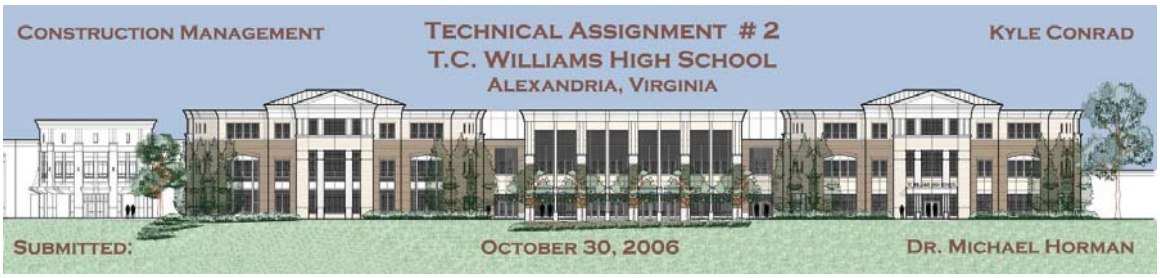

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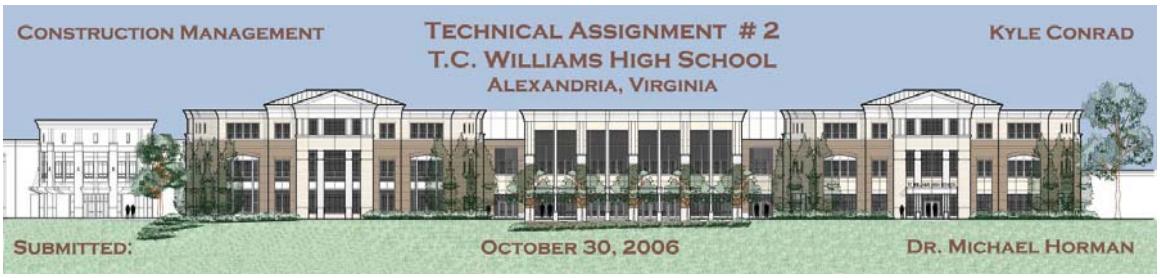


A. Executive Summary:

Technical Assignment #2 delves into the cost and methods for the construction of the T.C. Williams High School building systems. The detailed project schedule reveals a 37 month duration from project start-up and initial interim classroom mobilization in August of 2004 through the final completion of the high school facility in July of 2007. After analyzing the schedule activities for the construction of the superstructure, a clear progression of work flow was revealed and has been presented in the technical report. The strategic planning of the site logistics attempts to minimize the complications and delays that arise from site congestion.

An assemblies estimate addresses the cost of the mechanical systems that supply air to 445,370 square feet of conditioned spaces. R.S. Means was referenced to generate the $6,302,000 estimate for the multiple and single zone air handling units along with the system of fan coil units. The quantity takeoff of the structural steel members, designed for the construction of the high school, uncovers a complex assemblage of various steel shapes and sizes that increases the potential of construction errors and delays. In order to prevent construction delays, a heightened level of management is required to organize the erection of the structural steel. If the erectors do not have access to the appropriate members during the sequence of erection, the activity experiences delays. The general conditions estimate incorporates the project duration with the staffing plan of the general contractor and the application of site specific requirements, established through the site layout planning, to generate a cost for materials, equipment, and labor accrued by the GC. At 7.46% of the overall project cost, the general condition costs were estimated at $6,710,508.

B. Detailed Project Schedule:

Hensel Phelps employed the use of Short Interval Production Scheduling [SIPS] to manage the construction of the classroom towers at T.C. Williams High School. In SIPS, the schedule activities are established through a detailed investigation of the construction processes and building layout. The building is zoned into manageable construction blocks through which the trades flow in a sequence and predetermined unit of time. Crews are balanced based on the duration required to complete individual activities within the designated blocks. SIPS is effective in highly repetitive structures. T.C. Williams was divided into seven areas, three of which were subdivided into blocks to facilitate SIPS **(see Table 1 below)**. Refer to **Appendix A** for a detailed project schedule.

T.C. WILLIAMS CONSTRUCTION AREAS		
AREA	**DESCRIPTION**	**SIPS**
1	NE Tower	✓
2	Center Court	
3	NW Tower	✓
4	Kitchen Wedge	✓
5	Gym Wing	
6	Mechanical / Electrical Wedge – Auto Strip	
7	Auditorium	

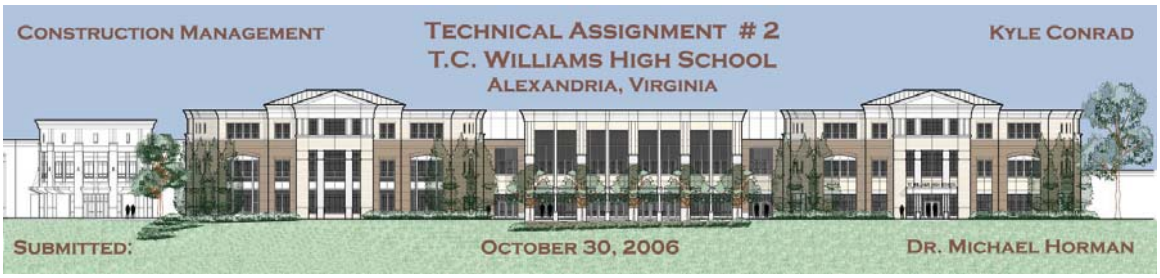
Table 1. Scheduling Areas for T.C. Williams High School

C. Site Layout Planning:

Access to the site can be obtained through any of the five gates in the site fence. The two gates along King Street are primarily for steel and concrete deliveries while the majority of construction materials are delivered through the main staging area gate at the entrance to the Chinquapin Drive loop. Trucks either exit through the gate from which they entered or drive though the staging area and exit onto the one-way Chinquapin Drive loop. Limited access roads are provided for contractors to move materials around the East and South sides of the structure.

The work flow for the erection of the superstructure commences in the kitchen wedge (Area 4) and progresses through the auditorium (Area 7) and along the Northwest classroom tower. Concurrently, the masons are constructing the CMU load bearing walls in the gymnasium and auto/mechanical/electrical wings (Areas 5 and 6 respectively). Afterwards, the steel joists are set in areas 5 and 6 and the erection of steel continues through the Northeast classroom tower (Area 1). Area 2 (the center court) contains the final sequences of the superstructure erection. The mobile crane was able to perform the majority of its structural steel picks from within the unobstructed center court area. As area 2 is constructed, the crane can back its way out from between the classroom towers as it positions the final steel members of the superstructure. Refer to the site layout plan **(Appendix B)** for clarification on the superstructure phase of work and traffic flow.

At the Northwest corner of the Northwest classroom tower, a concrete pump has been set up to ensure the ease of access for concrete trucks. Since the construction of Area 3 starts at the South side of the tower, the concrete is pumped along the structure and rises at the Southwest corner of the tower. Due to the long run of pipe, a relay pump may be required to force the concrete to the third floor for placement. The portable toilets and dumpsters have been strategically located on site to accommodate the construction personnel while maintaining their accessibility for waste removal trucks. Also, the man and materials hoist has been setup to provide a vertical form of transportation to an arterial corridor on second and third floors that runs East to West along the Area 1, 2, 3, 4, and 7 boundary lines out into the section of the gymnasium wing (Area 5) that occupies multiple stories.

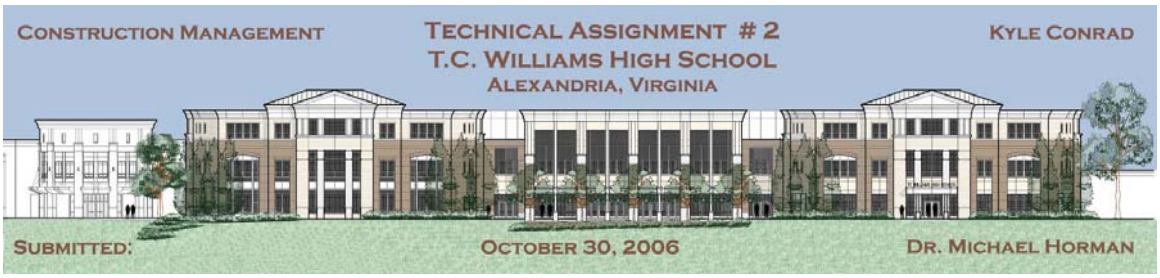


D. Assemblies Estimate:

The 2006 edition of the R.S. Means Assemblies estimating guide was used to generate an estimate for the HVAC systems in T.C. Williams High School. A combination of fan coil units and multiple/single zone rooftop and indoor air handling units service 445,370 square feet of conditioned spaces. The estimate summary is presented in **Table 2** below and the detailed calculations are included in **Appendix C** along with the tables used to calculate the square footage of conditioned space zones. Since T.C. Williams High School has several different mechanical systems servicing various areas of the building, a detailed investigation was performed into the coverage areas of the specific systems. The difficulty arose in selecting the appropriate R.S. Means systems to represent the systems specified for T.C. Williams. The fan coil, multiple-zone, and single-zone units were estimated using systems D3030 115, D3050 155, and D3050 150 respectively. Unfortunately, R.S. Means performs HVAC estimates based on packaged units whereas the facilities actual HVAC assemblies were built-up air handling units with higher quality equipment. Since the specified equipment for the T.C. Williams High School project was unable to be located in the R.S. Mean Assemblies manual, the calculations result in an inaccurate estimate that errs on the low side. However, the boilers and unit heaters were selected from within systems D3020 106 and D3010 530 respectively.

HVAC Systems Assemblies Estimate			
System	**Sq. Ft. Coverage**	**Cost/sq. ft.**	**Cost**
Multi-Zone Units	355,199	15.93	$5,659,705
Single-Zone Units	67,737	10.02	678,645
Fan Coil Units	22,434	11.13	249,665
Boilers	-	-	90,100
Unit Heaters	-	-	4,214
Subtotal:	445,370	15.00	$6,682,329
Alexandria, Virginia City Adjustment:			0.943
TOTAL (rounded):		**14.15**	**$6,302,000**

Table 2. Summary of 2006 R.S. Means Assemblies Estimate for T.C. Williams High School



E. Detailed Structural Systems Estimate:

Waiting on column schedule or steel shop drawings to complete quantity take-off and perform estimate.

F. General Conditions Estimate:

Once Hensel Phelps mobilized on-site in December of 2004, the field and office personnel were staffed on-site full time throughout the entire 32 month project. During the five months of value engineering, interim classroom work, set-up of temporary classroom trailers, and project start-up prior to the December mobilization, the project manager, project engineer, scheduler, and office engineers committed 100% of their time to the T.C. Williams High School Replacement Project. The general and project superintendents only devoted 60% of their time prior to the site mobilization. Even though the entire staff will continue with the parking garage phase of the project (phase B) after the high school is complete, one month has been added to the general conditions estimate for the project manager, project engineer, and office engineers to compensate for project close-out activities at the conclusion of the project. A summary of the general conditions estimate **(found in Appendix E)** has been provided in **Table 3** below.

CATEGORY	COST	% TOTAL PROJECT COST
Material	$ 376,625	0.42 %
Equipment / Sub.	$ 1,692,338	1.88 %
Labor	$ 4,641,546	5.16 %
Total GC:	**$ 6,710,508**	**7.46 %**
Total Project:	$ 90,000,000	100.00 %

Table 3. General Conditions Estimate Summary for T.C. Williams High School Project

Since the cranes are being supplied by the structural steel erector and mechanical contractor, a general conditions estimate would typically range between 7 to 10% of the total project cost. If the estimate is performed correctly, the labor of the general contractor's personnel will occupy the majority of the general conditions costs. The general conditions estimate for the T.C. Williams Replacement Project coincides with both of the aforementioned rules of thumb.