CHAPTER I

Background

The Imjin River, a tributary of the Han, flows in a meandering course a short distance south of a 25-mile-long stretch of the stabilized main line of resistance of the United Nations Forces in western Korea. Its presence close behind the line, between the front line troops and their sources of supply (and in some cases their artillery), greatly enhances the importance of the crossings available.

Seen for the first time during normal weather conditions, the Imjin is not a particularly impressive river; it can be forded easily in many places. Its active channel utilizes only about 150 to 200 feet of the 1,200-foot width of the dry riverbed, which is bordered by almost vertical rock cliffs standing approximately 75 feet above the mean low water level. It gives no indication in normal times of the tremendous power it develops when in flood.

During the Korean rainy season of July and August, the Imjin becomes a raging torrent, largely confined by its steep rocky banks. Fed by its larger tributaries and many small mountain streams, it reaches flood heights of 48 feet above mean water level and a velocity of 15 to 20 feet per second. The rapid runoff of approximately 95 percent of precipitation during heavy general rains has caused the Imjin, on occasion, to rise at a rate of more than six feet per hour.[1]

In addition to these extreme variations in the amount and speed of the water, the riverbed itself shifts and changes with each seasonal flood. The sand, gravel, silt, and boulders, which form the movable material (overburden) in the river bottom, are scoured out of their resting places by the force of the flood and deposited again wherever the eccentricities of the river currents dictate. Specific information as to the degree and nature of the movement of the Imjin River's overburden is not available. However, the experience of Japanese and Korean bridge builders, and that of the Corps of Engineers after two years in Korea, indicates that the overburden is unstable to a depth equal to the depth of the water in the stream, or to bedrock, whichever is less.[2]

During the severe Korean winter, icy winds sweep down the Imjin; the sub-zero temperatures cause thick ice to form on the river. Fluctuations in the level of the river, particularly tidal action in the lower reaches, break up this ice, and large amounts of floe ice pile up against any obstacle in the channel. The destructive force exerted by the floods and ice of the Imjin has made the task of the engineers responsible for building and maintaining bridges on the Imjin a most difficult one.

During the flood season (1 July to 15 September) and the ice season (15 December to 25 March), floating bridges cannot be used because they cannot stand the unusually strong force of the water or the pressure of the ice. Neither can ordinary military bridges of the rigid type withstand the pressure of the Imjin flood plus the impact of tons of debris, including parts of our own and enemy washed-out bridges which come floating down at high speeds.[3]

In July of 1952 there were five high-level bridges on the Imjin which were expected to provide communications with the I Corps front during the flood season.[4] These were, from north to south:

(1) Whitefront—a two-way, high-level bridge supported by timber bents on steel piles (CT 260133, Map: Korea 1:25,000).

(2) Parker Memorial (Pintail)-a two-way, high-level bridge supported by steel piers on concrete bases (CT 231097).

(3) Teal-a one-way, high-level bridge supported by timber-pile bents (CT 175057).

(4) X-Ray-a two-way, high-level bridge supported by timber-pile bents (CT 097012).

(5) Freedom Gate (Munsan-ni)—a reconstructed high-level railway and road bridge on concrete piers and one, light, steel-trestle pier (CS009955).

There were also in the I Corps sector several floating bridges and one low-level bridge; these were not expected to be usable during the flood season. Widgeon, the low-level bridge (CT 151035), is of interest, however, in that it was expected to survive the floods even though submerged. It was a treadway bridge supported by rock-filled cribs; this was the first attempt to build a cheap low-level bridge that would survive being submerged by the floods and provide a crossing during the rest of the year.

I Corps Headquarters was fully cognizant of the threat that the Imjin presented to the lines of communication to the front in its sector. An operational flood plan was prepared "which as-signed responsibility to individual units for communications and procedures for reporting river rises, for facilities necessary to protect bridges such as debris booms, LCM's [landing crafts, mechanized] and utility boats, for searchlight illumination to aid in night removal of debris, and for tanks or automatic weapons fire to break up floating debris."[5]

The flood season was late in getting started in the summer of 1952. It was on the 27th of July that the first of the Imjin floods came, a minor rise which overtopped Widgeon bridge and washed out its approaches but did not otherwise damage it. However, heavy general rains on the watersheds of the Imjin and the Hant'an, the Imjin's major tributary, during the night of 27-28 July and on 28 July presaged a more formidable rise. At Parker Memorial bridge the river rose 38 feet during the period 5 AM on 27 July to 3 PM on 30 July. Complete data as to flood heights at all bridge sites are not available due to the fact that flood gauges were in many instances affixed to the bridges and thus went down the river with them; but of particular interest is the following from the "Flood Report, 1 July-15 September 1952," Office of the Engineer, Headquarters, I Corps, 26 September 1952:

> After a rise of 27 feet at Teal ... two spans failed and were washed out at 1200 hours on 30 July. Failure of the bridge occurred when little debris was present in the channel, none hung on the piers, and when no previous observable displacement of the structure had occurred from the striking of debris. Debris was not a primary or secondary cause of failure within the observation of spectators. Previous pile penetration of ten feet had been reduced to as little as two feet on some piers by scour action. Nine piers were scoured at the base but otherwise still in good condition. Three piers were completely destroyed by the flood. Maximum velocities observed upstream were as great as 15-20 feet per second in the deepest part of the river?
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> At 1330 hours 30 July 1952 the X-Ray two-way high-level bridge failed when two piers went out. Striking of debris was a contributing cause of failure of X-Ray, when it was struck by large floating segments of crib and floor debris from the failure of Teal. This occurred slightly before the cresting of the flood at X-Ray, at a river stage about one foot below crest height. At this time, however, a portion of X-Ray bridge had already been displaced downstream about four feet from a primary cause which might have caused failure even in the absence of debris, and which was presumably sliding of pile bents.'

Freedom Gate (Munsan-ni bridge) and Widgeon held up well during this flood. Freedom Gate was closed to traffic for only four hours on 31 July so that a crane could be moved onto the bridge to remove debris lodged against the piers. Widgeon, overtopped by the flood, reappeared intact when the water subsided and was reopened to traffic on 3 August after minor repairs.

The Imjin remained fairly quiescent until 24 August when considerable rain fell to the north and east of the I Corps sector prior to 6 AM. At that time both the Imjin and Hant'an rivers started rapid rises where they entered U.N. territory. At the Parker Memorial bridge the river rose 40.5 feet between 7 AM and 5 PM. During this flood Widgeon bridge was almost completely destroyed and X-Ray bridge lost five more spans. "At various times ... Parker, Whitefront, and Freedom Gate bridges were closed to traffic for short periods to enable debris removal operations to be facilitated. Accumulation of debris against the timber pile piers combined with high river velocities constituted a continual hazard necessitating debris removal. The content of the debris indicated that the enemy had suffered damage to his installations and also that the neighboring Corps had some losses in bridge and ferry equipment."[8]

In early September floating bridges were placed at Teal and X-Ray sites, and a ferry was operated at Widgeon site as necessary. (*Figure* 19) The Imjin flood season of 1952 was over, and the central portion of the I Corps sector was left without bridges that could withstand the ice season which would begin in December.

The Commanding General, I Corps, felt that replacement of Teal and X-Ray bridges was an urgent military necessity and so informed the Commanding General, Eighth Army.[9] He also recommended that more substantial structures be built, rather than restoring the structures which had proved inadequate in the face of high water. In a later communication, it was pointed out that the floating bridges at these sites would have to be removed about 11 December to prevent unnecessary loss of equipment during the ice season and that it would be highly desirable that permanent structures be completed at these sites prior to that time in order to provide continued satisfactory support of the forward elements of I Corps.[10] The Eighth Army Engineer instituted an extensive study and research program to provide a basis for design and construction of bridges capable of withstanding the floods and unusual river conditions encountered on the Imjin.[11]

Armed with the basic data and specifications furnished by

Eighth Army and supplementing this with research of its own, the 2d Engineer Construction Group proceeded with the designing of suitable bridges to meet these needs.[12] Conferences between the Eighth Army and I Corps Engineers led to an informal agreement on the construction of a two-way, high-level bridge at X-Ray site and a two-way, low-level bridge at Teal site.[13] The formal concurrence of the Commanding General, I Corps, to this plan was obtained in late September, and construction at Teal began almost immediately.[14]

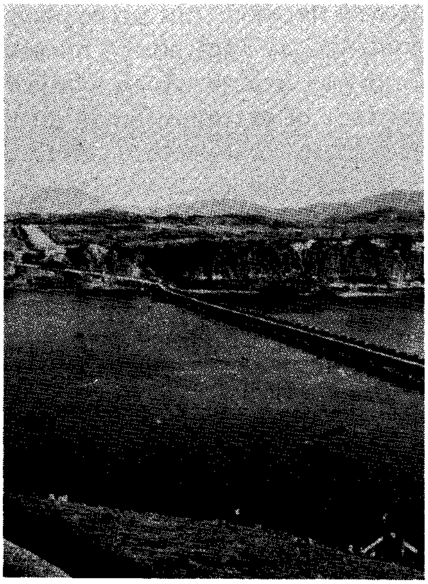

Figure 19. X-Ray site in October 1952 showing newly erected ponton bridge and perpendicular volcanic rock banks.

The result of the research program, which combined 36 years of Japanese and Korean observation with two years of American experience, was a firm conviction in the minds of all concerned that it would be useless to replace the washed-out bridges with ordinary structures. It was decided that only a high-level bridge resting on concrete piers extending down to or securely anchored in bedrock would have any potential of withstanding the extreme flood conditions of the Imjin River and providing a year-round crossing. It was further believed that there was an urgent military requirement for such a bridge at X-Ray site in the center of the I Corps sector, whether the current tactical situation continued, UN. forces advanced, or an armistice was signed. In the case of either an advance or an armistice, the Freedom Gate bridge (Munsan-ni) would probably have to be limited to rail traffic, and thus it would become imperative to have a highway crossing between Munsan-ni and Kaesong.

Such a justification did not appear to exist at Teal site; in fact, it was believed that although an urgent military requirement existed for a crossing at Teal as long as the current situation continued, either an advance or an armistice would remove the requirement for any crossing at all at this site. For these reasons it was decided that an expensive high-level bridge could not be justified at Teal site. The alternative adopted was a low-level highway bridge which would be available for use except during periods of extreme floods and was designed to permit use with minimum delay after the flood waters receded. Thus, a bridge which was expected to be available for use perhaps 50 weeks out of the year was to be built for less than half the cost, construction time, and engineer effort that would be required for the X-Ray bridge.[15]

The bridges designed for these sites created problems of construction which Army Engineers had not experienced before in an active theater. Teal bridge, for instance, was designed to duplicate the relatively inexpensive "low water" bridges so numerous in the southwestern United States. These bridges are sturdy enough to withstand being overtopped by flash floods and yet can be put back into service as soon as the waters recede. In order to duplicate this strength of construction, Teal was designed to be supported on piers composed of 16-inch, hollow, open-end steel piles, driven to bedrock and filled with concrete. This 16-inch Armco piling was available in the theater but had not been used for this purpose before. Other low-level bridges had been built in Korea, but none had been built with the permanent-type materials and strength of the proposed Teal.

X-Ray bridge, on the other hand, was a complete departure from military bridge construction. The Corps of Engineers has designed and supervised the construction of larger, wider, and higher bridges, but in most cases these bridges were actually built by civilian contractors or by skilled civilian labor under Engineer supervision. This was the first time that an all-new-construction bridge was to be built with sheet-pile cofferdams and reinforced concrete piers by troop labor. It was to be, in fact, a commercial rather than military type of bridge, which any state would be proud to have as part of its highway system.

Both bridges were to be built within easy range of the enemy's light artillery. As it turned out, although enemy artillery rounds fell near both bridge sites during construction, there was no indication that the enemy made a deliberate attempt to interfere with the building of the bridges?