

## 14. ENGINEERING. (V 10.11.20)

“Engineering” refers to all military applications of construction or demolition of installations by combat units.

### 14.A. ENGINEERING UNITS.

There are several types of engineers (shown on the UNIT IDENTIFICATION CHART), with engineering and combat abilities as described in Rule.

### 14.B. SIMPLE ENGINEERING SEQUENCE OF PLAY.

- 1) **Initial Engineering Phase:** In clear weather, reduce all “C#/D#” markers by one and remove them at “C0/D0.” In bad weather (Rule 42.A.2), reduce all “C#/D#” markers by one half. (See Rule ? below for quick construction effects). *For example, a “C2” marker would be reduced to a “C1” marker and a “C 1/2” marker which totals “C1 1/2”.*
- 2) **Initial Movement Phase:** Begin MP and turn based engineering functions.
- 3) **Reaction Phase:** Units in reserve begin allowable MP based construction or destruction.
- 4) **Exploitation Phase:** Begin allowable MP based construction or destruction by units in reserve.
- 5) **Secondary Engineering Phase:** Remove all “Repair” markers.

### 14.C. GENERAL ABILITIES OF ENGINEERS.

When a unit performs any engineering function, use the following procedure and rules:

- 1) If the work requires MPs, a “Repaired” marker is placed on the installation upon expenditure of the required MPs. *Note: See Rule 6.B.2 for effects on engineers in reserve.*
- 2) A engineering unit must spend its entire movement allowance to be placed under a “C#/D#” marker.
- 3) Engineers must be under the “C#/D#” marker to use their engineering abilities for turn based engineering.
- 4) If construction/demolition takes one or more turns, a “C#/D#” marker equal to the required turns is placed on the installation (or its marker) showing the finished task, which in turn is placed on the engineer. The engineer may expend no other MPs while participating in construction/demolition..
- 5) When completed, place the installation (or appropriate marker) at the bottom of the stack in the hex. *Note: When doing repairs some markers will be removed.*
- 6) If all the construction engineers leave the hex any time before a installation is built, the installation is removed. *Note: When building a higher level fort or airbase in a hex, it is done the same as stated above with the exception that if all the engineers leave the hex only the higher level counter is removed from the hex; the original fort or airbase counter remains.*

### 14.D. MODIFIERS TO ENGINEERING TIME & COST.

The supply state of a unit may affect construction costs and time required shown on the ENGINEERING SUMMARY, the NON-ENGINEER DEMOLITION SUMMARY, and the RAILROAD REPAIR SUMMARY as described below:

- a) Bad weather (Rule 42.A.2) adds +1 SP to the cost of regauging a hex.

- b) Any kind of mud weather prevents construction or repair of temporary airfields. Permanent/strategic airfields may not be started or have their “C” status changed during any kind of mud weather but may be repaired.
- c) If the engineer is not in full supply (Rule 16.A), all “C#/D#” markers are only reduced by “C 1/2”. *Note: This means that many rear area construction jobs will take twice as long as the engineers may be in limited supply.*
- d) If the construction unit is out of supply (Rule 16.A), the SP/SRPs required for engineering are doubled.
- e) During bad weather (Rule ???), all “C#/D#” markers are only reduced by “C 1/2”; “C 1/4” if not in full supply.
- f) Construction of fortifications in bad terrain (Rule 3.F.1.a) doubles the required time but halves the SRP cost.
- g) Construction of airbases in arid weather zones (Rule 43.A) halves the time required.
- h) Construction in mountain or Arctic hexes double the cost and time. *Note: This is in addition to bad terrain costs .*
- i) Engineer battalions only reduce all “C#/D#” markers by “C 1/2” unless two are working together as 1 RE.
- j) Any time that a construction marker would be reduced by only “C1/2”, double the engineering units required to maintain a “C1” reduction. *For example, a single out of supply engineer regiment in bad weather would have no effect. Two would be required to obtain a “C1/2” reduction and four to get a “C1” reduction.*

*Note: “AMaxMP” construction time is doubled to two turns for engineering purposes.*

### 14.E. REPAIR/RECERTIFY INSTALLATIONS.

An engineer repairs damaged installations by spending the number of turns/SPs listed on the ENGINEERING SUMMARY.

Engineers “recertify” installations that have suffered "Collateral Damage" when captured (Rule 3.E.2) by spending the number of MPs/SPs/SRPs listed on the ENGINEERING SUMMARY. *Note: Installations may be "recertified" during the same turn (or movement phase) that they suffer collateral damage.*

### 14.F. CONSTRUCTION OF INSTALLATIONS.

To build an installation an engineer spends the number of MPs or turns as specified on the ENGINEERING SUMMARY. SRPs/SPs/AA may also be required.

The engineer may either trace a special supply line (Rule 18.A.2.d) to the SRP/SP/AA being used for construction or be in regular supply (Rule 16.A) and able to remove the SRP/SP from the central pool. The SRP/SP/AA is spent when the unit begins construction. *Note: If construction is not completed, the SRP/SP/AA is not recovered.*

Follow the steps below when starting construction.

- 1) Place the appropriate "Installation" marker on top of the engineer to show the construction.
- 2) Place the correct construction time “C#” marker on top of the “Installation” marker.
- 3) The required SP/SRP/AA cost is removed at the start of construction. The removed AA is placed in the ELIMINATED UNISOLATED BOX.

Specific requirements are listed in the following rules.

## 14.G. QUICK-CONSTRUCTION.

Quick-construction can be used when either MPs or turns are required for engineering functions as described below. Any railroad engineer brigade or construction brigade with a defence strength of two or greater is treated as two REs for the purposes of quick-construction.

### 14.G.1. QUICK CONSTRUCTION REQUIRING MPs.

A player may use **two** REs of engineers (or any combination of allowable units) in conjunction to speed construction when **MPs** are required for construction purposes. The following conditions apply:

- 1) The construction units must be stacked together when using this ability.
- 2) Units may move together and then separate.
- 3) If using two units with differing MP costs for any kind of engineering project, each pays only its own MP cost.
- 4) The highest final MP expenditure of any one unit must be used by all engineers doing quick-construction. *For example, a 1-6 Penal II moves one MP and joins a 2-8 Combat Eng III. The 2-8 has used two MPs by this point. Both spend 4 MP for quick-construction of a temporary airbase; a total of 5 MP for the 1-6 and 6 MP for the 2-8. The 1-6 can move no further as 6 MPs have been spent by the 2-8, while the 2-8 has 2 MP still to expend.*

*Note: All MP costs for quick-construction by two REs are shown on the ENGINEERING SUMMARY in parentheses beside the normal construction times.*

### 14.G.2. QUICK CONSTRUCTION REQUIRING TURNS.

A player may use **up to four** REs of engineers (or any combination of allowable units) in conjunction to speed construction when multiple **turns** are required for construction purposes. The following conditions apply:

- 1) During clear weather, each RE of engineers reduces the "C#" by one level during the initial engineering phase.
- 2) During bad weather (Rule 42.A.2), each RE of engineers reduces the "C#" by one half during the initial engineering phase. Reduce the "C#" marker by one level and place a "C½" marker in the hex or remove a "C½" marker (if there is already one in the hex).
- 3) Each level of entrenchment in a hex may count as 1 RE of engineers for quick construction purposes when building a fort. Remove the entrenchment when used this way.

*Example: A fortified zone in bad terrain normally takes 8 turns to build if in full supply and in good weather. If one engineer started in the hex it would place the "Fortified Zone" marker on it and would put a "C8" marker on the "FZ" marker. In the next initial engineering phase of the player, it would be reduced to a "C7". Later in the turn, two more engineers enter the hex. Next initial engineering phase, the marker is reduced to a "C6". During the movement, the two new engineers are placed under the "FZ" marker joining the one already there. In the next initial engineering phase, the marker is reduced three levels to a "C3". One engineer leaves during the movement phase which leaves two. Next initial engineering phase, the marker is reduced to a "C1". One more engineer leaves during the movement phase leaving one in the hex. During the next initial engineering phase, the marker would be reduced by one again but since this would take it to a C0, it is removed and the FZ is placed at the bottom of the stack to show it is completed.*

### 14.G.3. ENTRENCHMENTS.

Any support division (Rule 9.A.3.a) may build or maintain entrenchments (Rule 40.D). The division must spend the number of turns/SPs listed on the ENGINEERING SUMMARY to build an entrenchment.

Entrenchments may not be built in the same hex as a city or fortification. There may only be one entrenchment in a

hex. *Note: If a fort is built in the same hex as an entrenchment, the entrenchment is removed when the fort is finished. Each level of entrenchment may count as 1 RE of engineers for quick construction purposes, at which point it is removed.*

Engineers may be used to improve entrenchments (Rule 40.D) as shown on the ENGINEERING SUMMARY.

### 14.G.4. FORTIFICATIONS.

Engineers may build, upgrade to a higher level, or repair different kinds of fortifications (Rule 40.E) as described below. Bad terrain (Rule 3.F.1.a) doubles construction time but halves the SRP cost as per the ENGINEERING SUMMARY.

#### 14.G.4.a. DAMAGED FORTS.

Engineers repair forts by spending the number of MPs and SPs listed on the ENGINEERING SUMMARY.

#### 14.G.4.b. FORTS.

An engineer may build a fort in any hex without another fortification by spending the number of turns and SRPs listed on the ENGINEERING SUMMARY. *For example, if a fort in a woods hex in full supply is begun during the initial movement phase of the Aug 3 41 turn, then it will be completed in the initial engineering phase of the Oct 3 41 turn.*

#### 14.G.4.c. IMPROVED FORTS.

Engineers improve forts by spending the number of MPs and SPs listed on the ENGINEERING SUMMARY.

#### 14.G.4.d. FORTIFIED AREAS.

An engineer may build a fortified area in any hex containing an improved fort as shown on the ENGINEERING SUMMARY. In addition, one positional AA factor is removed and is placed in the ELIMINATED UNITS BOX.

#### 14.G.4.e. IMPROVED FORTIFIED AREAS.

Engineers improve fortified areas by spending the number of MPs and SPs listed on the ENGINEERING SUMMARY.

#### 14.G.4.f. FORTIFIED ZONES.

A **construction** engineer may build a fortified zone in any non-major city hex containing an improved fortified area as shown on the ENGINEERING SUMMARY. In addition, one positional AA factor is removed as per fortified areas.

#### 14.G.4.g. EMERGENCY COMPLETION OF FORTIFICATIONS.

During any enemy engineering phase, a player may perform an emergency completion of a fortification under construction. Several conditions apply:

- i) The fortification could be finished construction in the next friendly player turn.
- ii) All engineers required to finish the fort's construction in the next turn, immediately get a "+1 MP" marker placed on them.
- iii) The "damaged" version of the fortification under construction is immediately placed on the map. This replaces the undamaged fortification marker and the "C#" marker on top of it.

#### 14.G.4.h. UPGRADING FORTIFICATION STRENGTHS.

Any fortification (Rule 40.E) may be upgraded up to its maximum (or less) defence strength by starting the initial movement phase with an engineer capable of building the fortification (requiring no MPs). Each point of defence costs 1 inf RP removed from the fronts (or pockets) replacement pool. Immediately replace the fort with the upgraded unit.

**14.G.4.i. IMPROVING FORTRESSES.**

Engineers may improve unimproved fortresses as shown on the ENGINEERING SUMMARY.

**14.G.5. AIRBASES.**

Engineers may build three kinds of airbases; temporary, permanent, and strategic (Rule [21.B](#)), as shown on the ENGINEERING SUMMARY.

**14.G.5.a. TEMPORARY AIRFIELDS.**

A temporary airfield with a capacity of one may be built in any clear or rough hex except one already containing an airfield. The temporary airfields capacity may be increased to two in the same manner that the initial capacity was built.

A temporary airfield remains on the map only if it is in an arid weather zone (Rule [43.A](#)), the weather is clear/frost, or there is an engineering/construction unit in its hex. (The unit need not be the one that built the airfield.) *Note: Weather occasionally affects unmaintained temporary airfields in arid weather zones as described in Rule [21.F](#).*

Temporary airfields may be upgraded to permanent airbases as shown on the ENGINEERING SUMMARY. *Note: In this case, the temporary airfield is removed from the map when the permanent airbase is completed.*

**14.G.5.b. PERMANENT AIRFIELDS.**

An engineer may build permanent airfields in any clear, rough, woods, or wooded rough hex (including such hexes containing other features such as reference cities or forts. Each increase in capacity is done by building a new 3-capacity permanent airfield.

Construction of more than one airfield in a hex may occur at the same time. Capacities are merely combined at the end of the different construction periods. Each hex has a maximum airfield capacity of twelve.

Permanent airfields replace the normal capacity of any cities or fortresses in the hex. *Note: There is no real reason to build a permanent airfield in any dot or major city unless the capacity is later going to be increased to greater than three.*

**14.G.5.c. STRATEGIC AIRFIELDS.**

Strategic airfields may only be built in clear terrain. They are built in the same manner as permanent airfields but have differing costs as shown on ENGINEERING SUMMARY.

**14.G.6. PORT CONSTRUCTION.**

The scenario deployment instructions may specify that certain ports start the game at a reduced status or they may be reduced as a result of enemy capture (Rule [31.A.6](#)). *For example, at the start of all War in the Desert scenarios, the port of Benghazi (18A:3121) is reduced to a standard port. Note: Mark the ports with "Reduced Port" markers.*

A construction unit or construction engineer may upgrade a port from reduced to full status by improving the port for a total of 6 turns per increase in capacity. There is a 1 SRP cost per capacity increase to do this. *Note: The entire SRP cost to upgrade a port to full status must be expended at the start of construction.*

A port construction engineer halves the required time to upgrade a port.

**14.H. RAIL LINE REPAIRS AND IMPROVEMENTS.**

Engineers may repair, regauge, recertify, and restore rail lines as per the following conditions.

- 1) The rail line being worked on must be connected to a national supply source through another rail line. *Note: The rail line may trace overseas through any operational port of at least level 1.*
- 2) The connecting rail line must be of the same level or better (or one being repaired to the same level).
- 3) For an engineer to be able to perform any engineering rail function it must have a "Repair" marker on any lower level of rail line in the hex.
- 4) The order in which railroad engineering functions must be done is shown below:
  - i) Repair all rail breaks and/or cuts (including marshalling yard damage).
  - ii) Regauge the rail hex to uncertified status if it is an unfriendly gauge.
  - iii) Recertify the rail hex to low-volume status.
  - iv) Restore the low-volume rail hex to high-volume status.

**14.H.1. REGAUGE RAIL LINES.**

A railroad engineer may regauge a rail line, changing the gauge from any gauge to any other gauge.

To regauge a rail hex, the railroad or construction engineer units must move over the hex and expend a specified number of MPs and SPs as shown on the RAILROAD REPAIR SUMMARY. *Note that all costs are cumulative.*

If the hex on one side of a bridge has been regauged and the bridge itself has been regauged, but the hex on the other side has not, use a "Bridge Regauged" marker to show this until the rail hexes on both sides of the bridge have been regauged.

**14.H.2. RECERTIFY RAIL LINES.**

Engineers may "recertify" rail hexes and bridges that have suffered "Collateral Damage" when captured (Rule [3.E.2](#)) or that have been converted from an enemy gauge to a friendly gauge.

To recertify a rail hex, the engineer must move over the hex and expend a specified number of MPs and SPs as shown on the RAILROAD REPAIR SUMMARY.

**14.H.3. RESTORE LOW-VOLUME RAIL TO HIGH-VOLUME.**

To be used normally, captured high-volume rail lines must be "restored" once they have been recertified to low-volume status. Construction and railroad engineers may be used to restore rail lines.

To restore a rail hex, the engineer must move over the hex and expend a specified number of MPs and SPs as shown on the RAILROAD REPAIR SUMMARY.

**14.I. DEMOLITION OF INSTALLATIONS.**

All installations may be damaged or destroyed by engineers as described below:

**14.I.1. PORT DEMOLITION.**

An engineer may demolish the capacity of a port by spending MPs as shown on the ENGINEERING SUMMARY. This allows the placement of one "Port Hit." *Note: Place the "Port Hit" marker in the sea hex beside the port for ease of play.*

**14.I.2. BRIDGE DEMOLITION.**

Engineers demolish bridges by spending MPs as shown on the ENGINEERING SUMMARY. A success roll is required on the BRIDGE DESTRUCTION TABLE for the bridge to be destroyed (Rule [7.C.3](#)).

**14.I.3. AIRBASE DEMOLITION.**

Engineers demolish airbase capacity by spending MPs as shown on the ENGINEERING SUMMARY. This allows the placement of one "Airbase Hit."

**14.I.4. RAIL DEMOLITION.**

An engineer may destroy a rail line by spending MPs as shown on the ENGINEERING SUMMARY. This allows the placement of one "Rail Cut" or "Rail Break" depending on the type of engineer performing the demolition.

**14.I.5. QUICK-DEMOLITION.**

A player may use two allowable engineering or combat units in conjunction to speed demolition of an installation or rail line. The units must be stacked together when using their demolition abilities. Each unit pays half the cost of damaging the facility or rail line as shown on the ENGINEERING SUMMARY. *Note: Civilian labour, construction or punitive units are usable as the second unit.*

**14.J. DISMANTLING INSTALLATIONS.**

Engineers may dismantle forts, fortified areas, fortified zones, and airfields to recover SPs/SRPs, AA, and inf RPs. This takes the same time as would be required to construct the installation. Use a "D#" marker for the required turns. The engineer must be in regular supply to do this.

When the dismantling is completed, 1/3 of the SPs/SRP construction cost is added to the fronts pool. When fortifications are dismantled, **all** positional AA and inf RPs used in construction are recovered and placed with next turns reinforcements. *Note: The reinforcements are either heavy or light AA removed from the Eliminated Unisolated Box.*

A fortified zone acts as an improved fortified area while it is being dismantled and is replaced by one when the work is completed. A fortified area acts as an improved fort while it is being dismantled and is replaced by one when the work is completed. A 3-capacity airbase being dismantled is not operational.

*Note: Quick dismantling is done in the same manner as quick construction (Rule [14.G](#)).*

**14.K. ABANDONING FORTIFICATIONS.**

Forts are reduced to a **zero** defence strength by abandoning them during the phasing players initial movement phase. Each point of defence strength is recovered and is counted as a disrupted inf RP. *Note: This means that the fort is no longer being maintained and will degrade unless garrisoned (Rule [40.E](#)).*

**14.L. TEMPORARY BRIDGES.**

Construction or combat engineers (Rule ?) may use their entire movement allowance to place a "Temporary Bridge" marker on the engineer. Place the marker on the engineer and point it to the bridged hexside. The "Temporary Bridge" marker has the following effects:

- 1) If forced to retreat, the engineer is eliminated and its combat strength is added directly to the RP pool.
- 2) Units crossing the river hexside of the temporary bridge spend MPs as shown on the TERRAIN EFFECTS CHART.
- 3) The rivers SLP cost is reduced as shown on the TERRAIN EFFECTS ON SUPPLY CHART.

**14.M. ENGINEERING LIMITATIONS.**

All engineers have some limitations to their abilities.

**14.M.1. MOTORIZED LIMIT.**

A c/m or s/m engineer may not use construction abilities in the exploitation or reaction movement phases unless it is in reserve.

**14.M.2. RESERVE LIMITS.**

Engineers in reserve may only use their construction or demolition abilities in the exploitation or reaction phases if their movement allowance is not exceeded. *Note: This means that some jobs will need quick-construction or demolition to perform and that some will not be allowed at all.*

**14.M.3. BATTALIONS.**

For construction purposes a single engineer battalion takes double the normal time to build an installation unless two are working together. *For example, two engineer battalions and one engineer regiment could work together for quick-construction purposes counting as 2 REs.*

**14.M.4. MAXIMUM DEMOLITION.**

The maximum amount of damage that an installation may suffer is shown on the MAXIMUM INSTALLATION DAMAGE TABLE (Rule [3.E.2.c](#)).

**14.N. UPGRADING TRANSPORTATION LINES.**

Transportation lines on the map may be upgraded by engineering units. Railroad engineers may upgrade a regular road to a railroad. Other engineers and construction units may assist railroad engineers as well as improve tracks and fair weather roads to regular roads. All conditions listed above for reguaging, recertifying, and restoring rail lines also apply when upgrading.

The engineering unit must trace a special supply line to the SRPs needed when it starts a transportation line upgrade, and the SRPs are spent at that time. *Note: A hex containing both a lower level transportation line and higher level line that it joins, must be upgraded for two lines to be connected. This will occur if there is a town or city in the hex.*

When a player upgrades a road hex to a railroad, he may upgrade it to any of the five gauges. Use "Railroad Upgrade" markers to mark the course of roads upgraded to railroads.

*Note: The upgrading of roads to railroads through the expenditure of SRPs is an additional capacity beyond Rule [7.E](#).*

Table 1 Transportation Line Upgrade Table

TRANSPORTATION LINE UPGRADE TABLE		
TYPE	SRP Cost	Turns
Track to Road	1/12 SRP	Max MPs (4 MPs)
Fair Weather Road to Road	1/6 SRP	Max MPs (4 MPs)
Road to Low-Volume Railroad	½ SRP	Max MPs (4 MPs)
Low-Volume to High Volume Railhead	½ SRP	Max MPs (4 MPs)
Road to High Volume Railroad	1 SRP	2(1)
City or town hex	x ½	x ½
Minor Bridge	x 1	x 2
Major Bridge*	x 4	x 4
Arctic*/Arid (Rule 43.A)	x 6	x 2
Bad Terrain	x 2	x 2
Mountain/Swamp Hex*	x 4	x 4

\* Prohibited in bad weather (Rule 42.A.2).  
 Note: Keep track of upgraded roads through the use of "Roadhead" markers.

Table 2 Non-Engineer Demolition Summary

NON-ENGINEER DEMOLITION SUMMARY					
TYPE OF DEMOLITION	MARKER	COST	SELF--SUPPORTING DIVISION	REGIMENT, BRIGADE, CADRE, OR UNSUPPORTED DIVISION	BATTALION OR REMNANT
Break Rail Hex (place "Rail Break" marker)	Repair	--	3 (2) MP/Break	4 (2) MP/Break	8 (4) MP/Break
Demolish Airbase (place "Airbase Hit" marker)	Repair	--	3 (2) MP/Hit	4 (2) MP/Hit	8 (4) MP/Hit

(#) Shows cost if quick-demolition is used.  
 Note: Artillery, antitank, and antiaircraft may not perform any form of demolition.

Table 3 Engineering Summary

ENGINEERING SUMMARY					
TYPE OF CONSTRUCTION	MARKER	COST	CONSTRUCTION ENG.	COMBAT ENG.	SUPPORT DIV./CORP
Build Entrenchment	C#	1 SP	----	----	3 (2) Turns
Improve Entrenchment	C#	1 SP	2 (1) Turns	2 (1) Turns	----
Repair Fort/Fortified Area	Repair	1 SRP \$	5 (2 ½) MP	6 (3) MP	----
Repair Unimproved Fortress/Fortress	Repair	1 SRP \$	2 (1) Turns	2 (1) Turns	----
Build Fort in Clear or Rough #	C#	1 SRP \$	4 (2) Turns	4 (2) Turns	----
Improve Fort/Fortified Area	Repair	1 SP \$	5 (2 ½) MP	6 (3) MP	----
Fortify Area in Clear or Rough#	C#	1 SRP+1AA	4 (2) Turns	4 (2) Turns	----
Build Fortified Zone in Clear or Rough	C#	2 SRP+1AA	4 (2)Turns	----	----
Improve Unimproved Westwall hex	C#	1 SRP	6 (3) Turns	----	----
Improve Unimproved Fortress	C#	3 SRP	16 (8) Turns	----	----
Build a 1-Capacity Temp. Airbase in Clear or Rough (for each 1 cap.)*,**,+	Repair	¼ SRP/3 SP	1 Turn (4 MP)	1 Turn (4 MP)	2 (1) Turns
Upgrade a 2-Capacity Temporary Airbase to a Perm. Airbase**,+	Repair	¾ SRP/2 SP	4 (2) Turns*	4 (2) Turns*	----
Build a 1 Capacity Perm. Airbase in Clear or Rough (for each 1 cap.)*,**,+	C#	¼ SRP	2 (1) Turns	2 (1) Turns	----
Upgrade a 2-Capacity Permanent Airbase to a 3-Capacity Perm. Airbase**,+	C#	¼ SRP	2 (1) Turns	2 (1) Turns	----
Build/Upgrade Permanent Airbase in Clear or Rough (for each 3 cap.)***,+	C#	1 SRP	4 (2) Turns	4 (2) Turns	----
Build Permanent Airbase in Woods or Wooded Rough (for each 3 cap.)***	C#	1 SRP	8 (4) Turns	8 (4) Turns	----
Build/Upgrade Strategic Airbase in Clear or Rough (for each 3 capacity)**,+	C#	2 SRP	8 (4) Turns	----	----
Upgrade port from "Reduced Status" to full (½ time if using Port Const. Eng)	C#	1 SRP/Cap	6 (3) Turns/Capacity Increase	----	----
Dismantle fort, fortified area, or permanent airfield	D#	-¼ SRP	2 (1) Turns	2 (1) Turns	----
Dismantle fortified zone	D#	-¼ SRP	2 (1) Turns	2 (1) Turns	----
* A maximum capacity of 2 may be built.		# In bad terrain double the time and ¾ the SRP cost.			
** No airbase construction allowed in any kind of mud weather.		+ Halve required time in Arid weather zones (Rule 43.A). Note: Half of one turn is equal to 4 MPs.			
\$ Spend an additional 1 SP if in an arid weather zone.					
TYPE OF REPAIR	MARKER	COST	CONSTRUCTION ENG.	COMBAT ENG.	SUPPORT DIV./CORP
Recertify Port's Collateral Damage	Repair	--	2 (1) MP	2 (1) MP	Max. MPs (½ M)
Repair Port Hit	Repair	¼ SRP	Max. MPs (½ M)	Max. MPs (½ M)	----
Repair Malta Box hit	Repair	1SRP/5 SP	Max. MPs (½ M)	Max. MPs (½ M)	----
Recertify Airbase's Collateral Damage	Repair	--	2 (1) MP	2 (1) MP	Max. MPs (½ M)
Repair Airbase Hits (only Permanent or Strategic hits in any mud weather)	Repair	--	4 (2) MP/Hit	6 (3) MP/Hit	1 Turn (4 MP)/Hit
TYPE OF DEMOLITION	MARKER	COST	CONSTRUCTION ENG.	COMBAT ENG.	SUPPORT DIV./CORP
Demolish Port Capacity (place "Port Hit" marker)	Repair	--	5 (2 ½) MP/Hit	6 (3) MP/Hit	----
Demolish Airbase Capacity (place "Airbase Hit" marker)	Repair	--	3 (1 ½) MP/Hit	4 (2) MP/Hit	2 (1) MP/Hit
Break Rail Hex (place "Rail Break" marker)	Repair	--	2 (1) MP/Break	3 (1 ½) MP/ Break	2 MP/Break
Demolish Rail Hex (place "Rail Hit" marker)	Repair	--	3 (1 ½) MP/Cut	4 (2) MP/Cut	Max. MPs/Cut
Demolish Bridge (spend MPs and then roll on Success Table)	Repair	--	Max. MPs (½ M)	Max. MPs (½ M)	Max. MPs (½ M)
(#) Shows cost if quick-construction/demolition is used with 2 REs of engineers.					
* Remove temporary airfield during upgrade turns.					
Note: All turn costs are doubled if construction is started in bad weather (Rule 42.A.2). Max. MPs becomes 1 Turn and use a "C#" marker.					
Note: In bad weather or is not in full supply, all repairs are half as effective (cumulative). I.e. A "C1" will become a "C ½" or a "C ¼" (if both conditions apply).					

Table 4 Railroad Repair Summary

RAILROAD REGAUGING, RECERTIFYING, RESTORING, AND REPAIRING SUMMARY					
REPAIR RAIL BREAK OR CUT	MARKER	COST	RAILROAD ENGINEER	CONSTRUCTION ENGINEER	COMBAT ENGINEER
Repair Rail Break	Repair	--	2 (1) MP	3 (1 ½) MP	4 (2) MP/Break
Repair Rail Cut	Repair	1 SP	4 (2) MP	5 (2 ½) MP	6 (3) MP/Cut
Repair Minor Bridge Damage Marker	Repair	1 SP	2 (1) MP	3 (1 ½) MP	4 (2) MP
Repair Major Bridge Damage Marker	Repair	1 SP	4 (2) MP	5 (2 ½) MP	6 (3) MP
Repair Destroyed Minor Bridge	C#.	½ SRP/2SP	2 (1) Turns	2 (1) Turns	2 (1) Turns
Repair Destroyed Major Bridge	C#	1 SRP	4 (2) Turns	4 (2) Turns	4 (2) Turns
Repair Marshalling Yard (Each "RM Hit")	Repair	½ SRP/2SP	5 (2 ½) MP	Max MPs (½ M)/Hit	----
REGAUGE DIFFERENT GAUGE TO UNCERTIFIED RAIL LINE	MARKER	COST	RAILROAD ENGINEER	CONSTRUCTION ENGINEER	COMBAT ENGINEER
Clear or Rough Hex	Repair	--	1 (½) MP	2 (1) MP	4 (2) MP
Bad Terrain Hex	Repair	1 SP	2 (1) MP	4 (2) MP	Max MPs (½ M)
Town Hex	Repair	--	+ 0 MP	+ 1 (½) MP	+ 2 (1) MP
Dot or Reference City Hex	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	+ 4 (2) MP
Major City Hex	Repair	+ 2 SP	+ 2 (1) MP	+ 4 (2) MP	Max MPs (½ M)
Minor Bridge Hexside	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	+ 4 (2) MP
Flooding Minor Bridge Hexside	Repair	+ 2 SP	+ 2 (1) MP	+ 4 (2) MP	Max MPs (½ M)
Major Bridge Hexside	Repair	+ 2 SP	+ 2 (1) MP	+ 4 (2) MP	Max MPs (½ M)
Flooding Major Bridge Hexside	Repair	+ 4 SP	+ 4 (2) MP	Max MPs (½ M)	----
RECERTIFY UNCERTIFIED RAIL TO LOW-VOLUME RAIL LINE	MARKER	COST	RAILROAD ENGINEER	CONSTRUCTION ENGINEER	COMBAT ENGINEER
Clear or Rough Hex	Repair	--	½ (0) MP	1 (½) MP	2 (1) MP
Bad Terrain Hex	Repair	+ 1 SP	1 (½) MP	2 (1) MP	4 (2) MP
Town Hex	Repair	--	+ ½ (0) MP	+ 1 (½) MP	+ 2 (1) MP
Dot or Reference City Hex	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	+ 4 (2) MP
Major City Hex	Repair	+ 2 SP	+ 2 (1) MP	+ 4 (2) MP	Max MPs (½ M)
Minor Bridge Hexside	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	+ 4 (2) MP
Flooding Minor Bridge Hexside	Repair	+ 2 SP	+ 2 (1) MP	+ 2 (1) MP	+ 4 (2) MP
Major Bridge Hexside	Repair	+ 2 SP	+ 2 (1) MP	+ 4 (2) MP	Max MPs (½ M)
Flooding Major Bridge Hexside	Repair	+ 4 SP	+ 4 (2) MP	Max MPs (½ M)	----
RESTORE LOW-VOLUME RAIL TO HIGH-VOLUME RAIL LINE	MARKER	COST	RAILROAD ENGINEER	CONSTRUCTION ENGINEER	COMBAT ENGINEER
Clear or Rough Hex	Repair	--	2 (1) MP	4 (2) MP	----
Bad Terrain Hex	Repair	--	4 (2) MP	Max MPs (½ M)	----
Town Hex	Repair	--	+ 0 MP	+ 1 (½) MP	----
Dot or Reference City Hex	Repair	--	+ 0 MP	+ 1 (½) MP	----
Major City Hex	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	----
Minor Bridge Hexside	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	----
Flooding Minor Bridge Hexside	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	----
Major Bridge Hexside	Repair	+ 1 SP	+ 1 (½) MP	+ 2 (1) MP	----
Flooding Major Bridge Hexside	Repair	+ 2 SP	+ 2 (1) MP	+ 4 (2) MP	----

(---) Shows cost if quick-construction or demolition is used with 2 REs of engineers.

Table 5 Modifiers to Engineering Times and Costs

ENGINEERING MODIFIERS TO TIME/COSTS TABLE		
MODIFIER CAUSE	COST MODIFIERS	TIME MODIFIERS
Bad Weather (Rule 42.A.2)	+ 1 SP if Regauging	Reduce construction/demolition effects by ½.
Mud Weather	--	No temp airbase repair. No new construction of airbases
Unit is not in full supply	--	Reduce construction/demolition effects by ½.
Unit is out of supply	x 2	--
Fortifications in bad terrain	x ¾	Reduce construction/demolition effects by ½
Mountain or Arctic Hex (in addition to bad terrain costs)	x 2	Reduce construction/demolition effects by ½
Unit is an engineer battalion		Reduce construction/demolition effects by ½

