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CHAPTER II

In America

For us here in modern America, enjoying the world's highest standard of living, it may be well to ponder a little on the reasons so many natives of European countries set out to make a new home for themselves in the countries of the west. Their reasons were many and varied, as the historians show. Some came because of religious persecution; others came to escape oppression by their rulers; while others, whom the world always has in great numbers, came seeking adventure. Whatever the reasons, they came, saw what was here, and through the years conquered. The marvel of it all would seem to be the welding of so many diverse elements into one country that has risen to the pinnacle of world leadership that is now the proud characteristic of the United States. And how did this come about? We must remember that the people who left their European homes to settle a new world had habits, customs, and religions of their own, each according to his country.

Even in the field of education we know that there was a great difference in methods and results. In Europe in the early days, and even in more modern times, the apprentice system was widely used. The Germans were noted particularly for this method of teaching trades and occupations to its youth. This fact carries a great deal of significance for modern technical education in the United States. Another important consideration, and a factor which probably had a great influence on engineering education of the present day, is the large number of prominent Americans of Colonial times and later who had some knowledge of engineering. In an uncharted world where millions of square miles of new territory had to be explored and developed, it is not to be wondered at that so many early Americans had a wide knowledge of pioneer engineering, surveying in particular. The most prominent that first comes to mind is George Washington himself. Most of us will recall reading that in his early days he completed much valuable surveying work in Virginia—in particular his survey of the vast Lord Fairfax estates--

and determining the exact boundaries of the land was a real undertaking.

The following extracts and excerpts are from Volume I, GEORGE WASHINGTON, by Douglas Southall Freeman, and some seem to be extremely pertinent and are made available by the courtesy of Mr. Allen P. Richmond, Jr. of the American Society of Civil Engineers:

"Describing the contents of his home at Ferry Farm in early youth, Freeman says: '...to George's eyes, doubtless, none of these things was comparable in interest to a tripod and certain boxes that Augustine Washington (father) himself had put carefully away in their appointed place. These were the surveying instruments which, with the rifle and axe, were the symbol of the extending frontier.....'"

"The Surveyor General was an appointee of the King or of the Governor until 1693. After that year the Visitors of the College of William and Mary discharged the functions of the office and

appointed as many Surveyors as the Governor and Council thought 'necessary and convenient.' A qualified Surveyor could work anywhere in Virginia, but usually one such official was designated for each County, with authority to appoint deputies for whom he was responsible. Over all these men the General Assembly held a rein, because it fixed their fees. Their discharge of their duties, moreover, was under the general direction of the Governor and his official advisers. Compensation for each survey rose steadily through the years but the total reward for a year's labor of course varied according to the activity in the patenting or transfer of land in a given County....'"

"The means of advancement were at hand. In the storehouse at home were the surveyor's instruments that had belonged to George's father. Across the river in Fredericksburg and elsewhere in the neighborhood lived men who knew how to use the surveyor's compass. Every County had its Surveyor; some of these men had deputies. From one or more of these officials George quickly

learned in 1746-47 the elements of surveying and began to run lines at Ferry Farm or on the plantations of his kinsmen. The work entranced him. He could not do enough of it. By August 18, 1747, and perhaps before that date, when fifteen years and six months old, he had attained to the required standard of accuracy on simple assignments. Within a few weeks he was deft and soon proficient on surveys that were not unduly complicated. Probably as some friendly Surveyor's deputy he was compensated, though perhaps at less than the regular fee. One batch of his surveys at the beginning of October brought the boy £2, 3s. This was in cash, not in tobacco notes. The law specified the fees in terms of tobacco but George got cash when he could. It was welcome coin to a boy who already had money-making as one of his ambitions. Surveying not only had interest and yielded a profit, but it also offered excellent training. A good Surveyor had to be accurate and thorough. As George wanted to excel in surveying and in everything else he undertook, he painstakingly gave neatness and

finish to surveys he made with the fullest care he knew how to display. (For these statements no specific source can be cited, but the supporting, inferential evidence is strong and clear in every surviving record of George's youth.)"

"Shortly after his 16th birthday 'Chance now offered George, in the spring of 1748, an opportunity.... A surveying party was about to start for the remote South Branch of the Potomac.... James Genn, a veteran Surveyor, was to be in charge; the Proprietor was to be represented by George William Fairfax. Chainmen and other helpers were to be recruited on the frontier. If George cared to do so he could go with the party. In the work he would find training and a measure of just such adventure as the heart.... He probably was told that he might be allowed to do some of the surveying....."

".....their expedition to the (Shenandoah) Valley....could be written down as compassing the most useful thirty-three consecutive days that George had ever spent. Doubtless he had acquired

more of profitable knowledge in like time spent in his first surveying lessons, but he had learned gradually the elements of the surveyor's art....."

"the success of George in his application for the surveyorship of Culpeper. On the last day of July, (1749) he completed the long ride to the temporary quarters of the Court and presented his commission from the President and Masters of the College of William and Mary, who alone could commission County Surveyors. As this document was in proper order, George was directed to swear allegiance to the person and government of the King. Then, under oath, he disclaimed all allegiance to the issue of James II, or anyone professing descent from James. Next George took the 'test oath' of non-belief in transubstantiation, and finally the special oath of Surveyor, 'that he (would) truly and faithfully to the best of his knowledge and power, discharge and execute his trust, office and employment.' Being sufficiently sworn, George proceeded immediately to exercise his new authority. He surveyed 400 acres

in Culpeper for Richard Barnes of Richmond County on July 22 and received promptly his fee of £2,3s.....!"

"'.....As a qualified County Surveyor, he could work anywhere he was engaged.... Work began on 2nd of November, 1749.....!"

Certainly the retreats across New Jersey, the victory at Trenton, the hardships of the Valley Forge winter, and the final realisation of victory on the peninsula at Yorktown all combined to emphasize a military genius that was supplemented by a quality of precision and accuracy in all things. And it requires no stretch of the imaginative processes for us to feel that Washington's early training in the art of surveying contributed mightily to the planning and successful carrying out of his military campaigns.

It's also interesting and worthy of note that George Washington had a very considerable part in the development of the western country through and because of his interest in highways. From the east to the west, that is, from the eastern seaboard to the region in western Pennsylvania where the Allegheny and the

Monongahela Rivers formed to join the Ohio, it was first the Pennsylvania Road which is described in the "PUBLIC ROADS OF THE PAST" published by the American Association of State Highway Officials:

"The Pennsylvania Road was the main trans-mountain route of the British Colonies in America because the Province of Pennsylvania was situated geographically so as to provide the shortest path over which our forefathers could pursue their primary objectives—a north-west short cut to China—while expanding their secondary objectives—home in the wilderness and trade with the Indians and the mother country. The pre-historic Indian Trail, known as the Allegheny Path, which slowly developed into the Pennsylvania Road, began at the Delaware Chief Shackamaxon's Indian village, on the site of the present city of Philadelphia, and rose and fell across the successive mountain passes and valleys to the junction of the Allegheny and Monongahela Rivers, and beyond."

Further, the same publication has this to say:

"In 1753 Washington crossed the Allegheny. In the wilderness

far removed from the frontier settlements there were no canoe ferries at river crossings. Woodsmen improvised^c crude log rafts built from the forest trees. The logs were bound together with withes-- slender flexible branches of willow or osier. This river crossing was the sequel to the action of a French army which had invaded the Allegheny River valley from Canada for the strategic purpose of gaining control of the Ohio River region so as to confine the British colonists to the narrow territory east of the Appalachian Mountains. Immediately upon learning of the invasion Governor Robert Dinwiddie of Virginia decided to challenge the bold attempt to seize territory claimed by the British Crown. His first problem was to find a suitable courier to carry an ultimatum across hundreds of miles of forest wilderness intervening between the Virginia settlements and Fort Le Boeuf (Waterford, Erie County, Pennsylvania), the nearest French outpost. Governor Dinwiddie solved the problem by choosing the 21-year-old Virginian who later became 'The Father of his Country.'

"Major Washington set out from Williamsburg, Virginia, on

October 31, 1753. Proceeding to Will's Creek (Cumberland, Maryland) at the outskirts of the settlements, Washington employed as his guide the experienced woodsman, Christopher Gist. With four other companions the pair left Will's Creek on November 14 and followed the Delaware Indian Nemacolin's trail as far as Gist's plantation. Thence they rode their horses over the Catawba Trail and the Raystown Path to the Delaware Chief Shannopin's Indian town (Pittsburgh, Pennsylvania) where there was a crossing of the Allegheny River on the 'main road' from the Susquehanna River to the Ohio country. A considerable portion of this trail followed the subsequent location of the National Pike, now United States Route 40. They swam their horses across the Allegheny River and encamped for the night on the north side, probably at the foot of the present Monument Hill. Washington found the forks of the river well situated for a fort commanding the approaches from both the Allegheny and Monongahela Rivers. The hardy travelers continued their journey through Venango to Fort Le Boeuf near Lake Erie where Major Washington delivered

Governor Dinwiddie's note of warning to the French Commandant Lagardeur de St. Pierre. The French officer's courteous but firm rejection of the message was an incident leading to the outbreak of the French and Indian War.

"Leaving on December 16, 1753, for the return trip, Washington and his party paddled down the river in a French canoe to Venango where they arrived on December 22. Here the French induced the Indian helpers to desert. Washington and his white companions pressed forward on horseback. After three days progress was so slow that Washington decided to relinquish the horses and baggage to the custody of the interpreter, Van Braam. The resourceful Major struck out on foot with Christopher Gist by the most direct route homeward through the woods. Arriving at the northerly bank of the Allegheny River on December 29, they hastily assembled the crude raft of logs and poled across to the island (Herr's) in the river above Shamokin's Town. On the way over Washington fell into the icy waters but saved himself from drowning

by clinging to the raft. They thawed out the Major's clothes and Gist's frozen fingers that night beside a camp fire lighted upon the island. The night was so cold that the surface of the river was frozen thick enough by the next morning to enable them to walk the remaining distance to Shannopin's Town across the ice. Thence the sturdy couriers tramped to John Fraser's place at the mouth of Turtle Creek. Major Washington returned to Williamsburg, Virginia, on January 16, 1754, and delivered to Governor Dinwiddie the refusal of the French commander to heed the warning. Washington's straightforward journal of the expedition, published at the order of the Governor, attracted favorable comment both throughout the Colonies and in the mother country across the sea."

Then we hear again of Washington in connection with Braddock's Road. It is interesting to note that Major George Washington was a military aide to General Braddock.

Benjamin Franklin¹ was another of the early Americans who

1 - FRANKLIN, BENJAMIN - 1706-1790 - American statesman, printer, scientist, and writer.

interested himself in science. In his autobiography Franklin tells of his experiments with a kite in Philadelphia which he sent aloft in an effort to show that electricity and lightning had the same properties. Probably best known for his work in Europe in securing French assistance in the early fight for the freedom of the American colonies, Franklin was also a pioneer scientist. Reports of his electrical experiments were sent to Europe, and referred to very often by European scientists as the "Philadelphia Experiment." At first highly skeptical of this unheard of principle, European scientists repeated these experiments and Franklin's conclusions were verified.

Alexander Hamilton¹ became famous as the first Secretary of the Treasury; but it must be appreciated that Hamilton's talents were many-sided. He might aptly be termed the first great American industrial executive, for his was the vision that in 1791 created the Society for Establishing Useful Manufactures. He recognized

1 - HAMILTON, ALEXANDER - 1757-1804 - American statesman and financier.

that the hard won independence of our new nation had to be developed to the point where the nation could be independent of the old world for manufactured goods. This could only be brought about by the young country's establishing its own plants and factories for producing a wide variety of goods. Hamilton's ideal was a vast emporium, equipped with every conceivable type of machinery, and employing thousands of workers; and the site selected was in our own New Jersey, at Great Falls, in the Passaic Valley. As might be expected there were many obstacles in this development. Ultimately it did get under way, but not on the magnificent scale that Hamilton envisioned. Nevertheless, it was the start of a manufacturing area in northern New Jersey which has stood unrivaled for many years for the quality and variety of its products. Alexander Hamilton owes most of his renown for his work as Secretary of the Treasury; but no one can deny that he possessed all the attributes of a modern industrial engineer.

Some time later Ulysses S. Grant, Commander of the Union Forces during the Civil War, showed that he had a good knowledge

of engineering, as witness his campaigns that owed a great measure of success to his knowledge of fortifications and canals and military works of both attack and defense. His campaign before Vicksburg and the construction of docks and canals seem to confirm the fact that he studied the efforts of some of the earlier engineers, as previously mentioned.

Even Abraham Lincoln spent some time in his youth as a surveyor, and we know of at least one instance where he completed satisfactorily a large surveying job in Illinois.

Another famous name in engineering in years after Washington, Franklin, and Hamilton, and contemporary with Ulysses S. Grant, is that of Robert E. Lee. The famous Commander of the Confederate Armies in the Civil War who, by some authorities, ranks in military genius with Napoleon, Hannibal, and Alexander, was an engineer.

A graduate of West Point with very high honors, he was assigned to the Corps of Engineers, United States Army. He designed a program for deepening and removing obstructions for the Mississippi River

near St. Louis.¹ Generals Zachary Taylor and Winfield Scott, Commanders of the American Armies in the defeat of Mexico, had Lee with them as a Captain in charge of engineering plans for attack and defense. In their reports to the War Departments both Generals gave full credit for the successful conclusion of the campaign to Captain Robert E. Lee. The world, of course, knows the valiant fight he later made for the cause of the Confederacy, culminating in the surrender on that sad spring day at Appomatox. Those of us in engineering, education, and industry may well reflect on this man and the credit he brought to our honored profession.

All of this is just by way of indicating that engineering has always been closely allied with the welfare of the people on all levels and has been particularly necessary not only with respect to the "hewing of wood and the drawing of water," but has had a part, and a very important part, not only in wars but in

1 - R. E. LEE, A BIOGRAPHY, Vol. I, Douglas Southall Freeman
Charles Scribner & Sons, 1935

the field of civil life as well. The designing of structures or projects for the benefit of mankind has been a necessary and a constituent part of our development from the beginning. Its importance is often underestimated because it is not known and it is rather strange to us here in America to realize that George Washington, Thomas Jefferson, Abraham Lincoln, Alexander Hamilton, all leaders in the development of our democracy, have had considerably more than a casual interest in engineering.

To be sure that type of engineering was not the type we see on the ascendancy today. It was an engineering which characterized the needs of a pioneering people whereas today we are interested primarily in the engineering which has to do with a rather highly developed and perhaps artificial civilization.

It is, however, to be observed that in building a democracy—a republic—the national welfare of the people was and still is of paramount importance. Things of the body as well as things of the mind and the spirit are important. In building our country in the

early years our leaders had to in some sense be engineers, seeing to it that human bodies were clothed and sheltered and human beings were not starving or even hungry.

So we must keep up this work if the world is to go on.

As previously pointed out, it is our object in these pages to try to convey some impressions of early engineering, mention a few of the most noteworthy individuals in the arts and sciences, and to show how many people, famous in other fields, made definite contributions to the progress of engineering. Our ultimate aim, of course, is to help the reader try to understand that technical education in America, and the founding and development of the Newark Technical School and Newark College of Engineering in particular, did not come about by accident. And so on to Newark at last.