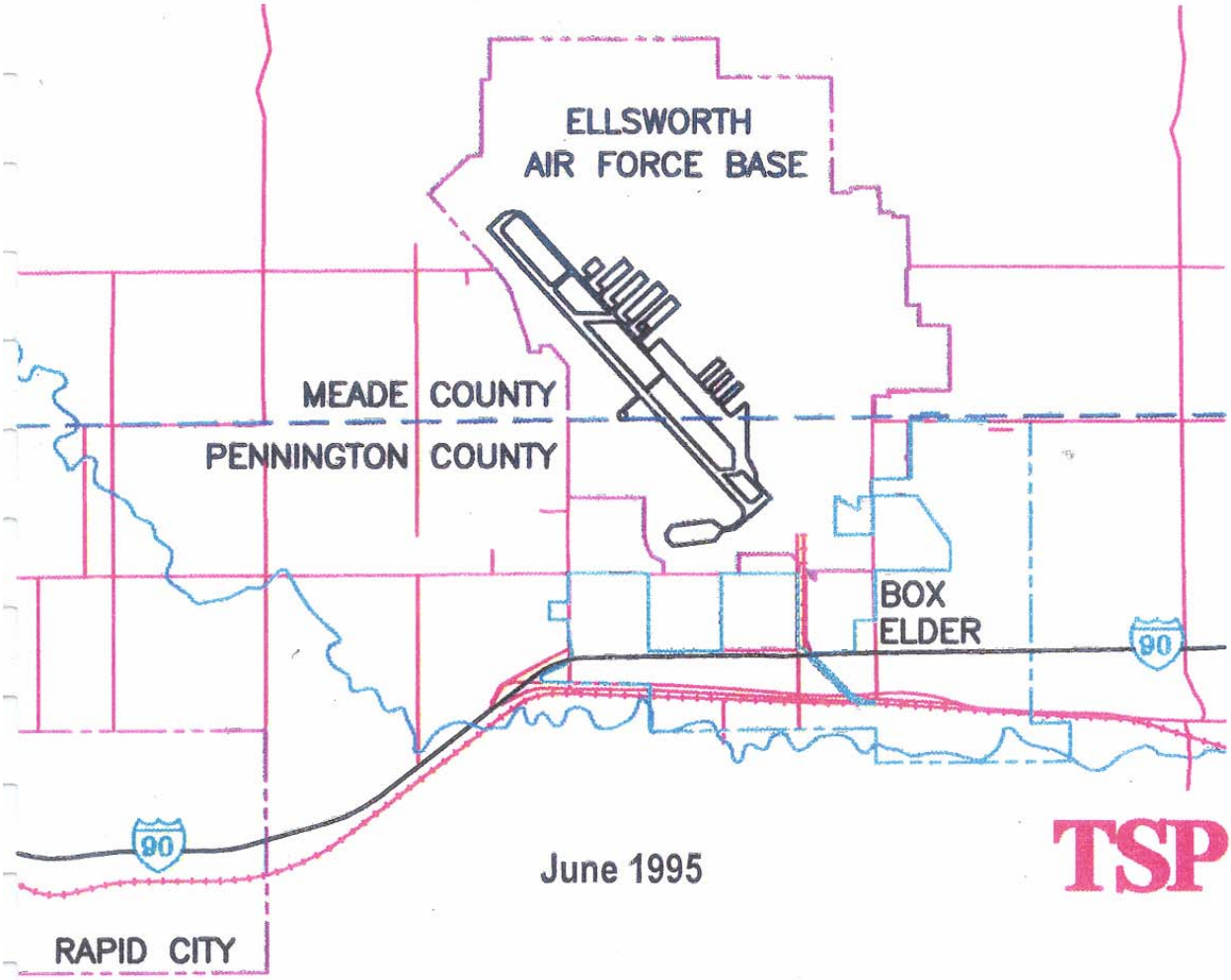
BOX ELDER AREA TRANSPORTATION NETWORK PLANNING STUDY



June 1995

TSP

Prepared For:

Black Hills Council of Local Governments
Box Elder
Ellsworth Air Force Base
Meade County
Pennington County
Rapid City
State of South Dakota

FELSBURG
HOLT &
ULLEVIG

Barnard Dunkelberg & Company

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Note: Figures are from the Ellsworth Air Force Base Joint Land Use Study, 1995.

INTRODUCTION

In 1993, a Coordinating Committee was established to guide the development of a Joint Land Use Study (JLUS) for Ellsworth Air Force Base. The goal of the Joint Land Use Study is to identify, analyze, and to the extent possible, resolve, community encroachment issues associated with the Ellsworth Air Force Base installation and the City of Box Elder, City of Rapid City, Pennington County and Meade County, to assure viability, growth and compatibility of the Air Force Base and the surrounding communities. The Coordinating Committee, made up of representatives from Ellsworth Air Force Base (EAFB), Box Elder, Rapid City, Pennington County and Meade County, met on May 10, 1994 to formally initiate the preparation of a report which will guide the political bodies of the communities surrounding Ellsworth AFB toward mitigating incompatible land uses.

During the development of the study outline for the Joint Land Use Study, the Coordinating Committee recognized the need for a concurrent Transportation Network Planning Study (TNPS) to assess the transportation system which is a basic determinant of land use patterns within the planning area. This plan serves as a supplement to guide the implementation of transportation alternatives to support the land use recommendations.

The transportation planning network study area is generally defined as the section of I-90 beginning at Crow's I-90 Truck Stop at the St. Patrick Street interchange (Exit 61) eastward to an unimproved rest area located approximately two miles east of Ellsworth AFB (mile marker 68.5). It also includes the area between Pennington County Road C272 just south of the Meade/Pennington County line and the ridge line (also known as Radar Hill) south of I-90.

Objectives

The following eight statements pertaining to surface transportation were taken from the eleven statements developed for the JLUS. They are presented to aid in defining the objectives of the study and to focus the work effort. The eleven objectives from the JLUS Report form the basis for the development of the plan. It should be noted that there are gaps in the numbering sequence.

Statement 1 - *Protect the long term operational integrity of Ellsworth Air Force Base to carry out its assigned military mission.*

Statement 3 - *Provide the public ample opportunities to give input to the study process including two scheduled work shops and public information meetings.*

Statement 4 - *Use land use plans and maps of the participating jurisdictions to develop policies and measures to be used to meet compatibility requirements in mitigating incompatible land uses where changes are recommended.*

Statement 5 - *Consider the flood plain areas described and depicted in the recent US Army Corps of Engineers study when mitigating incompatible land uses.*

Statement 6 - *Integrate the recommendations of the transportation network plan study being developed in conjunction with the joint land use study.*

Statement 7 - *Focus on a road network that will enhance safety and accommodate the travel needs of the local population.*

Statement 8 - *Evaluate relocating the interchange access to Ellsworth AFB from I-90 to an area outside the runway safety zones (i.e., Clear Zone and Accident Potential Zones I & II).*

Statement 9 - *Consider the socioeconomic impacts and funding available to implement any recommendations of the joint land use study.*

Study Assumptions

To begin the study process, several assumptions were developed as a basis for the development of the plan and program to follow. These assumptions provide a mutual understanding of the approach to the Ellsworth Air Force Base Joint Land Use Study, and have been reviewed by the Black Hills Council of Governments' Joint Land Use Study Coordinating Committee.

These study assumptions are not necessarily all-inclusive, but are comprehensive and inherent to this program to provide overall study guidance and coordination.

Here also, the following six assumptions pertaining to surface transportation were taken from the sixteen assumptions contained in the JLUS Report. Likewise, there are gaps in the numbering sequence.

Assumption 1 *- Ellsworth Air Force Base will remain in its present location and will retain its present general runway configuration and orientation.*

Assumption 5 *- The generalized study area will include applicable portions of the communities of Box Elder, Rapid City, Pennington County, and Meade County. Airspace issues regarding Rapid City Regional Airport will be considered in the planning process.*

Assumption 6 *- Land Use Classifications will include the categories of single family residential; mobile home residential; multi-family residential; office commercial; general commercial; light industrial; medium/heavy industrial; public; quasi-public; and, agricultural. Specific designations and notation will be made for schools, churches, hospitals and other noise sensitive uses.*

Assumption 9 *- Population growth figures will be ascertained from forecasts adopted by local jurisdictions. These figures will be used in the documentation, findings and recommendations relative to the Ellsworth Air Force Base Joint Land Use Study. Adopted future land use plans will be considered as guidelines for land use recommendations as appropriate.*

Assumption 10*-The recommendations of the Transportation Network Planning Study conducted concurrently with the Joint Land Use Study will be integrated into the recommendations to mitigate the incompatible land uses within the study area.*

Assumption 11*-Existing statutory requirements, enabling legislation and case law will be used to determine applicability of implementing land use controls.*

PARTICIPATING ORGANIZATIONS

The following State and Local organizations participating in the JLUS/TNPS are responsible for long-range planning and establishing transportation priorities within the study area.

South Dakota Department of Transportation (SDDOT)

SDDOT prepares studies to estimate the traffic demands along our State's system of highways. One such study indicates the need for widening Interstate 90 (I-90) to six lanes from Duster's Corner (Exit 63) westward to the I-90/I-190 (Business 90) interchange at Exit 60. These improvements will necessitate the purchase of right-of-way and improvements to interchanges along the route, including Duster's Corner. In addition, protective right-of-way is planned to be purchased from Duster's Corner to Ellsworth AFB main entrance road (Exit 66). Pavement spot repairs are also indicated from the Ellsworth interchange (Exit 66) eastward to a point four miles west of Wasta, SD.

Metropolitan Planning Organization (MPO)

The Rapid City MPO is an organization comprised of members of local jurisdictions including Rapid City, Box Elder and Pennington County who establish transportation priorities for the area. Among the goals set by the MPO, one concerns the area of Box Elder, Pennington County and Ellsworth AFB regarding a road connecting I-90 to the Rapid City Regional Airport. This proposed route would begin at the I-90 interchange at Ellsworth AFB (Exit 66) and continue south to the north end of existing Airport Road. A direct link between I-90 and the Rapid City Regional Airport would be created.

Meade County

Meade County is not a member of the MPO and is not responsible for any of the major roads (i.e., I-90; Highway 230, formerly Highway 14/16; and Ellsworth AFB main access roads) included in the study area. Meade County is responsible for the County Roads north of the Meade/Pennington County Line which serve the agriculture land uses east, north and west of the Base.

EXISTING CONDITIONS

Conditions concerning transportation issues facing Ellsworth AFB and the surrounding communities are: traffic volumes, level of service or capacity conditions, accident history, and land use patterns. Existing water, sanitary sewer and drainage infrastructure are also included in this report due to potential impacts.

An inventory of the Pennington County Roads was completed assessing each road in twelve road condition categories. The twelve road conditions categories inventoried were: stability and strength, typical cross section, surface drainage, longitudinal and transverse drainage, wearing surface condition, consistency of alignment, stopping sight distance, horizontal alignment, vertical alignment, maintenance economy, drainage control, rideability.

Each roadway listed below is depicted on Figure 1.

Traffic Volumes, Patterns, and Condition Evaluation

The Average Daily Traffic Volumes are listed in Table 1. The Peak Hour Traffic Volumes for Pennington County Roads 222 and 223 are listed in Table 2.

Interstate 90 (I-90) is a four-lane controlled access, paved highway. It is divided by a grassed median and has paved shoulders on each side of the roadways. I-90 runs east and west with interchanges at US Highway 230, Duster's Corner and Ellsworth AFB. Within the study area, I-90 runs through Pennington County and Box Elder but it does not enter Meade County.

US Highway 230 (Box Elder Road) (CR T414) consists of approximately 2.5 miles of four-lane, divided, paved roadway and then continues eastward as a two lane paved roadway. US Highway 230 begins approximately one-half mile west of the Box Elder city limit at an interchange with I-90. It then continues east through the entire length of Box Elder. US Highway 230 runs in an east/west direction south of, and approximately parallel to, I-90. This road is in good condition with some minor patching. US Highway 230 serves as an access to the western portion of Box Elder and the commercial gate on the south side of Ellsworth AFB. Within the City of Box Elder, US Highway 230 is also known as Box Elder Road.

ELLSWORTH AFB

DE–EMPHASIZE
(SCHOOL GATE)
13,700 (53%)

NEW FOCUS
(MAIN GATE)
7,500 (29%)

INTERSECTION
OPERATIONAL
ISSUES

COMMERCIAL GATE
4,500 (18%)

CR T224

CR C223

CR C222

CR C212

31

CZ

APZ I

APZ II

95%

5%

SUBSTANDARD
INTERCHANGE

Exit 66

90

E 16,000
P (21,200)

E 7,500
P (10,800)

E 7,200
P (9,200)

HWY 230

(CR T414)

INTERSECTION
OPERATIONAL
ISSUES

PROPOSED AIRPORT
CROSSOVER ROAD

Transportation Activity

E X,XXX – Existing Average Daily Traffic

P (X,XXX) – Planned Average Daily Traffic (Future)

School

Church

0 1/4 1/8 MILES

Ellsworth Air Force Base
Joint Land Use Study

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FIGURE 1

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Table 1
AVERAGE DAILY TRAFFIC VOLUMES
Box Elder Area Transportation Network Planning Study

Roadway	Average Daily Traffic (Vehicles per day)
Interstate 90	
East of Exit 66	16000
West of Exit 66	7500
US Highway 230 (formerly Highway 14-16)	
West of Pennington CR223	7200
East of Pennington CR223	1900
Pennington County Road 219	50
Pennington County Road 212	
1991 Count	1023
1993 Count	2500
Pennington County Road 222	
Northbound	2370
Southbound	2170
Pennington County Road 223	
Northbound	6820
Southbound	6920
Main Gate Road	
Westbound	3930
Eastbound	3570
Pennington County Road T224	300
Pennington County Road T272	250

Table 2
PEAK HOUR TRAFFIC VOLUMES
Box Elder Area Transportation Network Planning Study

Roadway	Peak Hour Traffic Volumes	
	Northbound	Southbound
Pennington County Road 222		
Morning	617	76
Noon	175	123
Evening	129	527
Pennington County Road 223		
At the EAFB School Gate		
Morning	635	208
Noon	513	455
Evening	491	802
At the EAFB Main Gate Intersection and South		
Morning	610	214
Noon	160	123
Evening	412	1149
Vehicles turning left from CR 223 to Main Gate Road		
Morning	310	
Noon	156	
Evening	110	

At Box Elder's east city limit, US Highway 230 becomes Pennington County Road T414. CR T414 proceeds east to CR T272 and then continues east past the limits of this study. This portion of the road is classified as a minor collector and has a speed limit of 50 mph. It serves as a connector to CR T272.

CR T414 is quite rough with frequent potholes and washboarding. Seven road condition categories received satisfactory ratings or better from Pennington County. Categories that received less than satisfactory ratings were stability and strength, surface drainage, wearing surface condition, consistency of alignment and rideability.

Pennington County Road C219 is a two-lane, paved road approximately 0.5 miles long. CR C219 proceeds north from US Highway 230, crosses over I-90 and joins Pennington County Road C214 just southwest of Ellsworth AFB. It is classified as a minor local feeder and has a speed limit of 35 mph. CR C219 serves as a connector between housing developments west of Ellsworth AFB to US Highway 230 and the westbound lanes of I-90. Within the City of Box Elder, CR C219 is known as Westgate Road and runs along the extreme western edge of the city.

Eight road condition categories received a satisfactory or better rating from Pennington County. Categories that rated less than satisfactory included consistency of alignment, stopping sight distances, vertical alignment and drainage control.

Pennington County Road C212 is a two-lane, paved road approximately 6 miles long. CR C212 runs north and south and proceeds from just south of I-90 to South Dakota Highway 44. It is classified as a major collector and has a speed limit of 50 mph. CR C212 runs through the southwest portion of Box Elder where it is known as Gumbo Drive. Within Pennington County this road is also known as Radar Hill Road. At present it serves as the only direct link between Box Elder and the Rapid City Regional Airport.

Eight road condition categories received a satisfactory or better rating from Pennington County. Categories that rated less than satisfactory included consistency of alignment, stopping sight distance, vertical alignment and drainage control.

Pennington County Road C222 is a two-lane, paved road approximately 0.8 miles long. CR C222 runs north and south and extends from Highway 230, in Box Elder, to the Commercial Gate on the south side of Ellsworth AFB. It is classified as a medium collector and has a speed limit of 45 mph. Within the City of Box Elder, CR C222 is known as South Gate Road and is located in the west-central portion of Box Elder.

All twelve road condition categories received a satisfactory or better rating from Pennington County. Some potholes and alligator cracking currently exist near the I-90 underpass.

Pennington County Road C223 (Ellsworth AFB Access Road) Pennington County Road C223 is a two- and three-lane, paved road approximately 1.9 miles long. CR C223 runs north and south from Highway 230 in Box Elder to the Meade County line. CR C223 serves as access to the Main Gate and the School Gate at Ellsworth AFB as well as a direct connection to I-90 for Ellsworth AFB and Box Elder. It is classified as a major collector and has a speed limit of 35 mph. Within Box Elder, CR C223 is known as Ellsworth Road and divides the city approximately in half.

From the School Gate to just south of its intersection with CR T272, CR C223 is three lanes. The road then constricts to two lanes and remains two lanes to just north of the Villa Ranchero Shopping Center. At this point CR C223 expands to three lanes. CR C223 continues as a three-lane road past the main entrance road to Ellsworth AFB and down a hill to a point at the south end of the former Renal Heights. At this point it contracts to two lanes. The road continues as two lanes through the low lying area, and back up to the top of a hill where it expands to three lanes. It continues as three lanes to the I-90 on ramp. The road narrows to two lanes as it goes under I-90 and then expands back to three lanes until it reaches US Hwy. 230. In all cases, the third lane is used as a turning lane.

All twelve road condition categories received an excellent rating from Pennington County.

Pennington County Road T224 is a two-lane, paved road approximately 0.7 miles long. CR T224 begins approximately 300 feet north of the Ellsworth AFB Main Gate Road and proceeds east from CR C223 for approximately 1100 feet (this portion is known as Villa Drive in Box Elder). CR T224 then jogs north and east and then north again, along the east boundary of Ellsworth AFB, to the Meade County line. This road is classified as a minor local feeder and has a speed limit of 25 mph. The entire length of this road lies within the northeast corner of Box Elder.

Five road condition categories received a satisfactory or better rating from Pennington County. Categories that rated less than satisfactory included stability and strength, surface drainage, wearing surface condition, consistency of alignment, maintenance economy, drainage control and rideability. There presently exist several potholes at the corner of CR T224 directly southwest of the school complex.

Pennington County Road T272 is a two-lane road that begins at Pennington CR T414 (US Highway 230) and proceeds north, passing under I-90, to approximately 215 feet south of the Meade County line. At this point the road has a "T" intersection and runs east and west. The westerly portion proceeds west to CR C223. This portion of CR T272 is paved. All other portions of this road are gravel. The easterly portion proceeds east to CR T229. Approximately 1.2 miles of this road are paved and approximately 5 miles are gravel. The westernmost mile of CR T272 lies along the northern limits of Box Elder. This road is classified as a minor collector and has a speed limit of 50 mph. The north-south portion of this road has a 6 ton load limit.

Eleven road condition categories received a satisfactory or better rating from Pennington County. The category that received a less than satisfactory rating was drainage control. Some longitudinal cracking exists in the portion of this road located between CR C223 and the "T" intersection.

Accident History

An analysis of major roads in the study area including I-90 and most state and county roads was conducted. Tables 3 through 10 list each road individually and summarizes the traffic volume and accident history for the period between January 1, 1992 and October 31, 1994. An accident is defined as any motor vehicle accident which causes an injury or fatality as a result of the accident or causes at least $500 damage to one person's property.

Table 3
Interstate 90 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	16,000
Deaths	3
Injuries	52
Peak Months	October and January
Peak Days	Tuesday, Thursday, and Friday
Peak Hours	6:00 a.m. to 7:00 a.m. 1:00 p.m. to 7:00 p.m.

Year	Number of Accidents	Location of Accidents		
		Exit 66 Interchange	Hwy. 230 Interchange	Other
1992	35	10	8	17
1993	31	8	3	20
1994	32	12	6	14
Total	98			

Note: Accidents occurred equally in the East and West bound lanes.

Table 4
US Highway 230 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	9,100
Deaths	0
Injuries	14
Peak Months	February (5 accidents)
Peak Hours	7:00 a.m. to 4:00 p.m.

Year	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
1992	12	10	2
1993	10	9	1
1994	10	7	3
Total	32		

Table 5
Pennington County Road 219 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	50
Deaths	0
Injuries	2
Peak Months	August (2 accidents)
Peak Hours	3:00 p.m. to 4:00 p.m.

Year	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
1992	2	1	1
1993	3		3
1994	2		2
Total	7		

Table 6
Pennington County Road 212 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	2,500
Deaths	0
Injuries	10
Peak Months	January and November
Peak Hours	3:00 p.m. to 5:00 p.m.

Year	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
1992	10	3	7
1993	8	1	7
1994	1	1	0
Total	19		

Table 7
Pennington County Road 222 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	4,540
Deaths	0
Injuries	2
Peak Months	January and October
Peak Hours	NA

Year	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
1992	0	0	0
1993	2	1	1
1994	1	0	1
Total	3		

Table 8
Pennington County Road 223 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	13,840
Deaths	0
Injuries	10
Peak Months	October (6 accidents)
Peak Hours	4:00 p.m. to 5:00 p.m.(7 accidents)

Year	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
1992	9	5	4
1993	13	4	9
1994	11	2	9
Total	33		

Table 9
Pennington County Road T224 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	300
Deaths	0
Injuries	0
Peak Months	NA
Peak Hours	NA

	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
Total	1	1	0

Table 10
Pennington County Road T272 Accident History
Box Elder Area Transportation Network Planning Study

Volume (ADT)	250
Deaths	0
Injuries	6
Peak Months	November (4 accidents)
Peak Hours	10:00 a.m. to 8:00 p.m. (3 accidents)

Year	Number of Accidents	Location of Accidents	
		Near an Intersection	Other
1992	2	0	2
1993	10	6	4
1994	5	3	7
Total	17		

Other Studies

In 1993, under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) the Heartland Express Economic and Engineering Feasibility Study was conducted. The Study explored the feasibility of a new highway between Scottsbluff/Gering, Nebraska and Rapid City, South Dakota. Several routes were identified and through the process of evaluation were reduced to three finalists. The three route options were subjected to five feasibility tests, including need based on traffic, engineering and cost feasibility, environmental feasibility, travel efficiency feasibility, and economic development feasibility. Based on the five feasibility tests which measured the benefit/cost ratio, the net present value and the rate of return, the three finalists were narrowed to a selected route.

The Heartland Expressway's most feasible route would connect Rapid City to Scottsbluff/Gering via Hot Springs, Chadron, and Alliance. The segments from Rapid City to Hot Springs and from Scottsbluff/Gering to Alliance were shown as a 4-lane highway. The segment between Hot Springs and Alliance via Chadron was shown as a improved 2-lane highway with appropriate turning and passing lanes.

The Study indicated that the more direct alignment would better attract the Denver area tourist traffic to the Black Hills as well as benefiting the economic development feasibility for the people in the corridor. As the Heartland Expressway enters Rapid City along Highway 79, the proposal shows it following the St. Patrick Street and I-90 at the St. Patrick interchange.

Problems and Relationship to Land Use Patterns

Problems relating to the incompatible land uses surrounding Ellsworth AFB and in particular the section of I-90 passing through Box Elder can be attributed to the existing layout of the road network. Because of the amount of traffic that uses this intersection, it became a natural "magnet" for commercial development. Commercial development becomes the heart of any community and further attracts other residential and support services to develop around it. This development has occurred over the years in Box Elder and has now come to the forefront as incompatible land uses.

Not only has Exit 66 attracted incompatible land uses, it has also created increased traffic along the main access road to Ellsworth AFB. Ellsworth AFB has studied the intersection of Rushmore Drive and Eleventh Street (County Road 223) and determined that the noon and evening peak hour traffic warrants consideration of traffic signals. In addition, because it is difficult to turn into the Base during these peak hours, many continue north on Eleventh Street and enter Ellsworth AFB at the school gate. This is just the reverse of the intent of Ellsworth's access to the base. They would rather the majority of the traffic use the Main Gate and less traffic pass through the school gate.

The proposed airport cross-over road from I-90 over Radar Hill to the Rapid City Regional Airport ties into County Road 223 on the south side of Box Elder. If this road is built, the additional traffic will only add to the problem. Transportation alternatives need to be developed that will provide the necessary access to the base, provide safe transportation for area residents and help to alleviate the incompatible land uses.

The primary concern for incompatible land uses lie within the Accident Potential Zones southeast of Ellsworth AFB. The following descriptions of those zones identify areas that impact land use patterns and associated transportation systems, and the relationship they may have on each other. Presently, the study area includes agricultural, residential, commercial, recreational and public/quasi-public land uses. Public/quasi-public areas include city parks, open spaces and city, state and federal buildings. Residential areas include single-family dwellings, multi-family and duplex dwellings and mobile homes. Agricultural areas are mostly grazing land. In some cases flood plain and other land uses may overlap.

Accident Potential Zone I (APZ I) is an area located beyond the Clear Zone that possesses a significant potential for accidents. There is one zone at each end of the runway. APZ 1 is 3000 feet wide by 5000 feet long and contains approximately 344 acres. Urban development lies only within the APZ I zone located at the south end of the runway. Development within the APZ I zone located at the north end of the runway is limited to isolated farms or ranches. All further references to APZ I refer to the south zone.

City of Box Elder development that lies within the APZ I zone includes 41 acres of residential land use, 51 acres of commercial land use and one church. The remaining land is agricultural and flood plain. Pennington County land located within the APZ I zone is undeveloped.

Accident Potential Zone II (APZ II) is a defined area beyond APZ I that has a lesser, but still significant, potential for accidents. There is one zone at each end of the runway. Each zone is 3000 feet wide by 7000 feet long and contains approximately 482 acres. Development lies only within the APZ II zone located at the south end of the runway. There is no development within the APZ II zone located at the north end of the runway. Further references to APZ II refer to the south zone.

City of Box Elder development within the APZ II zone includes 83 acres of residential land use, seven acres of commercial land use, three acres of public/quasi-public land use and one church. The remaining land is agricultural and flood plain.

Pennington County development within the APZ II zone includes nine acres of residential land use. The remaining land is agricultural or undeveloped.

Noise zones also impact land use patterns and criteria contained in the JLUS Report restrict certain development within these zones. This is another factor that must be considered in developing a transportation network plan.

DNL noise contours indicating the noise levels generated by current aircraft operations were developed by the computerized Day-Night Average A-Weighted Sound Level (DNL) metric and the Department of Defense NOISEMAP methodology. DNL contours within the study area range from 65 to 80 dB and are shown in increments of five dB on maps presented later in this report. For detailed land use analysis, see the Joint Land Use Study Report.

Study Area Infrastructure

The following descriptions of existing infrastructure are presented for reference only. They are included due to potential impact the utilities and transportation systems may have on each other. Figure 2 depicts the main Box Elder utilities. Appendix A is a detailed description of the Box Elder water and sanitary sewer system.

Water Supply. Existing water supply and distribution facilities in the study area are owned and operated by the two participating municipal jurisdictions, Box Elder and Rapid City. The residents in the two participating county jurisdictions receive water from private facilities. They include Pennington County and Meade County.

Box Elder's water system consists of three wells, located throughout the town, which supply one water tower and one 600,000 gallon reservoir. Both reservoirs are located south of town. Waterlines, ranging in size from 4-inches to 12-inches, distribute the water. Static pressures encountered within the system include 85 psi at well #4 (located in the southern part of town), 70 psi at well #1 (located in the western part of town) and 50 psi at well #3 (located in the northeastern part of town). Peak flows and pressures for individual lines are unknown at this time.

Ellsworth AFB's water is supplied by Rapid City through a 60 inch main running from the reservoir near Star Village to a 3.6 million gallon storage reservoir on Base. The water main is constructed of reinforced concrete pipe and supplies a maximum of 2,600 gpm to Ellsworth AFB. The 17 mile long water main is buried about 6 feet below grade and is restricted from water taps by other users throughout its entire length.

All water in Pennington County, within the study area and outside of Box Elder and Ellsworth AFB, is supplied through private wells and water systems.

All water in Meade County, within the study area and outside of Box Elder and Ellsworth AFB, is supplied through private wells and water systems.

Sanitary Sewer. Existing sanitary sewer collection and treatment facilities in the study area include main collector lines and treatment facilities for Ellsworth AFB, Box Elder and Rapid City. The residents within the counties are served by septic tanks and drain fields.

Ellsworth AFB's sanitary sewer system consists of pipe lines ranging in size from 6-inches to 18-inches. All pipes collect sewage and deliver it to a treatment plant located in the southern area of the base. There are no open lagoons on the Base. Some outlying areas are served by septic tanks and drain fields. No part of Ellsworth AFB is currently connected to the Box Elder sanitary sewer system. Treated effluent is discharged into a drainageway at the south end of the golf course and flows southeasterly into Boxelder Creek east of Box Elder.

Box Elder
Existing Utilities

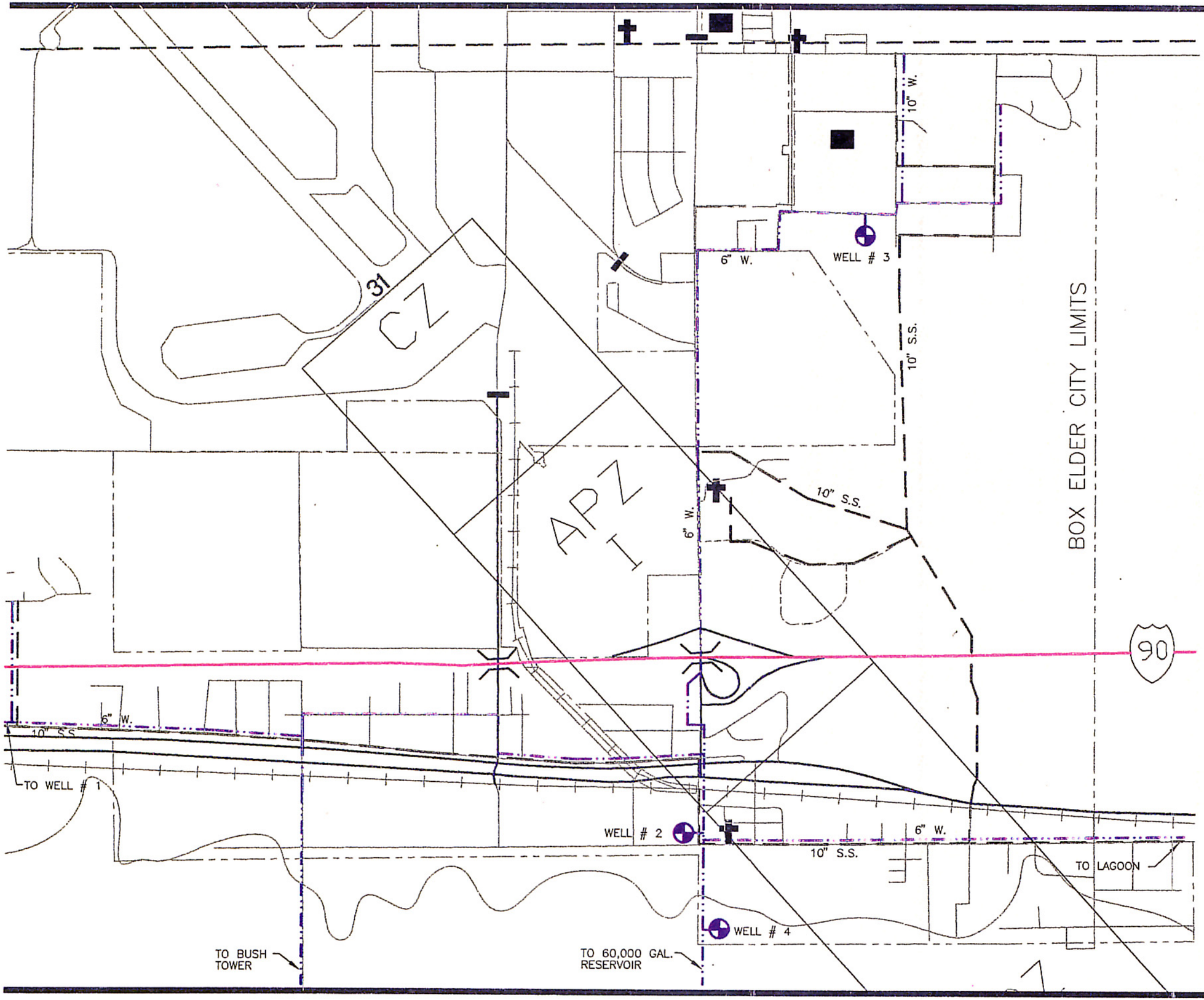
Legend

- Sanitary Sewer Main
- Water Main
- School
- Church

Notes:

Line locations and size are approximate.

Lines shown are Main lines. Service lines are not shown for clarity.



0 1/4 1/8 MILES

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FIGURE 2

17BE

Box Elder's sanitary sewer system consists of a series of 8- and 10-inch sewer lines flowing from west to east and north to south. All lines flow to a single treatment lagoon located east of town and south of I-90. Peak flow into the lagoon is 420,000 gpd. Peak flows and slopes of individual lines are unknown at this time. Using a minimum slope of 0.4% and a Manning's "n" value of 0.11 the capacity of an 8-inch pipe is 203 gpm and the capacity of a 10-inch pipe is 366 gpm.

All sanitary waste in Pennington County, within the study area and outside of Box Elder and Ellsworth AFB, is disposed of through the use of septic tanks and drain fields.

All sanitary waste in Meade County, within the study area and outside of Box Elder and Ellsworth AFB, is disposed of through the use of septic tanks and drain fields.

Storm Drainage. Storm drainage flows to Boxelder Creek which is the major drainage way within the study area. The main channel of Boxelder Creek meanders in a southeasterly direction from Pennington County Road C215, north of the Duster's Corner interchange, to I-90. It crosses under I-90 approximately 1000 feet west of the US Highway 230 interchange. Boxelder Creek then meanders in an easterly direction to Box Elder where it flows along the southern edge of town. It continues to flow in an easterly direction to its confluence with the Cheyenne River near Wasta 30 miles downstream from Box Elder.

Within the study area, there are several small tributaries that flow into Boxelder Creek from the north and south. The tributaries of most concern flow from the north. They include a tributary which crosses Gumbo Drive and flows into Boxelder Creek approximately 1500 feet east of Gumbo Drive, a tributary which flows from the northeast and parallels the Ellsworth AFB railroad spur and a tributary which flows from the north, crosses under I-90 and flows into Boxelder Creek in the southeastern section of Box Elder.

A flood hazard area, based on data from Section 22 Report, Planning Assistance to States, Boxelder Creek and Flood Insurance Study maps, has been established for Boxelder Creek and its tributaries. See Table 16 of the JLUS report for land use areas located within these flood hazard areas.

Currently there exists a potential for government funding in the form of relocation assistance for removal of structures from the flood hazard area. For more detailed information concerning storm drainage, see the Joint Land Use Study.

TRANSPORTATION ALTERNATIVES

Based on the review of the inventory of the existing transportation network, the operating characteristics of that network, and the goals established by the Coordinating Committee, this portion of the planning process involved identification of transportation alternatives and the evaluation of those alternatives. The primary focus of this effort should be the development of the backbone of the transportation network. All the remainder of the network, consisting of collector and local streets, could then be developed around this spine to serve local land uses.

Transportation Issues

The basic issue facing the area is to be able to provide a transportation system that would support existing and continued economic development in the community of Box Elder, while at the same time not adversely affecting the ability of the Air Force to fulfill its mission at Ellsworth Air Force Base. To better understand this overall issue, a number of more specific issues must be addressed.

- The employment base at Ellsworth Air Force Base is regional in nature, which means that the primary access to the base is via I-90. Furthermore, based on the traffic volume patterns, it is estimated that 95% of the traffic using I-90 to access the base is travel demand to and from the Rapid City area located to the west.

- Due to the location of the I-90 interchange in Box Elder (Exit 66) the primary access route to the Air Base, EAFB Access Road (County Road C223), travels through APZ 1 at the southern end of the runways. Being the primary access route, this in turn has encouraged commercial activity to develop along this roadway, thus resulting in some inappropriate land uses lying within the APZ as well as within the contours of unacceptable noise levels.

- The EAFB Access Road is carrying between 15,000 and 20,000 vehicles per day, which places a considerable burden on its basic two lane cross-section. Furthermore, because of the commercial nature of much of the adjoining development, numerous accesses exist along this stretch of road, thereby affecting the safety and capacity of the roadway.

- Although the land uses and the street system on the Air Base have been planned to focus entering and exiting traffic at the Main Gate, this requires a left turn movement from EAFB Access Road into the Main Gate, which is sometimes a difficult movement. Instead, the Access Road tends to focus incoming traffic toward the School Gate. This is reflected in the traffic data (Table 1) which indicate that approximately 53 percent of all traffic entering and leaving the Air Base uses the School Gate, while the Main Gate serves only approximately 29 percent (the remaining 18 percent utilizes the Commercial Gate).

- The existing interchange, while structurally sound, exhibits some geometric deficiencies. The loop ramp, for example, would require a minimum design speed of 30 MPH under today's standards; its present design has a 25 MPH design speed. In addition, the acceleration and deceleration lengths associated with the ramps at this interchange are also substandard under today's design standards. These conditions affect both the capacity and the safety of the interchange.

- The Regional Transportation Plan currently includes a new regional roadway, referred to as the Airport Crossover Road, extending from the Exit 66 interchange to the south to provide a connection between I-90 and activity in the vicinity of the Rapid City Airport. Implementation of this connection would provide even greater impetus for commercial development to occur in the vicinity of the existing interchange, thus promoting more such land uses within the APZ.

These issues are applicable under today's conditions and, as the area continues to grow, will become even more critical. For example, the Rapid City I-90 Corridor Study prepared by the South Dakota Department of Transportation projects that the total peak hour volume of traffic utilizing the ramps at the interchange will continue to grow at over 2 percent per year, resulting in a total peak hour volume of over 2,300 vehicles per hour by the year 2005. Similarly, the Box Elder Traffic Study indicated projections of over 21,000 vehicles per day on EAFB Access Road by the year 2000. Thus, unless modifications are implemented, traffic will continue to increase on the Access Road and the interchange, traffic flow and safety conditions will continue to worsen, and pressures for more development to occur along this route will continue to be experienced, thus compounding the principal issue which has promulgated this planning effort.

Development Of Alternatives

Considering the information from the transportation inventory, the transportation issues discussed above, and the objectives of the City and the Air Force, the Coordinating Committee recognized that the Access Road to the Air Base was the key to the transportation system alternative which would best address the land use compatibility issues. Thus, initial efforts focused on the identification of alternatives for this access road. Initial discussions identified five generic alternatives, including using the existing roadway, using the existing interchange and realigning the access road to the east, and three alternative locations for a new interchange with a new access road to the Air Base (the alternatives included locations as far east as 2 miles east of the existing interchange). No alternatives for a new primary access route west of the Air Base were considered to be viable alternatives because of the configuration of the Base.

These alternatives went through a preliminary assessment process, and the Coordinating Committee was presented with a summary of the basic characteristics of those alternatives. With that information, the Coordinating Committee chose three alternatives to be reviewed and evaluated in greater detail. These alternatives, which are illustrated on Figure 3, are generally described below:

Alternative 1 - *Improve Existing Roadway*

This alternative would involve improvements to the existing interchange, widening the existing access road to the Ellsworth AFB entrance, and relocating the incompatible land uses to locations along this route but removed from the APZ.

Alternative 2 - *Realign Existing Route*

This alternative would also make use of the existing interchange, with improvements, but would construct a new roadway routed to the east (out of the APZ as soon as possible), then heading north on an alignment about 1/2 mile east of the existing road, and swinging west to a connection with the main gate entrance to Ellsworth AFB. The incompatible land uses would be relocated along this route outside of the APZ.

Alternative 3 - *New Interchange and Access Road*

This alternative would involve the construction of a new interchange on the section line one mile east of the existing interchange, with a new roadway connecting from this interchange to the main gate entrance to Ellsworth AFB. Because this interchange would also provide new access to the City of Box Elder, a new roadway would also be constructed from the interchange south to Highway 230. The incompatible land uses would be relocated in the vicinity of the new interchange.

As illustrated, Alternatives 2 and 3 each included several scenarios for connecting to the Main Gate at the northern end. Alternatives 2A and 3A would bisect the golf expansion site to align directly with the existing Main Gate access. Alternatives 2B and 3B would be extended to the northern boundary of the golf course expansion site and would align with a modified Main Gate design to be considered by the Air Force. Although the difference in these alternative alignments was considered to be relatively insignificant in the larger community sense, both alternatives were carried through the evaluation process.

EVALUATION OF ALTERNATIVES

In order to evaluate these three basic alternatives, conceptual plans and profiles of each alternative were prepared. These plans were prepared recognizing the ultimate need for a four lane arterial roadway and were, therefore, developed using appropriate design standards. Thus, this section included four 12' travel lanes, a center turn lane, and curb and gutter. The design speed was assumed to be 45 MPH.

To assess these three alternatives, a series of seven evaluation factors were identified.

1. Physical Characteristics - This category basically describes physical characteristics such as length of roadway, maximum grade, maximum cuts and fills, etc. in order to provide a more definitive description of each alternative.

2. Construction Costs - These conceptual level opinions of probable cost are based on 1994 unit costs provided by the South Dakota Department of Transportation. The cost estimates include only construction costs and engineering costs. They do not include right-of-way costs; nor do they include the cost of major utility extensions which would most probably be done in conjunction with the roadway project, but which would likely be done as a result of land development.

Transportation Alternatives

ALTERNATIVES:

1 – Improve Existing Roadway

2 – Realign Existing Route

3 – New Interchange & Access Road

■ School

✝ Church

ELLSWORTH AFB

ALT 2B & 3B

ALT 2A & 3A

ALT 1

ALT 2

ALT 3

BOX ELDER

MEADE COUNTY

PENNINGTON COUNTY

BOX ELDER CITY LIMIT

BENNET RD

WESTGATE RD

CR 2-L

CR T272

CR C214

CR C212

SCHOOL GATE

EAFB MAIN GATE

EAFB GATE (COMMERCIAL)

E.A.F.B.

APZ I

APZ II

90

HWY 230

DM & E RR

BOXELDER CREEK

PROPOSED AIRPORT CROSSOVER ROAD

PROPOSED ALTERNATE CROSSOVER ROAD

0 1/4 1/2 MILES

Ellsworth Air Force Base
Joint Land Use Study

TSP
Barnard Dunkelberg & Company
Felsburg Holt & Ullevig

DATE: 6/30/95

FIGURE 3

22BE

3. Transportation Service - This factor involves an evaluation of each alternative's ability to provide transportation service to the community. It includes issues such as travel distance to Ellsworth Air Force Base, the ability to connect to the regional roadway system, the ability to provide a supporting local street system, potential affects on I-90, and the ability to provide an arterial roadway which would serve as a safe and efficient spine for the community's transportation network.

4. Safety - This factor evaluates the alternatives based on their ability to improve existing unsafe traffic conditions in the area and to ensure that the new roadway would provide for safe access to the community and to the Air Base.

5. Land Use Compatibility - The purpose of this factor was to evaluate the alternatives in relation to their ability to encourage land use patterns which would achieve the economic development goals of the community and the mission objectives of Ellsworth Air Force Base. Thus, considerations in this factor include access to new residential areas, provision of business relocation opportunities, compatibility with noise contours, and the provision of new economic development opportunities.

6. Ease of Implementation - This factor evaluates the alternatives for their ability to be implemented. Issues to be considered include the ability to use existing infrastructure as part of the plan, the amount of disruption to businesses during construction, the ability to maintain traffic flows during construction, and the institutional approvals necessary for implementation.

7. Environmental Impacts - Each of the alternatives was reviewed for potential significant impacts on vegetation, wildlife, and wetlands. In addition, geologic considerations were also reviewed.

Table 11 provides a summary of the evaluation of each of the alternatives. As noted above, each of the sub-alternatives at the northern end are included in this evaluation. Following is a brief discussion of the important information related to each factor:

1. *Physical Characteristics* - Clearly Alternative 1, the existing alignment, would be the shortest route, requiring reconstruction of approximately one mile of roadway. Interestingly, all of the other alternatives would be about the same length from the interchange north to the Main Gate, but each would be about twice as long as the existing route. However, Alternative 3 would also include approximately 2,500 feet of roadway which would also have to be constructed south of the interchange.

The maximum grades on all alternatives are reasonable, with the worst (4.5%) being on the existing roadway. Construction of any of the new alternative alignments would require cuts ranging as high as 15 to 20 feet because of the terrain in the area. Finally, Alternatives 1 and 2 would involve modification to the existing interchange, while Alternative 3 would require construction of a completely new interchange.

2. *Construction Costs* - Some of the characteristics mentioned above are reflected in the estimated construction cost for the alternatives. Alternative 1 is estimated to cost approximately $2.5 million, Alternative 2 would cost approximately $4.2 million, and Alternative 3 would cost approximately $7 million, depending on which alternative alignment and which design configuration of the interchange are chosen.

3. *Transportation Service* - While Alternative 1 would retain existing travel patterns and provide the most direct route from Rapid City to Ellsworth Air Force Base, it would continue to focus all Box Elder/I-90 traffic at one location and would continue to "aim" traffic at the School Gate. Relating to future travel service, it would align with the current proposal for the Airport Crossover Road; on the other hand, from Box Elder's standpoint, it would place the primary north/south arterial road on the western edge of the developing portion of the community.

Alternative 2 would also retain the same basic existing travel patterns to both Box Elder and Ellsworth, but it would add approximately 0.8 miles of additional travel for those motorists accessing the Main Gate. The benefits of this alternative are that it would "aim" the traffic at the Main Gate (as opposed to the School Gate) and it would provide an opportunity to build a new access road with an access management plan, thereby protecting the integrity of this road to provide arterial functions.

Alternative 3, while altering travel patterns to Ellsworth Air Force Base and adding about 2.7 miles of travel to the Main Access Gate, would allow for the dispersion of Box Elder/I-90 traffic to two locations, would also "aim" traffic at the Main Gate, and would provide a new primary north/south arterial in the approximate center of the developing area of the community.

4. *Safety* - Under Alternative 3, the construction of a new interchange and an entirely new route would provide an opportunity to ensure a safe design. Alternative 2 also provides this opportunity, but not as effectively as would Alternative 3. Finally, Alternative 1 would continue to experience difficulties in implementing a safe access plan and would retain the unsafe left turn movement at the Main Gate.

5. *Land Use Compatibility* Alternative 3 would appear to provide the greatest opportunity for encouraging relocation of incompatible land uses that exist today and for encouraging patterns of new land uses that would be consistent with the community's growth patterns. It would provide excellent opportunities for commercial development to occur near the new interchange with good visibility and close proximity to I-90. Furthermore, this alternative would provide good access opportunities for residential development projected to occur in northeast Box Elder.

TABLE 11
SUMMARY OF EVALUATION - TRANSPORTATION ALTERNATIVES
ELLSWORTH AFB JOINT LAND USE STUDY

Factor	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
1. *Physical Characteristics*					
• *- Length*	• 5,070 Ft.	• 9,200 Ft.	• 9,400 Ft.	• 11,500 Ft.	• 11,600 Ft.
• *- Maximum Grade*	• 4.5%	• 4.2%	• 3.4%	• 4.2%	• 3.0%
• *- Cuts/Fills*	• (Existing)	• 20' Cuts 12' Fills	• 20' Cuts 12' Fills	• 12-15' Cuts and Fills	• 12-15' Cuts and Fills
• *- Interchange w/I-90*	• Modify Existing	• Modify Existing	• Modify Existing	• Construct New Interchange	• Modify Existing
2. *Construction Cost*	• $2.51M	• $4.17M	• $4.23M	• $6.65M w/ Diamond • $7.10 w/Partial Cloverleaf	• $6.81M w/ Diamond • $7.26 w/Partial Cloverleaf
3. *Transportation Service*	• Retain existing travel patterns to both Box Elder and EAFB. • Most direct route from Rapid City to EAFB. • Would tie to current proposal for Airport Crossover Road. • Would focus Box Elder/I-90 traffic at one location. • Would continue to "aim" traffic at School Gate. • Would require significant access modifications to maintain capacity of Access Road. • Places primary N/S access to developing area on western edge.	• Retains existing travel pattern to both Box Elder and EAFB. • Adds 0.78 miles of travel to access Main Gate. • Would tie to current proposal for Airport Crossover Road. • Would focus Box Elder/ I-90 traffic at one location. • Would "aim" traffic at existing Main Gate. • Would provide opportunity to build new Access Road with an access plan. • Places primary N/S arterial in location with limited access possibilities.	• Retains existing travel pattern to both Box Elder and EAFB. • Adds 0.82 miles of travel to access Main Gate. • Would tie to current proposal for Airport Crossover Road . Would focus Box Elder/ I-90 traffic at one location. • Would "aim" traffic at Main Gate, but would require reconstruction of Gate. Would provide opportunity to build new Access Road with an access plan. • Places primary N/S arterial in location with limited access possibilities.	• Alters travel patterns particularly to EAFB. • Adds 2.70 miles of travel to access Main Gate from Rapid City. • Would require new route for Airport Crossover Road. • Would disperse Box Elder/I-90 traffic to two locations. • Would "aim" traffic at existing Main Gate. • Would provide opportunity to build new Access Road with an access plan. • Places primary N/S arterial in center of developing area.	• Alters travel patterns particularly to EAFB. • Adds 2.72 miles of travel to access Main Gate from Rapid City. Would require new route for Airport Crossover Road. Would disperse Box Elder/I-90 traffic to two locations. • Would "aim" traffic at Main Gate, but would require reconstruction of Gate. • Would provide opportunity to build new Access Road with an access plan. • Places primary N/S arterial in center of developing area.

TABLE 11 (Continued)
SUMMARY OF EVALUATION - TRANSPORTATION ALTERNATIVES
ELLSWORTH AFB JOINT LAND USE STUDY

Factor	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
4. Safety	• Would improve existing unsafe conditions at interchange. • Retains unsafe left turn into Main Gate. • Difficult to implement a safe access plan unless businesses are relocated. • Significant grades that can be unsafe in inclement weather.	• Would improve existing unsafe conditions at interchange. • Eliminates unsafe left turn at Main Gate. • New route with opportunity to develop safe access plan. • Requires curvature in vicinity of interchange.	• Would improve existing unsafe conditions at interchange. • Eliminates unsafe left turn at Main Gate. • New route with opportunity to develop safe access plan. • Requires curvature in vicinity of interchange.	• Would construct new interchange to safe design standards. • Eliminates unsafe left turn at Main Gate. • New route with opportunity to develop safe access plan. • Grades and curvature more conducive to safe design than Alt 2.	• Would construct new interchange to safe design standards. • Eliminates unsafe left turn at Main Gate. • New route with opportunity to develop safe access plan. • Grades and curvature more conducive to safe design than Alt 2.
5. Land Use Compatibility	• Would encourage further development in areas incompatible with flight operations. • Would not "open up" new areas for economic development. • Would not directly access new residential areas.	• Would encourage only limited development within APZ. • Would "open up" limited area for commercial activity near interchange. Poor visibility for commercial uses. • Would provide limited access to new residential areas because of terrain.	• Would encourage only limited development within APZ. • Would "open up" limited area for commercial activity near interchange. Poor visibility for commercial uses. • Would provide limited access to new residential areas because of terrain.	• Would encourage new development to occur outside APZs. • Would provide excellent opportunity for commercial development near interchange with good visibility. • Would provide good access opportunities for residential development in northeast Box Elder.	• Would encourage new development to occur outside APZs. • Would provide excellent opportunity for commercial development near interchange with good visibility. • Would provide good access opportunities for residential development in northeast Box Elder.

TABLE 11 (Continued)
SUMMARY OF EVALUATION - TRANSPORTATION ALTERNATIVES
ELLSWORTH AFB JOINT LAND USE STUDY

Factor	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
6. *Ease of Implementation*	• Would disrupt existing businesses all along Access Road while under reconstruction. • Interchange traffic would have to be maintained during modifications to interchange. • Allows maximum use of existing infrastructure (streets and utilities). • Interchange improvements can probably be implemented with minimal additional study efforts.	• Would disrupt some existing businesses along southern end of Access Road during construction. • Interchange traffic would have to be maintained during modifications to interchange. • Allows some use of existing infrastructure. • Interchange improvements can probably be implemented with minimal additional study efforts.	• Would disrupt some existing businesses along southern end of Access Road during construction. • Interchange traffic would have to be maintained during modifications to interchange. • Allows some use of existing infrastructure. • Interchange improvements can probably be implemented with minimal additional study efforts.	• Could be built with no disruption to existing businesses. • Could be built with no disruption to interchange or I-90 traffic. • Requires all new infrastructure. • New interchange will require detailed feasibility study and FHWA approval for new access to I-90.	• Could be built with no disruption to existing businesses. • Could be built with no disruption to interchange or I-90 traffic. • Requires all new infrastructure. • New interchange will require detailed feasibility study and FHWA approval for new access to I-90.
7. *Environmental Impacts*	• No known adverse environmental impacts.	• No known environmental "fatal flaws". • Geotechnical conditions would require special engineering for roadway and for development.	• No known environmental "fatal flaws". • Geotechnical conditions would require special engineering for roadway and for development.	• No known environmental "fatal flaws". • Geotechnical concerns but not as significant as Alternative 2.	• No known environmental "fatal flaws". • Geotechnical concerns but not as significant as Alternative 2.

Alternative 2 would open up new areas for development outside the APZ, but these areas would have limited potential for both residential and commercial development. The commercial areas would be relatively near to the interchange but would have poor visibility from I-90. Furthermore, the potential residential areas which would be bisected by the new alignment would likely be able to obtain only limited access to the roadway because of the terrain in the area.

Finally, Alternative 1 would appear to be in direct conflict with the land use goals of this entire planning effort because it would encourage further development in those areas incompatible with flight operations and would not provide enhanced access to new areas for economic development.

6. *Ease of Implementation* - Alternative 3, because all of its construction would occur at new locations, could be constructed while maintaining traffic operations on the existing interchange and access road. Thus, it could be implemented with minimal disruption to traffic patterns and to existing businesses. It will, however, require a detailed feasibility study (which will be addressed later) and Federal Highway Administration approval for the new access to I-90.

At the other extreme, Alternative 1 would require reconstruction of the existing interchange and the access road under traffic conditions. Even under the best of phasing plans, this would typically result in more difficult construction conditions, more likelihood of delay to traveling motorists, and greater disruption to the economic viability of existing businesses along the road.

Alternative 2 would have similar impacts as Alternative 1, but it would only be during construction of the improvements to the interchange and to the segment immediately connecting to the interchange. The remainder of the new access road could, like Alternative 3, be constructed while traffic continues to flow on the existing access road.

7. *Environmental Impacts* - The environmental review indicated that there were no known environmental "fatal flaws" related to any of the alternatives. There are geotechnical concerns which would need to be addressed in the design of the improvements for any of the alternatives. According to the geotechnical engineers, those concerns would not be as significant on Alternative 3 as they would be on Alternative 2.

RECOMMENDED ALTERNATIVE

The Coordinating Committee recommends that Alternative 3 be pursued as the preferred alternative. This alternative was chosen because it provides the best opportunity to achieve the goals of both the community and the Air Force. Of the alternatives considered, this alternative creates the best situation in which incompatible land uses could be encouraged to develop outside the areas of concern near the runways. The new interchange would present an appealing relocation option because

it would create development opportunities on the main access to EAFB with good visibility from and convenient access to I-90. Furthermore, the new access roadway alignment would provide excellent access to residential growth expected to occur in the northeast portions of Box Elder. The recommended alternative is illustrated on Figure 4.

This alternative was also preferred because its construction would allow the existing access condition to continue to function while the interchange and access road are being constructed. Design of the interchange bridge structure over I-90 would also have the least possible disruption to traffic flow on I-90 during construction.

The type of interchange configuration at the new location should be evaluated as part of the required interchange feasibility study. Two alternatives have been considered in this preliminary evaluation:

- Diamond interchange
- Partial Cloverleaf interchange

It is believed that both concepts could be designed to function well with appropriate ramp termini intersections. The partial cloverleaf design (with a loop ramp in the southeast quadrant) would serve the inbound movement from Rapid City to EAFB more efficiently, but it would also require more right-of-way and would be more expensive to construct. These details would typically be resolved through the feasibility study.

It is further recommended that the alignment connecting to the existing Main Gate intersection be pursued. The alternative would impact some land uses adjacent to the gate, which may not be feasible. Therefore, unless the Air Force decides to pursue that option and is prepared to fund the necessary modifications, it is recommended that the existing Main Gate configuration continue to be used for the connection to the new access road.

The Coordinating Committee also recommends that, although the existing EAFB Access Road will need to be discontinued north of the interchange, the existing interchange be retained to provide additional access to Box Elder for purposes of dispersing traffic and providing enhanced emergency access. The location of the new interchange is sufficiently spaced from the existing interchange to allow both interchanges to operate safely and efficiently without adversely affecting operations on I-90. This consideration will also need to be addressed in the interchange feasibility study.

Finally, with the implementation of the new interchange, the Coordinating Committee would encourage the regional transportation planning process to explore the possibility of realigning the Airport Crossover Road to the new interchange location. If the existing interchange remains, the Crossover Road could still connect to it. However, this would not provide good access to EAFB from the Crossover Road and would place additional demand on Highway 230 through Box Elder. Connecting such a regional road to the existing interchange would also continue to encourage development in the vicinity of the existing interchange, which is not consistent with one of the primary goals of the land use plan.

Transportation Alternative 3A
Land use Alternative 2B

ELLSWORTH AFB

BOX ELDER

BOXELDER CREEK

MEADE COUNTY

PENNINGTON COUNTY

CR T272

CR C214

CR C212

HWY 230

90

CZ

APZ I

EAFB SCHOOL GATE

EAFB MAIN GATE

EAFB GATE (COMMERCIAL)

E.A.F.B.

PENNINGTON COUNTY

BOX ELDER CITY LIMITS

EXISTING BOX ELDER CITY LIMIT

WESTGATE RD

PROPOSED AIRPORT CROSSOVER ROAD

DM & E RR

65

70

75

80

Recommended Alternative

(Box Elder area)

Land Use Plan Legend

- Agricultural
- Residential
- Commercial–Retail
- Commercial–Non Retail
- Public/Quasi–Public
- Recreational
- Industrial
- Flood Plain
- Floodway
- New Arterial Roadway
- Conceptual Street Layout

0 1/4 1/2
1/8 3/8

Ellsworth Air Force Base
Joint Land Use Study

TSP
Barnard Dunkelberg & Company
Felsburg Holt & Ullevig

DATE: 6/30/95

FIGURE 4

30 BE

3.

TRANSPORTATION SYSTEM STRATEGIES

In addition to the plan for the new interchange and new access road, several other elements of the transportation system plan are important to ensure that the goals and objectives of the plan are met:

- Collector Roadway System - In order to provide adequate accessibility to the growing community of Box Elder, it is important that a system of collector streets be planned to feed traffic to the new arterial roadway. Although terrain will be a defining characteristic of this street system, collectors should be provided in both north/south and east/west directions and should generally be spaced at one-quarter mile spacing.

- Access Management Plan - As plans for the new access road are developed, an access management plan should also be prepared in order to maintain the functionality of this arterial. In this plan, criteria should be established to provide guidelines for the location of public and private accesses. Major intersections (with collectors) should be on approximate one-quarter mile spacing. Private accesses should generally be limited to one per property and should only be allowed when other reasonable alternative access is not available. Further, adjoining properties should be encouraged to share accesses to the extent possible.

- Travel Demand Management - Although the primary issue to be addressed by the transportation plan is one of location, efforts should be made to manage travel demand as well. Such efforts could delay the time at which the ultimate roadway cross-section and other improvements would be necessary, thereby allowing a more cost-effective phasing of the improvements. With EAFB being such a large employer, the opportunities exist to implement programs to reduce travel demand. The Air Force should continue to explore strategies such as spreading of shifts, carpooling programs, vanpool programs, and shuttle service to Rapid City.

Improvement Costs

The recommended Alternative 3 is estimated to cost between $6.65 and $7.10 million to design and construct. These costs are in 1994 dollars and include only construction and engineering costs. The estimate is summarized in Table 3. In addition, right-of-way acquisition, major collector streets and associated utility work are expected to cost an additional $1.3 million.

APPENDIX A

Box Elder Water & Sanitary Sewer System Description

Appendix A
Box Elder Water and Sanitary Sewer System Description

WATER SYSTEM

Box Elder's water system consists of three wells, located throughout the town, which supply one water tower and one 600,000 gallon reservoir. Both reservoirs are located south of town. Waterlines, ranging in size from 4-inches to 12-inches, distribute the water. Static pressures encountered within the system include 85 psi at well #4 (located in the southern part of town), 70 psi at well #1 (located in the western part of town) and 50 psi at well #3 (located in the northeastern part of town). Peak flows and pressures for individual lines are unknown at this time.

A 12-inch line begins at the 600,000 gallon reservoir south of town and proceeds north along Cedar Street to the intersection of Cedar Street and Box Elder Road. This line connects to #4. The portion of this line south of Line Road is PVC. It is less than 15 years old and is in good condition. The portion of this line that is north of Line Road is PVC. Its age and condition are unknown.

A 6-inch line begins at the north end of the above described 12-inch waterline and proceeds north along the west side of Ellsworth AFB Main Access Road. Approximately 800 feet south of Villa Drive, the line crosses over to the east side of Access Road and proceeds north to Villa Drive. The line then proceeds east and north along Villa Drive and Parker Drive to service the northeast portion of Box Elder. Well #3 connects to this line. The portion of this line south of the Access Road crossover is Asbestos-Cement (AC) pipe. This portion is a minimum of 30 years old and in poor condition. The portion of this line north and east of the Access Road crossover is PVC. This portion is less than 15 years old and is in good condition.

A 6-inch Asbestos-Cement (AC) pipe that begins at an intersection, with the above described 12-inch pipe. This intersection is located directly south of well #2. It then proceeds east along Line Road to the intersection of Line Road and Circle Drive. This line serves the southeastern portion of Box Elder. It is a minimum of 30 years old and in poor condition.

A 6-inch AC pipe begins at the north end of the above described 12-inch pipe and proceeds west along Box Elder Road to Commercial Gate Road. This pipe then proceeds north along Commercial Gate Road to Douglas Road and continues west along Douglas Road to Gumbo Drive. This pipe serves the central portion of Box Elder. It is a minimum of 30 years old and in poor condition.

A 6-inch AC pipe begins at the Bush Water Tower located south of town and proceeds north along Gumbo Drive to the north side of I-90. This line serves future development in Box Elder north of I-90. It is a minimum of 30 years old and in poor condition.

A 10-inch PVC pipe begins approximately 210 feet downstream of the west most manhole on the Box Elder Road 10-inch line. This line proceeds north and serves the development north of I-90 and southwest of Ellsworth AFB. Its age and condition are unknown.

A 10-inch PVC pipe begins at the intersection of Line Road and Cottonwood Street. It proceeds north, under I-90, and then northeast following a tributary to Box Elder Creek. The line follows Valley Drive and Boulder Court north and west until it reaches Ellsworth AFB Main Access Road. It then proceeds north along the east side of Ellsworth AFB Main Access Road to Villa Drive. This line serves commercial development along Ellsworth AFB Main Access Road north of I-90. It is less than 6 years old and in good condition.

A 10-inch PVC pipe begins at a manhole located along the above described 10-inch line approximately 2000 feet north of I-90. It then proceeds north along the east boundary of Ellsworth AFB to Crow Drive. The line jogs east approximately 1200 feet and north approximately 1200 feet to Swallow Drive. It proceeds west along Swallow Drive approximately 1200 feet and north to the City Limits. This line serves the northeast portion of Box Elder. It is less than 6 years old and in good condition.

APPENDIX B

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BIBLIOGRAPHY

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