Sidewalk and Bus Stop Design

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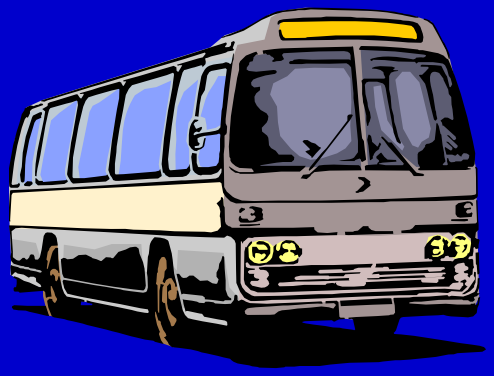
ENCE 667



Project Overview

- Consultants Working For Delaware Department of Transportation (DelDOT)
- Work in Churchmans Crossing Area
- 3-5 Years for All Design and Construction
- Design New Sidewalks and Bus Stops
- Improve Existing Conditions

Project Objectives

- Improve Pedestrian Mobility
- Promote a Multi-modal Transportation System
- Improve Traffic Conditions
- Complete and Connect Existing Networks
- Improve Drainage
- Satisfy Americans With Disabilities Act (ADA)

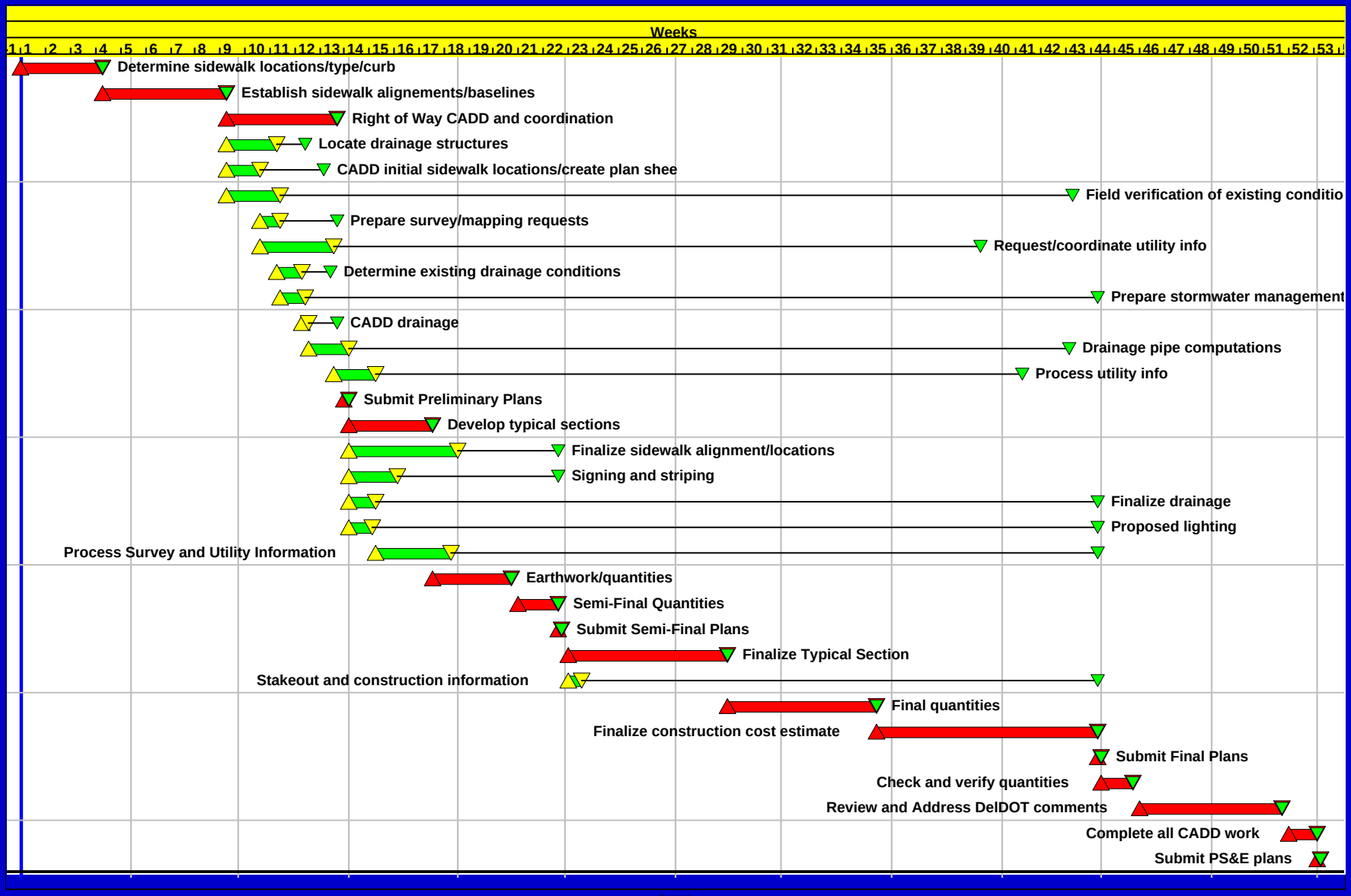
Performance Measures

- Critical Path Method (CPM)
- Project Crashing
- Subcritical Path Analysis
- Lead-Lag (Precedence) Relationships

Develop Base Schedule

- Determine Activities and Their Characteristics
- Create Activity on Arrow Diagram
- Complete Forward and Backward Pass
- Input into Primavera Scheduling Software
- Determine Critical Path and Overall Project Duration

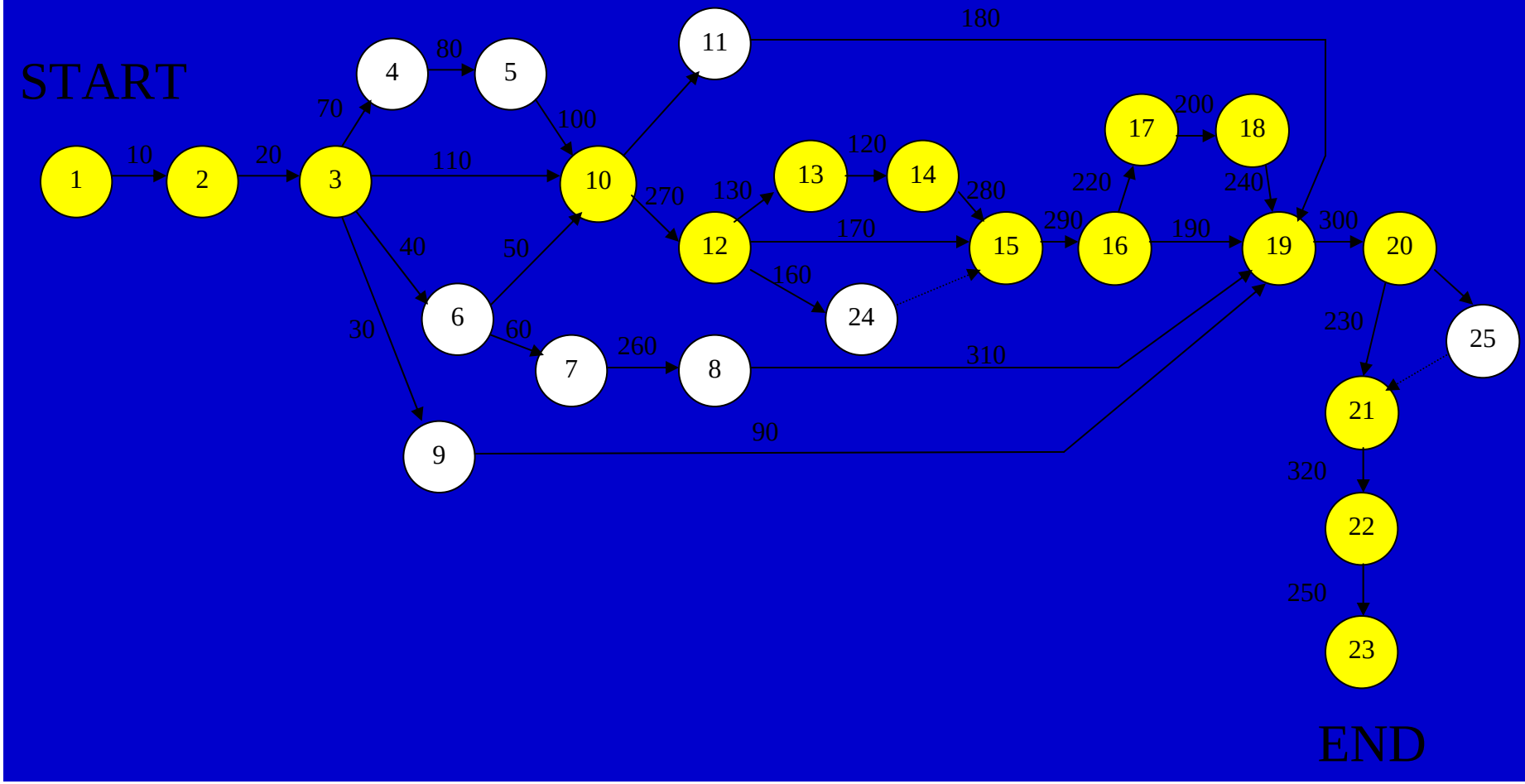
Base Schedule



Critical Path of Base Schedule

- Activities on Critical Path: 10, 20, 110, 270, 130, 120, 280, 290, 220, 200, 240, 300, 230, 320, 210, and 250
- Verified Project Duration of 256 Days and Critical Path in Linear Program

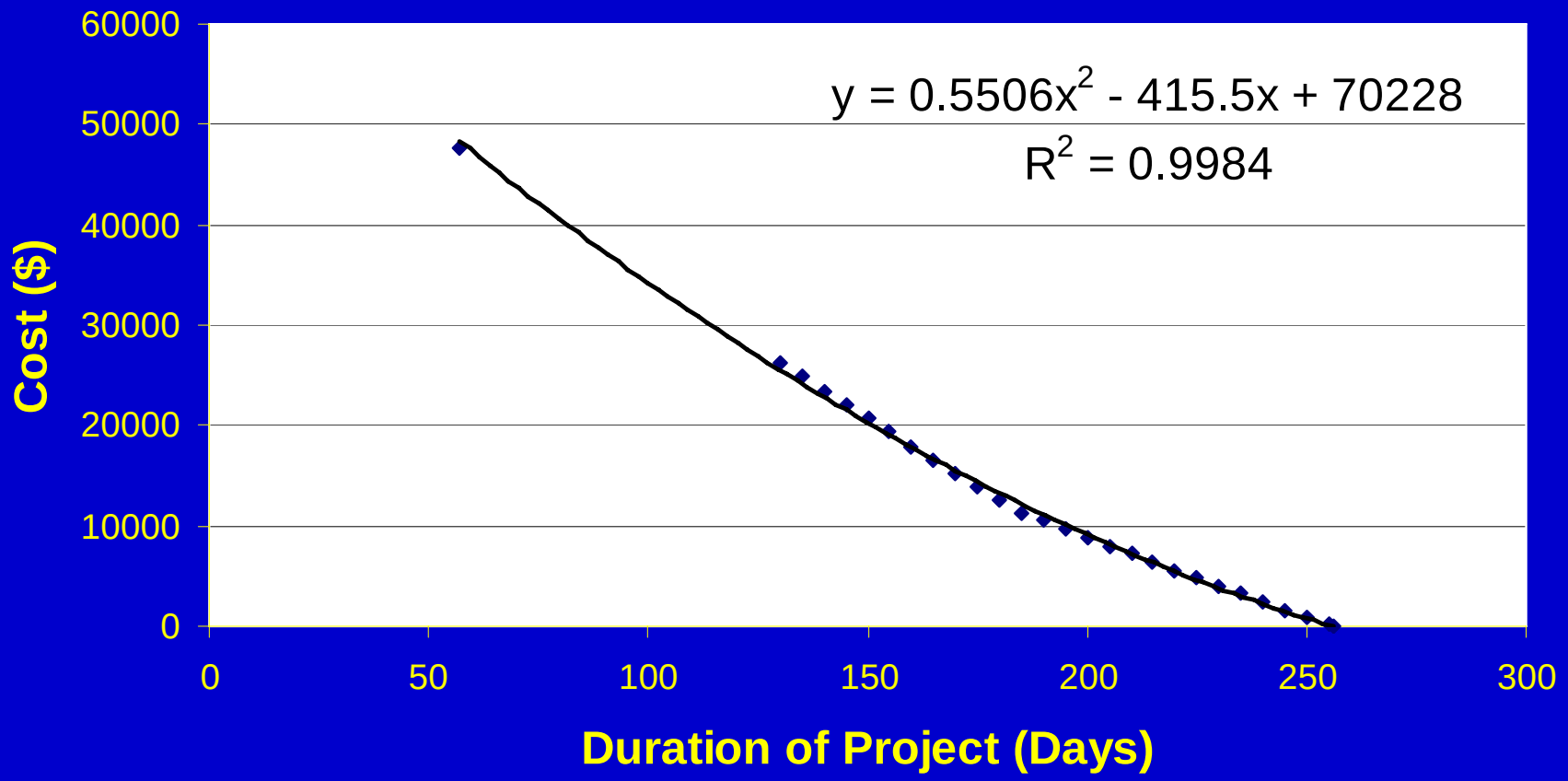
Network Diagram for Base Schedule



Project Crashing

- Modified Linear Program of Base Schedule
- Allowed for 11 Activities to be Crashed
- Could Not Crash an Activity To Less Than 1 Day
- Used Linear Programming to Generate Cost VS. Project Duration Graph
- Minimum Duration of Project = 57 Days

Cost VS. Project Duration



- 220 Days Costs $5600
- 210 Days Costs $7225

Difference = $1625

Subcritical Path

- 20% of Activities Generate 80% of Delays
- Paerto (1848-1923) Analysis
- Quantifies the Criticality of All Project Paths
- Utilizes the Following Equations:

$$\lambda = \frac{\alpha_2 - \beta}{\alpha_2 - \alpha_1}(100\%) \qquad \lambda' = 1 + 0.09\lambda$$

α_1 = the minimum total slack (or lag) in a network
α_2 = the maximum total slack in the network
β = total slack for the path whose criticality is to be calculated.

Subcritical Path Analysis

Path Number	Activities on Path	TS	G (%)	G' (%)
1	*	0	100.00	10.00
2	80, 70, 100	6	96.23	9.66
3	50, 40	12	92.45	9.32
4	170	20	87.42	8.87
5	160	33	79.25	8.13
6	190	103	35.22	4.17
7	60, 310, 260	130	18.24	2.64
8	180, 140	145	8.81	1.79
9	150	146	8.18	1.74

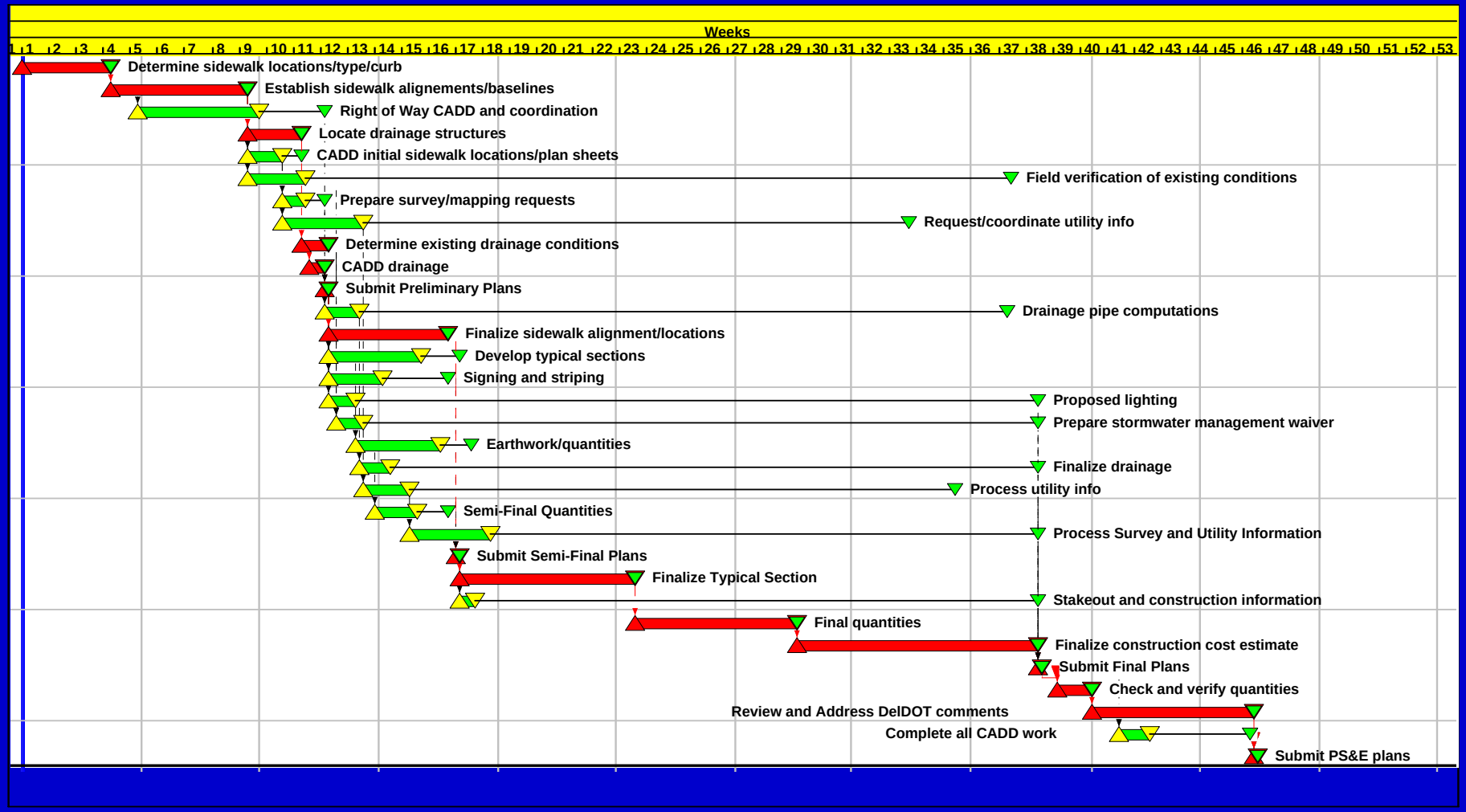
*** Path 1 includes the following activities : 320, 300, 290, 280, 270,250, 240, 230,220, 210, 200, 20, 130, 120, 110, 10**

Lead- Lag (Precedence) Relationships

- Utilizes CPM
- Shortens Project Duration by Allowing Activities to be Completed Simultaneously
- Implement Where Activities Could be Completed Simultaneously
- Shortened Project Duration from 256 to 224 Days (Saves 32 Days)

Example :Activity 110 can begin 5 days after activity 20 starts. Allows adequate time for initial SW & BS locations to be developed so that Right of Way can begin working

Modified Schedule With Lead-Lag Relationships



Future Work

- More Detailed Version of Schedule
- Implement Multi-Project Scheduling
- Resource Allocation
- Probability Analysis of Activity/Project Durations

Any Questions?