



فرآیند یکپارچه برنامه ریزی، زمانبندی و کنترل پروژه

بخش دوم:

مقدمه: مفاهیم برنامه ریزی، زمانبندی، ارزیابی و کنترل پروژه

ارائه دهندگان:

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(PhD, PMP, CMIT)

What we will learn?

- ☐ Planning and scheduling
- ☐ Schedule and records in contract
- ☐ Elements missing in the contract and need more consideration (general recommendation)
- ☐ Key activities & considerations for project schedule specification
- ☐ Project realities and effective solution

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

2. Detail within the proposed programme

- ☐ The **contractor's proposed programme** (and **any revisions**) should be prepared with **sufficient detail using logic links**
 - ❖ **Each activity** is linked to both a **predecessor** and **successor** activity or milestone
 - ❖ This is **very important** while **delay analysis** needs to be performed
- ☐ Depending on the **complexity of the works**, specify the **maximum duration** of an activity in the **contractor's proposed programme**.
 - ❖ **No activity** or **lag** should **exceed 28 days** in duration
- ☐ **Where possible**, an activity should **not encompass more than one operation** or **trade contractors**
- ☐ Where possible, **activities** on **one calendar** should **not be linked to activities** on a **different calendar** if at **all possible**.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

2. Detail within the proposed programme

❑ “Rolling wave” programming: **Activities** are **detailed** for the **next 6 to 18 months** of the project and the **remainder** of activities are **shown** at a **summarized level**:

❖ When “rolling wave” programming is used, an **activity limitation of 28 days** for **maximum duration** is **not necessary** for the later summarized activities.

Instead

❖ Common sense should be **applied** and reasonable summary bar activities **incorporated** in the programme that are then detailed as the **time to execute** them draws **nearer**.

شرایط عمومی پیمان – نشریه ۴۳۱۱ در اینباره عموماً سکوت کرده است!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

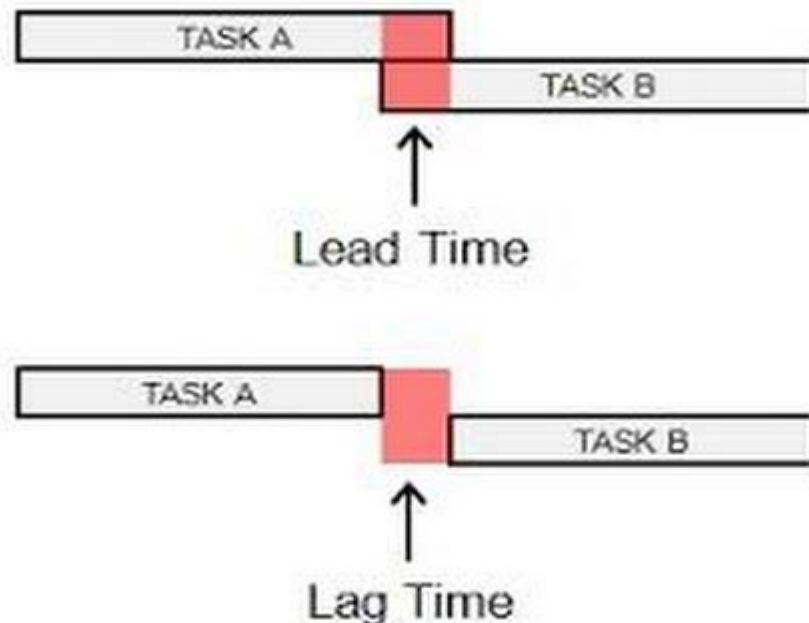
2. Detail within the proposed programme

❑ Activities should be **linked together** by the **appropriate logic links**:

1. **Finish to start**
2. **Start to start**
3. **Finish to finish**

❑ **Excessive leads and lags** should be **avoided**

❑ Where **excessive leads and lags** **used**, the **explanation** should be provided in **narrative schedule** by the **contractor**



STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

2. Detail within the proposed programme

❑ **Manually applied constraints** such as:

- ❖ **Must start fixed dates**
- ❖ **Must finish fixed dates**
- ❖ **Zero float**
- ❖ **Other programming techniques**

Should be avoided because it **affects** the schedule to be **flexible for changes**.

What if unavoidable?

Explain in the **narrative schedule report**

What is narrative report?

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

2. Detail within the proposed programme

❑ Based on CMAA

- ❖ A narrative report should be **submitted with each schedule**: preliminary, baseline and update.
- ❖ A narrative report assists the project team in thinking through project progress during the previous update period, the impact of major events during the period, the causes of delays, if any, and **actions that may be necessary** in the future as a result of the project events.
- ❖ The narrative also helps the **CM understand** the **contractor's means and methods** so as to ensure that the schedule logic and sequencing reflect the **contractor's intent**.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

2. Detail within the proposed programme

❑ Based on CMAA

- ❖ The narrative **should require**: executive summary, areas of progress, delays or potential delays, time extension requests, logic and duration changes, resource consumption or usage, recovery plans, and an overall assessment of schedule achievement.
- ❖ The **well-written narrative** provides crucial insight into the **contractor's intentions**,
 1. **Enhances** the communication value of the schedule,
 2. **Minimizes** scheduling issues and disputes.

شرایط عمومی پیمان – نشریه ۴۳۱۱ در اینبارہ عموما سکوت کرده است!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

2. Detail within the proposed programme

- ❑ **Key sources** such as labor, staff, tradesmen, dedicated resources, major materials, and work rates should **be indicated for major activities**

Or

❖ **Explained** in the **narrative schedule**

- ❑ When **works highly dependent** on **production rates**, **supplemental tools** such as:

❖ **Line of balance schedules**

❖ **Time location diagrams**

❖ **S-curves**

should be **developed** and **utilized** to **understand progress** of the activities reported in the **updated schedule**

شرایط عمومی پیمان – نشریه ۴۳۱۱ در اینبار عموما سکوت کرده است!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

3. Interaction with method statements

- ❑ The **contractor's proposed programme** should be **read in conjunction** with the **contractor's method statements** describing in **detail**:

- ❖ How the contractor intends to carry out the works?
- ❖ Key interfaces
- ❖ Resources it intends to use (which may **include subcontractors' resources**)

The Protocol recommends that the contract require the Contractor to provide such method statements, and that the Contractor's proposed programme and the method statements are fully cross-referenced.

- ❖ Narrative schedule should also be prepared by the contractor to **describe how** the proposed programme reflects the method statements.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

3. Interaction with method statements

- ❖ **Narrative schedule** should also be prepared by the **contractor** to **describe how** the proposed **programme** reflects the **method statements**.

(ب-۱۸)

پیمانکار متعهد است که سازمان، روش اجرا و برنامه زمانی تفصیلی اجرای کار را طبق نظر مهندس مشاور بر اساس نقشه‌های موجود. برنامه زمانی کلی تهیه کند و ظرف یک ماه از تاریخ مبادله پیمان یا مدت دیگری که در اسناد و مدارک پیمان تعیین شده است، تسلیم مهندس مشاور نماید تا پس از اصلاح و تصویب کارفرما برای اجرا به پیمانکار ابلاغ شود. اگر در اسناد و مدارک پیمان، جزییاتی برای چگونگی تهیه برنامه زمانی تفصیلی و بهنگام کردن آن تهیه شده باشد، پیمانکار ملزم به رعایت آن می‌باشد.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

4. Time within which to submit a proposed programme for acceptance

- ❑ It is **recommended** that a **fixed time period** for the **contractor's submission** of the **proposed programme** be **agreed** and **specified** in the **contract**.
 - ❖ Should be a **reasonable time** after the **contract award** or the **commencement date**, whichever is the earlier.

۴-الف)

این پیمان از تاریخ مبادله آن (ابلاغ از سوی کارفرما) نافذ است.

۴-ج)

تاریخ شروع کار، تاریخ نخستین صورت‌مجلس تحویل کارگاه است که پس از مبادله پیمان، تنظیم می‌شود.

۴-ب)

مدت پیمان..... ماه است. این مدت، تابع تغییرات موضوع ماده ۳۰ شرایط عمومی پیمان است.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

4. Time within which to submit a proposed programme for acceptance

- ☐ For a **long duration project**, **“rolling wave” programming** is recommended
 - ❖ **Submitting initial proposed programme** showing the **whole project schedule** with the **first three months of the works in detail.**
- ☐ The **proposed programme** should **not encompass any changes** or **delays** that have occurred since the **contract commencement date**.
 - ❖ **Any such delays** should be **dealt in accordance** with **delay analysis procedure** and it should **not be included in as-planned schedule**.

I have explained this in full detail in Delay Analysis Course!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

4. Time within which to submit a proposed programme for acceptance

(ج-۱۸)

نشریه ۴۳۱۱

در صورتیکه در حین اجرای کار، پیمانکار تشخیص دهد که تغییراتی در **برنامه زمانی** تفصیلی ضروری است، موظف است که پیش از رسیدن موعد انجام کارهایی که به نظر او باید در برنامه آن تغییر داده شود، مراتب را با ذکر دلیل، به مهندس مشاور اطلاع دهد. مهندس مشاور، تغییرات مورد تقاضای پیمانکار را در قالب **برنامه زمانی** کلی رسیدگی می‌کند و آنچه را که مورد قبول است، پس از تصویب کارفرما، به پیمانکار ابلاغ می‌کند. بدیهی است که این تغییرات در حدود مندرجات پیمان، از میزان تعهدات و مسئولیت‌های پیمانکار نمی‌کاهد.

قرارداد EPC صنعتی

۲-۳۲-

پیمانکار، می‌تواند در طول اجرای کار، تغییرات پیشنهادی در **برنامه زمانی** را بدون آن‌که باعث تأخیر در اتمام کل کار و یا بخش‌های اصلی آن شود، برای تصویب به کارفرما پیشنهاد کند.

کارفرما میتواند با این تغییرات مخالفت کند و چرا و چگونه؟

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

5. Mechanism for obtaining the CA's (AE or reviewer) acceptance of the proposed programme

- If the **contractor controls** the method and sequence of the works
 - ❖ The **contractor may perform** the works in the **manner it thinks appropriate**
 - ✓ Therefore, **to avoid any confliction**, the **contract provision** should reflect the **fact that employer constraints** should be **considered** by the **contractor**.

۱۸-ب)

پیمانکار متعهد است که سازمان، روش اجرا و برنامه زمانی تفصیلی اجرای کار را طبق نظر مهندس مشاور بر اساس نقشه‌های موجود. برنامه زمانی کلی تهیه کند و ظرف یک ماه از تاریخ مبادله پیمان یا مدت دیگری که در اسناد و مدارک پیمان تعیین شده است، تسلیم مهندس مشاور نماید تا پس از اصلاح و تصویب کارفرما برای اجرا به پیمانکار ابلاغ شود. اگر در اسناد و مدارک پیمان، جزییاتی برای چگونگی تهیه برنامه زمانی تفصیلی و بهنگام کردن آن تهیه شده باشد، پیمانکار ملزم به رعایت آن می‌باشد.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

5. Mechanism for obtaining the CA's (AE or reviewer) acceptance of the proposed programme

❑ To avoid uncertainty:

- ❖ The contract should contain wording to the effect that if the CA (AE or reviewer) does not respond to the contractor regarding the proposed programme within a specified time, it is deemed accepted and becomes the “accepted (as-planned) programme.”

شرایط عمومی پیمان – نشریه ۴۳۱۱ و EPC صنعتی در اینباره عموماً سکوت کرده، اما طرح و ساخت غیر صنعتی بدان پرداخته است.

در دوره مدیریت ادعا آنرا مفصل بررسی می‌نماییم!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

5. **Mechanism** for obtaining the CA's (AE or reviewer) acceptance of the proposed programme

❑ If the contractor fails to meet its contractual obligations with respect to **scheduling**:

1. The CA may consider contract provisions for dealing with **general defaults on behalf of the contractors.**
2. The CA should also maintained **update** a schedule with actual progress based on its own knowledge

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

5. **Mechanism** for obtaining the CA's (AE or reviewer) acceptance of the proposed programme

اگر کارفرما در تایید برنامه دیرکرد داشته باشد یا برنامه را تایید ننماید؟
منظور از طبق نظر مهندس مشاور چیست؟

۱۸-ب)

پیمانکار متعهد است که سازمان، روش اجرا و برنامه زمانی تفصیلی اجرای کار را طبق نظر مهندس مشاور بر اساس نقشه‌های موجود. برنامه زمانی کلی تهیه کند و ظرف یک ماه از تاریخ مبادله پیمان یا مدت دیگری که در اسناد و مدارک پیمان تعیین شده است، تسلیم مهندس مشاور نماید تا پس از اصلاح و تصویب کارفرما برای اجرا به پیمانکار ابلاغ شود. اگر در اسناد و مدارک پیمان، جزییاتی برای چگونگی تهیه برنامه زمانی تفصیلی و بهنگام کردن آن تهیه شده باشد، پیمانکار ملزم به رعایت آن می‌باشد.

۴۶-الف)

کارفرما می‌تواند در صورت تحقق هر یک از موارد زیر، پیمان را طبق ماده ۴۷ فسخ کند.

۴۶-الف-۲)

تأخیر در ارائه برنامه زمانی تفصیلی به مدت بیش از نصف مهلت تعیین شده برای تسلیم آن.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the **as-planned (accepted)/updated programme**

- ❑ The **contract** should require that the **accepted (as-planned) programme** be **updated with actual progress** at **intervals of no longer than one month**
 - ❖ **More frequent intervals** on **complex projects**

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the as-planned (accepted)/updated programme

اگر پیمانکار در تهیه گزارشات و به روز رسانی دیرکرد داشته باشد؟

۱۸-هـ)

پیمانکار متعهد است که در پایان هر ماه، گزارش کامل کارهای انجام شده در آن ماه را تهیه نماید. شکل و چگونگی تهیه گزارش را مهندس مشاور تهیه می‌کند. این گزارش، شامل مقدار و درصد فعالیت‌های انجام شده، میزان پیشرفت یا تأخیر نسبت به **برنامه زمانی** تفصیلی، مشکلات و موانع اجرایی، نوع و مقدار مصالح و تجهیزات وارد شده به کارگاه، تعداد و نوع ماشین‌آلات موجود و آماده به کار، تعداد و تخصص نیروی انسانی موجود و دیگر اطلاعات لازم می‌باشد. در صورتی که جزییات دیگری برای چگونگی تهیه گزارش پیشرفت کار در اسناد و مدارک پیمان تعیین شده باشد، پیمانکار موظف به رعایت آن است.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the **as-planned (accepted)/updated programme**

- ❑ From **time to time**, the **contractor** may wish to **revise** its plan for **carrying out the remainder of the works**.
- ❖ If **rolling wave programming** is used, **subsequently detailing later summary activities** is **not a revision to the contractor's plan** if the project **completion date is not changed**.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the as-planned (accepted)/updated programme

آیا مشاور میتواند با تغییر مخالفت کند؟ چرا و چگونه؟

(۱۸-ج)

در صورتیکه در حین اجرای کار، پیمانکار تشخیص دهد که تغییراتی در **برنامه زمانی** تفصیلی ضروری است، موظف است که پیش از رسیدن موعد انجام کارهایی که به نظر او باید در برنامه آن تغییر داده شود، مراتب را با ذکر دلیل، به مهندس مشاور اطلاع دهد. مهندس مشاور، تغییرات مورد تقاضای پیمانکار را در قالب **برنامه زمانی** کلی رسیدگی میکند و آنچه را که مورد قبول است، پس از تصویب کارفرما، به پیمانکار ابلاغ میکند. بدیهی است که این تغییرات در حدود مندرجات پیمان، از میزان تعهدات و مسئولیت‌های پیمانکار نمی‌کاهد.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the **as-planned (accepted)/updated programme**

- ❑ The contract should **contain provisions** allowing the CA to **require the contractor to produce a proposed revised programme** in case
 - ❖ There may be **contractor delay** to **completion** or **variations** and the contractor **wants to reasonably revise its planned logic, sequence, and activity durations** to ensure the contract completion date to be achieved.

مشاور تحت چه شرایطی میتواند این درخواست را مطرح نماید؟
پیمانکار در این موارد باید به چه موضوعاتی دقت نماید؟
منظور از با توجه به نظر مهندس مشاور چیست؟

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the as-planned (accepted)/updated programme

نشریه ۴۳۱۱

(ج-۱۸)

اگر تغییر برنامه زمانی تفصیلی از سوی مهندس مشاور مطرح شود، پیمانکار با توجه به نظر مهندس مشاور، تغییرات برنامه زمانی تفصیلی را تهیه می‌کند و به شرح پیش‌گفته، برای طی مراتب بررسی و تصویب، تسلیم مهندس مشاور می‌نماید.

قرارداد EPC صنعتی

۲-۲-۶۴-

کارفرما می‌تواند اتمام زودتر از برنامه زمانی پیمان را با در نظر گرفتن امکانات و توانایی‌های پیمانکار، درخواست کند. در این صورت، پیمانکار با بررسی شرایط مورد نظر کارفرما و با استفاده از قیمت‌های پیمان، سایر اسناد و مدارک لازم را تنظیم نموده، پیشنهاد خود را مبنی بر اضافه مبلغ احتمالی و امکانات مورد درخواست به کارفرما تسلیم می‌کند.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the as-planned (accepted)/updated programme

قرارداد EPC صنعتی

۳-۲-۶۴

پس از توافق کارفرما و پیمانکار دایر بر کاهش مدت پیمان، براساس بندهای «۱-۲-۶۴» و «۲-۲-۶۴»، تاریخ جدید به عنوان تاریخ اتمام پیمان تعیین می‌شود. پیمانکار باید **برنامه زمانی** اجرای کارهای موضوع پیمان را، به تناسب شرایط و تاریخ جدید اتمام پیمان، مورد تجدیدنظر قرارداده، برای بررسی مشاور کارفرما و تأیید او، تسلیم کند. **برنامه زمانی** جدید پس از تصویب کارفرما، به پیمانکار ابلاغ می‌شود؛ و از آن پس، سایر مفاد پیمان در مورد اتمام به هنگام کار، بر مبنای تاریخ جدید، نافذ خواهد بود. در صورت عدم تحقق کاهش مدت پیمان، در پایان مدت توافق شده موضوع این بند، اضافه مبلغ توافق شده پیمان به تناسب مدت کاهش نیافته، کاهش می‌یابد و پیمانکار از این بابت مشمول خسارت تأخیر نمی‌شود.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the **as-planned (accepted)/updated programme**

- ❑ If the CA disagrees with the progress the contractor considers it has achieved, it should notify the contractor and they should reach an agreement.

What if CA and contractor disagree with each other?

- ❖ If they **do not agree**, the **CA's view** should be **accepted** and **reflected** in the **updated schedules**

unless and until it is reviewed and replaced under the contract dispute resolution procedures

شرایط عمومی پیمان – نشریه ۴۳۱۱ در اینباره عموماً سکوت کرده است!

Do not forget to record contractor's position on the areas of disagreement

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the **as-planned (accepted)/updated programme**

- ❑ If the CA disagrees with the progress the contractor considers it has achieved, it should notify the contractor and they should reach an agreement.

What if CA and contractor disagree with each other?

قرارداد EPC صنعتی

۵-۳۲-

در موارد اختلاف پیمانکار و کارفرما، پیمانکار موظف به ادامه عملیات طبق برنامه زمانی بوده و به هیچ عنوان حق توقف و یا تعویق کل کار و یا بخش‌هایی از کارها را ندارد، مگر این‌که دو طرف به نحو دیگری توافق کنند. در شرایط اختلاف، کارفرما نیز باید به تعهدات قراردادی خود طبق برنامه زمانی عمل کند.

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the as-planned (accepted)/updated programme

قرارداد EPC صنعتی

ماده ۶۶- تأخیر در اتمام به موقع کار

پیمانکار، موظف به انجام کارها، طبق برنامه زمانی منضم به پیمان و آخرین تجدید نظرهای آن است. هرگاه در تاریخ تعیین شده در برنامه زمانی منضم به پیمان و یا آخرین تجدید نظر آن، انجام کار یا قسمت‌های اصلی آن به پایان نرسیده باشد، کارفرما به پیمانکار اخطار می‌کند که حداکثر در طول مدت ۱۴ روز، کارها را به پایان برساند. پیمانکار، در طول این مدت باید نسبت به اتمام عملیات اقدام کند، و یا با ارسال اسناد و مدارک لازم، تمدید مدت پیمان را طبق بند «۱-۶۴»، درخواست نماید. در صورت عدم اتمام کار در طول مدت یاد شده، یا عدم قبول دلایل وی از سوی کارفرما برای تمدید، پیمانکار ملزم به پرداخت خسارت تأخیر در کار، به میزان درج شده در شرایط خصوصی خواهد بود. حداکثر مبلغ خسارت نیز، در بند «۴-۵» موافقت‌نامه درج شده است. تاریخ مبنای محاسبه تأخیرها، آخرین تاریخ تغییر یافته طبق بند «۱-۶۴» یا «۲-۶۴» است.

این بخش به چه رویه ای از آنالیز تاخیرات اشاره میکند؟
در دوره آنالیز تاخیرات مفصل بحث میکنیم!

STEP 1: Defining programme (schedule) and records in the contract (CP 1) – Programme

6. Requirements for updating and saving the **as-planned (accepted)/updated programme**

قرارداد EPC صنعتی

۲۷-۱-

«دستور تغییر کار»، سندی است که افزایش، کاهش و یا تغییر کار و تغییرات در مدت و مبلغ پیمان ناشی از آن‌ها، در آن درج شده است و به امضای کارفرما و پیمانکار می‌رسد.

این بخش به چه رویه ای از آنالیز تاخیرات اشاره میکند؟
در دوره آنالیز تاخیرات مفصل بحث میکنیم!

**Elements Missing in the Contract and
Need More Consideration
(General recommendation)**



Introduction

فرآیند یکپارچه برنامه ریزی، زمانبندی، ارزیابی و کنترل پروژه
مقدمه: مفاهیم برنامه ریزی، زمانبندی، ارزیابی و کنترل پروژه

***All information presented in this section is the “Scheduling best practices” provided by
Navigant Consulting Inc. in 2016.***

- ☐ Detailed scheduling specification
- ☐ Baseline schedule submittal requirements tied to the notice of award
 - ❖ Timing
 - ❖ Preliminary construction schedule
- ☐ Requirement of monthly schedule updates
- ☐ Requirement of as-built schedule submittal
- ☐ Incorporation of financial incentives
- ☐ Pre-construction scheduling conference
- ☐ Scheduling software requirements
- ☐ Incorporation of a work breakdown structure (WBS)

Detailed scheduling specification – General recommendation

- ❑ Typically **very little direction** with respect to **scheduling requirements** in the **contract**
- ❑ **Most contracts** include **general language**
 - ❖ It means that **prior to the start of any work**, the **contractor** shall **submit its proposed construction schedule** for the **engineer's review** (too late)
- ❑ **Critical scheduling elements** are **often overlooked**
 - ❖ Specific timing for submitting schedules and updates
 - ❖ Level of detail required
 - ❖ Content of information
 - ❖ Format, including software requirements

Missing documents will make delay analysis very difficult

Detailed scheduling specification – General recommendation

**Great sample of General
condition**

[https://dralavipour.com/blog/
view/Contract-schedule-delay](https://dralavipour.com/blog/view/Contract-schedule-delay)

نمونه موردی از الزامات زمانبندی و تحلیل تاخیرات در شرایط عمومی قرارداد

در مقاله‌ای که درباره مشخصات فنی برنامه‌زمانی (Schedule Specs) منتشر شد، به شرح چک‌لیستی مهم که باید در قرارداد لحاظ شود، پرداختیم. اما باید بدانیم قراردادهای زیادی وجود دارند که به بررسی الزامات برنامه‌زمانی، تمدید زمانی (EOT) و خسارات مالی ناشی از آن پرداخته و این موارد از بخش‌های مهم آن‌ها تلقی می‌گردند.

از این‌رو، دانشگاه Texas State، یک فرم قراردادی همسان در سال ۲۰۱۵ (قرارداد UGC همان Uniform General Conditions for Construction Contracts) ارائه نموده و ادعا می‌نماید این نوع فرم قراردادی همسان می‌تواند برای قرارداد بین کارفرما و پیمانکار اصلی و یا مدیر ساخت (Construction Manager) و یا حتی برای پیمانکار طرح و ساخت (Design-Build Contractor) استفاده گردد. این قرارداد علاوه بر شرایط عمومی، یک نمونه از مشخصات فنی (Specification) را نیز ارائه کرده که در آن نیز به موضوع زمانبندی، تمدید زمانی و خسارات مالی ناشی از تاخیر در پروژه نیز پرداخته است. در این مقاله قصد داریم به این الزامات در شرایط عمومی قرارداد (UGC) پرداخته و در مقاله دیگری به بررسی جزئیات بیشتر در مشخصات فنی (Specifications) این نوع قرارداد بپردازیم.

در ادامه به شرح مواردی که در Article ۹ شرایط عمومی UGC برای تدوین برنامه زمانی اجرا/ساخت (Construction Schedule) درج شده، پرداخته‌ایم.

Detailed scheduling specification – General recommendation

Great checklist for Schedule Specs

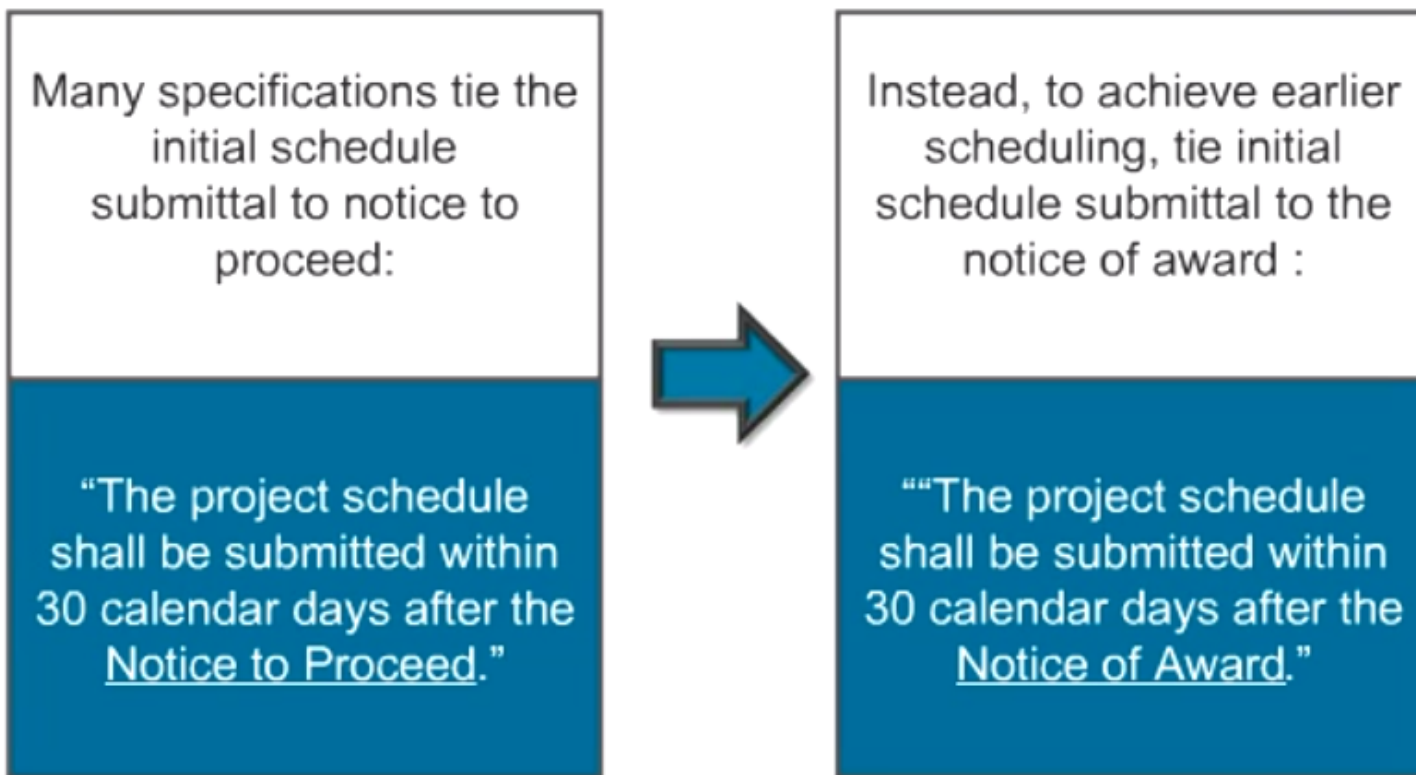
<https://dralavipour.com/blog/view/Schedule-specs>

چکلیست مشخصات فنی برنامه زمانی در قرارداد (Schedule Specifications)

مشخصات فنی برنامه زمانی (Schedule Specifications) یکی از مهم‌ترین اسناد قراردادیست که پایه ادعاهای فنی، مالی و زمانی بسیاری را تشکیل می‌دهد. مشخصاتی که تعهدات پیمانکار را در ارتباط با نحوه به‌روزرسانی و حفظ برنامه زمانی تعیین می‌نماید و محل استناد طرفین در زمان بسیاری از اختلافات خواهد بود. این مشخصات فنی می‌تواند شکل و ابعاد مختلفی داشته باشد و بر اساس نوع پروژه به شکل‌های متفاوتی تدوین شود، اما به صورت کلی موارد زیر را در بر می‌گیرد:

- نوع اطلاعات مورد نیاز در برنامه زمانی
- چگونگی تدوین برنامه زمانی
- شیوه به‌روزرسانی برنامه زمانی (Updating the Schedule)
- زمان و بازه‌های به‌روزرسانی برنامه زمانی
- الزامات چگونگی اصلاح برنامه زمانی قبل و بعد از وقوع تاخیر (Revising the Schedule)
- ارتباط برنامه زمانی با تمدیدهای زمانی برنامه (Extension of Time)
- ارتباط برنامه زمانی با خسارت‌های مالی (Liquidated Damages و Compensation)

Schedule submittals tied to the notice of award – General recommendation



Utilize existing downtime between Notice of Award and Notice to Proceed to begin scheduling

Requirement of preliminary construction schedule— General recommendation

فرآیند یکپارچه برنامه ریزی، زمانبندی، ارزیابی و کنترل پروژه
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❑ Issues:

- ❖ **30-day requirement** for baseline submittal may not be enough time for a thoroughly coordinated schedule
- ❖ Detailed plan requires **subcontractor input** and subcontractor may not be selected yet
- ❖ Contractor may put together schedule in order to simply comply with contract time requirement – could be **dramatically different** from the way the contractor will actually proceed

❑ Managing the issues:

- ❖ Require a startup schedule or 90-day schedule, followed by a **detailed construction schedule later:**
 - ✓ Gives contractor an **opportunity to develop detailed and logical short-term schedule** followed by a **detailed baseline**

This is called Preliminary Schedule that you will learn in Advanced Course!

Schedule submittals tied to the notice of award and preliminary construction schedule

ماده ۴- تاریخ تنفیذ، مدت، تاریخ شروع کار

۴-ج)

تاریخ شروع کار، تاریخ نخستین صورت مجلس تحویل کارگاه است که پس از **مبادله** پیمان، تنظیم می شود.

پیمانکار متعهد است از تاریخ تعیین شده برای شروع کار، در مدت..... ماه نسبت به تجهیز کارگاه به منظور شروع عملیات موضوع پیمان، اقدام نماید.

۲۸-ب)

کارفرما پس از مبادله پیمان، تاریخ تحویل کارگاه را که نباید بیشتر از ۳۰ روز از تاریخ مبادله پیمان باشد، به پیمانکار اعلام می کند. پیمانکار باید در تاریخ تعیین شده در محل کار حاضر شود و طی صورت مجلس هایی، اقدام به تحویل گرفتن کارگاه نماید. در صورتیکه حداکثر ۳۰ روز از تاریخ تعیین شده برای تحویل کارگاه حاضر نشود، کارفرما حق دارد که طبق ماده ۴۶، پیمان را فسخ کند.

Schedule submittals tied to the notice of award and preliminary construction schedule

۱۸-ب)

پیمانکار متعهد است که سازمان، روش اجرا و برنامه زمانی تفصیلی اجرای کار را طبق نظر مهندس مشاور بر اساس نقشه‌های موجود. برنامه زمانی کلی تهیه کند و ظرف یک ماه از تاریخ مبادله پیمان یا مدت دیگری که در اسناد و مدارک پیمان تعیین شده است، تسلیم مهندس مشاور نماید تا پس از اصلاح و تصویب کارفرما برای اجرا به پیمانکار ابلاغ شود. اگر در اسناد و مدارک پیمان، جزییاتی برای چگونگی تهیه برنامه زمانی تفصیلی و بهنگام کردن آن تهیه شده باشد، پیمانکار ملزم به رعایت آن می‌باشد.

ماده ۵- برنامه زمانی اجرای کار

۵-الف)

برنامه زمانی کلی: برنامه ایست که در آن، زمان بندی کلی کارهای مورد پیمان بر حسب ماه، منعکس گشته و در اسناد و مدارک پیمان درج شده است

۵-ب)

برنامه زمانی تفصیلی: برنامه‌ای است که زمان بندی فعالیت‌های مختلف کارهای موضوع پیمان، به تفصیل و در چارچوب برنامه زمانی کلی، در آن آمده است.

Requirement of monthly schedule updates – General recommendation

- ❑ Important to require **regular schedule updates** (monthly, weekly, other) that reflect:
 - ❖ **Actual** start dates and **actual** finish dates for **completed activities**
 - ❖ **Actual** start and **anticipated** finish dates for **current activities**
 - ❖ **Anticipated** start and finish dates for **future activities**
 - ❖ **Revisions** in **sequence or scope**

Include a provision that allows requests to revise schedule submittals within a time frame

Requirement of monthly schedule updates – General recommendation

☐ Update narratives which may include:

- ❖ Description of work accomplished in that period
- ❖ Current or anticipated delays/problems
- ❖ Planned corrective measures to mitigate delays
- ❖ Modifications to the schedule in the current update, including:
 - ✓ Changes in activity duration
 - ✓ Addition or deletion of activities
 - ✓ Changes to logic ties
 - ✓ Constraints

Requirement of monthly schedule updates – General recommendation

❑ **Additional helpful items** to include:

❖ **Contractual milestones**

- ✓ Currently scheduled dates for contractual milestones
- ✓ Previously scheduled contractual milestones dates

❖ **Anticipated impacts** for which scope/durations are unknown

Requirement of monthly schedule updates – General recommendation

۱۸-ب)

پیمانکار متعهد است که سازمان، روش اجرا و برنامه زمانی تفصیلی اجرای کار را طبق نظر مهندس مشاور بر اساس نقشه‌های موجود. برنامه زمانی کلی تهیه کند و ظرف یک ماه از تاریخ مبادله پیمان یا مدت دیگری که در اسناد و مدارک پیمان تعیین شده است، تسلیم مهندس مشاور نماید تا پس از اصلاح و تصویب کارفرما برای اجرا به پیمانکار ابلاغ شود. اگر در اسناد و مدارک پیمان، جزئیاتی برای چگونگی تهیه برنامه زمانی تفصیلی و بهنگام کردن آن تهیه شده باشد، پیمانکار ملزم به رعایت آن می‌باشد.

۱۸-ج)

در صورتیکه در حین اجرای کار، پیمانکار تشخیص دهد که تغییراتی در برنامه زمانی تفصیلی ضروری است، موظف است که پیش از رسیدن موعد انجام کارهایی که به نظر او باید در برنامه آن تغییر داده شود، مراتب را با ذکر دلیل، به مهندس مشاور اطلاع دهد. مهندس مشاور، تغییرات مورد تقاضای پیمانکار را در قالب برنامه زمانی کلی رسیدگی می‌کند و آنچه را که مورد قبول است، پس از تصویب کارفرما، به پیمانکار ابلاغ می‌کند. بدیهی است که این تغییرات در حدود مندرجات پیمان، از میزان تعهدات و مسئولیت‌های پیمانکار نمی‌کاهد.

اگر تغییر برنامه زمانی تفصیلی از سوی مهندس مشاور مطرح شود، پیمانکار با توجه به نظر مهندس مشاور، تغییرات برنامه زمانی تفصیلی را تهیه می‌کند و به شرح پیش‌گفته، برای طی مراتب بررسی و تصویب، تسلیم مهندس مشاور می‌نماید.

Requirement of monthly schedule updates – General recommendation

(د-۱۸)

پیمانکار متعهد است که هماهنگی لازم با دیگر پیمانکاران یا گروه‌های اجرایی متعلق به کارفرما، که به نحوی با موضوع قرارداد مرتبط هستند، به عمل آورد. برنامه‌ریزی چگونگی این هماهنگی توسط مهندس مشاور به پیمانکار ابلاغ می‌شود.

(ه-۱۸)

پیمانکار متعهد است که در پایان هر ماه، گزارش کامل کارهای انجام شده در آن ماه را تهیه نماید. شکل و چگونگی تهیه گزارش را مهندس مشاور تهیه می‌کند. این گزارش، شامل مقدار و درصد فعالیت‌های انجام شده، میزان پیشرفت یا تأخیر نسبت به برنامه زمانی تفصیلی، مشکلات و موانع اجرایی، نوع و مقدار مصالح و تجهیزات وارد شده به کارگاه، تعداد و نوع ماشین‌آلات موجود و آماده به کار، تعداد و تخصص نیروی انسانی موجود و دیگر اطلاعات لازم می‌باشد. در صورتی که جزئیات دیگری برای چگونگی تهیه گزارش پیشرفت کار در اسناد و مدارک پیمان تعیین شده باشد، پیمانکار موظف به رعایت آن است.

(و-۱۸)

پیمانکار متعهد است که یک نسخه از برنامه، نمودارها و جدول‌های پیشرفت کار را در کارگاه آماده داشته باشد تا در صورت لزوم مهندس مشاور و کسانی که اجازه بازدید از کارگاه را دارند از آن استفاده کنند.

Requirement of as-built schedule submittal – General recommendation

❑ Issues:

- ❖ Contractor's focus is merely on **tasks necessary** for project completion
- ❖ Towards the end of a project, **regular monthly schedule updates** can be **forgone** and **project record** left unclear with respect to completion dates

❑ Managing the issues:

- ❖ Include an **as-built schedule** as part of documents required for **final payment** and **release of retainage**
- ❖ Include **as-built schedule specification**:
 - ❖ List of all **activities performed** on the project with **start** and **end** dates
 - ❖ Record of **timing of all project work**

Financial incentives – General recommendation

❑ Ensure submission of project schedules through financial incentives

Mobilization Payment	Specific Pay Item
- Contingent upon receipt and approval of a schedule - If payment to be made in more than 1 installment 1st Payment- baseline approval 2nd Payment- acceptance or approval of baseline schedule 3rd Payment- submittal/ approval of first monthly update	- Scheduling included as specific pay item on schedule of values - Contractor can bill this line only after submittal and approval of initial schedule and monthly updates - If project completion is delayed, problems arise with this method

Pre-construction scheduling conference – General recommendation

❑ Issues:

❖ **Scheduling is not performed** on a project due to:

- ✓ Contractor **not being clear** on **importance** of schedule to the owner
- ✓ Contractor does **not fully understand** the **detailed requirements** of schedule specifications

❑ Managing the issues:

❖ **Require a pre-construction scheduling conference** that:

- ✓ Is **attended** by owner, contractor and their respective project managers and schedulers
- ✓ **Emphasizes importance** of **project scheduling**
- ✓ **Includes detailed discussion** of **scheduling specification requirements**
- ✓ **Addresses** any other **project-specific requirements** that are related to or could impact scheduling

Identify scheduling software requirements – General recommendation

- ❑ Scheduling specification should specify **scheduling software requirements**
- ❑ If **different systems** are used, **compatibility issues** arise and impact the **team's ability** to:
 - ❖ Accurately define progress
 - ❖ Understand delays
 - ❖ Identify scheduling risks
 - ❖ Develop recovery plans
- ❑ **Other software requirements:**
 - ❖ Software capable of being **cost** and **resource loaded**
 - ❖ Identifying **specific formats** for **data transfer** of schedule files, layouts, reports
 - ❖ Providing scheduling template **consistent** with **owner's internal system**

Incorporate a work breakdown structure – General recommendation

❑ **Owner** can **require contractor** to provide “specialty” schedules which include:

- ❖ Submittals information
- ❖ Work in specific areas
- ❖ Activities performed by certain trades

(۲۴-ب)

پیمانکار می‌تواند به منظور تسهیل و تسریع در اجرای قسمت یا قسمت‌هایی از عملیات موضوع پیمان، پیمان‌هایی با پیمانکاران جزء ببندد، مشروط به آنکه آنان را از واگذاری کار به دیگران ممنوع کند. در صورتیکه در اسناد و مدارک پیمان، کارفرما، لزوم تأیید صلاحیت پیمانکاران جزء را پیش‌بینی کرده باشد، پیمانکار موظف است که، تأیید کارفرما را در این مورد تحصیل نماید. این واگذاری نباید از پیشرفت کار طبق برنامه زمانی اجرای کار بکاهد، و به هر حال به هیچ روی، از مسئولیت و تعهدات پیمانکار نمی‌کاهد. پیمانکار مسؤول تمام عملیاتی است که توسط پیمانکاران جزء یا کارکنان آن‌ها انجام می‌شود.

اجرای کار در شب در موارد زیر مجاز است.

۲۵-الف)

در برنامه زمانی تفصیلی پیش‌بینی شده باشد.

۲۵-ب)

هرگاه به سبب بروز تأخیرهایی از سوی پیمانکار، انجام کار طبق تشخیص پیمانکار در مدت پیمان امکان پذیر نباشد، پیمانکار می‌تواند بدون آنکه حق دریافت اضافه هزینه کار را داشته باشد با تأیید مهندس مشاور و موافقت کارفرما، قسمتی از کار را در شب اجرا کند.

۲۵-ج)

هرگاه مهندس مشاور تشخیص دهد که پیشرفت کار پیمانکار، به نحوی نیست که همه عملیات در مدت پیمان پایان یابد، می‌تواند پس از موافقت کارفرما، می‌تواند به پیمانکار دستور دهد که قسمتی از کار را در شب اجرا کند. در این حالت پیمانکار مکلف به اجرای این دستور است و حق ادعا یا مطالبه هیچ گونه خسارت و اضافه بها ندارد.

مشاور میتواند در صورت انحراف از پروژه ولی در صورت تکمیل کارها در مدت پیمان به پیمانکار دستور دهد؟
فیدیک چه میگوید؟

۲۵-د)

نشریه ۴۳۱۱

اگر به تشخیص مهندس مشاور و تأیید کارفرما برای جبران تأخیرهایی که ناشی از قصور پیمانکار نیست، کار در شب نیز انجام شود، اضافه هزینه‌های مربوط به کار در شب، با تأیید مهندس مشاور و تصویب کارفرما، پرداخت می‌شود. در محاسبه این هزینه‌ها به منظور تعیین هزینه‌های اضافی دستمزد نیروی انسانی برای کار در شب، باید مقررات قانون کار و امور اجتماعی ملاک عمل قرارگیرد.

پیمانکار متعهد است که ترتیب کار را طوری دهد که تا حد امکان، اجرای کار در شب برای ساکنان مجاور مزاحمتی ایجاد نکند.

قرارداد EPC صنعتی

۲۸-۲-

بجز در مواردی که در شرایط خصوصی امکان کار در خارج از ساعتهای عادی روز و یا در شب پیش‌بینی شده باشد، پیمانکار موظف به انجام کارها در ساعتهای عادی روز است. همچنین، در مواردی که پیمانکار برای جبران عقب‌ماندگی از برنامه زمانی، درخواست کار در خارج از ساعتهای عادی روز و یا کار در شب را از کارفرما بنماید، تنها با تقبل تمام هزینه‌های اضافی ناشی از آن و پس از تأیید کارفرما، مجاز به کار در ساعتهای یاد شده است.

Key Activities & Considerations for the Project Schedule Specification



Introduction

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مقدمه: مفاهیم برنامه ریزی، زمانبندی، ارزیابی و کنترل پروژه

All information presented in this section is the “Scheduling best practices” provided by Navigant Consulting Inc. in 2016.

☐ Activities that should be directly addressed in schedule specification:

- ❖ Submittal/resubmittal review times
- ❖ Procurement and delivery
- ❖ Owner-furnished items
- ❖ Contractual constraints
- ❖ Interim milestone dates
- ❖ Substantial completion

☐ Other considerations:

- ❖ Maximum duration requirements
- ❖ Resource loading
- ❖ Change order impact evaluation

Submittal and resubmittal review times

- ❑ Amount of time **engineer** is given to review submittals and resubmittals should be **specified** to provide proper planning for contractor

1. Submittals:

❖ Different times for different situations:

- ✓ **Shorter durations** for simple submittals and catalogue cuts
- ✓ **Longer durations** for complex submittals
- ✓ **Even longer durations** for submittals requiring review by independent party

*Potential risk if owner/engineer **fail to return submittal on time***

*Recommend requiring a **master list of all submittals** be provided by the engineer in the **specifications***

Submittal and resubmittal review times

2. Resubmittals:

- ❖ **Time frame** for **resubmittals** can be the same or shorter than **original** submittals
- ❖ Schedules often **contain** one activity labeled “submittal and procurement” for **each item installed**
 - ❖ Better practice would be to require these activities:
 - ✓ Submittal, submittal review
 - ✓ Resubmittal, resubmittal review
 - ✓ Procurement
 - ✓ Delivery

Why?

Submittal and resubmittal review times

❑ **Contractor** should be required to:

❖ **Prepare** and **submit** its **own submittal** schedule listing all submittals **required by the contract documents**

✓ **Include** date it anticipates **furnishing each submittal** to **owner** and **engineer**

Submittal and resubmittal review times

One of initial submittals should be the contractor's submittal schedule

Importance of submittal schedule:

Helps to ensure that contractor is aware of and plans for all submittals

Allows owner and design professionals to plan staffing and workload in response to contractor's planned timing

Provides important documentation in a claim scenario

Mandate that fabrication, delivery and installation for all major contractor-furnished materials are separate activities in construction schedule

AND

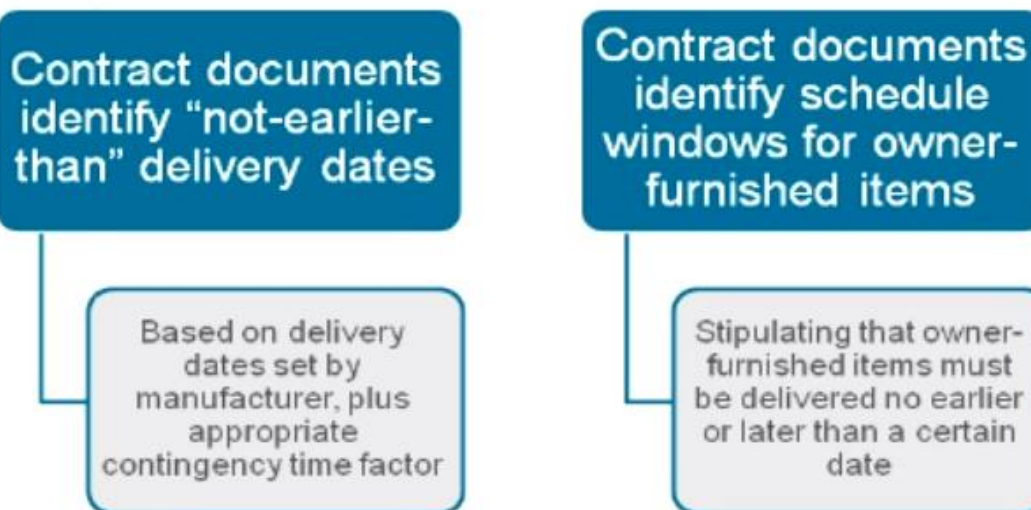
Require contractor to provide schedule report showing the anticipated order and delivery dates for each major piece of equipment

۲۰-د)

در مواردی که باید مصالح و تجهیزاتی باید بوسیله پیمانکار از خارج کشور تهیه شود، کارفرما اجازه ورود آن‌ها را از سازمان‌های ذی‌ربط به هزینه پیمانکار تحصیل می‌نماید. هرگاه ضمن اجرای کار، محدودیت‌های جدیدی پیش آید که بعلت آن، پیمانکار نتواند مصالح و تجهیزات مورد نیاز اجرای کار را، در مدتی که برنامه پیشرفت کار ایجاب می‌کند، از خارج کشور تهیه و وارد کند، مراتب را با ذکر دلیل و ارائه اسناد از طریق مهندس مشاور به اطلاع کارفرما می‌رساند تا با توجه به برنامه زمانی اجرای کار، کارفرما در مورد چگونگی تأمین این قبیل مصالح و تجهیزات، تصمیم‌گیری نماید.

Owner-furnished items

- ❑ Must be coordinated with contractor's work
- ❑ Specification options (two options mentioned below)



» Owner should provide contractor with status of these items as schedule updates are prepared and submitted

Activities in this section should not be changed without owner's approval

It is the owner's responsibility to update these items

Contractual constraints

- ❑ Typically **imposed** by an **owner** to meet their logistical, operational or safety needs
 - ❖ “Work in Area 1 to be completed before Area 2 begins”
 - ❖ “Power shutdowns must take place between 12a and 5a”
- ❑ Careful review of project requirements must take place so **all necessary constraints** are identified and noted in the **bid documents**
- ❑ All constraints and construction sequences must be **incorporated** in the specification for them to be enforceable without a **change order**

Owner's constraints should be identified in the design phase by the owner and designer/CM

Interim milestone dates

- ❑ Set **interim milestone dates** in the **contract** to define the **timing** for **performing certain work**
- ❑ **Interim milestone dates** will be **most useful** for projects
 - ❖ Involving renovation of existing facilities that must remain operational during construction
 - ❖ With multiple contractors
 - ❖ That interface with other concurrent projects

Scheduling specification must require that all these items be reflected in the schedule

Interim milestone dates

❑ Issues:

- ❖ Contractors take **position** that the owner **waived requirements** not shown on the schedule **when** the owner **accepts the baseline**

❑ Managing the issues:

- ❖ **Include** in **contract** a scheduling specification that says:

“To the extent a contract requirement is not incorporated into any schedule submittal, acceptance of the schedule submittal does not relieve the contractor of its responsibility to adhere to the contract requirements.”

Substantial completion

- ❑ Before bidding, carefully define what is necessary to achieve substantial completion of contract work
 - ❖ Helps **avoid disputes** regarding the imposition of **liquidated damages**
 - ❖ Must be **made** by the owner and engineer during the **design phase**
- ❑ Owner should **verify** all activities scheduled in baseline schedule to occur **after** the substantial completion milestone

Maximum duration requirements

Scheduling Specification Duration Requirements

Can establish
maximum
duration of any
activity in the
schedule

Influences level of detail in
construction schedule
ex. No activity can be longer
than (5) working days in
duration

Careful not to set too many
limits, making the schedule
burdensome

Watch out for
understated
activity
durations when
setting duration
requirements

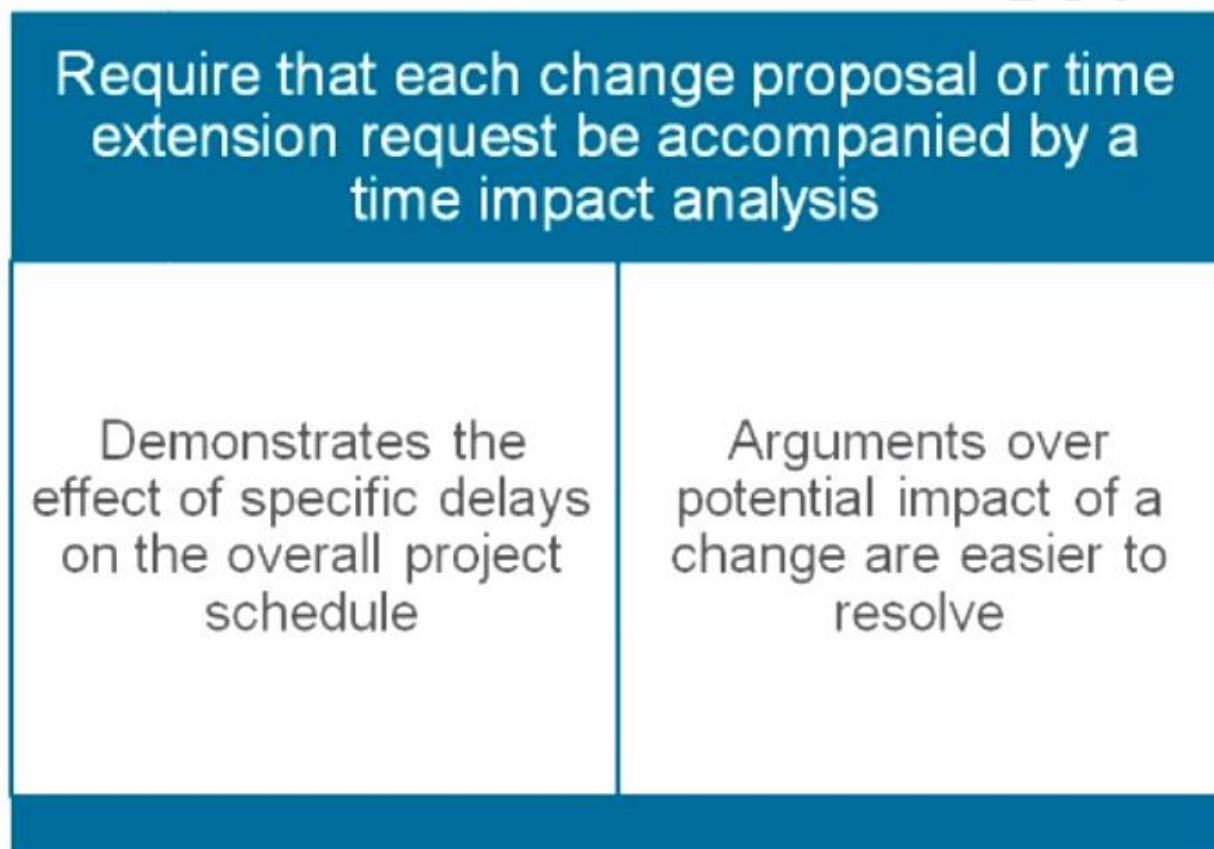
Resource loading

- ❑ Many projects have a **specification requirement** that all on-site construction activities be **resource-loaded** with
 - ❖ Costs
 - ❖ Manpower
 - ❖ Equipment
- ❑ This enables:
 - ❖ Owner's schedule consultant to compare **planned resource loading** with **planned schedule duration** to ensure it is **logical, reasonable** and **mutually supportable**
 - ❖ Owner to review the **reasonableness** of the **contractor's plan** for constructing project
 - ❖ **Baseline** against which to **measure actual performance** and **allocation of costs**

"Pay off the Schedule"

Description	Submittal	Downsides to Method
• Every activity is cost loaded with the appropriate portion of the total project's schedule of payment values • Emphasizes the necessity for proper planning and execution—gives financial incentive	• At end of every month, contractor's payment application consists of: • A list of all schedule activities completed or in progress • Percentage of work accomplished • Calculation of the value of work performed	• Makes monthly progress payment more complicated • Requires all owner personnel responsible for reviewing monthly payment applications be schedule-oriented

Change order impacts



Scheduling specification in the contract

- ❑ We need **scheduling specification** that clearly requires the construction contractor to **perform all the mechanics** of the **schedule production process**.

See File #4

Project Realities and Effective Solutions

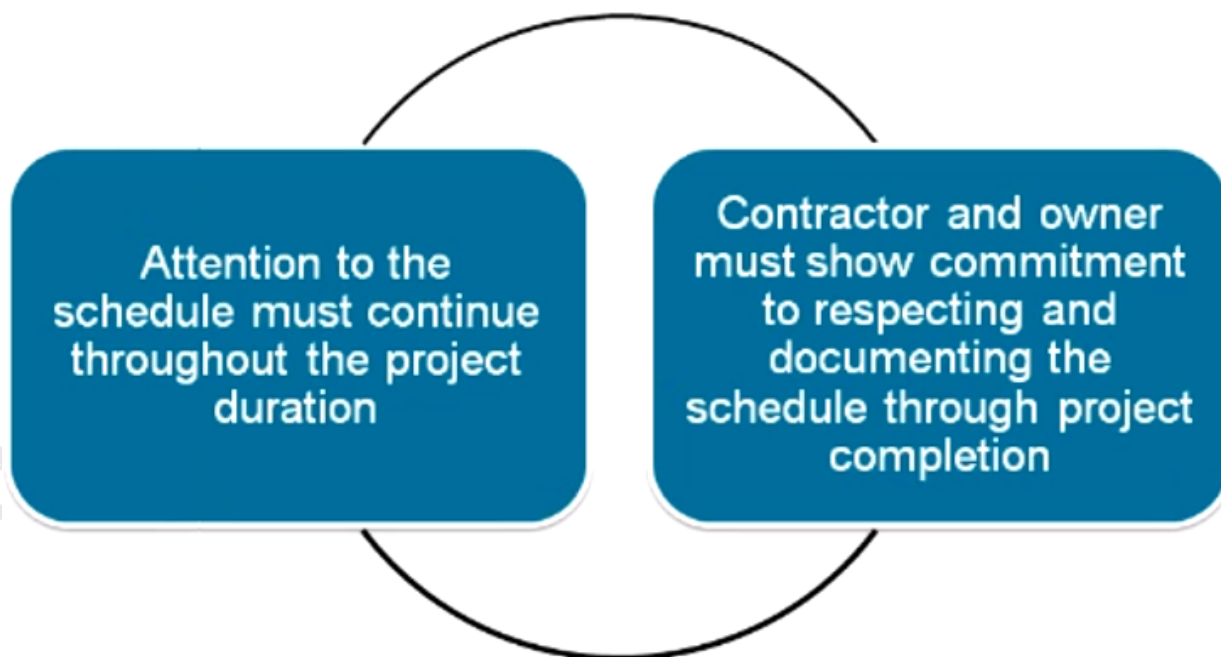


Introduction

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Navigant Consulting Inc. in 2016.***

Keys to a Successful Schedule



Practical need for dedicated schedulers

Possible considerations when drafting specification

- Require contractor to submit resume for proposed scheduler
- Require contractor's scheduler to be on site at certain times and attend meetings
- Enable owner to direct contractor to remove the scheduler and find replacement if needed

Owner should have own qualified scheduler

- To ensure
 - Accuracy
 - Contract compliance
 - Risk management
 - Project planning

Contractor's project management team

❑ Issues:

- ❖ If contractor's project management team is **involved with planning** project but not developing the schedule====disconnect
- ❖ Increased likelihood that the **schedule** will not be an effective planning tool

❑ Managing the issues:

- ❖ Include **detailed specification** requiring contractor to identify member of project management team responsible for **providing input** and **sign off** on schedules

Electronic submittals

- ❑ **Require** the contractor to **electronically** transit all scheduling submittals
 - ❖ In addition to the **paper** and **written** narratives
 - ❖ Reviewing schedules **electronically** can assist in **identifying** **areas** affected by **changed durations** or **logic**
- ❑ **Owner's scheduler** can **review** the changes made and:
 1. **Verify** the **necessity** for the **changes**
 2. **Open** a **dialogue** with the **contractor** about the **reason** for the **changes** to minimize the **schedule delay risk**

Thorough review of baseline and updated schedules

- ❑ Must **understand liability** associated with reviewing and accepting **contractor's schedules**
- ❑ **Key flags:**
 - ❖ Unrealistically shortened activity durations
 - ❖ Artificially increased activity durations
 - ❖ Unreasonable logic ties
 - ❖ Inappropriate review times
 - ❖ Sequestering of float
 - ❖ Open-ended activities
 - ❖ Failure to include critical activities or know constraints identified

Thorough review of baseline and updated schedules

☐ Schedule or activity settings

- ❖ Retained logic vs. progress override (you can choose in Primavera)
- ❖ Total float calculation
- ❖ Lag
- ❖ Activity percent complete calculation

Thorough review of baseline and updated schedules

❑ Critical path

- ❖ Lowest total float
- ❖ Longest path
- ❖ Activities on the critical path
- ❖ Near-critical paths

Thorough review of baseline and updated schedules

□ Activities

- ❖ Number of activities
- ❖ Number of completed/In progress/Not started activities
- ❖ Open ends
- ❖ “Should Have” started or finished activities

Thorough review of baseline and updated schedules

Schedule update reviews may include accuracy review of actual dates with:

Contractor weekly bar charts or three week look-ahead schedules (or both)

Monthly progress reports, including photographs

Daily field reports

Inspection records

Weekly project meeting minutes



فرآیند یکپارچه برنامه ریزی، زمانبندی و کنترل پروژه

بخش سوم:

استاندارد اجرایی: شناسایی و تعریف همه فعالیتها

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

What we will learn?

- ☐ Practical guide for project schedule
- ☐ Capturing and defining all activities
- ☐ Work breakdown structure (WBS)
- ☐ Recommended approach in developing WBS
- ☐ Checklist for a scheduler for capturing all activities
- ☐ An auditor's key questions and documents for capturing all activities

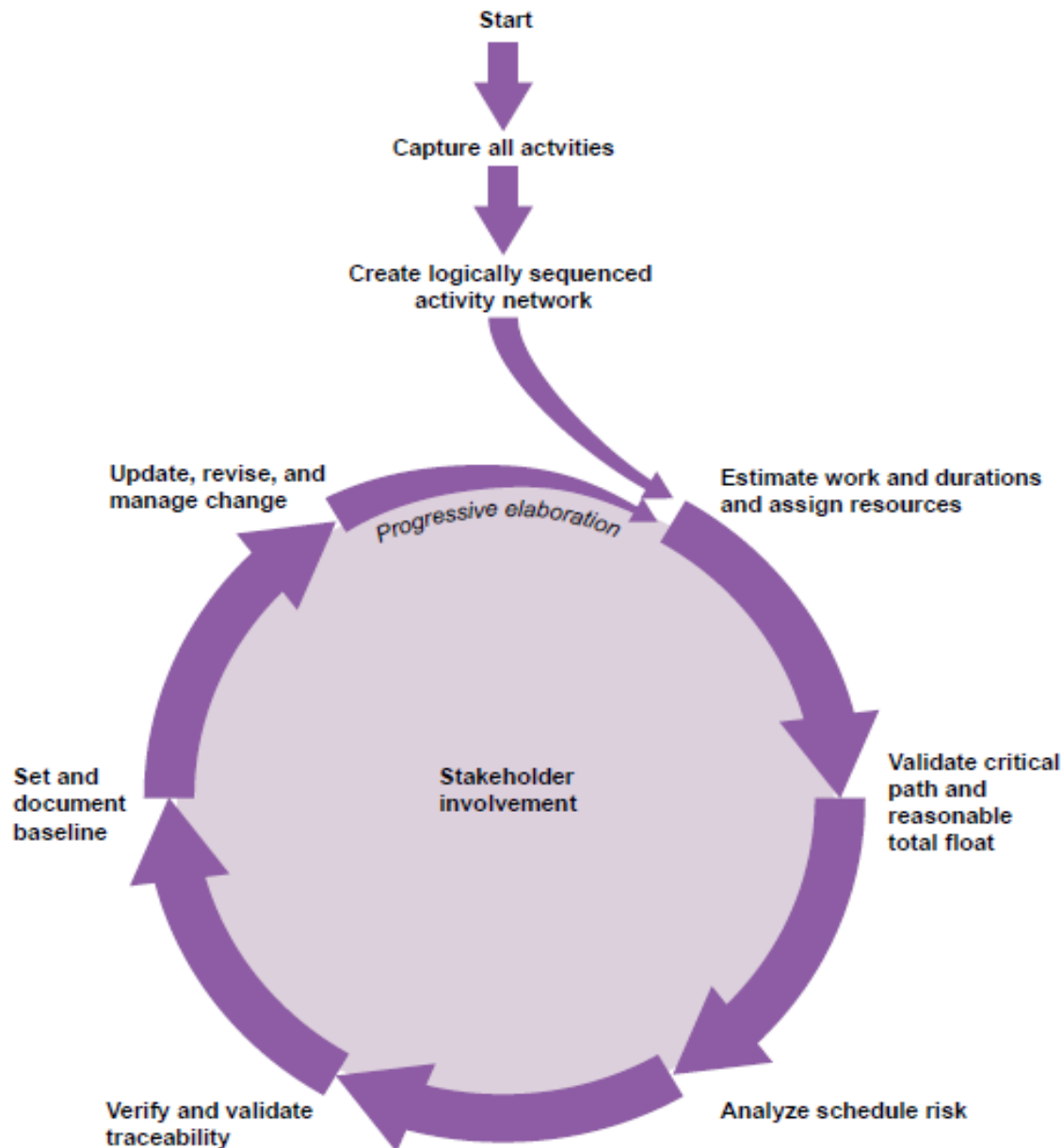
Practical guide for project schedules



فرآیند یکپارچه برنامه ریزی، زمانبندی، ارزیابی و کنترل پروژه استاندارد اجرایی: شناسایی و تعریف همه فعالیتها

A process for creating and maintaining reliable schedules

- ❑ This is a cyclic process
- ❑ Elaborated through rolling wave process.



A process for creating and maintaining reliable schedules

Process step	Corresponding action	Section
Capture all activities	Capturing all activities	3
Create logically sequenced activity network	Sequencing all activities	4
Estimate work and durations and assign resources	Allocating and leveling resources	5
	Determining and assigning durations to activities	6
Validate critical path and reasonable total float	Critical path determination, assessment, and validation	7
	Ensuring reasonable total float	8
Analyze schedule risk	Schedule constructability and risk analysis	9
Verify and validate traceability	Verifying that the schedule can be traced horizontally and vertically	10
Set and document baseline	Setting, monitoring, controlling, and Maintaining a baseline schedule	11
Update, revise, and manage change	Setting, monitoring, controlling, and Maintaining a baseline schedule	11
	Updating the schedule using actual progress and logic	12

Capturing and Defining All Activities

Integrated Master Plan (IMP)

- ❑ An **Integrated Master Plan (IMP)** is an **event-based plan** that demonstrates **maturation** of a **deliverables** as it progresses through a **program's life cycle**.
- ❑ It represents the **top-level execution strategy** for the program and often **serves** as the **outline of the IMS**.
- ❑ **Although** the Events appear in **sequential order**, the plan demonstrates the **execution** approach **without being time-related**.
- ❑ **Done correctly**, an IMP helps to **reduce execution risk**, and resulting in a more **robust IMS**.

Integrated Master Plan (IMP)

- ❑ In some cases an **IMP** is **contractually required**.
- ❑ **Many companies** have adopted the **IMP** as part of their **standard planning process**.
 1. **In some cases**, **acquisition** professionals use the term **IMP** in reference to **only** an **IMP Matrix/Product Section**
 - ❖ Events
 - ❖ Accomplishments
 - ❖ Criteria
 2. **In other cases**, they use the term in reference to a **larger document** that contains **several sections**, including:
 - An introduction describing the IMP
 - An IMP Matrix/Product Section
 - A Narrative Section
 - A Glossary

Integrated Master Plan (IMP) – IMP Matrix

❑ IMP Matrix is a hierarchy of:

1. Level 1 – program-selected **Events**
2. Level 2 – Significant **Accomplishments** (SAs) required to complete the Event
3. Level 3 – Accomplishment **Criteria** (AC) that demonstrate completion of the Accomplishment

Integrated Master Plan (IMP) – IMP Matrix

- ❑ The **elements** of the IMP Matrix are **not constrained** by **calendar dates**.
- ❑ Each Event is **complete** when its Accomplishments are **complete**.
- ❑ Each Accomplishment is **complete** when its Criteria are **complete**.
- ❑ The format for an IMP can be a **list, spreadsheet table, or narrative document** or any **combination of the three**.
- ❑ Typically, Accomplishment and Criteria level descriptions use **past tense verbs** to describe clearly the **element's completed scope**.

Integrated Master Plan (IMP) – IMP Matrix example

- ❑ One format for an IMP Matrix

IMP Level	IMP ID	Task Name
Event	5.0	[-] Internal Integration & Pre-Qual Test Complete
Accomplishment	5.1	[-] GNC Software Builds Complete
Criteria	5.1.1	[+] GNC Software Build 1 Complete
Criteria	5.1.2	[+] GNC Software Build 2 Complete
Criteria	5.1.3	[+] GNC Software Build 3 Complete

Integrated Master Plan (IMP) – IMP event example

□ Example of event dictionary elements

EVENT	DEFINITION
Post-Award Conference (PAC) Completed	The purpose of this event is to ensure that the contractor's management processes and tools have been implemented and that both the Government/contractor have a common understanding of the program to be executed. The IMP Accomplishments and Criteria and overall schedule will be reviewed, as well as risk status and program metrics. The PAC Event represents the transition from initial post-contract award process implementation and planning updates to a major block of activity related to...
Critical Design Review (CDR) Completed	The purpose of this event is to ensure that the detail design is essentially complete. It will (1) determine that the detail design under review satisfies the performance and engineering requirements; (2) establish the detail design consistency; (3) assess risk areas (on a technical, cost, and schedule basis); and (4) finalize the preliminary item specifications for the subsystems.
Functional/Physical Configuration Audit (FCA/PCA) Completed	The purpose of this Event is to ensure that the contractor has established a baseline design and physical configuration that meets the performance requirements of the program. It includes validation that the development of a configuration item has been completed satisfactorily and that the configuration item has achieved the performance and functional characteristics specified in the functional or allocated configuration identification. It also includes a technical examination of designated configuration items to verify that the configuration item "As Built" conforms to the technical documentation which defines the configuration.

Integrated Master Plan (IMP) – IMP code example

- IMP code (numbering structure)

IMP

<i>E</i>	<i>A</i>	<i>C</i>	<i>Description</i>
A			Event #01
A	01		Accomplishment #01
A	01	01	Criteria #01
A	01	02	Criteria #02
A	02		Accomplishment #02
A	02	01	Criteria #01
A	02	02	Criteria #02

Integrated Master Schedule (IMS)

- ❑ **Anything** that must be **accomplished** (whether by the **owner**, **contractor**, **subcontractor**, **supplier**, **inspector**, or **other party**) in order for the project to be completed.

The schedule should reflect all activities as defined in the program's work breakdown structure (WBS), which defines in detail the work necessary to accomplish a program's objectives, including activities both the owner and contractors are to perform.

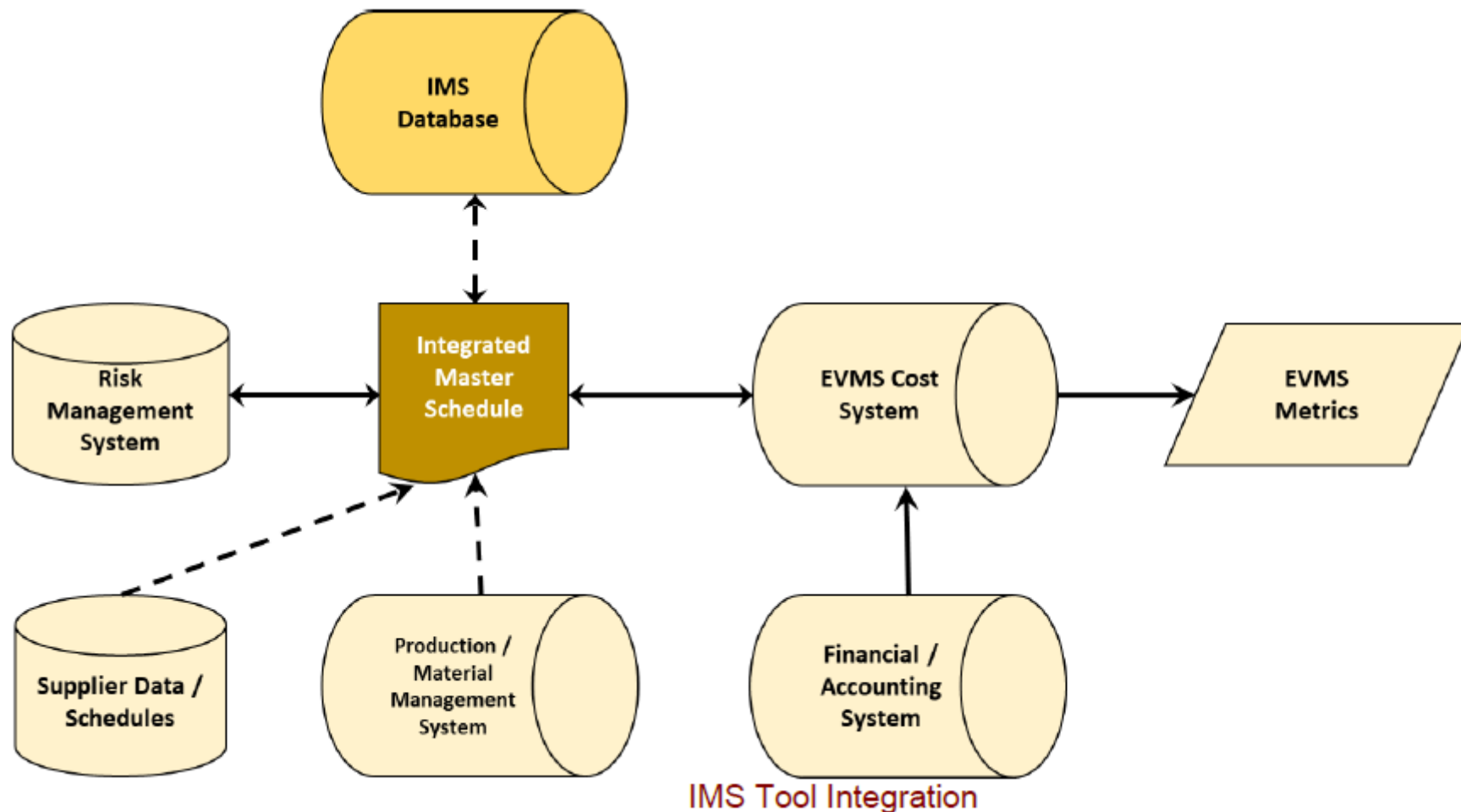
If activities are missing from the schedule, then other practices will not be met.

A program IMS is not simply the prime contractor's schedule

Integrated Master Schedule (IMS)

- ☐ A **contractor project schedule**, as a **subset** of the **overall program effort**, includes only **contractually authorized work**, and limited to, the **contract**.
- ☐ It is the **responsibility** of the **owner's representative** to integrate **all owner** and **contractor work**.
- ☐ **Everyone** who is **affected** by the schedule should clearly **agree on the final actions** that constitute the completion of the program.

Integrated Master Schedule (IMS)



Integrated Master Schedule (IMS) – Milestone, detail, summary, level of effort, and apportioned effort activities

❑ **Planned effort and events** are represented in a schedule by a **combination** of:

- ❖ Milestones
- ❖ Detail activities
- ❖ Summary activities
- ❖ Level-of-Effort activities (LOE)
- ❖ Apportioned effort activities

Integrated Master Schedule (IMS) – Milestone activities

- ❑ **Milestones** are points in time that have no duration but that **denote** the **achievement** or **realization** of key events and accomplishments such as **contract start dates**.
- ❑ **Two important milestones** that every schedule should include are
 1. Project's start milestone
 2. Project's finish milestone
- ❑ **No work** should **begin before** the start milestone, and **all project scope** must be **completed before** the finish milestone.

*For instance, if the scope includes financial closeout, contract disputes, and final payment activities, these should be **completed before the finish milestone**.*

Integrated Master Schedule (IMS) – Milestone activities

*A project plan that does **not emanate** from a **single start milestone activity** and **terminate** at a **single finish milestone activity** is **not properly constructed** and may produce an erroneous critical path.*

Integrated Master Schedule (IMS) – Milestone activities

- ❑ The presence of **too many milestones** in a schedule may **prevent** the proper recording of **actual progress**.
 - ❖ When too many milestones are introduced into a schedule, the **activity sequences** may become **increasingly difficult** to **identify**.
- ❑ If work is represented by milestones, **actual progress recorded** in the schedule cannot be **used** to **forecast the dates of key events**.

Integrated Master Schedule (IMS) – Milestone activities – Example

- Examples of milestones include the start and finish of the design stage, start and finish of subcontractor work, and key hand-off dates between parties.

Activity	Duration	Start	Finish	08/3/2025						
				S	M	T	W	T	F	S
Budget and design complete	0 days	8/8	8/8							

Source: GAO. | GAO-16-89G

Integrated Master Schedule (IMS) – Milestone activities

Add a milestone with a duration

Sometimes a milestone takes time. For example, the approval process at the end of a phase might take a week, so that milestone would need to take place over time like a normal task.

Some instructors have said that since MSP allows to allocate time to the milestone, then milestone could have a duration!

What do you think?

Integrated Master Schedule (IMS) – Milestone activities

Primavera has another approach!



A Milestone has zero duration and is used to mark the start or finish of a major event. [Primavera](#) differentiates between **Start** and **Finish Milestones** in the same way as P3 and SureTrak, where a Start Milestone has a start date and no finish date and a Finish Milestone has a finish date and no start date. This is unlike [Microsoft Project](#), which only has one type of Milestone. Later versions of Microsoft Project allow milestones with durations.

What other references said?

Integrated Master Schedule (IMS) – Milestone activities

Not only the GAO, but also many context like CMAA Time management guideline has said the same thing!

Key milestone dates or durations included in the master schedule should be the basis of the detailed design schedule.

Is it important to distinguish between key milestone dates and key durations?

How about NDIA Document?

Things to Avoid

Program milestones and toll-gate milestones should not be used to represent actual work.
Milestones are only reference points used to monitor a program's progress.

Integrated Master Schedule (IMS) – Milestone activities

PMI CPM Scheduling for Construction Best Practice

Guidelines

Definitions

A milestone is a zero duration activity or event that receives special attention, and is generally used to denote a particular point in time for reference or measurement. Milestones are often used for management summary reporting, and should be capable of validation by meeting all of the items prescribed in a defining checklist as agreed with the stakeholders.

Purpose

Milestones are used to represent significant points in time in a schedule for measurement of progress.

Default Condition

Most contract documents and specifications will require that significant events be reflected as milestones in the schedule.

What are the best practices and recommended practice?

Let's see it from **contract perspective**!

Integrated Master Schedule (IMS) – Milestone activities

Best Practices

The schedule must, at a minimum, include the milestones required by the contract and/or specification documents. A start milestone should represent the start of an activity or set of activities. A finish milestone should represent the completion of an activity or a set of activities.

Recommended Practice

The schedule must include all contractually mandated milestones. Typical contractually required milestones include contract award, notice to proceed (NTP), substantial completion, and final completion. The contract may require certain milestones be shown for payment purposes.

The schedule should include milestones for any interim work start or completion as required by contract.

Other milestones that could be shown are structural completion, building dry-in, mechanical completion, and electrical completion.

A start milestone should represent the start of an activity or multiple activities. Start milestones include NTP and start construction.

A finish milestone should represent the completion of an activity or multiple activities. Finish milestones include substantial completion and final completion.

Key meetings may be shown as milestones in a schedule in lieu of showing them as one-day tasks. Meetings may include pre-installation meetings for specific scopes of work, user group meetings, and design review meetings.

Decision points as required by the contract and scope of the project may also be shown as milestones and may highlight go/no-go decisions.

Integrated Master Schedule (IMS) – Milestone activities

Advisories

All stakeholders must agree to what milestones are to be shown in the schedule and understand what the milestones represent. It is important to use the correct type of milestone, either start milestone or finish milestone, to represent the key event.

Milestones must have a calendar assigned; some specifications will require that milestones be shown on a seven-day, 365-day-per-year calendar. The use of multiple calendars can create issues when analyzing the schedule's critical path.

Some contracts may require that certain milestones have a date constraint assigned. It is important to understand what type of constraint, if any, should be assigned, as the use of constraints in a schedule will impact the schedule calculations. Constraints in a schedule should be limited to those required by contract.

The scheduler must ensure that all logic ties to and from the milestones are correct.

Milestone activities must be properly updated during the schedule update process.

Integrated Master Schedule (IMS) – Milestone activities

Not only the context, but also many schedule specs have said the same thing!

18. Milestone. An activity with no duration; typically used to represent the beginning or end of the project or its interim phases or stages.

UGC Contract specs

- 2.4 The Project Schedule shall be developed with a certain amount of float time. This float, which shall be no less than ten percent of the total duration of the project, shall be presented in a format which facilitates reporting of progress and trends and can be used to identify risk and opportunities, project upcoming activities and forecast project milestones.

Integrated Master Schedule (IMS) – Milestone activities

When a **resource** is assigned to a task, it has some work effort.

According to the formula, $Work = Duration * Units$.

- Typically, the **purpose of a milestone** is **not to accomplish some work**, but to **close some phase** (i.e. a set of tasks under the summary task) or to **check** if those tasks are **really done**.

A milestone is a reference point that marks major events, decision points, or deliverables that a project manager and other stakeholders **need to pay attention to**.

Unlike project tasks, milestones have no duration.

Integrated Master Schedule (IMS) – Detail activities

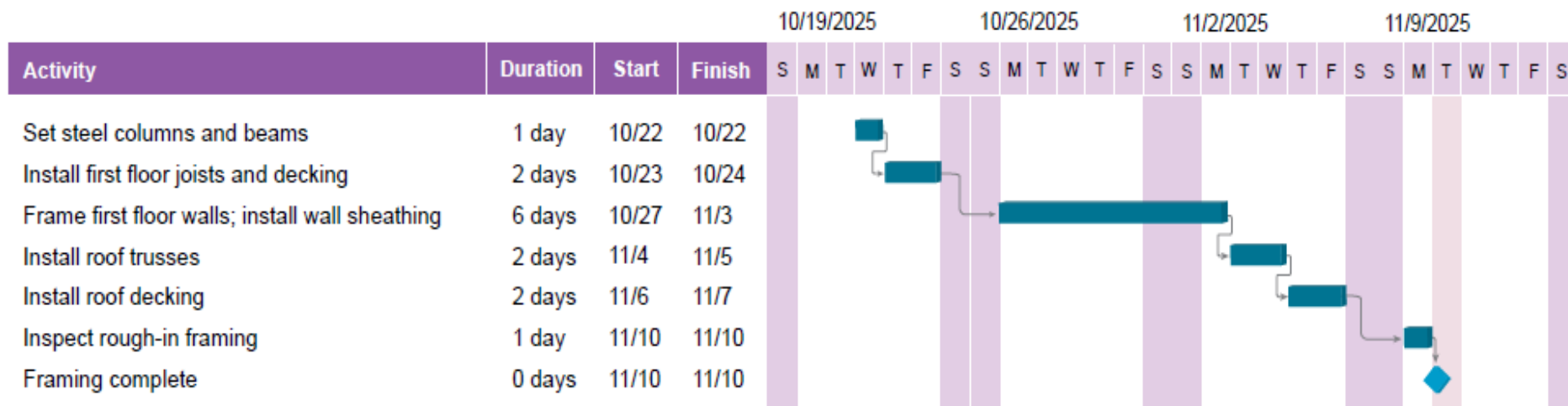
- ☐ **Detail activities** are at the lowest level of the **WBS**.
- ☐ **Detail activities** **represent** the performance of actual discrete work that is **planned** in the project.
- ☐ **Detail activities** are **measurable portions** of effort that result in a **discrete product** or **component**.
- ☐ **Detail activities** are also **logically linked** to other preceding and **succeeding** activities that **must** be **accomplished** to complete the project.

Integrated Master Schedule (IMS) – Detail activities

- ☐ **Logically related paths** of detail activities are **linked to milestones** to **show** the **progression** of work that is planned.
- ☐ Detail activities have an **estimated duration** and are **assigned resources**.
- ☐ The **status of detail activities** is examined **regularly** to **record actual progress**.

Integrated Master Schedule (IMS) – Detail activities – Example

- ❑ This figure shows an example of a sequence of activities necessary to complete **framing in a house construction project.**



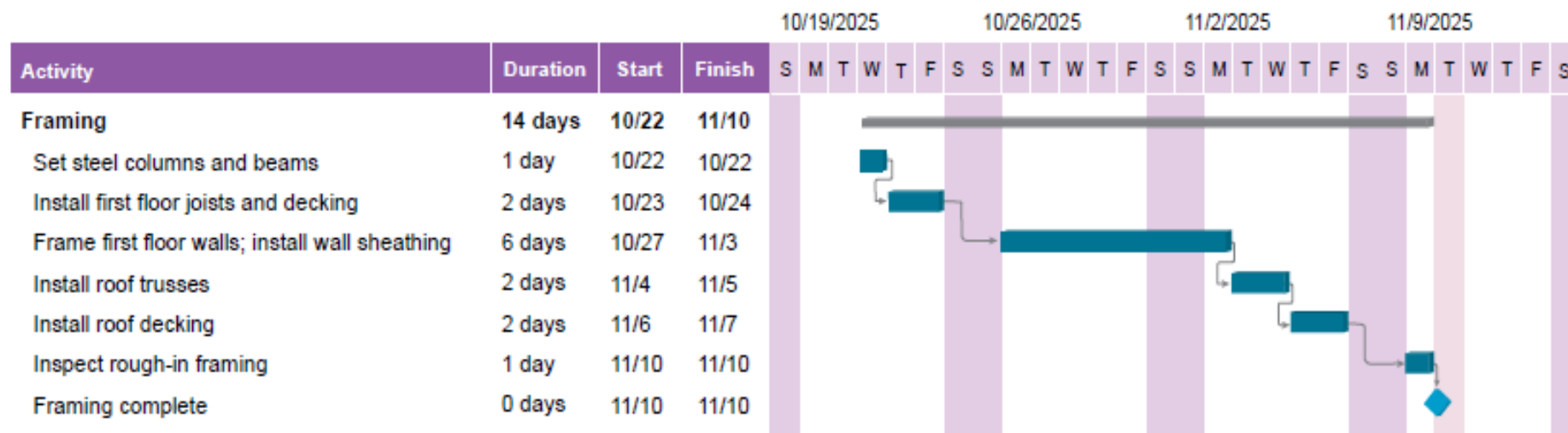
Source: GAO. | GAO-16-89G

Integrated Master Schedule (IMS) – Summary activities

- ❑ Some scheduling software packages include **summary activities** as an **option**.
- ❑ **Summary activities** are **grouping elements** that are useful for **showing the time** that **activities of lower levels of detail** require.
- ❑ **Summary activities** derive their **start and end dates** from **lower-level activities**.
 - ❖ Do not have a **set duration**
 - ❖ **Float** is shown based on the float on the **last activity**
- ❑ Because the **work is done** at the **level of detailed activities**, **summary activities** should **never be linked** to or from **other activities**.

Integrated Master Schedule (IMS) – Summary activities – Example

- ❑ This figure shows a summary activity, **rolling up the time and effort** required to complete framing.



Source: GAO. | GAO-16-89G

Summary activities are used for reporting purposes and can also carry costs and resources

attributed to the portion of the schedule they summarize.

Integrated Master Schedule (IMS) – Level of effort activities

- ❑ Level-of-effort (LOE) activities are **typically** related to management and other oversight that support **detail activities**.
 - ❖ Supportive or general nature
- ❑ LOE activities has **no measurable output** and **cannot be associated** with a physical product or defined deliverable.
- ❑ **Progress** on LOE activities is based on the passage of time.

Integrated Master Schedule (IMS) – Level of effort activities

CMAA Time management guideline

Level of Effort (LOE) – A type of schedule activity whose duration is determined by the schedule program as the number of days between its predecessor and successor activities that can be cost and resource loaded with costs and resources shared by the activities it spans. Its duration can fluctuate based on the movement of the activities it spans. It by itself cannot cause delay an LOE but must be monitored for resource usage.

PMI CPM Scheduling for Construction Best Practice

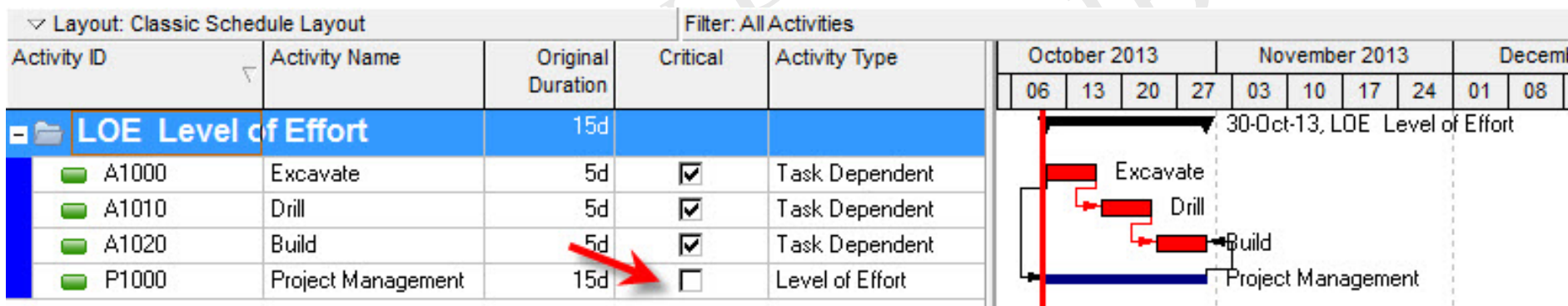
Level of Effort (LoE)—LoE is a type of activity that reports on a fragnet of activities over a period of time. An LoE activity's duration is dependent on the time frame from its earliest predecessor and latest successor activities. The term level of effort is also known as effort activity or effort-driven activity.

Neither the level of effort nor hammock activities should have constraints assigned to them. Level of effort activities are not affected by resource leveling calculations. Level of effort activities should be used to report on a group of ongoing tasks.

Integrated Master Schedule (IMS) – Level of effort activities

❑ Examples of Level of Effort activities include:

- ❖ Customer Meetings
- ❖ Project Management tasks
- ❖ Security



Integrated Master Schedule (IMS) – Level of effort activities

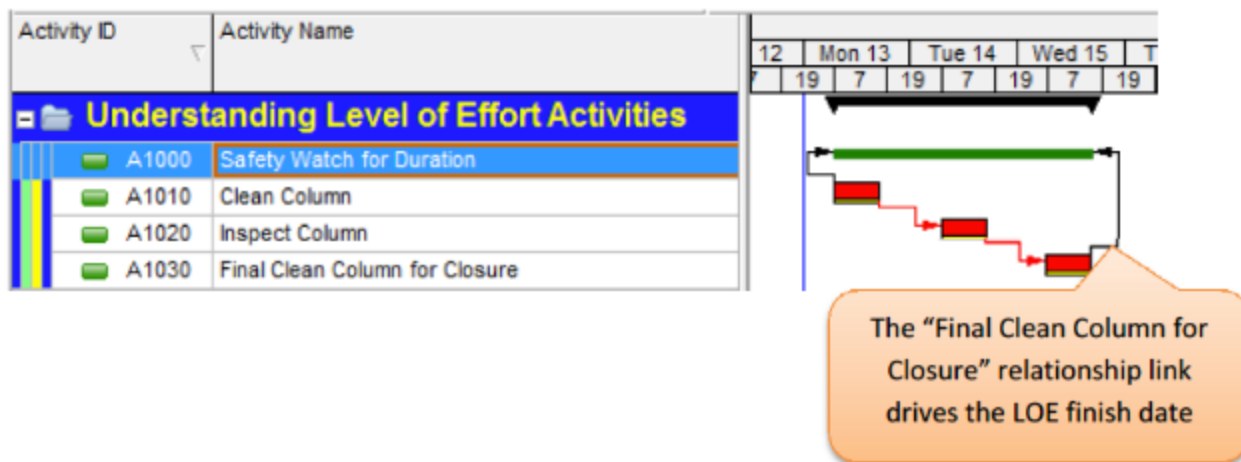
❑ How LOE represented in schedule?

1. LOE is **represented** by summary activities in **certain scheduling software packages**.
2. LOE is **represented** with detailed activities of **estimated long duration** by some schedulers.

In some software, such as MS Project, hammock/LoE activities, called summary activities, are often generated automatically by the software while developing or managing the schedule. These activities should not be tied logically into the network because they are just reporting activities.

Integrated Master Schedule (IMS) – Level of effort activities

How should we link LOE?

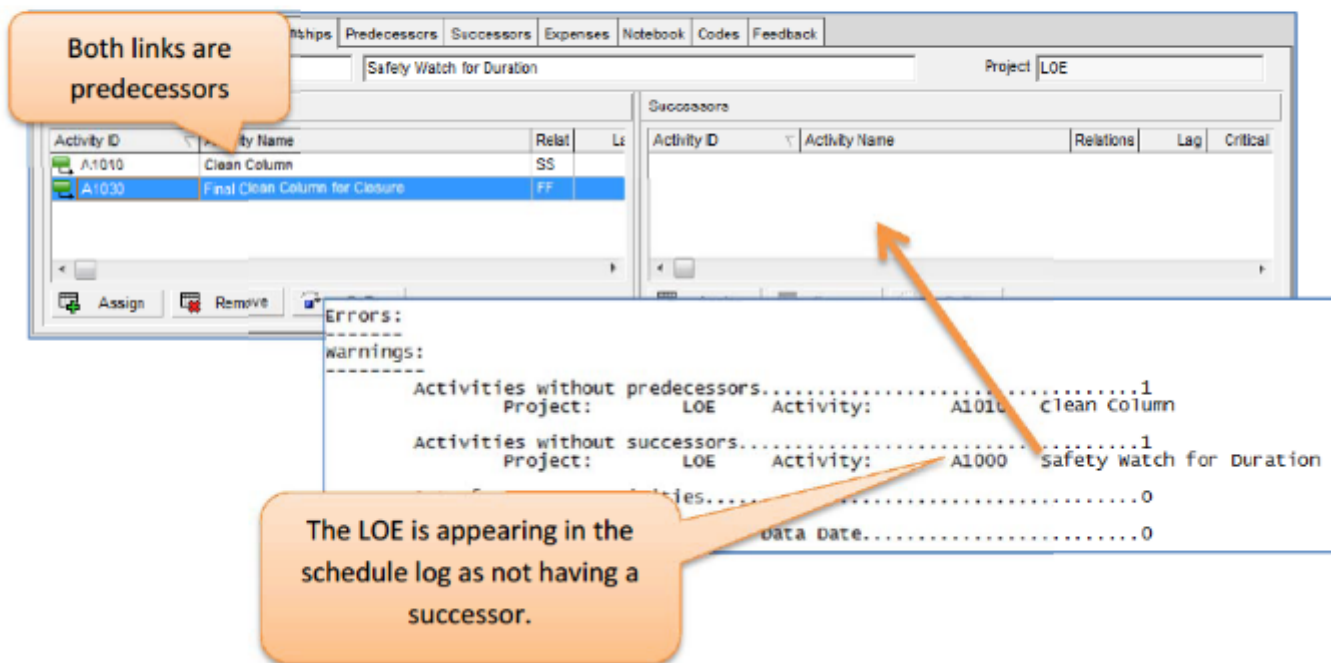


Since a LOE duration is determined by the activities it is linked to, both the LOE start relationship link and the LOE finish relationship link are technically supposed to be predecessors, since realistically both the LOE start and finish are supposed to be driven by other activities. **We are noting this because you may encounter other P6 users that will argue this point.**

What is the problem here?

Integrated Master Schedule (IMS) – Level of effort activities

The problem is that both links are predecessors to the LOE. That being said, there is not a successor assigned, which causes the P6 log file to flag the LOE as being open-ended:



Both links are predecessors

Activity ID	Activity Name	Relat	L
A1010	Clean Column	SS	
A1030	Final Clean Column for Closure	FF	

Successors

Activity ID	Activity Name	Relations	Lag	Critical
-------------	---------------	-----------	-----	----------

ERRORS:

warnings:

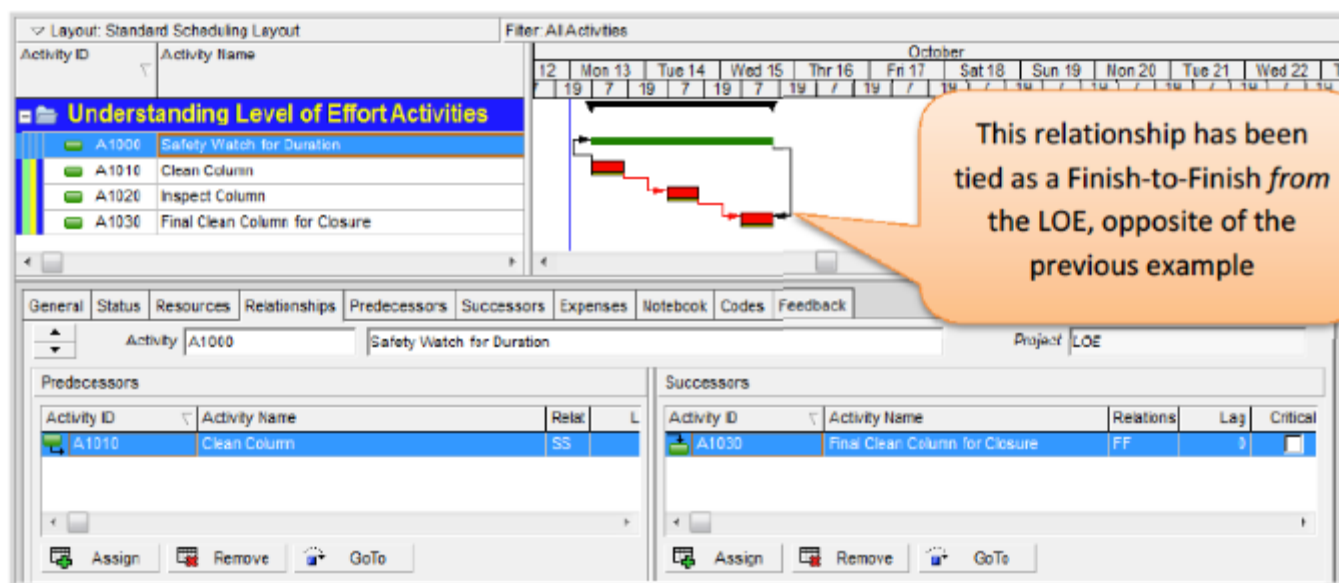
```

Activities without predecessors.....1
Project: LOE Activity: A1010 Clean Column
Activities without successors.....1
Project: LOE Activity: A1000 Safety watch for Duration
  
```

The LOE is appearing in the schedule log as not having a successor.

How to resolve?

Regardless of the technical concept that LOE's must be driven by predecessor links to define both the start and finish dates of the LOE, we at TEPCO recommend a simplistic approach to ensure there is both a predecessor and successor on the LOE:



Integrated Master Schedule (IMS) – Level of effort activities

❑ Important point about **LOE**

- ❖ **Allocation of budget and resources** across the program
- ❖ **Period of performance** to manage efforts
- ❖ **No measurable** output
- ❖ **No schedule variances** on LOE tasking **until after** the package is **complete**
- ❖ **Schedule performance** on these tasks is earned with the **passage of time** in alignment with the baseline distribution
- ❖ Typically used for “**overhead resources and costs**”
- ❖ Should **not assign constraint** to them
- ❖ **Not** included in **leveling**
- ❖ **Any types of relationship** can be assigned

How about **critical path** and consideration in **delay analysis**?

Integrated Master Schedule (IMS) – Level of effort activities

Although including LOE helps to have better resource distribution and budget control, if modeled incorrectly, can cause inaccurate total float and critical path calculations.

HOW?

Integrated Master Schedule (IMS) – Level of effort activities

Can LOE be on critical path?

- ❑ When **represented** as summary or long-duration detailed activities in a fully networked schedule, LOE activities may inadvertently define the **length of a project** or program and become critical.

*LOE activities **should never** be on the critical path because they **do not represent discrete effort**.*

LOE activities should not add any duration to the project

How about WBS?

Integrated Master Schedule (IMS) – Level of effort activities

How about WBS?

Level of Efforts cannot be directly associated with a specific WBS level.

*The **use of LOE** activities allows the schedule to accurately reflect the data in the **WBS** and **EV** systems.*

This is not summary activities. What is the difference?

Integrated Master Schedule (IMS) – Level of effort activities

The only similarity is about summarizing attribute!

☐ Logic

☐ Resource and cost

☐ Float

☐ Update

❖ The Duration % Complete and Units % Complete should automatically update on the LOE. This should **not be considered summarization either**.

Read this article:

<https://tepco.us/2020/06/15/understanding-how-to-use-level-of-effort-activities/>

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

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