



Airport Master Plan Update

CHAPTER FOUR DEVELOPMENT ALTERNATIVES

The objective of this chapter is to identify and evaluate alternative plans for the implementation and development of the facility requirements discussed in the previous chapter. These facilities are required to satisfy the estimated aviation demand levels for Rapid City Regional Airport throughout the 20-year planning period. A three step process has been used to accomplish this task:

- (1) Identify alternative concepts that will meet the requirements for airport and landside facilities imposed by estimated future demand levels;
- (2) Evaluate each alternative, using a variety of criteria, to determine relative efficiency levels and the costs required for implementation; and
- (3) Select a "preferred" alternative that maximizes the return on investment within the context of community and airport objectives.

Overall, the primary goal is to produce a balanced airside and landside complex to serve forecast aviation demand. The following three areas are examined in this chapter:

- * **Airfield Alternatives;**
- * **Industrial/Commercial Area Alternatives;**

* **Transportation and Access Alternatives.**

In identifying alternative ways of meeting the defined facility requirements, the following parameters were used as guidelines:

- * To maximize the use of existing facilities;
- * To provide sufficient airfield flexibility to meet the long-range demand that is forecasted to occur;
- * To provide facilities in a manner that minimizes impacts on the community;
- * To plan future airfield alternatives that maintain an emphasis on airfield safety and efficiency;
- * To provide for a reasonable and cost-effective phasing of proposed improvements; and
- * To identify facilities that can be effectively maintained at reasonable cost to users and non-users alike while maintaining a high level of safety.

With this background, a range of possible alternative airport development scenarios were identified.

4.1 Runway Development Alternatives Evaluation

The focus of this section is to evaluate the effects of the various alternatives and thus provide the basis necessary for selecting a "preferred" airport development plan. Alternatives are subjected to an evaluation that will permit a comparison of the merits and deficiencies of all options under consideration. Many of the alternatives are long-range items that are beyond the 20-year planning period based upon the forecasts of aviation demand. However, to fully ensure that the potential long-term needs of the airport are investigated, each alternative was evaluated with the following criteria:

Airspace Compatibility: Potential airspace obstructions will impact the feasibility of airport expansion plans. A determination of future airspace use and compatibility for traffic patterns will be completed.

Airfield Capacity Maximization: The capacity of an airport is determined by analyzing runway configuration, existing and future total operations, and fleet mix (types of aircraft using the airport).

Operational Efficiency: The "critical" types of aircraft must be able to operate efficiently. The critical aircraft for Runway 14-32 is the Douglas DC-9-30. The predominant aircraft that would use the crosswind runway would include the Cessna 172 and Beechcraft Bonanza. Small aircraft are more susceptible to crosswinds than commercial service aircraft. However, during emergency

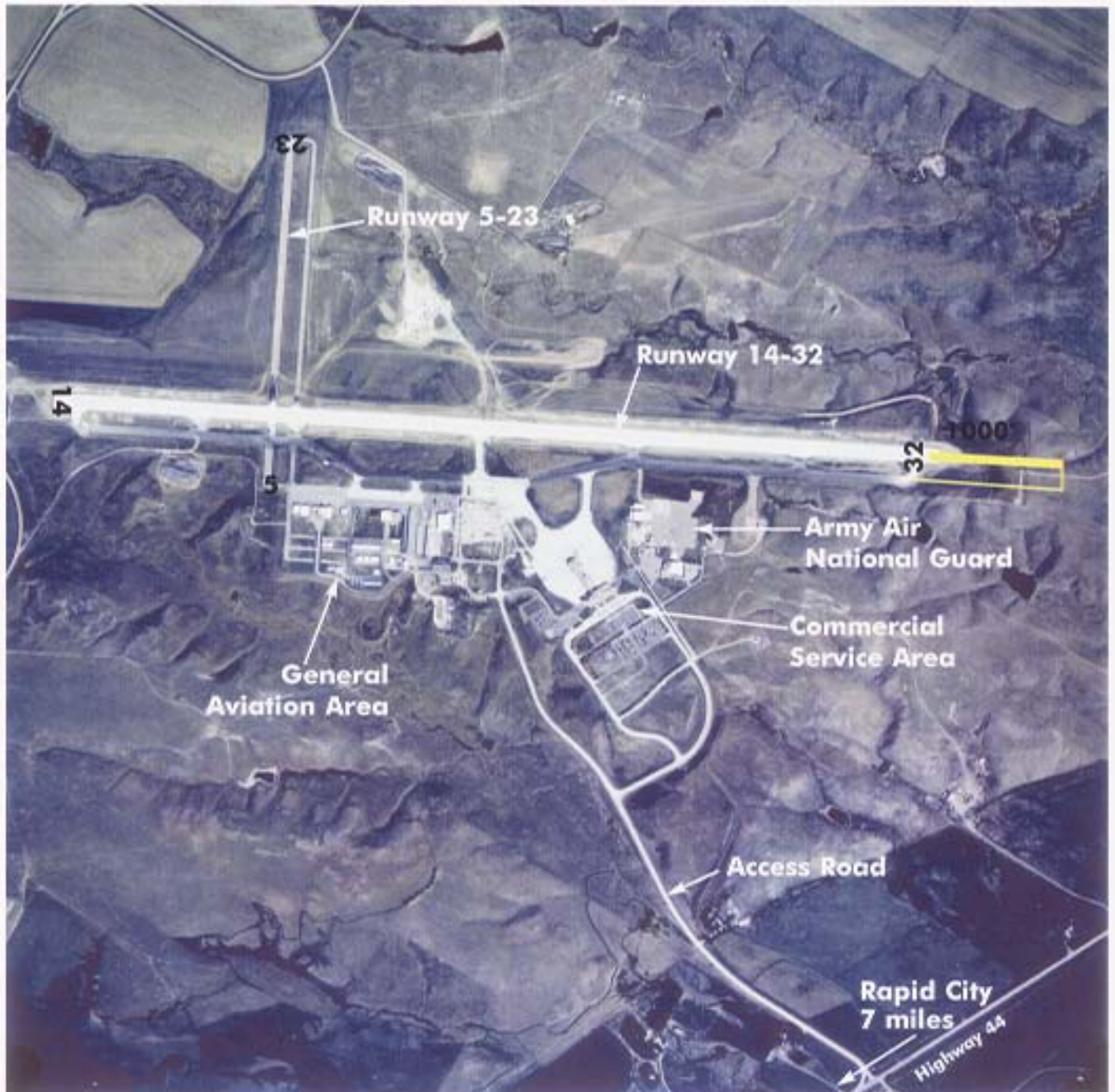
situations the crosswind runway may need to be used by all aircraft operating at Rapid City Regional Airport with some restricted loads.

Development Costs: Estimates of the developments costs required for each alternative were evaluated as part of the overall evaluation program. The capital provides basis for analyzing the cost and benefit of each alternative. Cost estimates for each alternative are presented in Tables 4-1 to 4-5.

4.2 Airfield Alternatives

This section examines the scenarios for Rapid City Regional Airport to accommodate future aviation demand. Five airfield alternatives were investigated including: (1) extension of the primary Runway 14-32 to 9,600' in length; (2) the development of a 6,100' parallel Runway to 14-32; (3) extension of Runway 05-23 to 7,000'; (4) reconstructing the crosswind Runway 5-23 to remove the line-of-site problems; and (5) increase the Runway to Taxiway "A" separation to 400'.

These alternatives represent a reasonable range of options available at Rapid City Regional Airport and, when compared with the maintenance of the status quo, will determine the most advantageous course of action to be followed. The following Figures 4.1 - 4.4 show these alternatives, which are generalized, but are in sufficient detail to identify the limitations and constraints that occur. Each scenario is described as follows:



Aerial photography provided by Horizons

Figure 4.1

4.2.1 Alternative One

Alternative One evaluates the impact of an extension to Runway 14-32 to 9,600' and a similar extension of the associated Taxiway "A." The taxiway would be built at the 265' separation that now exists. This involves an extension to accommodate possible future airport usage by aircraft in the FAA Design Group IV. These aircraft include the Boeing 767.

Recommendation

Selection of a recommended airfield alternative was based upon factors presented in Chapter Three and professional judgement based on previous planning experience. Review of the factors indicates that *runway extension does not provide a significant advantage* over the current situation. While many of the negatives due to the runway extension are associated with costs, the additional length is not required for the current or future "critical" aircraft or to accommodate other types of aircraft that could operate at Rapid City Regional Airport. The cost for the runway extension project is estimated at \$5,330,000. Table 4-1 shows the cost estimates for the runway extension.

4.2.2 Alternative Two

The primary feature of this alternative is to build a parallel Runway 14L-32R. This runway would be 6,100 x 100' and be used to accommodate C-II aircraft when and if the primary runway is unavailable. It would also

be used to reduce demand on the primary runway which would reduce delay.

Recommendation

In evaluating Alternative Two it was determined that *the parallel runway does not provide significantly more advantages* than the current situation. The development of the parallel runway would cost approximately \$14,847,000 while doing very little to reduce the already small amount of delay experienced at Rapid City Regional Airport. The cost compared to the benefit of the parallel runway clearly indicates that a parallel runway at this point is beyond the 20 year planning horizon. Table 4-2 shows the cost estimates for the parallel runway.

4.2.3 Alternative Three

The desire to have both runways at the airport able to accommodate commercial service aircraft is due to the primary runway reconstruction in 1996 that required all commercial operations to be moved to Ellsworth Air Force Base for a 3-month period. While any major construction will not close the primary runway any time in the near future, the possibility exists for an incident to occur which would close the runway which could temporarily halt all commercial service operations. This Alternative involves extending the Runway 05-23 to 7,000' to accommodate the associated carriers at maximum payload and to allow use by the majors with only limited load capacities.

Recommendation

The extension of Runway 5-23 would provide a level of flexibility in the airport's ability to accommodate commercial service operations. With two runways, the airport would be less likely to have commercial service shut downs due to an aircraft incident, NAVAID malfunction or periodic construction work on the primary runway. While these situations could happen, the events are not likely to disrupt commercial service at Rapid City over the long term. With the cost of development estimated at \$22,885,290, *it is recommended not to extend Runway 5-23 to 7,000'.*

4.2.4 Alternative Four

Alternative Four includes the reconstruction of the existing crosswind Runway 5-23. The runway length and taxiway separations currently meet FAA criteria for the types of aircraft currently operating; however, there is a line-of-site problem which does not meet standards. Line-of-site refers to a pilot's ability to see objects or other aircraft along the length of the runway. The criteria varies, but the line-of-site would be corrected under this option.

Recommendation

Based on FAA criteria, the established goal for wind coverage is 95%, which primary Runway 14-32 currently meets. While the primary runway currently meets wind coverage criteria, the crosswind runway provides an additional level of safety and flexibility in airport operations. The cost of development

to resolve the line-of-site issue on the crosswind runway is estimated at \$1,034,000. In this case either of the choices could be pursued (no build or reconstruction) which would result in varying degrees of satisfaction and acceptance by airport users. However, the no development alternative is not an acceptable alternative if the airport is to maintain flight training and provide an additional safety feature that is important to light aircraft. *It is recommended to keep and rebuild the existing crosswind runway.*

4.2.5 Alternative Five

Alternative Five involves the upgrading of Taxiway Alpha to FAA separation criteria of 400' for C-III aircraft. This is an item that needs to be analyzed because the north and south ends currently only have a 200' separation. The runway/taxiway system was designed with separation shortfall due to the severe terrain elevation change that made it very costly to raise the grade to allow for aircraft movement.

Recommendation

The elevation to the runway/taxiway separation has already been reviewed by FAA and a "Modification to Standards" has been issued. The ultimate forecast of operations by C-III aircraft is 3,016, or approximately 8 operations per day. The amount of use by the C-III aircraft at the 200' separation does not significantly impact safety nor will it create a capacity problem. *It is recommended to maintain the 200' separation and the Modification to Standards.*

**TABLE 4-1
ALTERNATIVE ONE
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA**

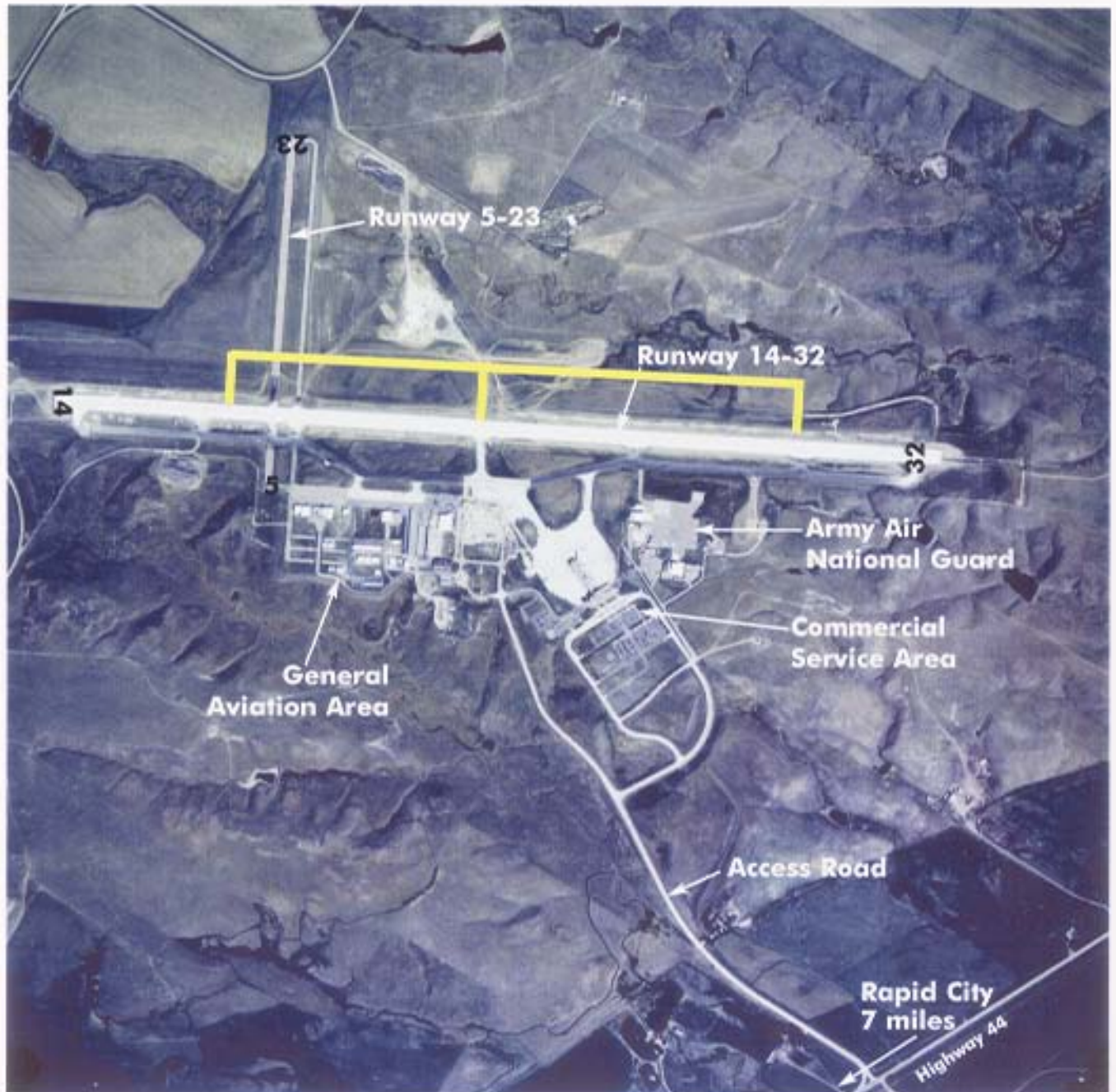
**1,000' EXTENSION RUNWAY 14/32 AND TAXIWAY "A"
Construct 1,000 LF Extension, PCC Pavement, Lighting, Painting, Safety Area**

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization	Lump Sum	L.S.	\$ 169,750.00	\$ 169,750.00
2	Field Laboratory	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
3	Demolition of Existing Blast Pad	3,333	S.Y.	\$ 0.50	\$ 1,666.50
4	Relocate Existing Taxiway Lights	8	Each	\$ 250.00	\$ 2,000.00
5	New Taxiway Lights Base Mounted	25	Each	\$ 650.00	\$ 16,250.00
6	New Runway Lights Base Mounted	12	Each	\$ 650.00	\$ 7,800.00
7	Cable in Duct	5,215	L.F.	\$ 6.00	\$ 31,290.00
8	Trenching and Backfill for Light Cables	5,300	L.F.	\$ 3.50	\$ 18,550.00
9	New MALS Threshold Outboard Lights	2	Each	\$ 650.00	\$ 5,200.00
10	New MALS Threshold Central Lights	8	Each	\$ 650.00	\$ 5,200.00
11	Relocate Buried Cable in Duct	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
12	Relocate MALSR Control Building and Distribution Panel	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
13	Adjust MALS Light Bars	9	Each	\$	\$
14	Relocate ILS	Lump Sum	L.S.	\$ 15,000.00	\$ 15,000.00
15	Demolition of MALS Light Bar	Lump Sum	L.S.	\$ 1,500.00	\$ 1,500.00
16	Distance Remaining Sign	1	Each	\$ 1,200.00	\$ 1,200.00
17	Signs	5	Each	\$ 1,200.00	\$ 6,000.00
18	New Electrical Manhole	1	Each	\$ 600.00	\$ 600.00
19	Unclassified Excavation	23,441	C.Y.	\$ 0.80	\$ 18,752.80
20	Borrow	820,776	C.Y.	\$ 1.24	\$ 1,017,762.24
21	Embankment in Place	844,217	C.Y.	\$ 0.94	\$ 793,563.98
22	Bituminous Base Course (Crushed Ledge Rock)	8,474	Ton	\$ 23.00	\$ 194,902.00
23	Asphalt Cement for Base Course AC 5 or 120 - 150 PEN. (Crushed Ledge Rock)	508	Ton	\$ 170.00	\$ 86,360.00

**TABLE 4-1
 ALTERNATIVE ONE
 ENGINEER'S ESTIMATE OF PROBABLE COST
 RAPID CITY REGIONAL AIRPORT
 RAPID CITY, SOUTH DAKOTA**

**1,000' EXTENSION RUNWAY 14/32 AND TAXIWAY "A"
 Construct 1,000 LF Extension, PCC Pavement, Lighting, Painting, Safety Area**

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
24	PCC Pavement (15 1/2")	34,166	S.Y.	\$ 25.00	\$ 854,150.00
25	PCC Pavement Grooving	21,040	S.Y.	\$ 1.40	\$ 29,456.00
26	Joint Sealing Filler	17,960	L.F.	\$ 2.00	\$ 35,920.00
27	Bituminous Prime Coat, MC-70	36	Ton	\$ 330.00	\$ 11,880.00
28	Bituminous Tack Coat SS-1H/CSS-1H	7	Ton	\$ 500.00	\$ 3,500.00
29	Runway and Taxiway Painting	16,415	S.F.	\$ 1.00	\$ 16,415.00
30	New Chain Link Fence	2,000	L.F.	\$ 20.00	\$ 40,000.00
31	Relocate Chain Link Fence and Gate	Lump Sum	L.S.	\$ 4,000.00	\$ 4,000.00
32	Hydromulching	44	Acre	\$ 500.00	\$ 22,000.00
33	Seeding and Fertilizing	44	Acre	\$ 700.00	\$ 30,800.00
34	Placing Topsoil	23,145	C.Y.	\$ 2.00	\$ 46,290.00
35	Relocate PAPI	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
36	24" RCP	890	L.F.	\$ 28.00	\$ 24,920.00
37	Drain and Grate	2	Each	\$ 2,500.00	\$ 5,000.00
38	Class 1 Rip Rap	30	Ton	\$ 30.00	\$ 900.00
39	Incidental Work	Lump Sum	L.S.	\$ 30,000.00	\$ 30,000.00
40					
41	ESTIMATED CONSTRUCTION COST - SUBTOTAL				\$ 3,564,678.52
42	CONTINGENCY				\$ 534,701.78
43	ADMIN., LEGAL, DESIGN, CONSTRUCTION ENGINEERING				\$ 1,229,814.09
44					
45	TOTAL				\$ 5,329,194.39



Aerial photography provided by Horizons

Figure 4.2

TABLE 4-2
ALTERNATIVE TWO
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA

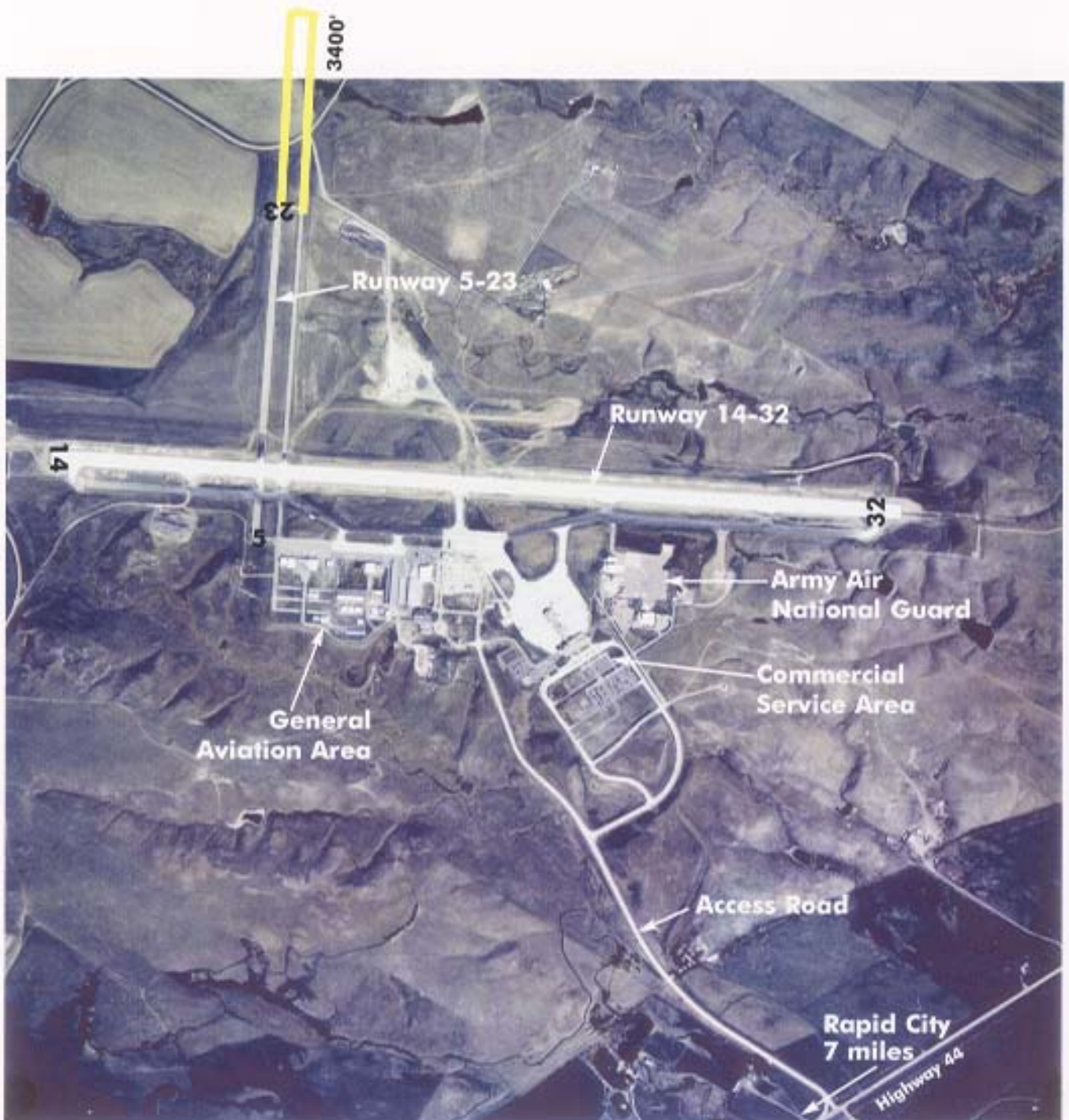
6,100' X 100' RUNWAY 14/32 AND CONNECTING TAXIWAYS
Construct PCC Pavement, Lighting, Signs, Painting,
Safety Area, and Connecting Taxiways

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization	Lump Sum	L.S.	\$ 453,200.00	\$ 453,200.00
2	Field Laboratory	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
3	New Runway and Taxiway Lights Base Mounted	183	Each	\$ 650.00	\$ 118,950.00
4	Cable in Duct	45,675	L.F.	\$ 6.00	\$ 274,050.00
5	Relocate Buried Cable	Lump Sum	L.S.	\$ 2,500.00	\$ 2,500.00
6	Trenching and Backfill for Light Cables	15,750	L.F.	\$ 3.50	\$ 55,125.00
7	Relocate ASOS	Lump Sum	L.S.	\$ 25,000.00	\$ 25,000.00
8	Install New PAPI	2	Each	\$ 20,000.00	\$ 20,000.00
9	Relocate Wind Cone and Segmented Circle	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
10	Distance Remaining Signs	2	Each	\$ 1,200.00	\$ 2,400.00
11	New Runway Exit and Taxiway Signs	24	Each	\$ 2,500.00	\$ 60,000.00
12	New Electrical Manhole	28	Each	\$ 600.00	\$ 16,800.00
13	Unclassified Excavation	2,005,900	C.Y.	\$ 0.80	\$ 1,604,720.00
14	Embankment in Place	2,395,650	C.Y.	\$ 0.94	\$ 2,251,911.00
15	Borrow	389,756	C.Y.	\$ 1.24	\$ 483,297.44
16	Bituminous Base Course (Crushed Ledge Rock)	27,753	Ton	\$ 17.60	\$ 488,452.80
17	Asphalt Cement for Base Course AC 5 or 120-150 PEN. (Crushed Ledge Rock)	1,666	Ton	\$ 130.00	\$ 216,580.00
18	PCC Pavement (15 1/2")	96,376	S.Y.	\$ 25.00	\$ 2,409,400.00
19	PCC Pavement Grooving	55,067	S.Y.	\$ 1.40	\$ 77,093.80
20	Joint Sealing Filler	58,900	L.F.	\$ 2.00	\$ 117,800.00
21	Bituminous Prime Coat, MC-70	117	Ton	\$ 200.00	\$ 23,400.00
22	Bituminous Tack Coat SS-1H/CSS-1H	21	Ton	\$ 470.00	\$ 9,870.00



TABLE 4-2
ALTERNATIVE TWO
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA
6,100' X 100' RUNWAY 14/32 AND CONNECTING TAXIWAYS
Construct PCC Pavement, Lighting, Signs, Painting,
Safety Area, and Connecting Taxiways

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
23	Runway and Taxi Entrance	155,010	S.F.	\$ 0.55	\$ 85,255.50
24	New Chain Link Fence	3,464	L.F.	\$ 20.00	\$ 69,280.00
25	Relocate Chain Link Fence and Gates	Lump Sum	L.S.	\$ 50,000.00	\$ 50,000.00
26	Hydromulching	126	Acre	\$ 300.00	\$ 37,800.00
27	Seeding and Fertilizing	126	Acre	\$ 700.00	\$ 88,200.00
28	Placing Topsoil	700	C.Y.	\$ 0.20	\$ 140.00
29	Gravel Surfacing	817	Ton	\$ 18.00	\$ 14,706.00
30	24" RCP	2,762	L.F.	\$ 28.00	\$ 77,336.00
31	48" RCP	2,700	L.F.	\$ 85.00	\$ 229,500.00
32	48" Flared End Section	1	Each	\$ 1,200.00	\$ 1,200.00
33	Drain and Grate	9	Each	\$ 2,500.00	\$ 22,500.00
34	Class 1 Rip Rap	30	Ton	\$ 30.00	\$ 900.00
35	Incidental Work	Lump Sum	L.S.	\$ 100,000.00	\$ 100,000.00
36	ESTIMATED CONSTRUCTION COST - SUBTOTAL				\$ 9,517,367.54
37	CONTINGENCY				\$ 1,903,473.51
	ADMIN., LEGAL, DESIGN, CONSTRUCTION ENGINEERING				\$ 3,426,252.31
	TOTAL				\$14,847,093.36



Aerial photography provided by Horizons

Figure 4.3

**TABLE 4-3
ALTERNATIVE THREE
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA**

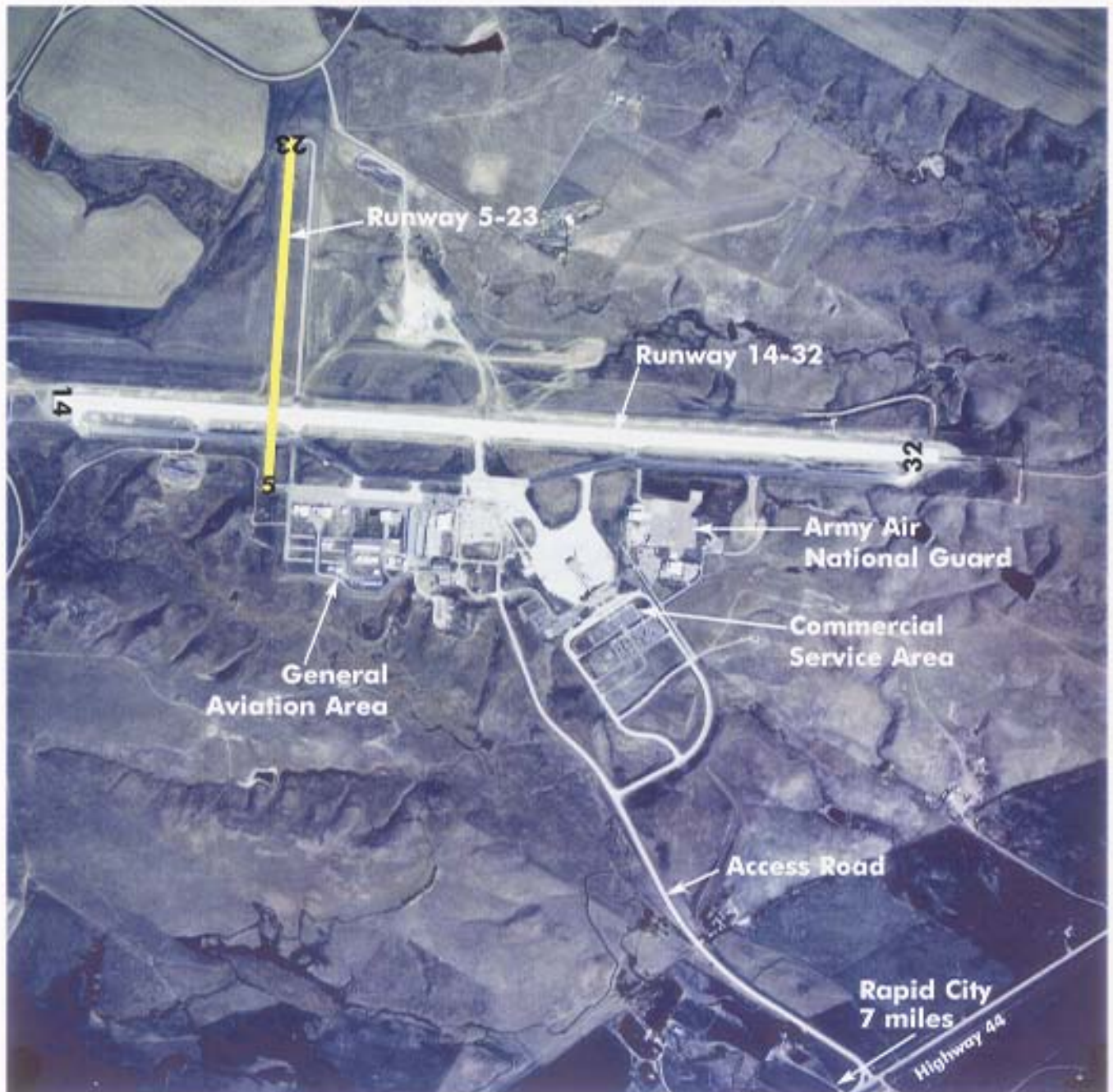
**RUNWAY 5/23 EXTENSION
Extend 5/23 & Taxiway "B", 3,400' x 100' Wide, Widen Existing 3,600' 5/23 by 25',
Asphalt Paving, Lighting, Signs, Painting, Relocate 7,500 LF County Road**

ITEM NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization	Lump Sum	L.S.	\$ 690,000.00	\$ 690,000.00
2	Field Laboratory	Lump Sum	L.S.	\$ 4,000.00	\$ 4,000.00
3	Unclassified Excavation	143,775	C.Y.	\$ 2.00	\$ 287,550.00
4	Embankment in Place	2,157,390	C.Y.	\$ 3.00	\$ 6,472,170.00
5	Borrow	2,013,615	C.Y.	\$ 2.00	\$ 4,027,230.00
6	Crushed Aggregate Base Course	49,110	C.Y.	\$ 28.00	\$ 1,375,080.00
7	Bituminous Surface Course (Crushed Ledge Rock)	11,840	Ton	\$ 23.00	\$ 272,320.00
8	Asphalt Cement for Surface Course AC 5 or 120-150 PEN. (Crushed Ledge Rock)	710	Ton	\$ 170.00	\$ 120,700.00
9	Bituminous Prime Coat, MC-70	83	Ton	\$ 330.00	\$ 27,390.00
10	Bituminous Tack Coat SS-1H/CSS-1H	15	Ton	\$ 500.00	\$ 7,500.00
11	Bituminous Flush Seal	15	Ton	\$ 500.00	\$ 7,500.00
12	Runway and Taxi Entrance Painting	20,100	S.F.	\$ 1.00	\$ 20,100.00
13	New Runway and Taxiway Lights Base Mounted	102	Each	\$ 650.00	\$ 66,300.00
14	Cable in Duct	22,700	L.F.	\$ 6.00	\$ 136,200.00
15	Trenching and Backfilling for Light Cables	35,700	L.F.	\$ 3.50	\$ 124,950.00
16	New Electrical Manhole	6	Each	\$ 600.00	\$ 3,600.00
17	New Runway Exit and Taxiway Signs	4	Each	\$ 2,500.00	\$ 10,000.00
18	Relocate Runway Lights	40	Each	\$ 350.00	\$ 14,000.00
19	Relocate Signs	4	Each	\$ 1,200.00	\$ 4,800.00
20	Relocate PAPI	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
21	New Chain Link Fence and Gates	8,250	L.F.	\$ 20.00	\$ 165,000.00

**TABLE 4-3
ALTERNATIVE THREE
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA**

RUNWAY 5/23 EXTENSION
Extend 5/23 & Taxiway "B", 3,400' x 100' Wide, Widen Existing 3,600' 5/23 by 25',
Asphalt Paving, Lighting, Signs, Painting, Relocate 7,500 LF County Road

ITEM NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
22	Relocate Chain Link Fence and Gates	Lump Sum	L.S.	\$ 20,000.00	\$ 20,000.00
23	Hydromulching	70	Acre	\$ 500.00	\$ 35,000.00
24	Seeding and Fertilizing	70	Acre	\$ 700.00	\$ 49,000.00
25	Placing Topsoil	37,730	C.Y.	\$ 2.00	\$ 75,460.00
26	Gravel Surfacing	3,300	Ton	\$ 18.00	\$ 59,400.00
27	24" RCP w/Flared Ends	1,400	L.F.	\$ 35.00	\$ 49,000.00
28	48" RCP w/Flared Ends	1,900	L.F.	\$ 105.00	\$ 199,500.00
29	Drain and Grate	2	Each	\$ 2,500.00	\$ 5,000.00
30	Class 1 Rip Rap	250	Ton	\$ 30.00	\$ 7,500.00
31	Incidental Work	Lump Sum	L.S.	\$ 136,500.00	\$ 136,500.00
32					
33	ESTIMATED CONSTRUCTION COST - SUBTOTAL				\$14,477,750.00
34	CONTINGENCY				\$ 2,895,550.00
35	ADMIN., LEGAL; DESIGN, CONSTRUCTION ENGINEERING				\$ 5,211,990.00
36	EST. LAND ACQUISITION @ ESTIMATED 100 AC.				\$ 300,000.00
37	TOTAL				\$22,885,290.00



Aerial photography provided by Horizons

Figure 4.4

**TABLE 4-4
ALTERNATIVE FOUR
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA**

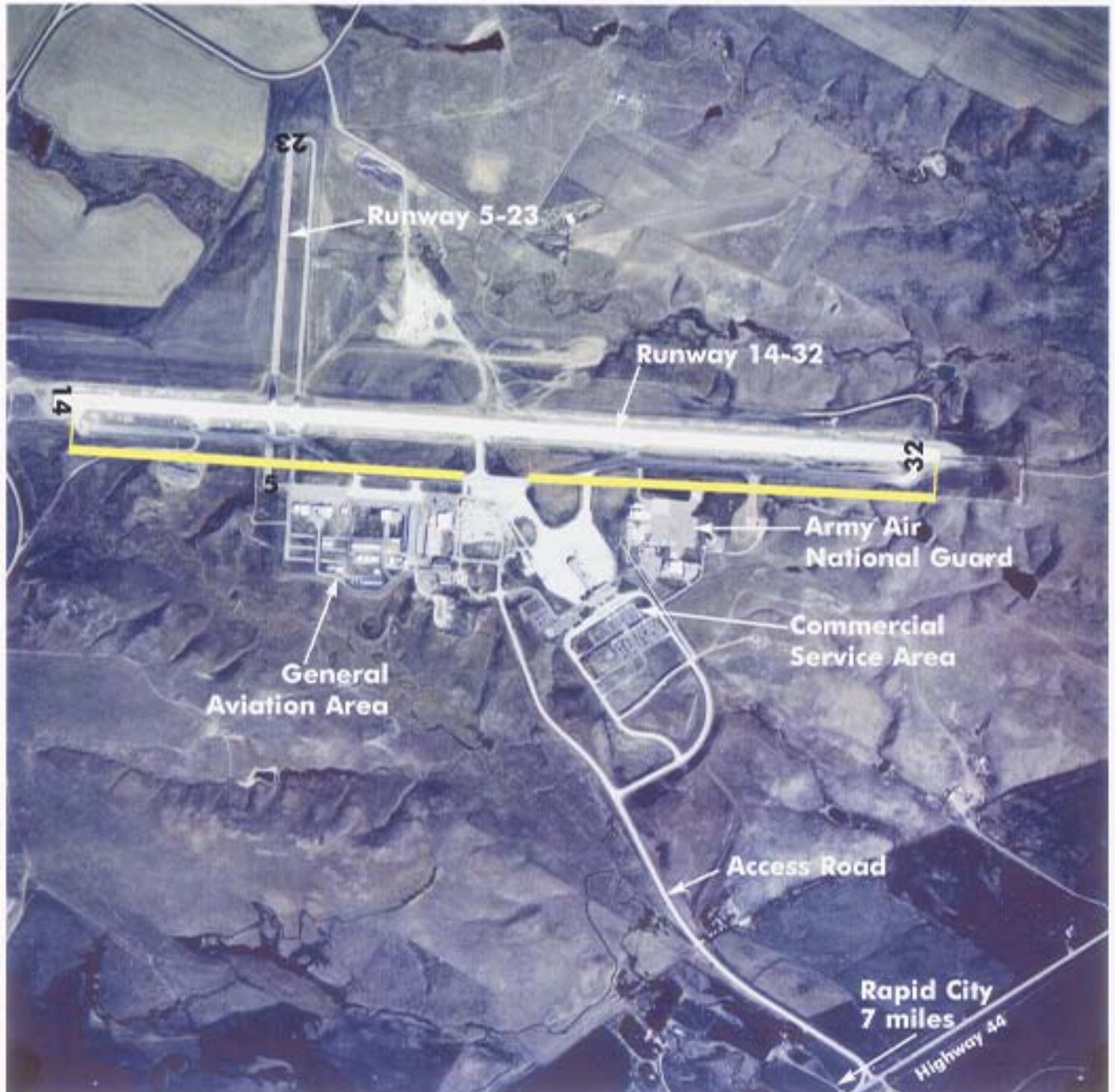
**RUNWAY 5/23
Reconstruct 1,600 L.F. to eliminate sight obstruction,
3" Overlay over remainder of runway**

ITEM NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization	Lump Sum	L.S.	\$ 37,500.00	\$ 37,500.00
2	Field Laboratory	Lump Sum	L.S.	\$ 4,000.00	\$ 4,000.00
3	Unclassified Excavation	47,170	C.Y.	\$ 2.00	\$ 94,340.00
4	Embankment in Place	8,200	C.Y.	\$ 3.00	\$ 24,600.00
5	Incidental Work	Lump Sum	L.S.	\$ 15,000.00	\$ 15,000.00
6	Crushed Aggregate Base Course	6,600	C.Y.	\$ 28.00	\$ 184,800.00
7	Bituminous Surface Course (Crushed Ledge Rock)	6,634	Ton	\$ 23.00	\$ 152,582.00
8	Asphalt Cement for Surface Course AC 5 or 120-150 PEN. (Crushed Ledge Rock)	398	Ton	\$ 170.00	\$ 67,660.00
9	Bituminous Prime Coat, MC-70	18	Ton	\$ 330.00	\$ 5,940.00
10	Bituminous Tack Coat SS-1H/CSS-1H	7	Ton	\$ 500.00	\$ 3,500.00
11	Bituminous Flush Seal	7	Ton	\$ 500.00	\$ 3,500.00
12	Runway Painting	9,140	S.F.	\$ 1.00	\$ 9,140.00
13	Seeding and Fertilizing	12	Acre	\$ 700.00	\$ 8,400.00
14	Placing Topsoil	6,289	C.Y.	\$ 2.00	\$ 12,578.00
15	Hydromulching	12	Acre	\$ 500.00	\$ 6,000.00
16	New Runway Lights Base Mounted	16	Each	\$ 650.00	\$ 10,400.00
17	Cable in Trench	3,600	L.F.	\$ 3.00	\$ 10,800.00
18	Trenching and Backfilling for Light Cables	3,600	L.F.	\$ 3.50	\$ 12,600.00
19					
20					
21	ESTIMATED CONSTRUCTION COST - SUBTOTAL				\$ 663,340.00
22	CONTINGENCY				\$ 132,668.00
23	ADMIN., LEGAL; DESIGN, CONSTRUCTION ENGINEERING				\$ 238,802.40
24					
25	TOTAL				\$ 1,034,810.40

**TABLE 4-5
 ALTERNATIVE FIVE
 ENGINEER'S ESTIMATE OF PROBABLE COST
 RAPID CITY REGIONAL AIRPORT
 RAPID CITY, SOUTH DAKOTA**

**RELOCATE TAXIWAY "A"
 Relocate Taxiway "A" to 400' from Runway 14/32
 Grading, PCC Pavement, Painting, Lighting, Signs**

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization	Lump Sum	L.S.	\$ 312,400.00	\$ 312,400.00
2	Field Laboratory	Lump Sum	L.S.	\$ 3,000.00	\$ 3,000.00
3	Relocate Taxiway Lights Base Mounted	145	Each	\$ 224.00	\$ 32,480.00
4	New Taxiway Lights Base Mounted	15	Each	\$ 650.00	\$ 9,750.00
5	Cable in Duct	46,925	L.F.	\$ 6.00	\$ 281,550.00
6	Trenching and Backfilling for Light Cables	17,460	L.F.	\$ 3.50	\$ 61,110.00
7	New Electrical Manhole	18	Each	\$ 600.00	\$ 10,800.00
8	Relocate Buried Cable	Lump Sum	L.S.	\$ 5,000.00	\$ 5,000.00
9	New Taxiway Signs	4	Each	\$ 3,000.00	\$ 12,000.00
10	Relocate Taxiway Signs	22	Each	\$ 1,200.00	\$ 26,400.00
11	Unclassified Excavation	525	C.Y.	\$ 0.80	\$ 420.00
12	Embankment in Place	1,455,639	C.Y.	\$ 0.94	\$ 1,368,300.66
13	Borrow	1,455,114	C.Y.	\$ 1.24	\$ 1,804,341.36
14	Bituminous Base Course (Crushed Ledge Rock)	21,437	Ton	\$ 17.60	\$ 377,291.20
15	Asphalt Cement for Base Course AC 5 or 120-150 PEN. (Crushed Ledge Rock)	1,286	Ton	\$ 130.00	\$ 167,180.00
16	PCC Pavement (15 1/2")	71,024	S.Y.	\$ 25.00	\$ 1,775,600.00
17	Joint Sealing Filler	43,530	L.F.	\$ 2.00	\$ 87,060.00
18	Bituminous Prime Coat, MC-70	90	Ton	\$ 200.00	\$ 18,000.00
19	Bituminous Tack Coat SS-1H/CSS-1H	16	Ton	\$ 470.00	\$ 7,520.00
20	Taxiway Painting	5,825	S.F.	\$ 0.55	\$ 3,203.75
21	Relocate Chain Link Fence and Gates	Lump Sum	L.S.	\$ 40,000.00	\$ 40,000.00
22	Hydromulching	69	Acre	\$ 300.00	\$ 20,700.00



Aerial photography provided by Horizons

Figure 4.5



TABLE 4-5
ALTERNATIVE FIVE
ENGINEER'S ESTIMATE OF PROBABLE COST
RAPID CITY REGIONAL AIRPORT
RAPID CITY, SOUTH DAKOTA

RELOCATE TAXIWAY "A"
Relocate Taxiway "A" to 400' from Runway 14/32
Grading, PCC Pavement, Painting, Lighting, Signs

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
23	Seeding and Fertilizing	69	Acre	\$ 700.00	\$ 48,300.00
24	Placing Topsoil	32,280	C.Y.	\$ 0.20	\$ 6,456.00
25	24" RCP	1,440	L.F.	\$ 28.00	\$ 40,320.00
26	24" RCP Flared End	6	Each	\$ 400.00	\$ 2,400.00
27	Drain and Grate	6	Each	\$ 2,500.00	\$ 15,000.00
28	Class 1 Rip Rap	30	Ton	\$ 30.00	\$ 900.00
29	Incidental Work	Lump Sum	L.S.	\$ 25,000.00	\$ 25,000.00
30					
31	ESTIMATED CONSTRUCTION COST - SUBTOTAL				\$ 6,560,082.97
32	CONTINGENCY				\$ 1,312,016.59
33	ADMIN., LEGAL; DESIGN, CONSTRUCTION ENGINEERING				\$ 2,361,629.87
34	TOTAL				\$10,233,729.43

4.3 Alternatives Conclusion

The airport operates efficiently with the airfield facilities currently in place. Runways 14-32 and 5-23 and corresponding taxiways are appropriately designed to accommodate "critical" aircraft that operate on them. The airspace is clear and will allow for expansion of either of the alternative development options. The airport is clearly not deficient in airport capacity, and throughout the 20-year planning period the airfield facilities at the airport should be maintained at the current dimensions.

4.4 Airport Land Use

The vacant or underutilized areas adjacent to the airport operating areas can be a valuable commodity for providing additional revenues. Current use is agricultural but due to potential business activity that airports can attract, an in-depth look at the real possibilities for the airport land has been conducted. The objective of this section of the study is to develop a concept for maximizing the value of the remaining airport land, and to suggest areas to be enhanced. The purpose is to help support the airport, local commerce and encourage further development. In discussions with local officials, the following topics are the primary focus of this effort:

- * To offer a plan of locations for economic development.
- * To maintain Rapid City's positive image at the airport's gateway.

- * To distinguish among different land uses within and around the airport site.
- * To develop a framework and plan for access and utility improvement.

4.5 Development Principles

The following principles generally apply to companies that lease and/or purchase industrial property.

A large area of undeveloped land in a rural area is not usually accepted by the typical industrial client because the client must assume many things will occur (utilities, upgrade of roads, etc.) in a specific time period. There are few industries which are willing to assume the role of a pioneer involving real estate. For this reason, industrial parks go through a very slow start up period. When there are several occupants that other firms can identify with, or do business with, the rate of absorption in the park accelerates.

Prices of land and facilities are not the major determining factors when an industry decides to relocate. For a manufacturer or other large employer, the cost of the facility represents only about 5%-8% of sales. More significant factors are the cost of labor, regulatory laws, access to markets, utilities, taxes, affordable housing, transportation, amenities of the surroundings and weather.

4.6 Site Utilities and Physical Characteristics

For the Airport to have a real opportunity to develop a viable industrial, commercial, or business area in the future, the site must have adequate utilities, particularly sanitary sewer service. Current waste water treatment is handled by a sewage lagoon on the airport site. This treatment application is adequate for treating typical domestic sewage. Larger industrial occupants, depending on their discharge, may require mechanical wastewater and pretreatment facilities. This would require a link to a traditional sewage treatment plant. The airport park is served by electricity, natural gas, telephone and water. Because these utilities do not depend on gravity they are much more easily brought to a site.

The airport is located on a plateau that has approximately a 100' grade change from the entrance to the terminal building. An area owned by the airport that could be used for economic development is west of the terminal. Included in this area is a meandering creek. The creek hasn't been mapped for flood areas, this will have to be completed before any development occurs. Plant species include native grasses and some Cottonwood and Cedar trees along the creek.

A second area owned by the airport that is well above any flood-prone areas is located south of the terminal access road. The area has a small drainage creek on site and the land is currently used as pasture and includes some weather data equipment. The weather

equipment needs to be 15' higher than any man made structures within 500'.

4.7 Land Use

With consideration of the opportunities and site constraints, the overall land use concept was assembled from the inventory analysis, with recognition of planned road and utility improvements, and relative to airport functional use areas. In general, seven categories of future activities are envisioned for the site. Each has separate infrastructure requirements.

- * Airport Operations (Runways, Taxiways, Runway Protections Zones)
- * General Aviation (Tie-Downs, FBO, T-Hangars)
- * Commercial Service (Terminal, Parking, Apron)
- * Agriculture (pasture and grazing)
- * Support Services (sewer lagoon, easements, fuel facilities)
- * Federal Government (Army Air National Guard, Forest Service)
- * Light Industrial (storage, manufacturing, distribution)
- * Office Park/Commercial (restaurants, office space, hotel)
- * Recreation (golf course, walking trail)

A generalized land use guide has been prepared to indicate a possible comprehensive

and systematic development program for the landside development. The land use guide is shown in Figure 4.6.

4.8 Design Guidelines

There are several different components that make up an integrated industrial park. The following text describes those components.

4.8.1 Main Entrance

The main entrance establishes the initial visual impression of the airport. In addition to serving as a gateway, it is a critical area for directional and informational signing to guide motorists to their destination. This is a prominent area and affords an excellent opportunity to create a strong image of the airport to the visitor. The primary visual design objective of the entry feature is to create an attractive and safe sense of arrival that reflects an appropriate character, image and identity for the industrial park and Rapid City Regional Airport.

4.8.2 Roads

Vehicular circulation provides not only primary means of on-site access but also a primary vantage point along which people will view the airport park. To reduce development costs future roads should be designed to reduce impact on existing terrain. The circulation system should define a hierarchy of flow from the airport/industrial park entrance to major and minor roads leading to specific destinations. A clearly structured circulation system can provide

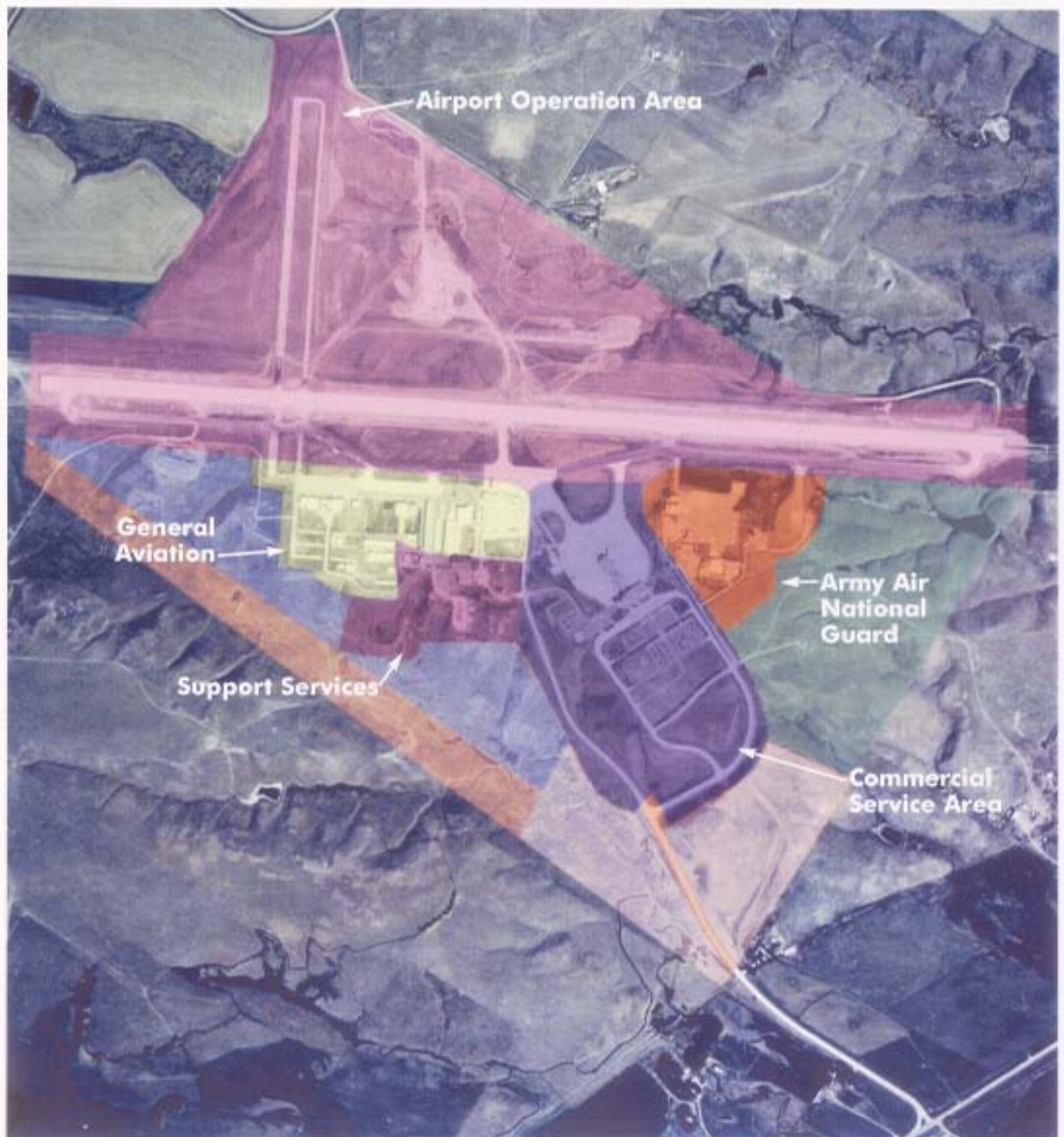
coherence to the overall industrial park theme. If visually reinforced, the system can simplify driver decisions, decrease motorist confusion, provide a level of visual continuity and enforce a sense of place and well being for the motorist.

Within developing areas, planting, screening, setbacks and other techniques can be used to visually integrate roads with the environment they serve. The construction of curbs and gutters or swales and ditches is a primary consideration. If a mixed approach is used, awkward transition areas develop and the cohesive image that is being sought can be destroyed.

4.8.3 Utilities

Utility systems provide the basic infrastructure of power, water, sewer, and communication necessary for the operation of an industrial park. Their location plays an integral part in which areas will develop first and influence patterns of development. They play a key role in determining visual character of an industrial park as well.

Traditionally, street rights-of-way have been used for the location of most utility systems. This provides for efficient distribution systems but becomes a negative factor when repairs have to be made and can become a detriment to the industrial park's image. To combat this problem it is recommended that the new utilities should be located in easements along the backside of property lines. This still allows for double frontage of the lots on utilities while limiting the negative impacts.



- | | | |
|---|--|--|
|  Airport Operations |  Support Services |  Light Industrial |
|  General Aviation |  Commercial Service |  Recreation |
|  Agriculture/Pasture |  Office Park | |

Aerial photography provided by Horizons

Figure 4.6

Utilities such as sewer lines, water lines, electricity, and telephone should all be contained in the utility easements.

4.8.4 Electricity

Power distribution lines should be located underground. If burying the lines is not an option, overhead distribution lines should be aligned along edges of land use areas, along the interior side of property lines or within a utility easement. Electrical feeder lines to businesses should be located underground. Transformers should be screened from public view with plant material or enclosure walls.

4.8.5 Sanitary Sewer

Sanitary sewage treatment is the most critical utility to land development. The airport is served by an on-site lagoon sanitary sewage treatment facility. This will need to be expanded with the use that an office or industrial park would create. Lagoon systems are not able to handle heavy industrial sewage; therefore, the uses at the airport must be similar to the types already common at the airport. A link-up with the Rapid City mechanical wastewater facility is possible. A sewage treatment plant is located approximately 1.5 miles from the airport.

4.8.6 Water

There are several locations in which water lines are available on the site. Future water lines should be underground and separated horizontally from sewer lines by 10 feet and vertically by two feet. Fire hydrants should be

highly visible and of uniform location throughout the airport industrial park.

4.8.7 Stormwater

Stormwater drainage systems in low density areas can be handled on-site or with drainage swales and ditches that are compatibly contoured into the natural land form. Based on costs and location drainage swales and ditches are recommended at Rapid City Regional Airport.

4.8.8 Natural Gas

Natural gas is available at the site. Additional feeder lines and distribution lines will be developed as necessary and contained in the easement corridors.

4.8.9 Telephone

Telephone lines will also be recommended to be placed in the easement corridors throughout the site. Telephone lines should be underground.

4.8.10 Noise Levels

All owners and users of parcels in the property should clearly understand that an airport exists in the nearby vicinity, and that noise levels consistent with an airport, with use by turbo prop and jet aircraft, exist in the vicinity of their property. This disclosure statement should be placed on the deed as a matter of notice for all parcels.

4.8.11 Building Architecture

This guideline should be incorporated into a minimum standards agreement. The aim is to promote an overall unity of design through compatible architecture. The airport terminal is the most significant design feature at the airport and all other elements should attempt to conform the style exemplified by the terminal. Any new structures should not attempt to copy exactly the terminal but should try to compliment it through color schemes, construction material, facade treatments and texture.

All necessary signs and coordinated site furnishings should be used to enhance the streetscape and natural character of the industrial park.

4.8.12 Landscaping

Budgets for plant materials often are eliminated or reduced which create stark and sparsely planted facilities. All too often planting design is thought of as a decoration while ignoring many functional issues. The overall objective of plantings is to improve the physical environment.

Skillful utilization of plants can significantly increase the energy efficiency of buildings. Air conditioning requirements for most buildings result from solar energy being absorbed by building surfaces. By shading building surfaces that receive the most sun, cooling requirements can be reduced.

4.8.13 Protective Covenants

The purpose of protective covenants is to establish and maintain a planned business and industrial center with certain design standards which may be in addition to those development regulations imposed by Rapid City. In order to establish general rules and guidelines for the improvement and development of the property, the city should impose mutual and beneficial restrictions for the benefit of all lands in the property and for the benefit of all future owners of lands in the property.

4.8.14 Design Review Committee

In order to enforce or review potential development items a design review committee should be established. The committee would oversee and provide input and recommendations as to alterations, site plans and expansion of the airport industrial park.

4.8.15 Maintenance

All users of the property should be obligated to keep and maintain the buildings, structures, parking areas, landscaping, signs and other entities of the parcel in an orderly and well maintained condition.

All waste, rubbish or surplus materials should be stored in properly screened enclosures and removed regularly. No materials, supplies, equipment, finished or semi-finished products should be permitted to be stored outdoors, except in areas approved by the committee, as per an approved site development plan.

If user of a parcel on the property fails to adequately maintain a building, structure, landscaping, parking lot or other premises, the Airport may, after giving appropriate legal notice, undertake maintenance of that parcel. The cost of the Airport's maintenance activities shall be recovered by the Airport through legal channels.

4.8.16 Height of Buildings

All buildings and structures will comply with Federal Aviation Regulation Part 77, "Objects Affecting Navigable Airspace".

4.9 Conclusion

Success with the additional economic development depends on consensus, cooperation, and the continued forward movement of the development process. The land use guide takes advantage of the site's unique features including the plateau location, existing roadway pattern, and utilities. The visual image of the airport and associated economic development should include aesthetics, underground utilities where possible, and appropriate irrigated landscaping. Following the recommendations summarized in this section, the Airport should be competitive in attracting additional economic growth opportunities.

4.10 Surface Transportation Issues

Information on the existing system of streets, highways and public transit was collected from local, regional and state agency sources. The purpose of this effort is to assess the type

and quality of airport access. Traffic impacts and issues associated with additional airport use are described. In particular, future plans with regard to connections with I-90 and potential transit operations will be described.

4.10.1 Street and Highway System

The primary roadway access to the Rapid City Regional Airport is from State Highway 44. SD 44 is classified by the Rapid City Transportation Planning Organization as a principle arterial. SD 44 is a four lane road west of Longview and provides good access from Rapid City and Rapid Valley to the airport area. An access road into the airport connects with Highway 44. Daily traffic volumes for the year 1996 on SD 44 were as follows:

Between the Airport and Reservoir Rd.	5,300
Between Reservoir Rd and Jolly Ln.	6,900
Between Jolly Lane and Twilight Dr.	14,300
Between Twilight and St. Patrick St.	28,200
Between St. Patrick and Sedivy Ln.	16,800
Between Sedivy Ln. and Campbell St.	19,000

I-90 provides for east-west interstate travel across South Dakota connecting Sioux Falls, Rapid City, the Badlands area and continuing into Wyoming and Montana. I-90 carries approximately 25,000 vehicles per day, except between Haines Avenue and I-190 where volumes are 37,000. Daily traffic volumes in

the vicinity of the Regional Airport are shown in Figure 4-7.

While Highway 44 provides access from the central area of Rapid City, the airport is less accessible from the I-90 corridor and from the southern portions of the Rapid City area. North-south access to the airport is limited to routes which connect with SD 44 in Rapid City and then continuing to the east on SD 44 to enter the airport area. Another east-west principal arterial is St. Patrick Street. This route provides for an east-west movement between US-16 and SD 44. However, there are no arterial routes located east and south of St. Patrick and SD 79. There are also no connections between I-90 and SD 44 located east of the E. St. Patrick Bypass.

4.10.2 Proposed Improvements

The Rapid City Area Long Range Transportation Plan includes three high priority corridor projects which would positively impact access to the Rapid City Regional Airport. A number of these projects are shown in Figure 4-8. These projects include:

- SD 230 (the South West Connector Route) from I-90 to SD 79. Construct a new primary arterial segment.
- SD 79 from SD 36 south of Hermosa to Rapid City. Widening and reconstruction.
- SD 79 (Heartland Expressway) from I-90 to Nebraska state line.

In addition one project is included under the category of High Volume Arterial Construction/Reconstruction which will positively impact access to the regional airport. It is listed below:

- SD 235 (South east Truck Route). The proposed Southeast Truck Route would connect the existing South Truck Route, US 16B and Elk Creek Road (SD 437).
- A corridor study of I-90 from I-190 to Duster's Corner was conducted by the SDDOT. Long range plans are to widen this stretch and prior to widening, several interchanges must be reconstructed to provide adequate width.

A number of studies have been prepared to address transportation and land use issues in the Box Elder area. This area is impacted by the location of the Ellsworth Air Force Base. These studies listed below have a less direct impact on the Rapid City Regional Airport, although the need for a connection between the two aviation facilities and between the I-90 and SD 44 corridors is reinforced in these studies. The projects recently completed for the Box Elder area, include:

The Ellsworth Air Force Base Joint Land Use Study

The Box Elder Area Transportation Network Planning Study

The Exist 67/I-90 Interchange justification Study

Box Elder Central Arterial Corridor Analysis

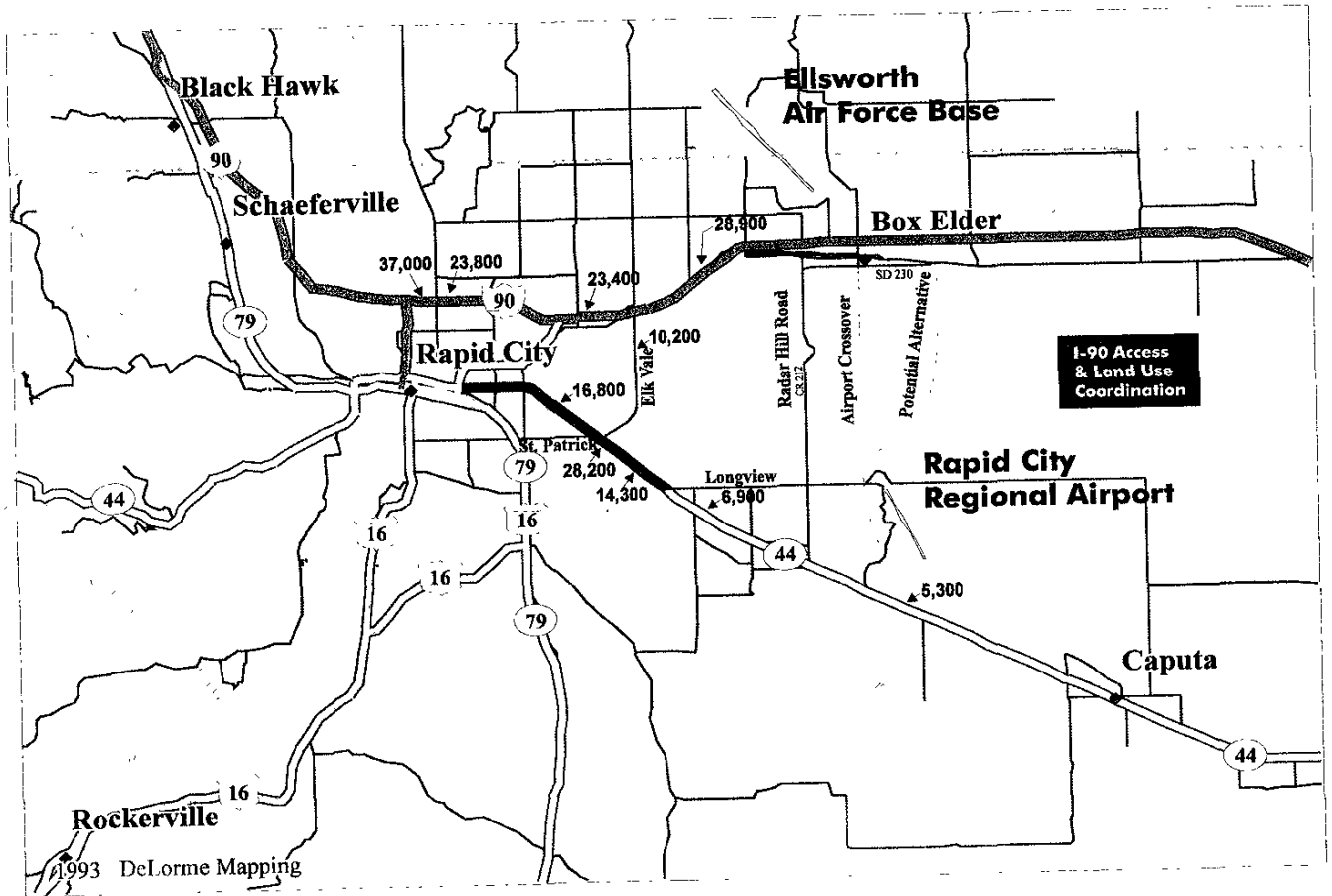


Figure 4.7

These studies have led to completing a detailed analysis of traffic conditions in the I-90 corridor. Currently, an improvement to the I-90 interchange at Exit 66 is programmed. A second interchange location was then studied to be located one mile east at milepost 67. These two locations provide an opportunity for a northern terminus to a route to connect the Air Force Base with the Regional Airport.

4.10.3 Airport Crossover Road

The idea of a connection between the two airports is not a new one. Rapid City and Pennington County proposed to connect the Regional airport to I-90 by improving County Route 212, rebuilding a bridge and connecting to the I-90 interchange 66. The planning for this project started in 1985. A new project was brought forward in a corridor approximately one mile east. This project, called the Airport Crossover Road, is included in the Rapid City area Long Range Transportation Plan and would begin at the northern terminus of the existing Airport Road which extends from SD 44 to the northern end of the airport. The proposed route would connect I-90 with SD 44 and would also provide a direct connection to the Ellsworth Air Force Base. A traffic analysis completed by SDDOT projected a peak seasonal daily traffic on this roadway if constructed at between 2,600 and 5,200.

The construction of a new interchange at milepost 67 has resulted in a second locational consideration relating to the northern connection with I-90. An interchange access study has been completed and accepted by the Federal Highway Administration. This plan

would result in construction of a new interchange one mile east of the Interchange 66. The ramps at Interchange would be removed and the connection at N. Ellsworth would be closed and replaced with a new arterial connection to Interchange 67. The Airport Crossover Route could also be relocated to connect as an extension of Spruce Street. Alternatively, SD 230 could be rebuilt between Spruce Street and a southern extension of Commercial Gate Road (CR 222). The primary purpose of construction a route in one of these corridors would be to accommodate traffic to the Regional Airport from the east.

4.11 Public Transportation

Formalized public transportation is not provided to the Regional Airport. The fixed route transit system operates in the City of Rapid City. Service is not extended to the airport. Transportation is provide by taxi service and rental cars companies. A typical rental car rate is \$45 per day. Taxi service between the Regional Airport and downtown Rapid City is \$15.

4.11.1 Proposed Railroad Operations

Developers of the planned Dunbar Resort near Deadwood have proposed a 56-mile long passenger train service between Whitewood and Deadwood. The proposed rail line operates parallel to SD 44. A rail stop would be made at the Regional Airport. The rail line would then potentially provide a connection between the Regional Airport and destinations such as downtown Rapid City, Deadwood,

and the planned Dunbar Resort. The cost of the line from the Rapid City area to Deadwood and then to the Dunbar Resort have been estimated at \$23 million.

The extent in which the proposed railroad operation will impact aviation related travel between the Regional Airport and Rapid City and to the Deadwood area is uncertain. Factors which will influence the demand for the transit service include frequency, cost, boarding time, the cost and frequency of competing travel options, and access to destinations from the rail stations. Service levels and frequency will greatly depend on potential demand and revenues. Other alternatives such as shuttle service, motor coach, private or shared ride taxi are alternatives to provide public transportation to these major destinations or could be used until rail service is started.

Future airport enplanements are forecast at 311,000 annually. Marketing studies identify numerous destinations for business and recreational travelers. Approximately 50,000 passengers are anticipated to be destined to the Dunbar Resort. A typical modal split for transit given a frequent rail service is approximately 10%. This would yield annual rail ridership of over 60,000 to 80,000 associated with airport operations. This level of usage equates to approximately 220 daily riders.

An intermodal transfer station is being considered to provide a rail station at the Regional Airport. The terminal could be used to facilitate movements between plane, rail,

private vehicle, bus and taxi travel. This area will be located east of the terminal near the airline ticket counters.

4.12 Conclusion

The Regional Airport is located on SD 44 east of Rapid City. SD 44 provides good access to the Regional Airport to travel from the central area of Rapid City. Access is less optimal for origin traffic approaching the Regional Airport on I-90 from the east. This traffic must travel further west to Elk Vale Road and then back east on SD 44. Direct access to the Regional Airport is made on a roadway directly from SD 44. Regularly scheduled fixed route transit service is not provided to the airport. Local travel must be made by private auto, rental car, shared ride or by taxi.

The transportation network is limited between I-90 and SD 44. This area is not highly developed and topography constrains the construction of a new roadway connection between I-90 and SD 44. A route alignment study should be completed to establish a route in this area and address the best way to connect at both the north and south terminal points.

The potential development of passenger rail service between the Regional Airport and Deadwood with a stop in Rapid City offers a second major opportunity to improve access to the Regional Airport. The costs associated with the construction and operation of passenger rail service will likely require some form of public or private subsidy. In addition to riders between Rapid City and the airport,

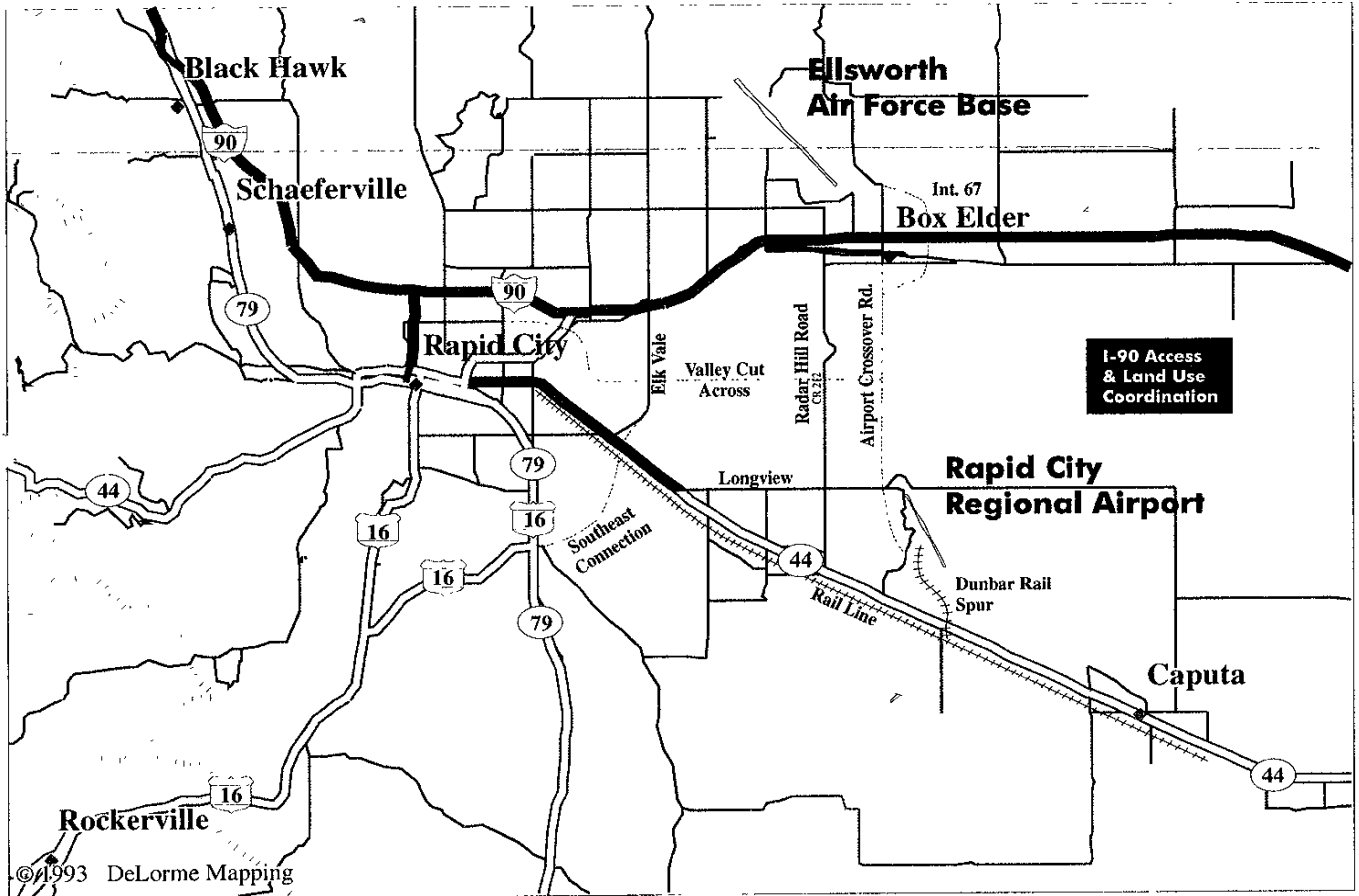


Figure 4.8



the potential use by air passengers traveling to the Dunbar Resort offers a second market segment from which to attract transit riders.

On site improvements will need to be made to accommodate the major proposed off site projects. Internal vehicle circulation will need to be accommodated to connect with the Airport Crossover Route.