فرمول جامع برای تدوین لایحه تاخیرات

(بر اساس دو قرارداد FIDIC و AIA)

معرفی دوره

ارائه دهنده:

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مقدمه

تحلیل تاخیرات و ارائه ادعاهای مرتبط با آن نیازمند دانشی تخصصی در ابعاد مختلف فنی، قراردادی و حقوقی است. اما صرف‌نظر از این دانش، چالش متخصصان این حوزه نداشتن یک فرایند فرموله‌شده برای تدوین لایحه تاخیرات است. بسیاری از متخصصان این حوزه حتی با داشتن دانش تخصصی، باز هم در زمان تدوین لایحه تاخیرات دچار سردرگمی می‌شوند و فرایند اصولی منطبق بر قرارداد را نمی‌شناسند.

اما این موضوع راهکار مشخصی دارد. رویه فرموله‌شده، بر بستر قراردادی و با جزئیاتی مشخص که نیاز به فراگیری دارد و تا به امروز در کشورمان شناخت کافی نسبت به آن‌ها نبوده است. از آنجا که موسسه ACEMI جامع‌ترین و تخصصی‌ترین دوره تحلیل تاخیرات را تا به امروز در ایران برگزار کرده است، این‌بار دوره‌ای را در سطح پیشرفته برگزار می‌کند که این دغدغه را نیز برطرف کند و باعث توسعه بیش‌تر این دانش در کشورمان گردد.

این دوره پیشرفته در گام اول به ارائه یک چهارچوب مشخص برای تدوین لایحه تاخیرات می‌پردازد و فرمولی را برای انتخاب روش مناسب برای تحلیل تاخیرات ارائه می‌کند. در گام دوم و سوم به ارائه تفصیلی این چهارچوب بر اساس دو قرارداد رایج در دنیا، قراردادهای AIA-A201 و FIDIC قرمز که هر دو نسخه ۲۰۱۷ هستند، پرداخته می‌شود و با تطبیق بندهای این قراردادها با چهارچوب پیشنهادی، نحوه تدوین یک لایحه اصولی را در ابعاد بین‌المللی فرا می‌گیرید. نکته مهم آن است که این چهارچوب برای قراردادهای داخلی کاملا قابل استفاده بوده که درباره نحوه تطبیق‌سازی آن نیز در این دوره آموزش خواهید دید.

اما در گام چهارم یک اتفاق جالب رخ خواهد داد و نکات بسیار حرفه‌ای را به صورت یک راهنما برای استفاده از یکی از بهترین روش‌های تحلیل تاخیرات به نام Time Impact Analysis، هم به صورت آینده‌نگر و هم به صورت گذشته‌نگر، از منظر فنی و قراردادی یاد می‌گیرید. نکته مهم در این بخش تحلیل دو نمونه موردی حقوقی است که در پایان این بخش انجام می‌شود.

شرکت در این دوره که در سطح پیشرفته برگزار می‌شود، باعث متمایزسازی متخصصان کنترل پروژه، قراردادی و تحلیل تاخیرات در بالاترین سطح در عرصه بین‌الملل می‌شود و پیش‌نیاز آن دانش جامع در زمینه تحلیل تاخیرات و گذراندن دوره پیش‌نیاز است.

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مقدمه: معرفی دوره

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ویژگی‌ها و جزئیات

آنچه خواهید آموخت

این دوره که در سطح پیشرفته ارائه می‌شود، تدوین لایحه تاخیرات را به صورت فرموله‌شده و از منظر قراردادی به شما آموزش می‌دهد تا فرایند مشخصی را برای ارائه یک لایحه تاخیرات حرفه‌ای طی کنید. در واقع در این دوره:

۱. چهارچوب اصولی برای تدوین لایحه تاخیرات را فرا می‌گیرید.
۲. این چهارچوب را مطابق با دو قرارداد بسیار مهم در عرصه بین‌الملل (AIA و FIDIC) فرا می‌گیرید.
۳. با یک راهنمای حرفه‌ای برای پیاده‌سازی مدل TIA به دو صورت آینده‌نگر و گذشته‌نگر مواجه می‌شوید تا با ارزیابی نمونه‌های حقوقی مرتبط با آن در سطحی بالاتر از متخصصان این امر در عرصه بین‌الملل قرار بگیرید.

وجه تمایز این دوره

- ارائه گواهینامه معتبر با امضای مدرس رسمی و تأییدشده انجمن مدیریت ساخت آمریکا (CMAA) در ایران
- آموزش نحوه تدوین لایحه تاخیرات بر اساس ساختار فرموله‌شده و بر بستر قراردادی برای اولین بار در کشور
- ارائه تخصصی‌ترین نکات برای پیاده‌سازی یکی از بهترین روش‌های تحلیل تاخیرات (TIA)، هم از منظر فنی و هم از منظر قراردادی
- برگزاری دوره پیشرفته تحلیل تاخیرات توسط اولین برگزارکننده دوره جامع آنالیز تاخیرات در کشور
- متمایزسازی فراگیران به دلیل آموزش به‌روزترین اسناد تخصصی مدیریت ساخت در دنیا که بعضا دسترسی به برخی از آن‌ها در کشور سخت و یا ناممکن است.
- ارائه ویدیوها و جزوات به صورت کامل (جزوات تنها در اختیار اعضای کانون قرار می‌گیرند).
- گروه پشتیبانی ۶۰ روزه از زمان شروع دوره (پشتیبانی دائمی از پنل کاربری برای اعضای کانون مادامی که عضو هستند).
- ارائه محتوا به صورت جامع، ساختار یافته و هدفمند در راستای نقشه راه CM

نوع: مدیریت ساخت (CM)	
نوع دوره: مهارت سخت	دپارتمان: مدیریت قرارداد
سطح تخصص: سطح ۳	سطح دوره: ارشد - استراتژی
مدرس: دکتر سید محمدرضا علوی‌پور	
پیش‌نیاز: فرایند جامع آنالیز تاخیرات در پروژه (تدوین لایحه تاخیرات جامع)	

گواهینامه حضور

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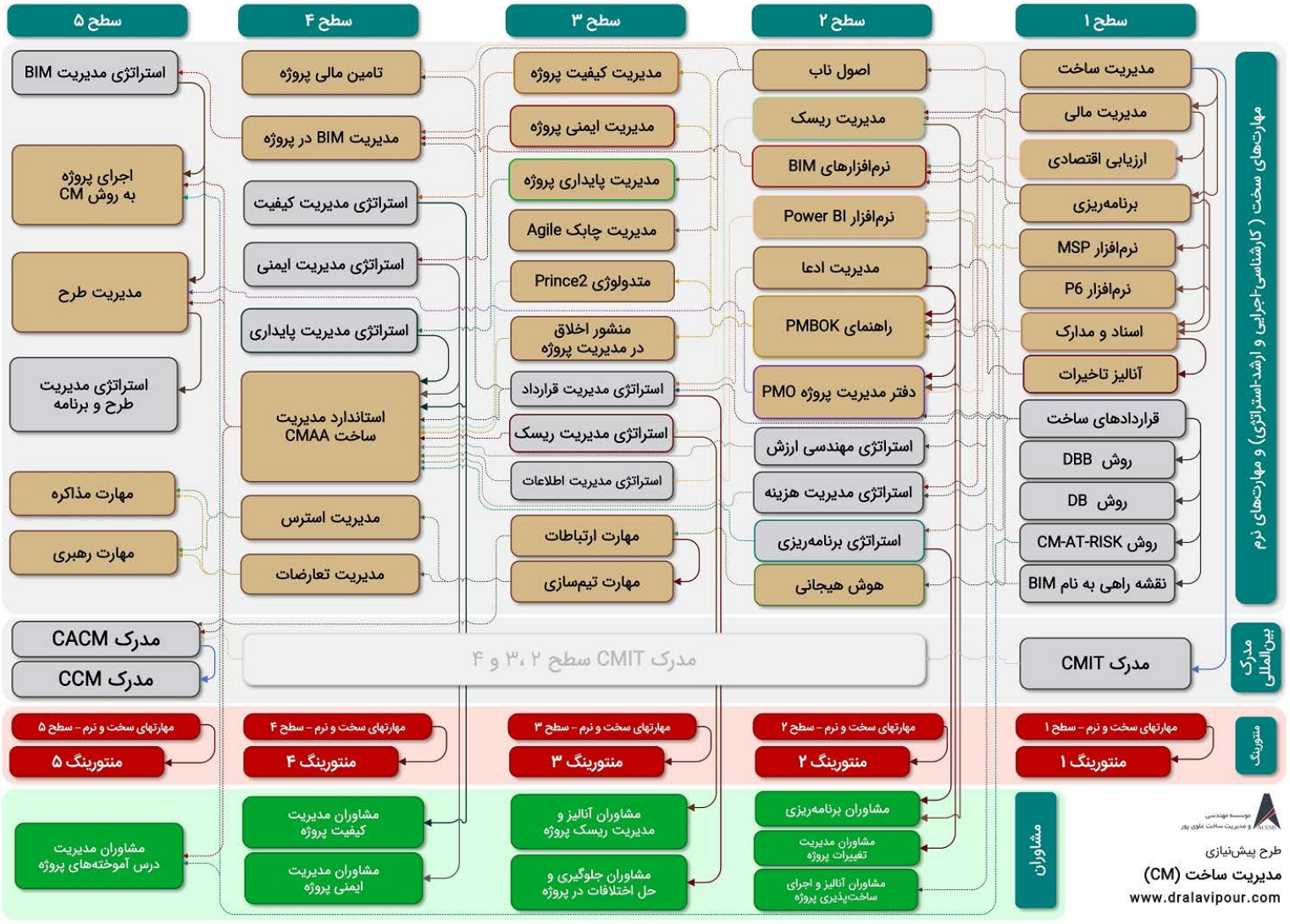
Road map



References Used in This Course

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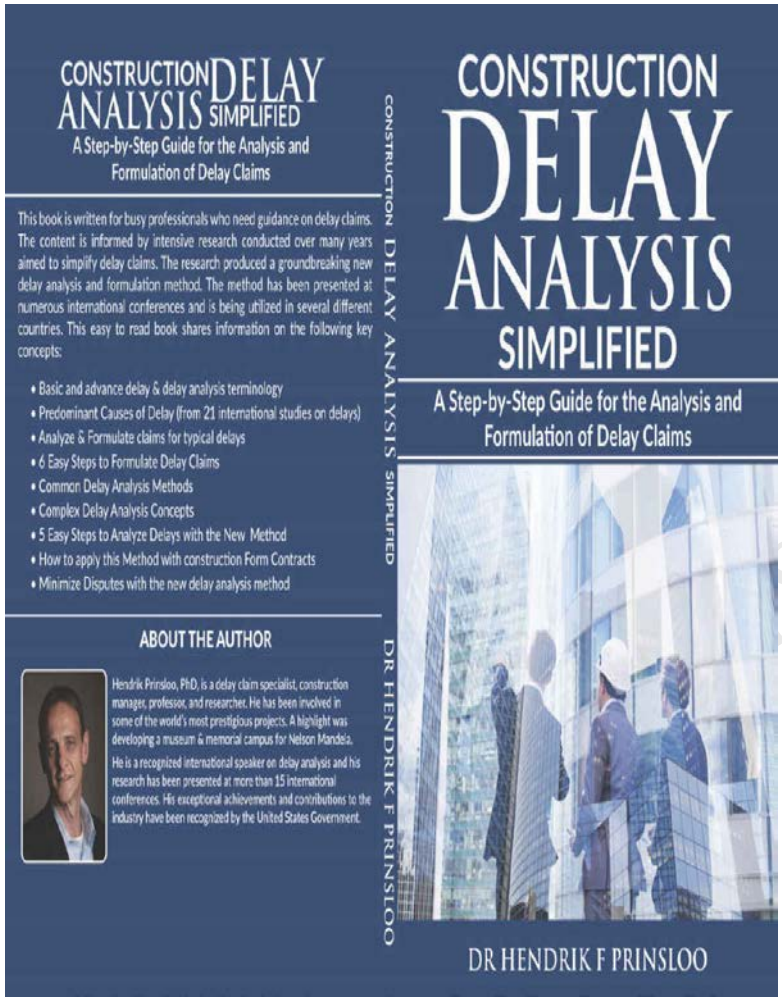

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KSCE Journal of Civil Engineering (2022) 26(12):4926-4941
DOI 10.1007/s12205-022-2394-1

pISSN 1226-7988, eISSN 1976-3808
www.springer.com/12205

Construction Management

Delay Analysis Selection Model for a Construction Project

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[b]Member, School of Architecture, Civil, Environment and Energy, Kyungpook National University, Daegu, Korea

Primary references

NAVIGANT | Construction Forum™
Building on the lessons learned in construction dispute avoidance and resolution.

Primary references

Primary references

PROJECT DELAYS & EOT

CMAA Webinars

Concurrent Delays: What To Look For?

Amin Terouhid, Ph.D., PE

ADROIT

Adroit Consultants, LLC

Sourav

فرمول جامع برای تدوین لایحه تاخیرات

(بر اساس دو قرارداد FIDIC و AIA)

بخش اول: روش سریع و ساده برای تدوین لایحه تاخیرات

ارائه دهنده:

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What we will learn?

- Introduction
- Development of the New Method
- Five Simple Steps
- Delay Claim Formulation
- Identifying Symptoms of Types of Claims
- Delay Analysis Selection Model for a Construction Project

Introduction

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What impacts the schedule in construction?

Engineers & Architects	Owners	Construction Managers	Contractors	Other
• Poor Design • Incomplete Design • Slow Response Time	• Excessive Changes • Delayed Approvals/ Permits • Prolonged Planning • Delayed Payment	• Poor Planning/ Scheduling • Poor Contract Management • Coordination Issues • Unachievable Schedule • Poor Data Management • Mismanagement of Resources	• Unachievable Bid • Poor Productivity/ Performance • Mismanagement of resources • Labor Shortages • Default	• Unanticipated Weather • Changing Market Conditions • Unforeseen Conditions • Force majeure

The need for a new method

- Delay claims were always one of the **most difficult issues** to deal with in the projects.

- We should find a **sensible** and **easy way** to assess and analyze delay claims.

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The need for a new method

- Unfortunately, the **form contracts** do not provide any **guidance on how delay claims** should be **analyzed** to determine whether an extension of the contract period is **justifiable**.

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Everything is about decisions

- The **process of assessing delay claims** consists of a **series of decisions** taken regarding a number of different matters, ranging from

  compliance to **contractual clauses** to

  risk allocation between contractor and owner.

- In essence, the evaluation of delay claims is a **sequential decision-making process**, in which each decision would impact on the outcome of the claim.

- A **guidance tool** should, therefore, support this sequential process of **decision-making.**

Everything is about decisions

- From the onset one of the most important objectives was to develop a **user-friendly guideline** to **assist practitioners** to navigate this potential minefield of **complexities** in the process of the assessment and **formulation of delay claims**.

Methodology

Development of the New Method

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Introduction

- The **decision** on whether the delay is **compensable** can only be made **once all** the other decisions have had a **positive outcome** and it is established that **additional time should be awarded.**
  - If a specific decision would lead to the **rejection of the delay claim**, it would make sense to consider this **decision first**.

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Introduction

- To determine whether a **delay is critical** is normally the **most complex** and time-consuming part of a delay claim analysis.
  - A **practitioner** would not want to embark on this cumbersome process **without knowing the contract provisions** were complied with and the delay is indeed **excusable**.

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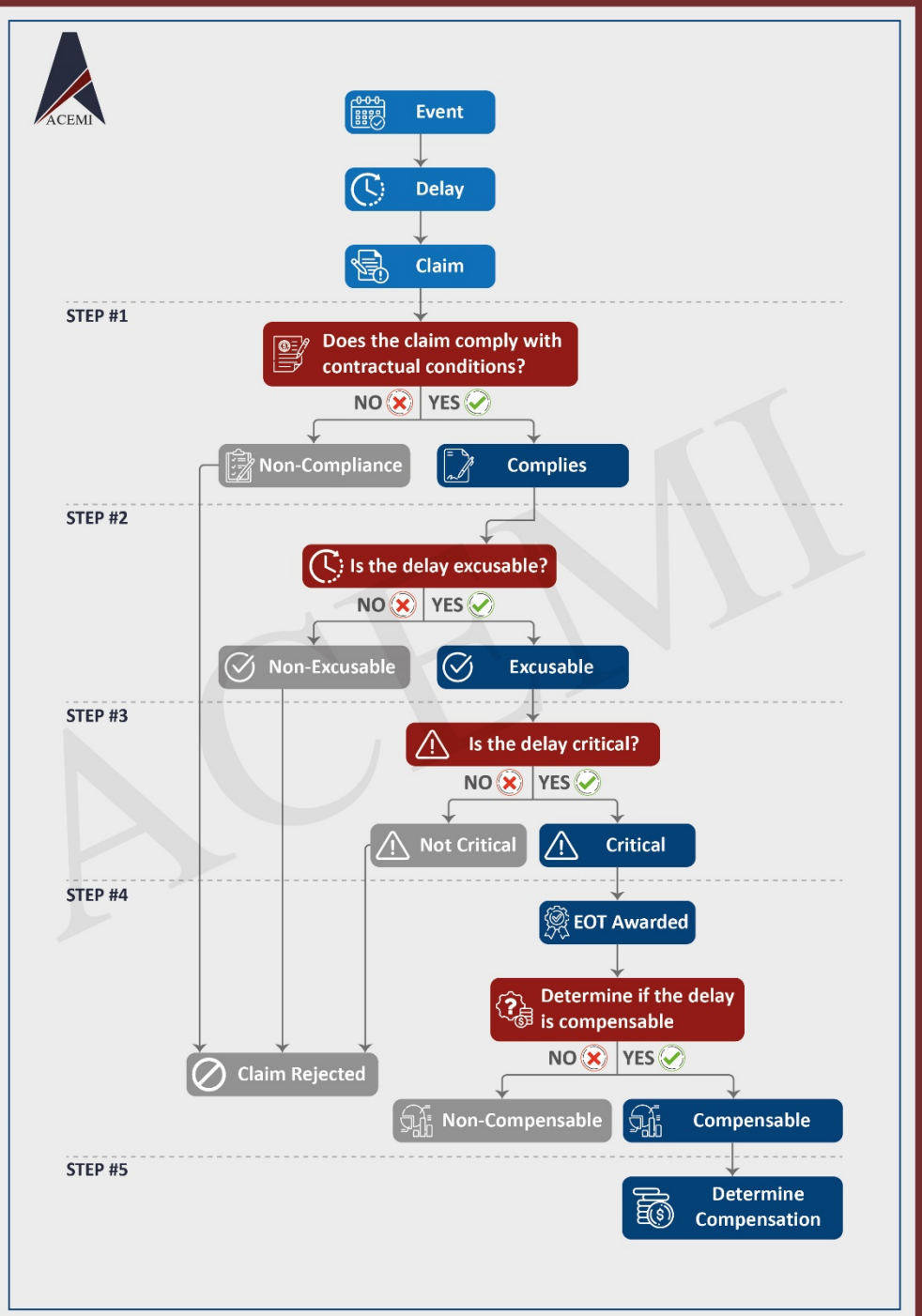
Introduction

- For this reason, it is proposed that **criticality should only** be considered after
  1. **contractual compliance** was assessed and
  2. the question of **whether the delay is excusable** has been addressed.
     - To determine whether a **delay is excusable** (beyond the contractor's reasonable control) can **sometimes be complex.**
       - ✓ It is reliant on
         1. the **evidence presented** by the contractor and
         2. the **verification** by the **person responsible** for the claim analysis.

Introduction

- The following sequence of decision making is therefore proposed:
  1. Decision 1 – Were the contractual provisions complied with?
  2. Decision 2 – Was the delay excusable?
  3. Decision 3 – Was the delay critical?
  4. Decision 4 – Was the delay compensable?

Five Simple Steps



Step 1 – Does the claim comply with the Contractual Provisions?

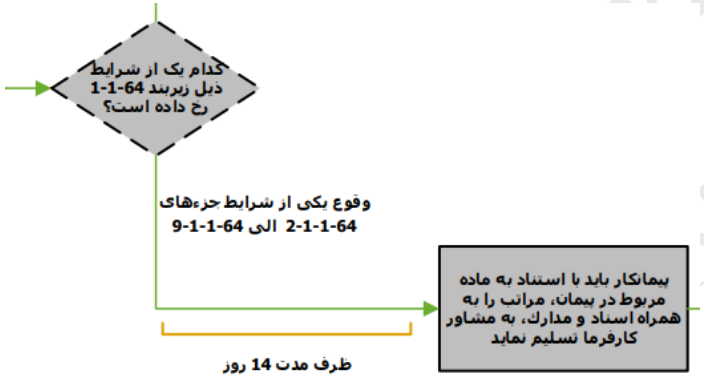
- **Compliance** with the contractual provisions is a **prerequisite** for a delay claim to be considered for **approval**.
- Delay claim clauses in most construction contracts can be separated into the following **two main categories**:
  1. Clauses dealing with the **notification** of a possible delay; and
  2. Clauses dealing with the **claim itself**.

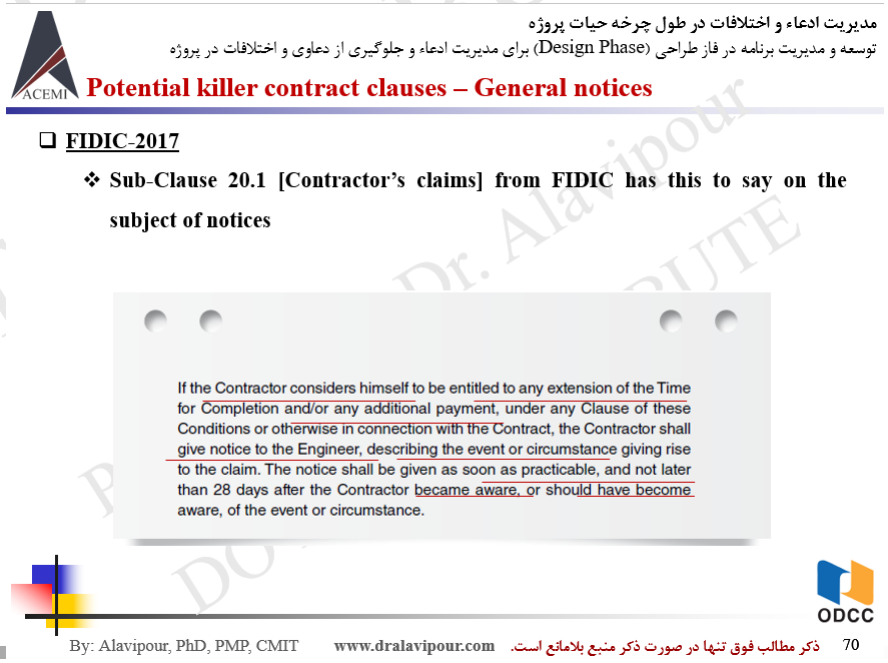
Step 1 – Does the claim comply with the Contractual Provisions?

- The **first step** in the analysis process is to
  1. **Identify** the relevant delay-related contract clauses and then to
  2. **Test** the contractor's compliance with these clauses.

Step 1 – Does the claim comply with the Contractual Provisions?

- Many contracts have a **strict time provision** or time bar for the contractor to **notify** the owner when a **delay event occurs**.
- A **maximum number of days** will be stipulated within **which the contractor** will have to notify the owner.
- The counting of the number of days would typically **start from** …?





Step 1 – Does the claim comply with the Contractual Provisions?

- Normally, the contract would **dictate** that **non-compliance with the notification** time bar would result in the **delay claim not being considered**.
- The decision tree **allows for the claim** to be **rejected** in cases where the **notification deadline was missed.**

Potential killer contract clauses – General notices

- قرارداد همسان EPC صنعتی مورخ ۱۴۰۳

تبصره ۱: درصورتی‌که پیمانکار ظرف مهلت‌های مقرر در جزء ۶۴-۱-۲-۱ اقدام ننماید، مدت پیمان در ارتباط با آن موضوع، تمدید نخواهد شد و کارفرما مسئولیتی در این‌خصوص نخواهد داشت، مگر آنکه دلایل دیرکرد پیمانکار در ارائهٔ درخواست، موردقبول کارفرما واقع شود.

تبصره ۲: چنانچه مشاور کارفرما ظرف مهلت مقرر در جزء ۶۴-۱-۲-۱ اقدام نکند، پیمانکار باید درخواست تمدید مدت پیمان را به کارفرما ارائه نماید تا وی مطابق جزء ۶۴-۱-۲-۱ درخواست پیمانکار را بررسی نماید. درصورتی‌که کارفرما ظرف مهلت مقرر بررسی و ابلاغ تمدید مدت پیمان را انجام ندهد و یا پیمانکار با مدت تمدید پیمان که توسط کارفرما ابلاغ شده است موافق نباشد، پیمانکار می‌تواند موضوع اختلاف را به کمیتهٔ دائمی پیشگیری و رسیدگی به اختلاف موضوع بند ۷۵-۱ ارجاع نماید.

Potential killer contract clauses – General notices

- FIDIC-2017
  - Sub-Clause 20.2 [Contractor's claims] carries on to emphasizes the importance of submitting such notices as follows

If the claiming Party fails to give a Notice of Claim within this period of 28 days, the claiming Party shall not be entitled to any additional payment, the Contract Price shall not be reduced (in the case of the Employer as the claiming Party), the Time for Completion (in the case of the Contractor as the claiming Party) or the DNP (in the case of the Employer as the claiming Party) shall not be extended, and the other Party shall be discharged from any liability in connection with the event or circumstance giving rise to the Claim.

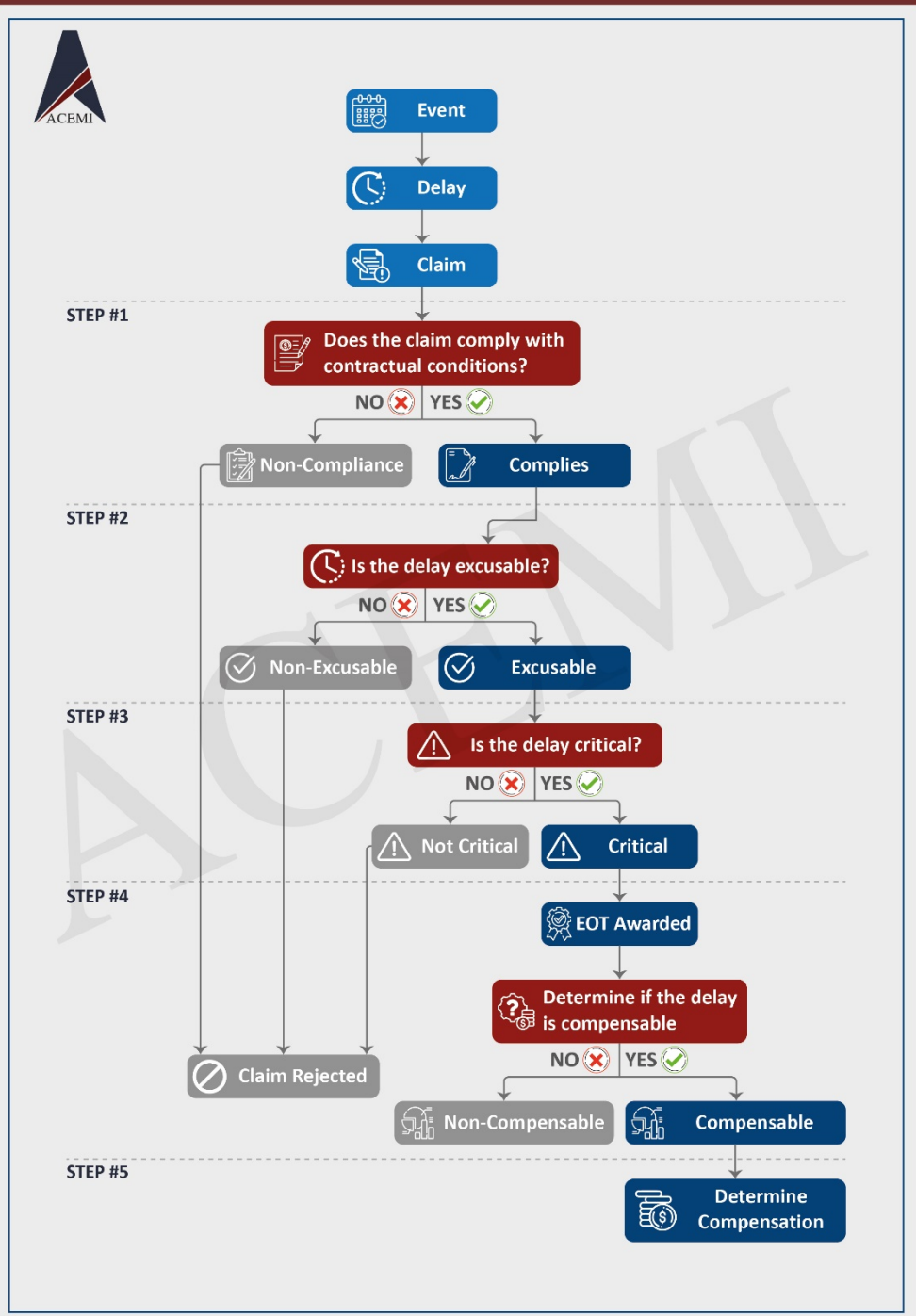
Step 1 – Does the claim comply with the Contractual Provisions?

- Normally, the contract would **dictate** that **non-compliance with the notification** time bar would result in the **delay claim not being considered**.
- The decision tree **allows for the claim** to be **rejected** in cases where the **notification deadline was missed.**

Step 1 – Does the claim comply with the Contractual Provisions?

- Contracts typically include **requirements for the delay claim** itself.
- The requirements include stipulations on the **content** of the claim and the **time** allocated to the contractor to prepare and submit the delay claim **documentation**.
  - It is very **seldom** that a construction contract would allow the **outright rejection** of the claim if the **requirements were not met**.
    - ✓ *For example, if the contractor does not fully comply with the claim content requirements the possibility that the claim for additional time will succeed is slim. Delay claims would typically still be considered even in cases where the claim content requirements or the time allocation for the delay claim submission was not adhered to.*

The next step will be to consider whether the claim was excusable.



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Step 2 – Is the delay Excusable (Owner's Risk)?

- **Most contracts** provide for an extension of the contract period – but only if a delay is deemed to be **excusable**.
- When a claim is being evaluated, it is essential to determine **whether** the delay in question is an **excusable** delay or a **non-excusable delay**.

۳۰-الف)

درصورت وقوع هریک از موارد زیر که موجب افزایش مدت اجرای کار شود، پیمانکار می‌تواند درخواست تمدید مدت پیمان را بنماید. پیمانکار درخواست تمدید مدت پیمان را با ارائه محاسبات و دلایل توجیهی، به مهندس مشاور تسلیم می‌کند و مهندس مشاور پس از بررسی و تأیید، مراتب را برای اتخاذ تصمیم به کارفرما گزارش می‌کند و سپس نتیجه تصمیم کارفرما را به پیمانکار ابلاغ می‌نماید.

Step 2 – Is the delay Excusable (Owner's Risk)?

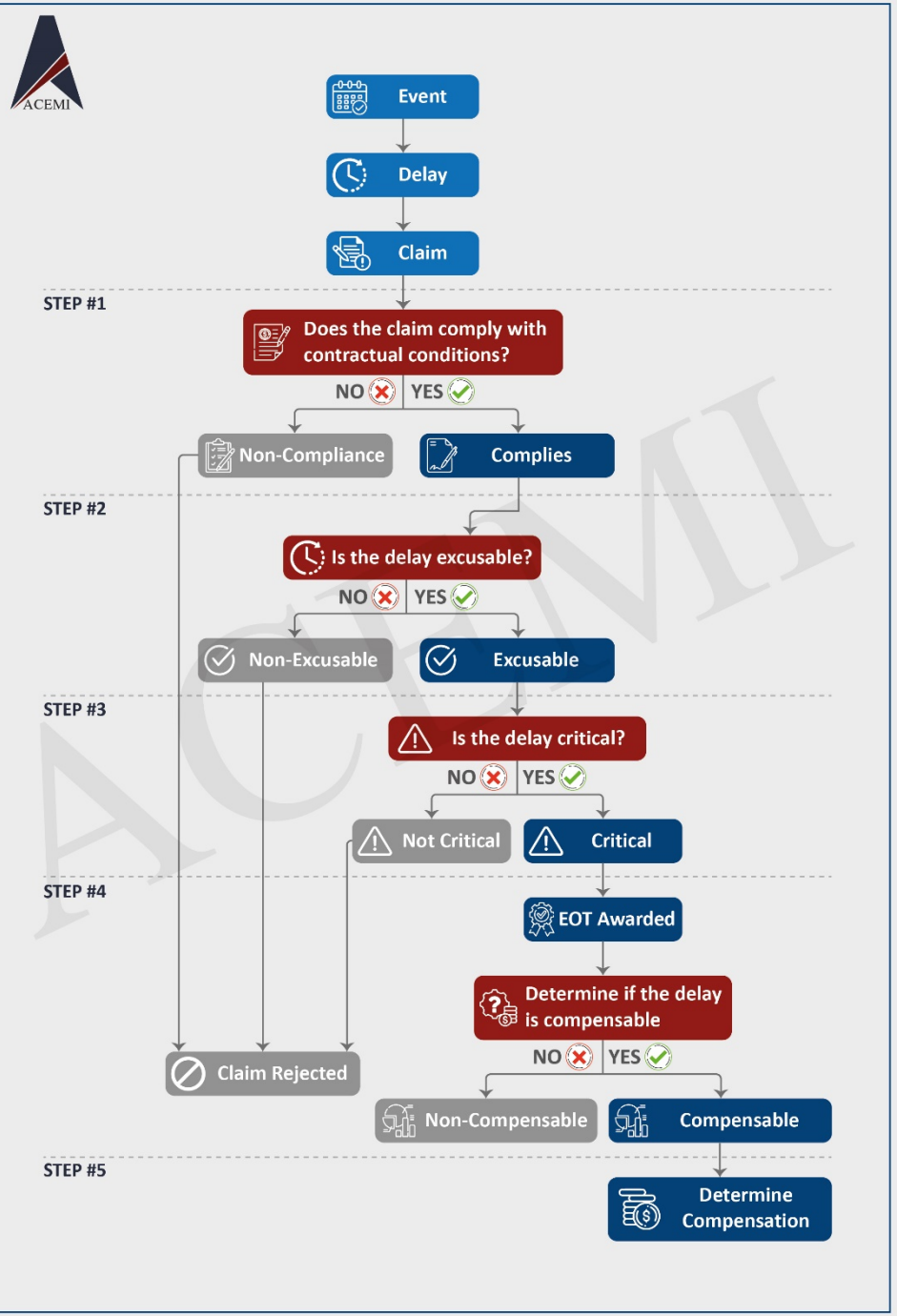
- An excusable delay can be described as a delay caused by either of the following two factors:

  1) Third parties or incidents beyond the control of the client and the contractor; and

  2) The owner or the owner's agents.

Step 2 – Is the delay Excusable (Owner's Risk)?

- To determine whether a delay is excusable, it is required to assess the **root cause of the delay event.**
  - **Contracts** normally provide guidance on what type of delay events can be considered excusable.
    - ✓ If the **contract stipulates** that the cause of the delay event is not excusable, in other words the contractor's risk, the **claim can be rejected**.
- When the delay is **indeed excusable** the decision tree considers the criticality of the delay in **step 3.**



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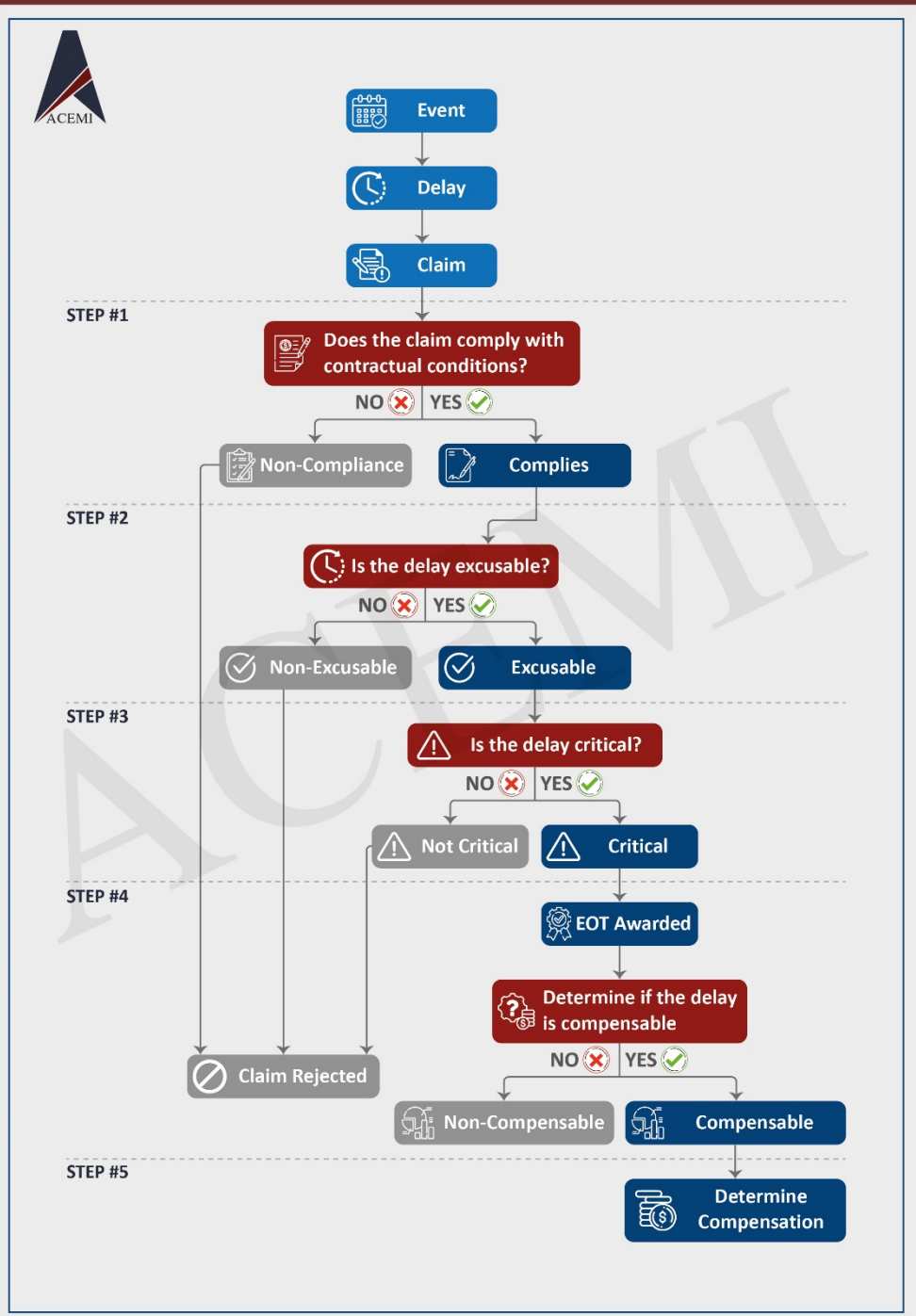
Step 3 – Is the delay Critical?

- **Most construction contracts only** make provision for the extension of the contractual completion date for events causing a delay to the **contractual completion date**.
- The **completion date** will **only be impacted** when
  1. a delay event: effects a critical activity (an activity on the critical path); or
  2. if the effect on a non-critical activity is so severe that the activity becomes critical.

We will see AIA and FIDIC

Step 3 – Is the delay Critical?

- During Step 3 the delay event will be assessed to determine whether the occurrence of the event **delayed the completion date**.
- **Several methods** to analyze the impact of a delay event on the completion date were developed over the years.
- If the completion date was **not delayed** the claim can be **rejected**.
- For delays that impacted the completion date the next step will be determine whether the delay is **compensable**.



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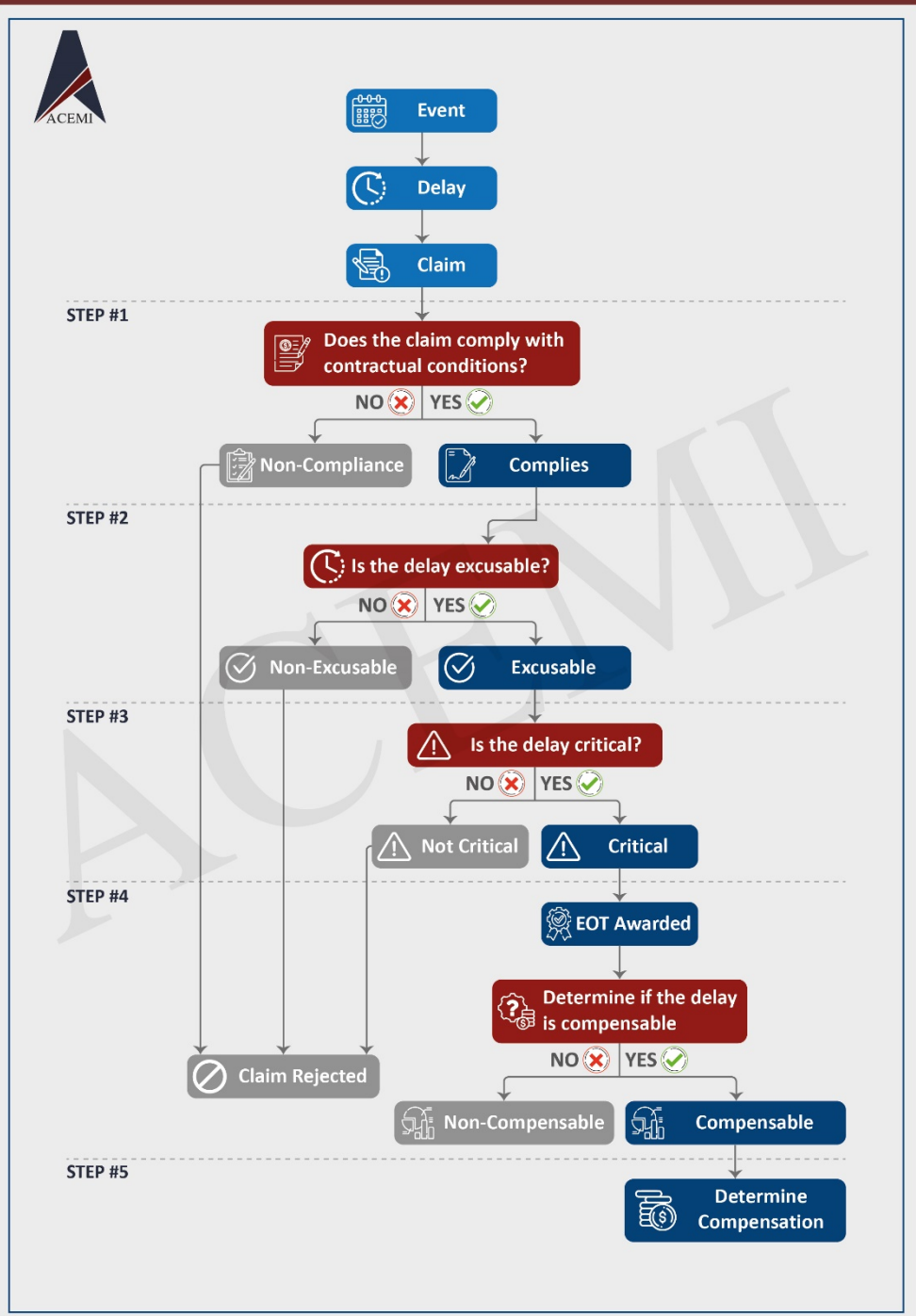
Step 4 – Is the delay Compensable?

- It is **general practice** that **only excusable delays** caused by the owner or within his control is compensable.
- During step 4 the contract will be consulted to determine **whether the delay** is compensable.
  - If **no guidance** is provided in the contract it can be **safely assumed** that compensation will only payable to the contractor for
    1. **delays caused by the owner** or
    2. which the **owner took on the risk**.
- If the claim is compensable the compensation will be calculated as part of **step 5 of** the decision tree.

We will see AIA and FIDIC



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Step 5 – Calculate Compensation

- The **construction contract** utilized would normally provide **guidance** on how compensation should be **calculated** when a **delay event occurs**.
- The **compensation calculation** provided by the contractor as part of the claim should be **analyzed** to determine whether it is **in line with the provisions** of the contract.
  - **Many contracts** provides for the **payment of delay** related compensation on a proven actual cost basis for cost incurred as a **direct result** of the claim.
- In such cases, the delay claim should include information **substantiating the cost**.
  - The **cost information** should be reviewed and
    if it is **lacking additional information** should be requested.
    Whether that was a **direct result** of the delay.

Delay Claim Formulation

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Introduction

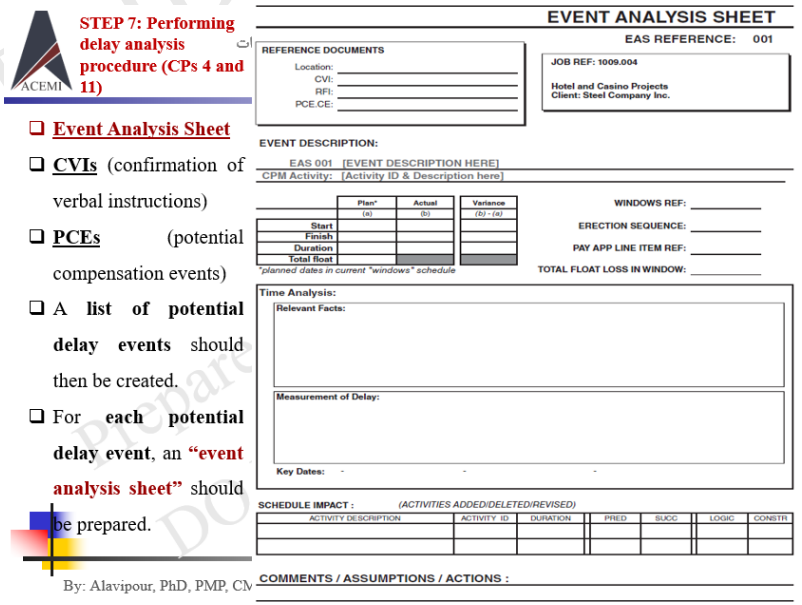
- The possibility of success of a claim is **not only** influenced by the strength of the **motivation** but also by the way the **information is presented**.

- The **claim** should present the information in such a way that the content information is **easy to**
  1. access and
  2. understand.

- The following sections should be **included in the claim.**

Section 1 – Describe the Delay

- A **short concise description** of the delay should be provided **explaining** the cause and effect.
  - For example, **late information** from the owner (cause) resulted in the late start of the excavation (effect).
- The description should include the following information:
  1. When did the delay occur;
  2. Where did the delay occur;
  3. Why did the delay occur; and
  4. The activity or activities that were affected

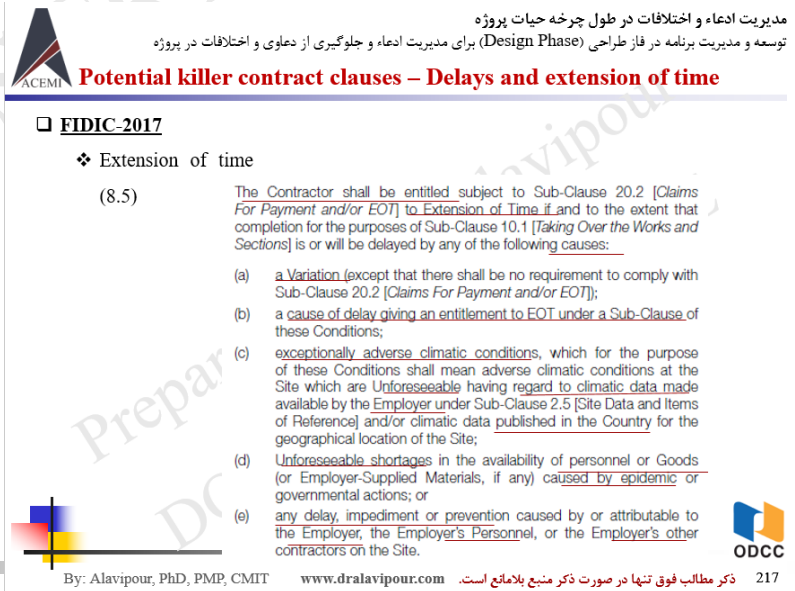


Section 1 – Describe the Delay

- The purpose of this section is to
  1. explain what caused the delay and
  2. what was the effect in a paragraph or two.
- This section acts as a **summary** and should give the reader a **clear explanation** of what the **claim is all about**.

Section 2 – The Right to Claim

- When claims are analyzed the first consideration is normally to **determine** whether the contractor has the **right to claim.**
- **Written construction contracts** normally provide for the contractor to submit a claim when **specific events have occurred**.
- In the **case of delay claims** most contracts would stipulate specific circumstances that will be categorized as **excusable delays** and would provide the right to the **aggrieved party to claim.**



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Section 2 – The Right to Claim

- No matter the bases of the agreement

  the **right to claim** should be **explained**.

- In the **case of a written agreement**,

  1. The specific contract clauses explaining the **right to claim** should be quoted and
  2. A **brief description** of **how the circumstances** giving rise to the claim complies with the clause(s) in the contract.

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Section 2 – The Right to Claim

- **Not all projects** have the benefit of a **written agreement.**

- In **smaller projects** where an informal approach is followed claims normally arise because of a **deviation** from the **initial promise or deliverable**.

- It is possible that the initial **promise or deliverable** was agreed in a **verbal discussion** between the parties.

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Section 2 – The Right to Claim

- If **no written agreement** was entered into,
  1. An **explanation** of how the actual promise or deliverable deviated from the **initial agreed promise** or delivery should be provided.
  2. Furthermore, the **basis for the right** to claim should be justified by **explaining the reason** for such deviation.

Section 3 – Compliance with Contractual Provisions

- Normally a **notification** should be provided when the contractor **becomes aware** of the **delay** and a claim should then be **submitted after some time.**
- This section of the claim should
  1. Firstly provide a **description** of the **contractual provisions** that have to be **complied with** and
  2. Would **secondly** have to **explain how the provisions** were adhered to.

Section 4 – The Impact on the Completion Date

- The **risk allocation** in most construction contracts would only **make provision** for the extension of the contractual completion date for a **delay impacting** on the **completion date**.
  - In other words, **only delays to activities** on the critical path (critical activities) will delay the contractual completion date and would constitute a **valid delay claim**.

مدیریت ادعاء و اختلافات در طول چرخه حیات پروژه
توسعه و مدیریت برنامه در فاز طراحی (Design Phase) برای مدیریت ادعاء و جلوگیری از دعاوی و اختلافات در پروژه
Potential killer contract clauses – Delays and extension of time
❑ قرارداد همسان EPC صنعتی جدید

فصل ۱۲: تغییرات مدت پیمان، تأخیر، تعلیق، فسخ و خاتمهٔ پیمان

ماده ۶۳ – زمان‌های پیمان

تاریخ شروع کارهای موضوع پیمان، تاریخ تعیین شده در بند ۵-۲ موافقت‌نامه است و پیمانکار موظف است در این تاریخ کارها را مطابق بند ۳-۲ شرایط عمومی شروع نماید. همچنین مدت پیمان و مدت دورهٔ مسئولیت رفع نقص در بند ۵-۳ موافقت‌نامه ذکر شده است که پیمانکار موظف به رعایت آن است.

هریک از مقاطع زمانی قسمت‌های اصلی کار تعیین شده در پیوست شماره ۱۴ پیمان برای کارهای موضوع پیمان، مانند مدت پیمان از ارکان اصلی پیمان محسوب می‌شود.

مدیریت ادعاء و اختلافات در طول چرخه حیات پروژه
توسعه و مدیریت برنامه در فاز طراحی (Design Phase) برای مدیریت ادعاء و جلوگیری از دعاوی و اختلافات در پروژه
Potential killer contract clauses – Delays and extension of time
❑ قرارداد همسان EPC صنعتی جدید

ماده ۶۴ – تغییرات مدت پیمان

۶۴-۱ تمدید مدت پیمان

۶۴-۱-۱ شرایط تمدید مدت پیمان

تمام زمان‌ها و مدت‌های پیش‌بینی شده برای شروع و خاتمه و مقاطع زمانی قسمت‌های اصلی کارها، تنها در صورت وقوع هریک از شرایط زیر، می‌توانند افزایش یابند.

۶۴-۱-۱-۱ تغییر کار موضوع ماده ۴۹ که منجر به افزایش مدت پیمان شود؛

۶۴-۱-۱-۲ تعلیق و توقف کارها موضوع ماده ۶۵؛

۶۴-۱-۱-۳ تأخیر در پرداخت موضوع بند ۵۳-۳؛

۶۴-۱-۱-۴ بروز شرایط قهری و شرایط تنگنا، موضوع ماده ۷۳؛

۶۴-۱-۱-۵ تغییر قوانین و مقررات نسبت به تاریخ ارائهٔ پیشنهاد قیمت از طرف پیمانکار که به طور مستقیم و مؤثر باعث تأخیر در انجام بخش‌هایی از کار شود؛

۶۴-۱-۱-۶ بروز شرایط جوی استثنایی که بر اساس اطلاعات و آمار هواشناسی در ۲۰ سال گذشته قابل پیش‌بینی نبوده است و مانع انجام کار گردد؛

۶۴-۱-۱-۷ کشف اشیا فرهنگی-تاریخی به نحوی‌که منجر به وقفه در انجام کارهای پیمان گردد؛

۶۴-۱-۱-۸ تصمیم کارفرما مبنی بر به‌کارگیری پیمانکاران دیگر در محدودهٔ کار[۴۲] پیمانکار، به شرح درج شده در بند ۳۸-۲ که مانع از انجام به‌موقع کارهای موضوع پیمان و یا بخش‌هایی از آن شود؛

۶۴-۱-۱-۹ وقوع سایر عوامل و شرایط غیر قابل‌پیش‌بینی که ناشی از نقض تعهدات پیمان توسط پیمانکار نبوده و باعث تأخیر در اجرای کار شود.

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Section 4 – The Impact on the Completion Date

1. Firstly, it is important to **clearly show** that the delay event **indeed impacted** on a **critical activity**.
2. Secondly, the **severity** of the impact should be **quantified**.
   - ❖ Several methods can be utilized to quantify the delay.
     - ✓ However, a **detailed description** explaining and quantifying by means of a **simple calculation** of **how the impact on a critical activity** resulted in a delay to the completion date is sometimes **much more effective.**

Section 5 – Compensation Calculation

- **Construction contracts** normally **allow** for **compensation** to be paid to the contractor for **excusable delays** for circumstances where the risk lies with the owner.
- In this section, a **calculation should be provided** on **how** the compensation due is **calculated**.

Section 5 – Compensation Calculation

- The **calculation** should be informed by the **principles set in the contract**.
- Should the contract provide for **delay related cost** to be compensated on a proven actual cost basis the relevant supporting document should be included with the claim.

Potential killer contract clauses – Delays and extension of time

- **AIA A201-2017: General conditions for construction**
  - Contractor's entitlement to EOT

§ 15.1.5.1 Claims for Additional Time
If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

Note:
1. **Estimate of cost**
2. **Probable effect**
3. **Continuing delay**

What else do you see here?

ODCC

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Section 6 – Request

- The **claim** should be concluded by **clearly summarizing** the **request** made by means of the claim.
  - *For example: In terms of clause ….. of the contractual agreement, we request that the completion date should be extended with … days changing the current contractual completion date from ……to ……. and that compensation of ……. should be paid.*
- **Supporting information** to substantiate any section of the claim should be **added at the end** of the claim and clearly **cross referenced** in the body of the claim.

Identifying Symptoms of Types of Claims

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Time related claims fall into categories

- Simple delay claims
  1. Disruption claims (inefficiency of labor typically)
  2. Acceleration claims
     - Directed acceleration
     - Constructive acceleration
     - Cumulative effect of change orders
- It is possible to anticipate these categories and minimize or avoid the conditions that lead to the claims

Schedule Administration

- Recognizing Late Performance
  - Have a process in place
  - Require response to first recognition of late performance

Schedule Administration

- Change Management System
  - Incorporate system (Force Account?) for failure to submit analysis
  - Require and monitor use of system (collect actual data)
  - Provide timely and appropriate responses

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Schedule Administration

- Avoid Constructive Acceleration
  - Require Time Impact Analyses at the time of the delay
  - Review and negotiate appropriate time extensions
  - Review and negotiate change
  - Do not allow time discussions to wait until project completion

- Effective Negotiation Process

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Many problems

- **Many problems** are caused by **Contractor's misunderstanding** of what a CPM Schedule should provide:
  - Schedule **isn't only for billing** or to fulfill a contract requirement
  - Schedule needs to be a **tool for the superintendent**
  - Schedule needs to be developed by a **qualified scheduler**, not a "Schedule Monkey" or "Software Jockey"
  - Schedule needs to communicate Contractor's plan to owner, including **explanation in form of narrative**
  - Schedule needs to provide a **comparative baseline** to monitor progress
  - **Not all schedules** can be brought **back to on-time completion**

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Common techniques

- These are the more common techniques that exist in CPM Schedules or are used to manipulate CPM Schedules to set up for claims:
  - Manipulation of logic & Original Durations
  - Failure to provide Cost and/or Resource Loaded Schedule
  - Float Suppression through Constraints
  - Float Suppression through preferential logic
  - Misuse of SS and FF relationships
  - Misuse of Lags

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Common techniques

- These are the more common techniques that exist in CPM Schedules or are used to manipulate CPM Schedules to set up for claims:
  - Predefined Critical Paths
  - Relationship of Percent Complete to Remaining Duration
  - Misuse of Calendars & Alterations to Calendar ID
  - False Early Completion in the Baseline Schedule
  - Progress Override
  - Failure to submit regular periodic updates
  - Creation of Concurrent Delay or concealment of Contractor's Concurrent Delay

Manipulation of Logic and Original Durations

- **Easy-to-use scheduling software** provides opportunities to use logic to **hide problems or provide misleading** schedules.
  - **Issues:**
    - ✓ Baseline & Periodic Updates: Presenting or **revising logic or durations** with the **sole purpose** of meeting the **pre-determined contract completion date.**
      - This is used to **drive the baseline logic** or when there is a **lack of progress** on current activities, and the logic/durations of future activities are changed to **hide that fact**.
      - Also used to **show false acceleration** as a set up for a claim.
    - ✓ Recovery Schedule: Same issues. **Revising logic/durations** to show a completion date that is contractually mandated.

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Manipulation of Logic and Original Durations

- **Easy-to-use scheduling software** provides opportunities to use logic to **hide problems or provide misleading** schedules.
  - **Solution:**
    - ✓ Ensure that all logic and duration assignments, especially when changed, are a result of study of
      - durations,
      - resource availability,
      - production rates, and
      - efficiency factors.

Manipulation of Logic and Original Durations

Consigli has revised the project schedule to reflect schedule delay impacts to date, including design delays, additional scope impacts, and delays in the approval of change requests. The schedule update dated 10/29/07 indicates that the overall project start date has been delayed 6 months, and the overall schedule duration has been extended 1 month, from 12 months to 13 months as compared with the original baseline schedule dated 3/5/07. This change request only represents additional general conditions costs Consigli is incurring as summarized below and detailed in the attached Exhibit 1:

•Quote above from Contractor Change Request 009 – F. L. Olmsted National Historic Site Alpha Response, "The October 2007 schedule forecasts contract completion as October 31, 2008. It includes a net increase of 101 activities and 267 relationships; approximately doubling the activities in the schedule and nearly tripling the relationships, as the March schedule had a total of 115 activities and 141 relationships. The schedule depicts the claimed six month demobilization period as well as the various design changes. The schedule also includes a significant amount of development over the March schedule. Consigli must provide specific explanation to the NPS as to the nature of the changes made and, in particular, define whether the changes represented changed scope due to the various sets of design revisions, or whether they represented corrections to deficiencies in the original baseline schedule. ."

Change Request Amount - $4.5M

Failure to provide cost and/or resource loaded schedules as required in specifications

❑ Issues:

- ❖ Attempt to **withhold resource planning** to **prevent monitoring** of Contractor resources
- ❖ Makes it **much harder** to prove or disprove **acceleration**
- ❖ Makes it **much harder** to **link slippage** to lack of manpower on project

❑ Solution:

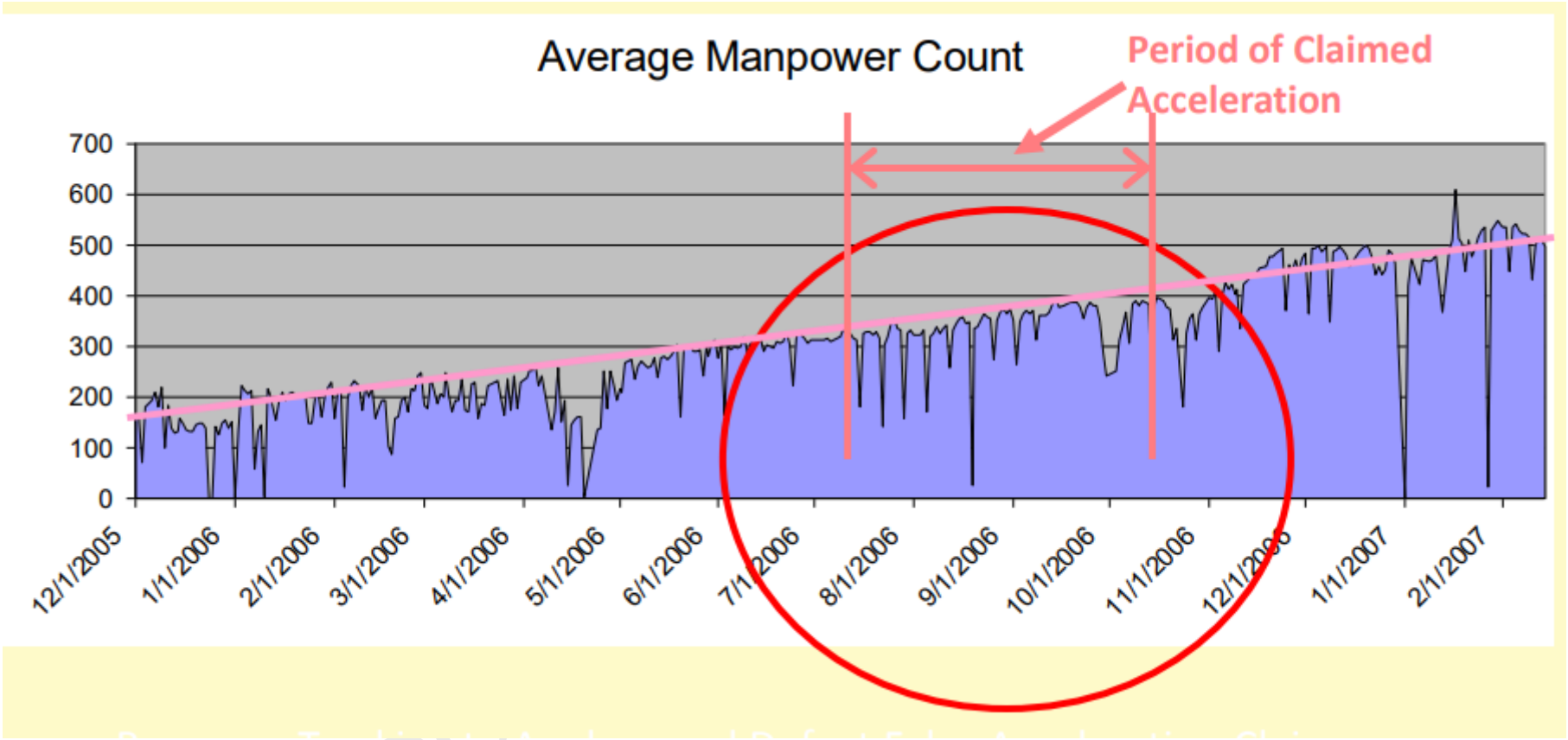
- ❖ **Enforce** Resource and Cost Loading when required by **specification**

Failure to provide cost and/or resource loaded schedules as required in specifications

- "Since there is no available document which states the original level of manpower anticipated by the Contractor, Alpha can only review this available data for trends that would indicate the Contractor had an original plan, had been following it, and then initiated a sudden increase of manpower to respond to some of the alleged issues of acceleration. Note that in fact the rate of increase for manpower is steady from December 2005 to November 2006. The average manpower on site increases at a rate of approximately 24 personnel per day during this period. There are no apparent spikes in manpower at any point during this period. By way of demonstrating this, refer to the Contractor's August 2006 Schedule Narrative, in which they state that they intended to increase manpower in the month of August by 100 people, and maintain that level of manning until October 2006. As the chart demonstrates, no such spike occurred. In fact, the average daily manpower on August 1, 2006 was 324, and a total increase of 100 people was not achieved until the middle of November 2006. The claim of acceleration does not correspond with the contemporaneous records."

  Alpha Corporation Schedule Review Report, 2007, Response to $14M claim for delay and acceleration

Failure to provide cost and/or resource loaded schedules as required in specifications



Float Suppression through Constraints

- The **use of early start constraints** can be used to **hide float** in a schedule.
  - Issues:
    - ✓ In general, by case law, **float belongs** to the entity that gets to it first.
    - ✓ Often, contractors will conduct the passes through the network to **determine** the **finish date**, then **constrain** the **early start** of any activities that have float.
      - As a result, the **activity is pushed out** so that its **LS equals its ES**, and **no float is apparent**.
    - ✓ This technique of **"float suppression"** **misleads** the owner/prime contractor as to the **presence of float** and the **location of the critical** path. It also provides the **opportunity for a contractor** to claim that an **activity is critical** that, in fact, simply has its **float suppressed**.

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Float Suppression through Constraints

- The use of early start constraints can be used to hide float in a schedule.
  - Solution:
    - ✓ Have a **qualified scheduler check** the schedule for constraints, disallowing any that have **no purpose** other than float suppression.

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Float Suppression through Constraints

"The critical path includes added activities for "Award HVAC" and "MEP Coordination Drawings" which added 35 work days of duration alone to the critical path. These activities represent work that should have been part of the original baseline schedule and exceed the month of time that Consigli argues was NPS-caused delay because of not approving Change Orders. The critical path is being driven by an apparent constraint on awarding the HVAC subcontract until change orders are approved.
."

Alpha Corporation Schedule Analysis Report, 2008, F. L. Olmstead Historic NPS project. Site Contractor added activities using constraints to drive the Critical Path

Misuse of SS and FF relationships

- The **use of Start to Start (SS)** and **Finish to Finish (FF) relationships**, as opposed to Finish-to-Start (FS) relationships, can be used to **improperly model** the construction process with the **intent of shifting float**.
  - **Issues:**
    - ✓ The ease of use of most commercial project planning software packages allows schedulers to **change relationships** from **FS to FF or SS**.
    - ✓ This has the effect of **presenting a misleading model** of the construction process, the nature of which is **obscured from view in a cursory scan** of the schedule.
    - ✓ Changes in these relationships may
      1. increase or decrease float,
      2. altering the critical path or
      3. hiding float on high-float activities.

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Misuse of SS and FF relationships

- The **use of Start to Start (SS)** and **Finish to Finish (FF) relationships**, as opposed to Finish-to-Start (FS) relationships, can be used to **improperly model** the construction process with the **intent of shifting float**.
  - **Solution:**
    - ✓ During the schedule development process, have a **qualified scheduler review** the **number** of SS and FF relationships.
    - ✓ **Question the rationale** behind the assignment of these relationships, **require explanation** in a **narrative**.
    - ✓ During **subsequent periodic updates**, have a **qualified scheduler review** any changes in relationships and **question** the rationale behind these changes.

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Misuse of Lags

- Lags do **not easily print** on reports and are **easy to overlook** in review
  - **Issues:**
    - ✓ Contractor inserts lags into network
    - ✓ No explanation or purpose for lags
    - ✓ Used for concealment and sequestering of float
    - ✓ Used to push activities onto Critical Path
    - ✓ Used to adjust start and completion of activities
    - ✓ Very hard to monitor

Misuse of Lags

- Lags do **not easily print** on reports and are **easy to overlook** in review
  - **Solution:**
    1. Require limited use of lags,
    2. Require explanation and rationale for lags, and
    3. Retain ability to reject inappropriate use of lags and removal.

Misuse of Lags

"There are 6043 relationships between 2329 activities: 623 Start-to-Start ("SS"), five Start-to-Finish ("SF"); 958 Finish-to-Finish ("FF"); and 4457 Finish-to-Start ("FS") relationship types. There are 767 lags utilized in the schedule, both positive and negative.

The positive lags, of which there are 762, range from 1 to 270, with the majority of the lags between 3 and 10. The lags are more or less evenly split between construction activities and procurement activities. Procurement activities appear to have been given a lag of 10 work days ("WD") in order to account for time to clear customs for material arriving in Jamaica; however, no other explanations for any of the lags are given.

Use of any means to limit or control ownership of float, such as inclusion of unnecessary "Lag" assignments, will not be acceptable. As these lags are not defined, this is a discrepancy which needs to be fixed"

Alpha Corporation Schedule Review Report, 2007, Contractor eventually submitted a REA for $6.4M

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Predefined critical paths

- The **scheduler designs logic** in such a way as to **satisfy the bias** of the management team or to **force the Critical Path**, rather than allowing the schedule to **calculate** the Critical Path **based on reasonable** logic and estimated durations.
  - **Issues:**
    - ✓ Often, the **scheduler** will make **decisions** about **critical activities** based on their **personal historical perspective**, so that specific trades will appear on the Critical Path.
    - ✓ However, **this advice** may **not be an exact fit**. It may differ through:
      - Differences in resource availability
      - Differences in plans
      - Differences in specifications, particularly in phasing requirements and owner-defined milestones
      - Differences in material availability

ACEMI

Predefined critical paths

- The **scheduler designs logic** in such a way as to **satisfy the bias** of the management team or to **force the Critical Path**, rather than allowing the schedule to **calculate** the Critical Path **based on reasonable** logic and estimated durations.
  - **Solution:**
    - ✓ **Mandate** good review of the Baseline Schedule.
    - ✓ The scheduler should develop the schedule as the **contract documents** and all other factors **permit**.
    - ✓ The **schedule** will then **calculate** the critical path as scheduled.
    - ✓ Should this **differ** from the **experience of a member** of the project management team,

      the **team** should discuss the **scheduler's underlying assumptions** in order to determine the **causes of the difference** and the **validity** of the critical path, and any changes, if necessary.

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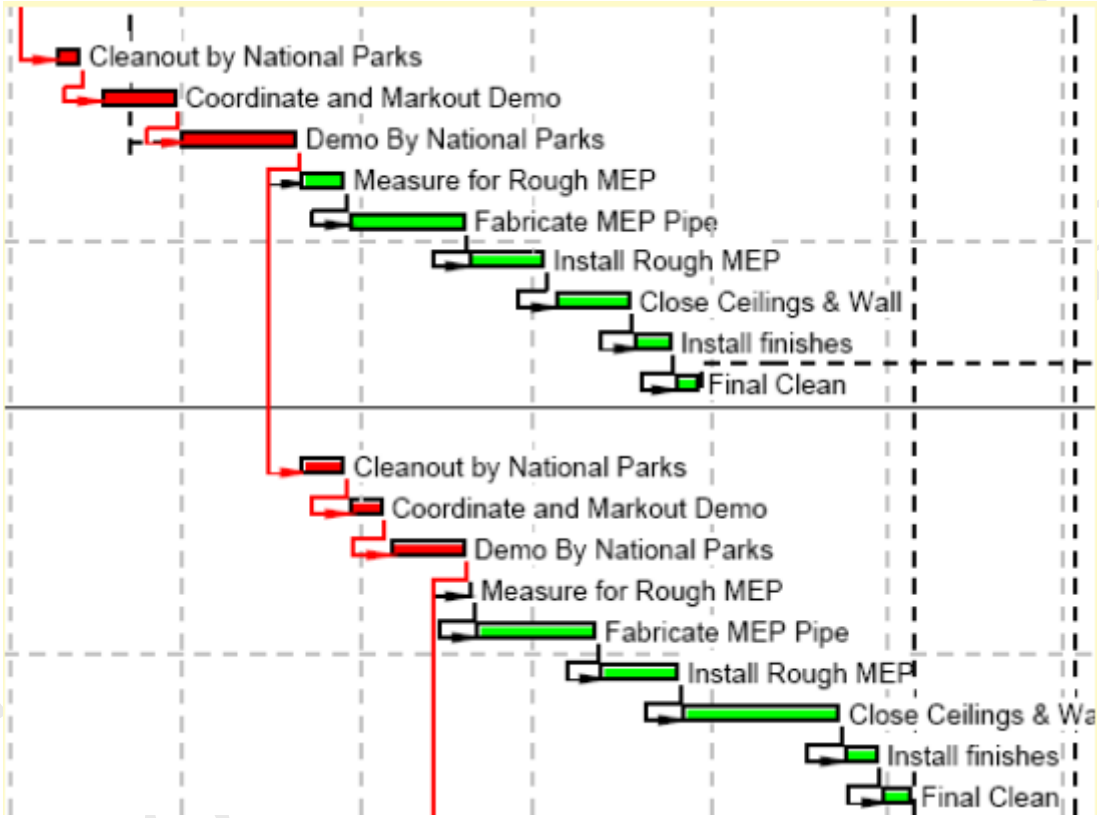
Predefined critical paths



Predefined critical paths

Consigli has revised the project schedule to reflect schedule delay impacts to date, including design delays, additional scope impacts, and delays in the approval of change requests. The schedule update dated 10/29/07 indicates that the overall project start date has been delayed 6 months, and the overall schedule duration has been extended 1 month, from 12 months to 13 months as compared with the original baseline schedule dated 3/5/07. This change request only represents additional general conditions costs Consigli is incurring as summarized below and detailed in the attached Exhibit 1:

1) Additional GC's due to 6 month suspension of work (reference attached NPS letter dated 6/6/07)
2) Additional GC's for 1 month overall schedule extension due to delayed construction drawings, scope increase, and change approval delays.

- Quote above from Contractor Change Request 009 – F. L. Olmsted National Historic NPS Site
- Alpha Response, "The Cleanout and Demolition activities performed by the NPS as reflected in the March 2007 schedule make up the majority of the critical path. This representation is highly suspect as it gives the appearance of intentionally sequencing the work to place criticality on the Owner. The schedule does not contain procurement related activities such as submittals and material fabrication, as required by Specification 01323. Inclusion of such activities could have a significant effect on the overall schedule."

Read it yourself!

Relationship of Percent Complete to Remaining Duration

- Allowing **Remaining Duration** to be calculated **solely** by entering **Percent Complete**, rather than checking the **Remaining Duration** for validity.
  - **Issues:**
    - ✓ **Often the case** when the schedule is **nothing** more than a **billing tool.**
    - ✓ **Particularly dangerous** when activities are **cost loaded** in accordance with a **bid schedule of values**.
    - ✓ If percent complete and remaining duration are linked,

      then entering a **percent complete** will **automatically calculate** a **remaining duration**,

      based on the **original duration**.

Relationship of Percent Complete to Remaining Duration

- Allowing **Remaining Duration** to be calculated **solely** by entering **Percent Complete**, rather than checking the **Remaining Duration** for validity.
  - **Issues:**
    - ✓ **Though** this **might show the value** of the work in place, it may **not accurately reflect** the time **remaining to complete** the activity, because:
      - The **Original Duration** may have been **wrong**.
      - **Resource availability** may be **different than originally** planned.
      - **Methods of construction** may have changed **due to** unforeseen conditions, updates to the plans, or simply a change of heart by the **superintendent based on field** conditions and experience.
      - **Stored materials** will **artificially show** optimistic completion.

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Alterations to Calendar ID

- The **changing of calendars** to **reduce** the number of non-work days in an effort to **shorten** the **overall project duration**.
  - **Issues:**
    - ✓ A **properly designed calendar** will show **all non-work days**, including weekends, holidays, planned adverse weather days, and any **other contractually** agreed-upon non-work periods.
    - ✓ **Removal of these days** on a schedule will show an **unrealistically short completion date** for individual activities and the **overall project**.
    - ✓ **Removal of these days** may violate contractual obligations, reflect an **unrealistic work schedule** (i.e. 7-day work week for extended periods of time), or **ignore** historical weather data.

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Alterations to Calendar ID

- The **changing of calendars** to **reduce** the number of non-work days in an effort to **shorten** the **overall project duration**.
  - **Solution:**
    - ✓ **During** the **schedule development** phase, have a **competent scheduler review** each calendar to verify the propriety of **non-work day assignment.**
    - ✓ **Review each activity** to ensure a **proper calendar** is applied (i.e. an outdoor weather calendar for outdoor activities).
    - ✓ During **periodic updates**, compare
      1. calendars and
      2. activity Calendar ID's

      for consistency, and question the reasoning behind any shifts.

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Alterations to Calendar ID

Actual Schedule Submittal Narrative from Contractor:

"WMI did not incorporate into the calendar the effect of *normal weather* conditions, as it is very difficult to predict the effect of weather on individual work activities and its influence on marina work is quite different than its effect on land-side work.
WMI will continually monitor the effects of weather on the work schedule and the actual progress will be tracked against planned progress closely. WMI will make every effort to achieve or better the planned progress, and in circumstances where the actual production is falling short, WMI will work extra hours, additional days per week or, in extreme circumstances, a second shift will added to compensate for reduced production levels.
Extreme, abnormal weather conditions that have a verifiable impact on the project plan may be presented as the basis for an extension of the contract time and additional contract cost."

This is an effort to set the project up to prevent Owner comparison with original weather planning for reasonableness. Note the "WMI will continually monitor…".

False early completion date in the baseline schedule

- The **design** of a **baseline schedule** that finishes before the contract completion date, with the **intent of claiming against** the owner for any **delays** between the baseline completion date and the contract completion date.
  - **Issues:**
    - ✓ Contractors sometimes develop a baseline schedule showing an **early completion date**, before the contract completion date.
    - ✓ Baseline schedules developed with an early completion date could be an **early step** towards a **contractor seeking** extended overhead and a time extension in a contract.
    - ✓ Attempts to take **"ownership" of Float**

False early completion date in the baseline schedule

- The **design** of a **baseline schedule** that finishes before the contract completion date, with the **intent of claiming against** the owner for any **delays** between the baseline completion date and the contract completion date.
  - **Solution:**
    - ✓ Have a **qualified scheduler review** all baseline schedules for realism, reliability, and possibility.
    - ✓ Current language requiring *"The late finish date shown on the schedule shall be the same date as the last day of the contract period."* is good language.
      - ➢ Could employ **specification language** that provides for the **issuance of a change order** to
        1. Make the CCD equal to the baseline completion date, or
        2. Require the difference in **dates to be defined as float** for the **exclusive use of the owner**.

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Progress override

- The use of the **Progress Override function** in Primavera Project Planner to **cover out-of-sequence work.**
  - **Issue:**
    - ✓ The **use** of the Progress Override function usually indicates that **existing logic no longer** accurately reflects the **construction process**.
    - ✓ Progress Override **forces** the software to **ignore** predecessor relationships of out of sequence activities, producing an **overly optimistic completion date**.
    - ✓ Progress Override is **sometimes used** when a project **slips due to Contractor fault** in an attempt to **hide slippage**

Progress override

- The use of the **Progress Override function** in Primavera Project Planner to **cover out-of-sequence work.**
  - **Solution:**
    - ✓ Have a **competent scheduler check** for the use of Progress Override, **question the reasoning behind** its use, and **review/revise logic** to reflect **actual construction methods**.

Failure to submit regular periodic complete updates

Issue:

- The Contractor is **late** and **unconcerned** about providing **formal update schedules**
- **Incomplete updates**, such as without narratives, are designed to **limit the Owner's ability** to analyze progress and changes
- Sometimes used when project slips due to Contractor fault to **hide slippage**, in **hopes of recovering**, or to **confuse issues**
- **Conceals changing nature** of Critical Path from period to period
- Makes it **much harder to analyze schedules**, and removes Owner ability to recognize slippage

Failure to submit regular periodic complete updates

❑ Solution:

- ❖ Require regular updated schedules,
  - ✓ submitted on time and in full,
  - ✓ with all required components such as narratives.
- ❖ Formally review, validate, and approve/reject all submittals.

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Failure to submit regular periodic complete updates

"As part of this Change Request, Consigli provided a purported baseline schedule dated March 5, 2007 and an updated schedule dated October 23, 2007 to demonstrate the effects of the claimed delays. The baseline schedule forecast a contract completion date of March 26, 2008. The schedule update forecast a contract completion date of October 31, 2008, a project delay of 219 calendar days.

Alpha Corporation Schedule Analysis Report, 2008, F. L. Olmstead project, NPS

219 days of delay are claimed across a single 160 day period without updates. This makes it impossible to isolate and analyze individual delay events, and makes it very hard to identify any concurrent delay issues.

Creation or concealment of concurrent delays

- The **manipulation** of the schedule makes it appear to have a concurrent delay or **conceals** a Contractor concurrent delay.
  - **Issue:**
    - ✓ In the event of a delay claim, **contractors may employ** several techniques of
      - logic manipulation,
      - over and under-developed trade contractor detail,
      - fragnet insertion, or
      - other methods, to

        make a **concurrent delay appear** that would be the responsibility of the Owner, or to conceal a concurrent delay of the Contractor.

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Creation or concealment of concurrent delays

- The **manipulation** of the schedule makes it appear to have a concurrent delay or **conceals** a Contractor concurrent delay.
  - **Solution:**
    - Require **reasonable baseline schedules**, and
    - Employ a **technical schedule analyst** to examine concurrent delays and determine validity

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Creation or concealment of concurrent delays

"Since the overwhelming majority of the Activities are Storm Drain and Storm Sewer activities, the Critical Path, shown in Exhibit 2, will inevitably be driven by those activities. Conversely, any of the activities within the other features of work are so inadequately described that neither progress nor delay can be measured with any accuracy. In this way, the Critical Path is forced to include the more developed and detailed activities and ignores the less or non-existent developed activities, as opposed to scheduling the entire Project with equal detail in all features of work and then allowing the CPM process to determine the Critical Path. This is a form of "preferential logic" which pre-determines where the Critical Path of the schedule will occur, but does not meet the Project's specifications for a proper CPM network. By the same token, with the lack of definition in the other features of work, any delays experienced in areas other than Storm Drainage will be difficult to identify, thereby eliminating the potential for showing concurrent delays except through the development of an As-Built Schedule.

Alpha Corporation 2nd Baseline Schedule Resubmittal, 2005, Contractor eventually submitted a claim for $6.4M

Delay Analysis Selection Model for a Construction Project

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Introduction

KSCE Journal of Civil Engineering (2022) 26(12):4926-4941
DOI 10.1007/s12205-022-2394-1

pISSN 1226-7988, eISSN 1976-3808
www.springer.com/12205

Construction Management

Delay Analysis Selection Model for a Construction Project

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Acknowledgments

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) [grant number NRF-2018R1A5A1025137] and close collaboration with Kyungpook National University (KNU), Daegu, Korea.

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Introduction

- The **decision to** use static, dynamic, additive, or subtractive delay analysis is critical because making the wrong decision may have serious undesired consequences.
- As a response to this problem, a **delay analysis selection (DAS) model** was developed that **identifies the most appropriate type** of delay analysis for a target case.
- It involves a case-base that is populated by **3,776 possible cases developed** by using combinations of **26 attributes** that were found in the literature to influence the selection of the most appropriate type of delay analysis.
- The **26 attributes** were organized in **7 categories**.

This study is the first attempt to automate the selection of the most appropriate type of delay analysis.

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Introduction

- Practitioners and researchers generally **agree that no single type** of delay analysis is suitable for all delay claim situations and

  that **knowledge on the factors** that affect the selection of the **most appropriate** type of delay analysis is **critical** (Nelson and Livengood, 2017).

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Introduction

- In addition, **using a type of analysis** that does **not suit a particular delay situation** may **fail to demonstrate** the delay impacts on the completion of a project and therefore may be **rejected by courts and boards**.
  - For example, the appeal of Contel Advanced Systems, Inc. to the **Armed Services Board of Contract Appeals (ASBCA)** used static analysis to demonstrate **consequential damages** allegedly caused by the government but was **denied because** this type of delay analysis did **not** have the capability to **demonstrate productivity loss** (ASBCA, 2003).

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Introduction

- A Delay Analysis Selection (DAS) model is presented in this study.
- The model establishes an **automated process** which makes a **decision based solely** on the **information provided** about the actual conditions in a target case.
- The DAS model consists of **four basic types** of delay analysis assessed by **26 attributes** that have been identified in the literature to affect **stakeholders' preferences** for different types of delay analysis.

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Introduction

- It uses a **case-base** that includes **all possible situations representing** different combinations of attributes.
- Similarity assessment techniques are used to find a **perfect or the closest match** between a target case and the **cases in the case-base**.
- This model is expected to find the **most objective** and **effective** solution to the delay analysis selection problem.

Introduction

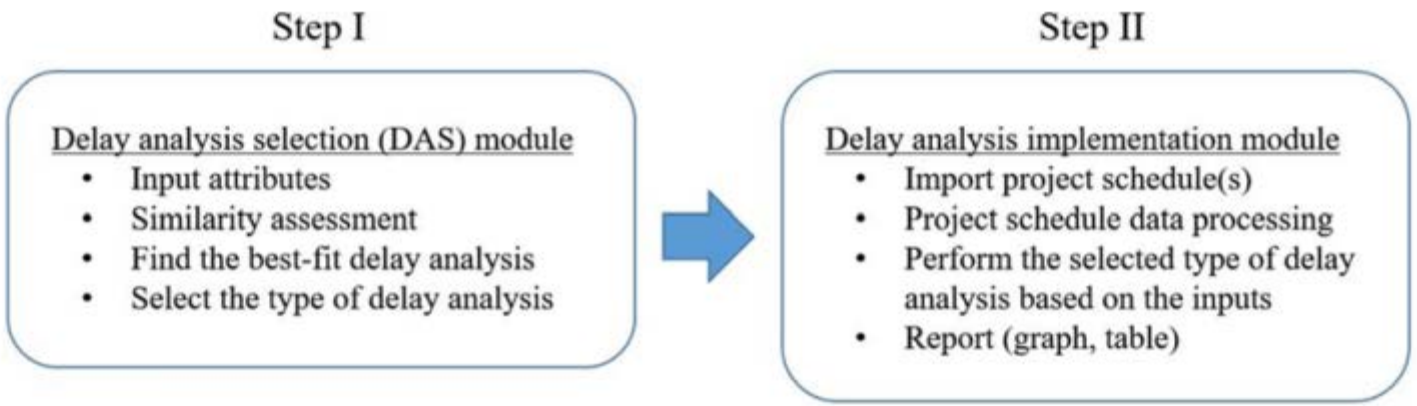

Fig. 1. Integrated Selection and Implementation of Delay Analysis

Development of the DAS Model

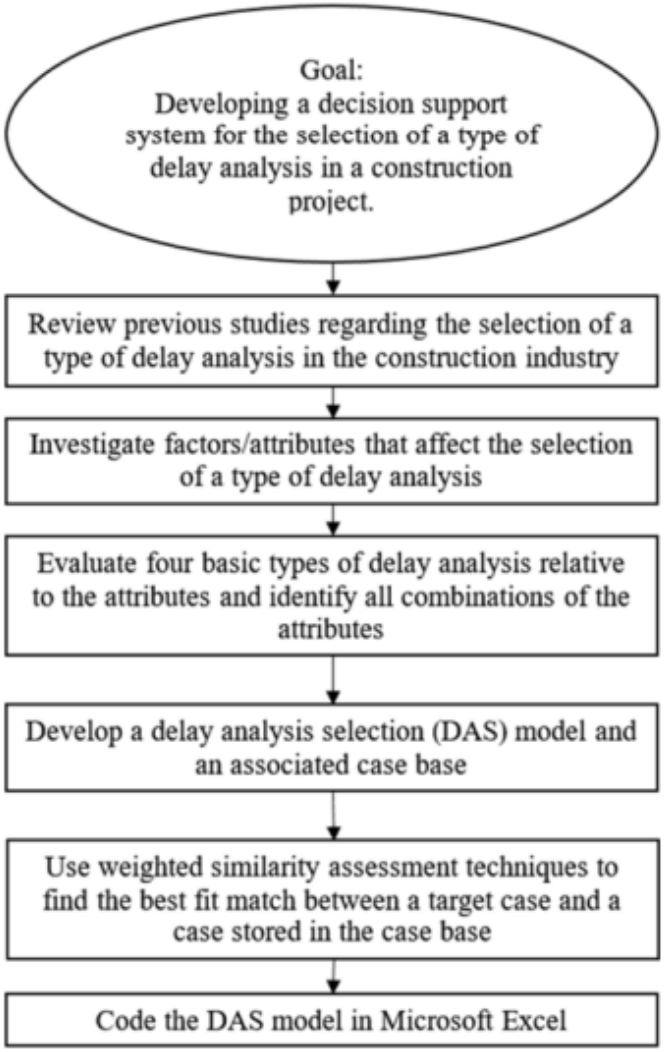

Fig. 2. DAS Model Development

Development of the DAS Model

- The process was **automated** by using **Microsoft Excel coding**.
- The DAS model was designed to allow a **delay analyst** to select the **most appropriate delay analysis** for a target case

  rather than using an **arbitrarily selected type** of delay analysis or a type of delay analysis that represents the subjective preference of the analyst.
- The DAS model **streamlines** and **formalizes** the selection process and **makes it easier and faster** for delay analysts to make the most sensible decision.

Development of the DAS Model: Background on delay analysis

- According to the basic principles commonly used in delay analysis (Zafar, 1996; Bubshait and Cunningham, 1998; AACEI, 2011), **four types of delay analysis** were recognized, namely
  1. static analysis,
  2. dynamic analysis,
  3. additive analysis, and
  4. subtractive analysis.
- All four types of delay analysis can be used for **forensic** and **contemporaneous** analyses.

Development of the DAS Model: Background on delay analysis

1. Static analysis is the **observation** of the **difference** between the duration of **what has been built** against the **original duration planned** at the outset.

- The "as-planned vs. As-built", "planned vs. actual", "as-planned vs. update", "global impact", and "net impact" methods are performed by using static analysis.
- The "as-planned vs. as-built" method, **observing any variances** between the start and finish dates of the **as-built critical activities**, assessing the impact of delays on the project, and determining the causation and responsibility of delays that impact the project completion (Arditi and Pattanakitchamroon, 2006),

  whereas the "global impact" and "net impact" methods observe **any variances** between the start and finish dates of the various activities in the original as-planned schedule with those of an as-built schedule and calculate the total delays as the sum of all delayed events (Zafar, 1996).

Development of the DAS Model: Background on delay analysis

2. Dynamic analysis, also known as **multiple-run analysis**, updates the schedule with delay information **observed in a window of time**.

- The window is defined either by **each individual delay event** or by **a period specified** by the analyst (e.g., a day, a week, a month, etc.).
- The "time-impact analysis" method, also termed as the "updated impact" method (Bramble and Callahan, 2004), the "contemporaneous impact" method (Callahan et al., 1992), and the "contemporaneous period analysis" and "windows analysis" methods (AACEI, 2011) track the impact of delays on project duration using either contemporaneous delay information or delay information obtained from site records at the end of the project (Baram, 1994).

Development of the DAS Model: Background on delay analysis

3. Additive analysis tracks the **changes in the durations** of the activities in the original schedule **submitted by the contractor** and **approved by the owner**.

- The "impacted as-planned" method, also termed as the "impacted baseline", "plan plus delay", and "impacted update analysis" methods (AACEI, 2011) and the "as-planned but-for" method (Braimah, 2013) use additive analysis.
- Such an additive and single run approach allows **"what-if" analysis** that can be performed during construction, hence helping minimize delays along the way (Schumacher, 1995).

Development of the DAS Model: Background on delay analysis

4. Subtractive analysis starts out with the **latest updated schedule** showing what has been built and works **backwards to track** the effect of delays in individual activities.

- The "collapsed as-built", "but-for", "modified as-built" and "as-built less delay" methods (AACEI, 2011) and the "as-built but for" method (Braimah, 2013) are performed by using subtractive analysis.

Development of the DAS Model: Background on delay analysis

- Arditi and Pattanakitchamroon (2006) **compared four methods** that represent these four types of delay analysis using **22 attributes in four categories**, namely availability of information, timing of analysis, capabilities of the delay analysis method, and time-cost-effort.
- Three more categories were added in the DAS study, including
  1. acceptance by courts of law (Arditi and Pattanakitchamroon, 2008; AACEI, 2011; Dale and D'Onofrio, 2014; D'Onofrio, 2015),
  2. capabilities of the time management team (Baram, 2000; Braimah and Ndekugri, 2007; Perera et al., 2016; Avalon, 2017), and
  3. budget constraints (Perera et al., 2016; Avalon, 2017),

  to enhance the precision of the decision-making process, bringing the total number of attributes to **26.**

Development of the DAS Model: Background on delay analysis

- The choice of the type of delay analysis **depends on several factors**, some related to
  1. the capabilities of the analysis,
  2. some to the information available, and
  3. some to the capabilities of the analysts and
  4. available resources.

Development of the DAS Model: DAS model design

- As seen in Table 1, the DAS model includes four types of delay analysis that use static, additive, subtractive, and dynamic approaches.
- These four types of delay analysis were assessed by using 26 attributes that impact their selection grouped in seven categories, including
  1) type of schedule,
  2) type of information,
  3) timing of analysis,
  4) expectations from delay analysis,
  5) acceptance by courts of law,
  6) capabilities of the time management team, and
  7) budget constraints.
- The search space was defined by identifying **all possible scenarios** that lead to the selection of the type of delay analysis.
- Each scenario represents a combination of attributes.

Development of the DAS Model: DAS model design

Table 1. Comparison of Four Types of Delay Analysis

Categories and their constituent attributes that affect the selection of the type of delay analysis		Type of delay analysis			
		Static analysis	Dynamic analysis	Additive analysis	Subtractive analysis
Category I - Type of schedule					
1	As-planned schedule	●	●	●	○
2	As-built schedule	●	●	○	●
3	Updated schedules	○	●	○	○
4	Adjusted schedules	○	●	●	●
	The number of possible combinations	4	1	4	4
Category II - Type of information					
1	Bar chart	○	-	-	-
2	Progress records	-	-	-	○
3	CPM not updated	○	-	○	-
4	CPM updated	○	○	○	○
	The number of possible combinations	3	1	2	2

Note: "●" Required; "○" Available or supported; "–" Unavailable or unsupported

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Development of the DAS Model: DAS model design

Table 1. Comparison of Four Types of Delay Analysis

Categories and their constituent attributes that affect the selection of the type of delay analysis		Type of delay analysis			
		Static analysis	Dynamic analysis	Additive analysis	Subtractive analysis
Category III - Timing of analysis					
1	Foresight	-	-	o	-
2	Real time	-	o	o	-
3	Hindsight, during construction	o	o	o	o
4	Hindsight, after project completion	o	o	o	o
	The number of possible combinations	2	3	4	2
Category IV - Expectations from the delay analysis					
1	Float consumption	o	o	o	o
2	Time extension	o	o	o	o
3	Concurrent delay	o	o	-	-
4	Resequencing	-	o	-	o
5	Dynamic nature of CPM	-	o	-	-
6	Acceleration	o	o	-	-
	The number of possible combinations	16	64	4	8

Note: "●" Required; "o" Available or supported; "–" Unavailable or unsupported

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Development of the DAS Model: DAS model design

Table 1. Comparison of Four Types of Delay Analysis

Categories and their constituent attributes that affect the selection of the type of delay analysis		Type of delay analysis			
		Static analysis	Dynamic analysis	Additive analysis	Subtractive analysis
Category V - Acceptance by courts of law					
1	Limited	-	-	o	-
2	Moderate	o	-	-	-
3	Wide	-	o	-	o
	The number of possible combinations	1	1	1	1
Category VI - Capabilities of the time management team					
1	Limited	o	-	o	-
2	Moderate	o	-	o	o
3	Advanced	o	o	o	o
	The number of possible combinations	3	1	3	2
Category VII - Budget constraints					
1	Low	o	-	o	o
2	Significant	o	o	o	o
	The number of possible combinations	2	1	2	2
Total number of possible combinations = 3,776		2,304	192	768	512

Note: "•" Required; "o" Available or supported; "–" Unavailable or unsupported

Development of the DAS Model: DAS model design

❑ Category I - Type of Schedule

❖ An **"adjusted schedule"** reflects **logic revisions** in terms of

1. Additions and deletions of activities and/or their relationships, and
2. Changes in the quantities of resources compared to the baseline schedule.

❖ An as-planned schedule, an as-built schedule, and updated schedules are **commonly required** as part of **typical administrative** procedures,

while adjusted schedules are **created specifically** for delay analysis purposes.

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

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