliminate the need for suppliers to complete the process for each of many customers.

- Develop an education program for top supplier management, including a presentation PowerPoint slide show or video -to persuade top management that the MMOG/LE self- assessment is a worthwhile program deserving attention and resources.

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Journal of Transportation Management

# Guidelines for Submission/Publication

**GENERAL**

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2. Articles should be submitted electronically to Dr. Taylor at taylorjohn@wayne.edu.

3. Articles should be submitted using Microsoft Word for Windows in either doc or docx formats. Articles prepared on Mac systems should be saved in Word for Windows compatible format. Accepted articles, in final form, are also submitted via email.

4. Article length should be in the range of 6000-7000 words including references. Tables and figures are in addition to the word count. However articles including all text, references, appendixes, tables and figures (but excluding front matter) should not exceed 30 double spaced pages in the format described below. Shorter articles are also acceptable. It will be difficult to publish articles much longer than 7000 words.

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1. First Page - Title of the paper, name and position of the author(s), author(s) complete address(es) and telephone number(s), e-mail address(es), and any acknowledgment of assistance. Times New Roman with 12 point font.

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$y = c + ax + bx$
$y = a + 1x + 2x + 3x + ax$

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7. All references to journals, books, etc., are *italicized,* NOT underlined. Examples are as follows:

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Pohlen, Terrance L. (2003), "A Framework for Evaluating Supply Chain Performance," *Journal of Transportation Management,* 14(2): 1-21.

**Book Chapter:**
Manrodt, Karl (2003), "Drivers of Logistics Excellence: Implications for Carriers," In J. W. Wilson (Ed.), *Logistics and Transportation Research Yearbook 2003* (pp. 126-154) Englewood Cliffs, NJ: Prentice-Hall, Inc.

**Book:**
Coyle, John J., Bardi, Edward J., and Novack, RobertA. (2004), *Transportation*, 6th ed., Cincinnati, OH: South-Western College Publishing.

**Website:**
Wilson, J. W. (2003), "Adapting to the Threat of Global Terrorism: Reinventing Your Supply Chain," [On-line]. Available: http//:georgiasouthern.edu/coba/centers/lit/threat.doc. Created: 11/01/02, Accessed: 11/12/03.

**MANUSCRIPT SAMPLE**

**A FRAMEWORK FOR EVALUATING SUPPLY CHAIN PERFORMANCE**

Terrance L. Pohlen, University of North Texas

**ABSTRACT**

Managers require measures spanning multiple enterprises to increase supply chain competitiveness and to increase the value delivered to the end-customer. Despite the need for supply chain metrics, there is little evidence that any firms are successfully measuring and evaluating inter-firm performance. Existing measures continue to capture intrafirm performance and focus on traditional measures. The lack of a framework to simultaneously measure and translate inter-firm performance into value creation has largely contributed to this situation. This article presents a framework that overcomes these shortcomings by measuring performance across multiple firms and translating supply chain performance into shareholder value.

**INTRODUCTION**

The ability to measure supply chain performance remains an elusive goal for managers in most companies. Few have implemented supply chain management or have visibility of performance across multiple companies (Supply Chain Solutions, 1998; Keeler et al., 1999; Simatupang and

Sridharan, 2002). Supply chain management itself lacks a widely accepted definition (Akkermans, 1999), and many managers substitute the term for logistics or supplier management (Lambert and Pohlen, 2001). As a result, performance measurement tends to be functionally or internally focused and does not capture supply chain performance (Gilmour, 1999; *Supply Chain Management*, 200 I) . At best, existing measures only capture how immediate upstream suppliers and downstream customers drive performance within a single firm.

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Table 1 about here

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**Developing and Costing Performance Measures**

ABC is a technique for assigning the direct and indirect resources of a firm to the activities consuming the resources and subsequently tracing the cost of performing these activities to the products, customers, or supply chains consuming the activities (La Londe and Pohlen, 1996). An activity-based approach increases costing accuracy by using multiple drivers to assign costs whereas traditional cost accounting frequently relies on a very limited number of allocation bases.

$$y = a^2 - 2ax + x^2$$

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