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1. Purpose of project:

The purpose of studied projects is construction of freeway axis between Ahvaz-Dehdez and Lordegan in Khuzestan Province, and in continue, Chaharmahal & Bakhtiari Province for achieving goals such as reduction of users cost (reduction of operational cost of traffic attracted and transferred to this road), increase of benefit in the regions that new route is crossing through them, socioeconomic development of project zone, path shortening, travel time reducing, axis safety increasing, and reduction of accidents.

2. The effective area of project

The freeway begins from Ahvaz County in Khuzestan Province and after crossing through Izeh and Dehdez Counties ends in Lordegan County located at Chaharmahal & Bakhtiari Province, and its continue is currently joining to Esfahan as a four-line highway, 200km in length.

3. Importance of establishment of Ahvaz-Dehdez-Lordegan Highway (Izeh-Dehdez-Lordegan Parcel)

3-1 Regional importance

Currently, the connectivity between Ahvaz and Dehdez cities is made through Ahvaz-Koupal three-way, Haftgol-Baghmalek-Izeh-Dehdez axis. This axis within Ahvaz-Koupal three-way has desirable specifications. From Koupal three-way to Dehdez (particularly Izeh-Dehdez-Lordegan parcel), the specification is not desirable. Establishment of freeway in addition to the safe and smooth traffic in this axis will provide the socioeconomic development of the project region.

The length of axis available in Ahvaz-Koupal three-way- Haftgol-Baghmalek-Izeh-Dehdez-Lordegan axis is about 320km, that upon

construction of freeway (item 2), this length is reduced about 50km, and diminished to 271km (item 2). In addition, the mean speed of the project and movement is increased from 60km/hrs to 95 km/hrs, and its geometric specifications are improved considerably.

Moreover, Khuzestan Province has frequent capabilities in agriculture, livestock breeding, fisheries, industry and mine. In addition, this province has natural, touristic, historical and religious attractions, thus establishment of Ahvaz-Izeh-Dehdez-Lordegan freeway has an important role in development of region as well as the province. The touristic attractions along this axis include the lakes and tourist sites of Karoon Dams 3 and 4 and Khorasan Dams 1 and 2. These attractions may increase the tendency for use of this freeway.

3-2 Trans-regional importance

Currently, connectivity between Ahvaz, center of provinces located at the center, east, north and northeast to Esfahan is possible through paths as main road and sometimes with inappropriate quality and low safety. High demand of travel between Khuzestan province and the said zones, situation of industrial and economic centers as well as opening border markets and transport connectivity to Iraq, emphasizes on the necessity of supplying the appropriate path with high traffic quality for connectivity between this province and central regions of country.

Ahvaz-Dehdez-Lordegan Freeway in case of establishment may be assumed as the major axis for connectivity of Khuzestan Province to the country center (Chaharmahal & Bakhtiari, Yaze, Qom and Esfahan provinces). Furthermore, according to the surveys, currently two following main axes are used for crossing through Ahvaz toward Esfahan:

- 1- Ahvaz-Haftgol-Baghmalek-Izeh-Lordegan-Boroujen-Mobarakeh-Esfahan
- 2- Ahvaz-Andimeshk-Pole Zal-Khorramabad-Aligoudarz-Najafabad-Esfahan

Axis no. 1 in addition to the regional function, has also transregional function. This axis is located inside Khuzestan Province, and as estimated, in case of establishment of the freeway, due to upraising the geometric specifications and decreased travel time, a part of traffic for departing to Esfahan is attracted to the freeway. Axis no. 2 has transregional function, and as estimated, after construction of freeway, due to upraising the geometric specifications and decreased travel time, a part of traffic of this axis is attracted to the freeway.

In addition, according to the studied, it was specified that this axis may be one of the most important connectivity ways from Tehran Province to Khuzestan Province. At present, the vehicles that intend to traffic from Tehran to Ahvaz, use Tehran-Arak-Khorramabad axis. In case of establishment of this freeway, a major part of this traffic will use the freeway and highway axes of Tehran-Kashan-Esfahan-Lordegan-Izeh-Ahvaz. The length of new-constructed axis (Ahvaz-Lordegan Freeway and Lordegan-Esfahan-Tehran axis) is almost equal to the present axis (Ahvaz-Khorramabad-Arak-Tehran), that in this event, the willing for use of the studied freeway will be increased.

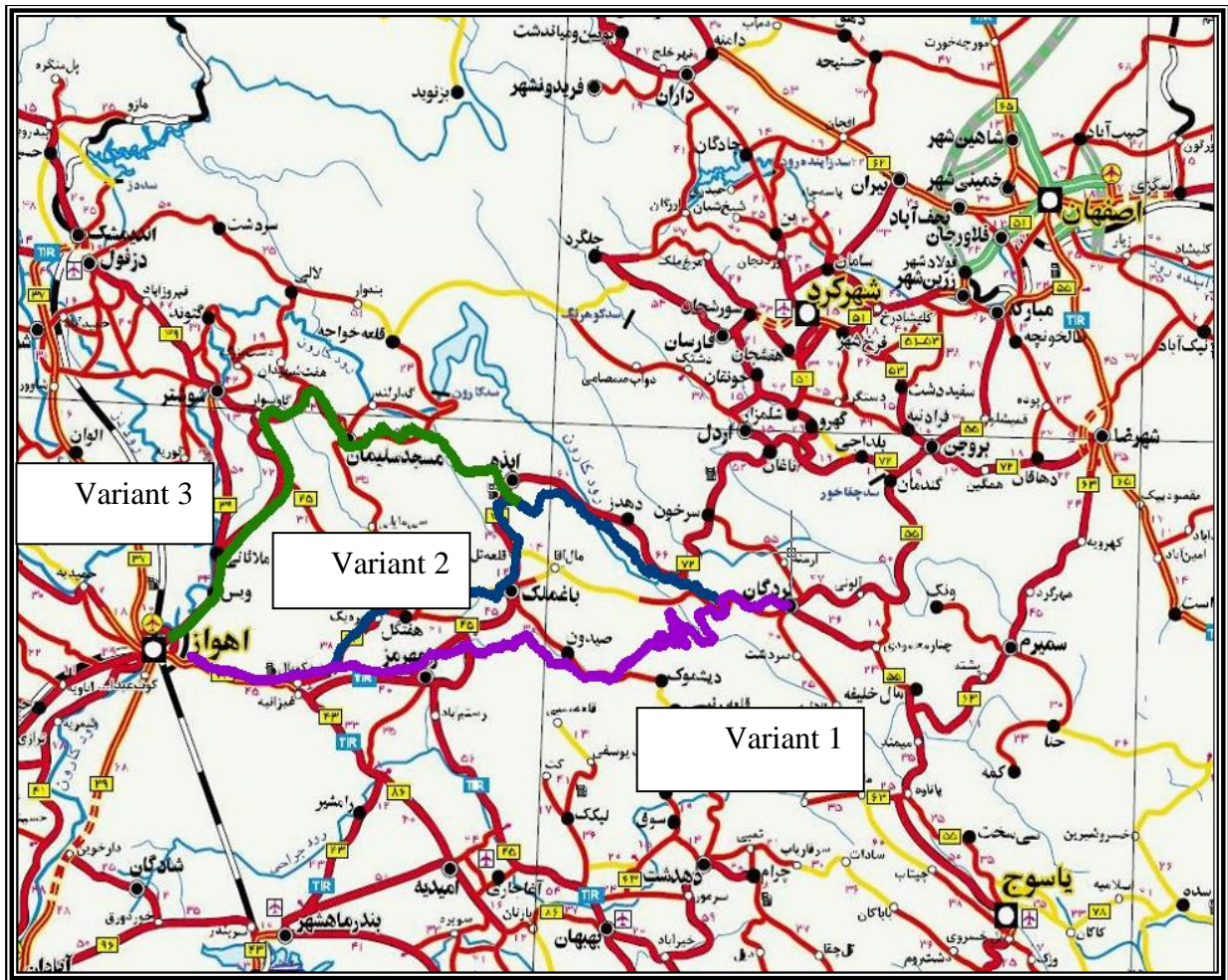


Image 1- Situation of Ahvaz-Dehdez-Lordegan Freeway

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Izeh-Dehdez-Lordegan Freeway
Summary of Report



Izeh-Lordegan Path-serpentine curves



Izeh-Lordegan Path- steep horizontal curves



Unsafe overtaking of sedan vehicles due to high traffic of heavy vehicles

4- Description of alternatives for Ahvaz-Dehdez-Lordegan freeway

In order to establish Ahvaz-Dehdez-Lordegan freeway, three alternatives were totally studied, the characteristics of which are presented in table 1.

According to studies and investigations, alternative 2 as the proposed alternative has the following advantages:

4-1-Advantages of alternative 2

- 1) More appropriate geometrical features than other alternatives
- 2) Shorter travel time compared to other alternatives (with respect to a shorter route and faster speed)
- 3) More economic, social and tourism attractions than other alternatives
- 4) A wider sphere of influence (more critical cities and economic centers) compared to other alternatives

Table 1- a summary of characteristics of alternatives
 for Ahvaz-Dehdez-Lordegan freeway

row	route design	Length of route design	Average design speed (km/h)	Length of tunnel (m)	Length of massive bridges on rivers (m)	Length of massive bridges on valleys (m)	Number of grade-separated intersections (interchanges)
1	Alternative 1	283 km	85	15400	1400	600	5
2	Alternative 2	271 km	95	15700	1000	2400	8
3	Alternative 3	324 km	95	23300	800	2400	5

Table 1- a summary of characteristics of alternatives
 for Izeh-Dehdez-Lordegan freeway

row	route design	Length of route design	Average design speed (km/h)	Length of tunnel (m)	Length of massive bridges on rivers (m)	Length of massive bridges on valleys (m)	Number of grade-separated intersections (interchanges)
2	Izeh-Dehdez-Lordegan	119 km	95	15700	450	2400	3

5- Estimating the costs of study alternatives

With respect to the magnitude and operations, estimation of the costs of alternatives in Rials according to 2016 price list is as follows:

- Izeh-Dehdez-Lordegan freeway : 13,987,872 million Rials (2016 price list)

6. Traffic studies

In the traffic studies of Izeh-Dehdez-Lordegan Freeway, at first upon survey of studied region, the sphere of influence of interprovincial and intra-provincial roads and passages network was specified. Later, upon review, assessment and use of statistics of origin and destination of the load and passenger, as well as passenger and freight vehicles, traffic status of axes under sphere of influence in the current status was analyzed.

6-1 Review of the daily traffic growth of axes within the project

Whereas in case of establishment of Izeh-Dehdez-Lordegan Freeway, a part of Izeh-Dehdez-Lordegan and Ahvaz-Andimeshk traffic is attracted to the studied axis, to obtain the growth value of these axes, the traffic statistics of a few available axes were studied, as per following table:

Table (3)- Growth rate of different axes traffic

Axis	Growth index (%)		
	Total vehicles	Light vehicles	Heavy vehicles
Izeh-Dehdez-Lordegan	7.1	5.6	10.3
Ahvaz-Andimeshk	5.4	6.8	2.5

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In the following tables, the online traffic-counting provided by Road Maintenance & Transportation Organization within 2013-2014, is presented. These statistics of traffic were used as basis for traffic calculations due to estimation of subsequent traffic, during the project period.

Output of online average daily traffic counter from March 21, 2013 to March 20, 2014

Light				Heavy				Sum total
Axis	Year	Sedan	Truck	Minibus & autobus	2-axis truck	3-axis truck	4-axis truck and more	
Izeh-Dehdez	2013-2014	2293	728	370	762	431	369	4953

Output of online average daily traffic counter from March 21, 2013 to March 20, 2014

Light				Heavy				Sum total
Axis	Year	Sedan	Truck	Minibus & autobus	2-axis truck	3-axis truck	4-axis truck and more	
Dehdez-Lordegan	2013-2014	2265	846	386	794	449	384	5525

Output of online traffic counter from March 21, 2013 to March 20, 2014

Light				Heavy				Sum total
Axis	Year	Sedan	Truck	Minibus & autobus	2-axis truck	3-axis truck	4-axis truck and more	
Andimeshk-Pole Zal	2013-2014	2267	1856	739	604	953	1241	7961

6-2 Selection of growth indices for the project operation years

According to table (3), the traffic growth of light and heavy vehicles has been high, and considering limitations such as number of vehicles, ownership percent of vehicle in saturated state, growth and development of other traffic and transportation manners such as railway etc. in the future, use of such statistics for regression analysis causes the estimated values to be very high

and illogical. Thus, to estimate the traffic of studied axis within the first 10 years of operation, the growth index 5% for light vehicles and 4% for heavy vehicles and within the second 10 years of operation, the growth index 4% for light vehicles and 3% for heavy vehicles, was used.

6-3 Study of the traffic quality level of status quo

Considering the traffic existing in the said axes, their traffic quality at present and within operation period is reviewed. The calculation procedure of traffic quality level is based on the available solutions and derived from bulletin 415. It is notable that the acceptable quality for 4-line route within plain is 2, and for the first grade main road within foothills is 2 and 3 in the mountainous region. Analysis of the quality level of existing Izeh-Dehdez-Lordegan axis in 2 parcels and 2 scenarios is as follows:

		Non-establishment of freeway-Status quo of axis							
		Lot-1 (Izeh-Dehdez)				Lot-2 (Dehdez-Lordegan)			
	year	Foothills	mountain	special uphill parcels	special uphill parcels	Foothills	mountain	special uphill parcels	special uphill parcels
Status quo	1392	5	5	6	5~6	5	5	6	5~6
	1398	5	5	6	6	5	5	6	6
	1402	5	5	6	6	5	5	6	6
	1407	5	5	6	6	5	6	6	6
	1412	5	6	6	6	6	6	6	6
	1417	6	6	6	6	6	6	6	6
Status quo with the assumption of transportation of 50% of load by the studied railway	1392	5	5	6	5~6	5	5	6	5~6
	1398	5	5	5~6	5	5	5	6	6
	1402	5	5	6	6	5	5	6	6
	1407	5	5	6	6	5	5	6	6
	1412	5	5	6	6	5	5	6	6
	1417	5	6	6	6	5~6	6	6	6

6-6-5 Estimation of traffic in Izeh-Dehdez-Lordegan Freeway

The traffic of studied freeway (Izeh-Dehdez-Lordegan) is calculated for corridor No. 2 (optimal and proposed option). Item no. 2 crosses through Ahvaz-Haftgol-Baghmalek-Izeh-Dehdez and Lordegan. Whereas the studied axis is new-constructed, it is concluded that the freeway traffic includes 2 parts: transitional traffic and induced traffic.

In addition, the transitional traffic of freeway also includes 2 parts:

- a. Traffic transferred from existing parallel axes that their interprovincial function is studied.
- b. Traffic transferred from intra-provincial axes that intend to traffic to the destination of freeway, that their transregional function is studied. At this step, it is estimated that traffic of axes that intend to depart to the destination of freeway (e.g. Esfahan), in the event of construction of freeway, is attracted to the freeway. At present, two following main axes are used for traffic from Ahvaz toward Esfahan:
 1. Ahvaz-Haftgol-Baghmalek-Izeh-Lordegan-Boroujen-Mobarakeh-Esfahan
 2. Ahvaz-Andimeshk-Pole Zal-Khorramabad-Aligoudarz-Najafabad-Esfahan

Axis no. 1 in addition to the regional function, has also transregional function. This axis is located inside Khuzestan Province, and as estimated, in case of establishment of the freeway, due to upraising the geometric specifications and decreased travel time, a part of traffic for departing to Esfahan is attracted to the freeway. At end, it is also estimated that which rate of local and regional traffic is attracted to the freeway.

Axis no. 2 has transregional function. Thus, after construction of freeway, due to upraising the geometric specifications and decreased travel time, it is estimated that which rate of traffic of this axis is attracted to this freeway.

To estimate this traffic value, the province to province origin-destination statistics (comprehensive statistical book of state transportation and urban development), and later, traffic allocation procedure is used based on the experimental curves on the basis of distance and travel time in 2 parallel routes.

6-6-6 Traffic of Izeh-Dehdez-Lordegan Freeway

According to the foregoing, traffic status of Izeh-Dehdez-Lordegan Freeway is as per following table:

First scenario (without applying rail)
Traffic of Izeh-Dehdez-Lordegan Freeway within operation years (without rail)

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 Summary of Report

Traffic		Year	Operation year	Light		Heavy				Sum total
				Sedan	Pickups	& Minibus autobus	axis-2 truck	axis-3 truck	axis-4 & truck more	
Transitional traffic	Traffic transferred from existing Izeh-Lordegan axis to freeway	1397	Izeh	2616	831	411	849	481	409	5597
	Traffic transferred from Andimeshk-Pole Zal axis to freeway		Pole Zal	984	711	277	189	297	387	2845
Traffic of Izeh-Dehdez-Lordegan Freeway		1397		3600	1542	688	1038	778	796	8442
Traffic rate		1398		42.7%	18.30%	8.13%	21%		9.40%	
Traffic of Izeh-Dehdez-Lordegan Freeway applying 10% of induced traffic		1398	1	4158	1781	791	1194	895	915	9734
Traffic of Izeh-Dehdez-Lordegan Freeway applying 10% of induced traffic		1399	2	4781	2048	902	1361	1020	1043	11155
Traffic of Izeh-Dehdez-Lordegan Freeway		1400	3	5020	2150	947	1429	1071	1095	11712
Traffic of Izeh-Dehdez-Lordegan Freeway		1401	4	5271	2258	985	1486	1114	1139	12253
Traffic of Izeh-Dehdez-Lordegan Freeway		1402	5	5535	2371	1024	1545	1159	1185	12819
Traffic of Izeh-Dehdez-Lordegan Freeway		1403	6	5811	2490	1065	1607	1205	1232	13410
Traffic of Izeh-Dehdez-Lordegan Freeway		1404	7	6102	2615	1108	1671	1253	1281	14030
Traffic of Izeh-Dehdez-Lordegan Freeway		1405	8	6407	2746	1152	1738	1303	1332	14678
Traffic of Izeh-Dehdez-Lordegan Freeway		1406	9	6727	2883	1198	1808	1355	1385	15356
Traffic of Izeh-Dehdez-Lordegan Freeway		1407	10	7063	3027	1246	1880	1409	1440	16065
Traffic of Izeh-Dehdez-Lordegan Freeway		1408	11	7346	3148	1283	1936	1451	1483	16647
Traffic of Izeh-Dehdez-Lordegan Freeway		1409	12	7640	3274	1321	1994	1495	1527	17251
Traffic of Izeh-Dehdez-Lordegan Freeway		1410	13	7946	3405	1361	2054	1540	1573	17879
Traffic of Izeh-Dehdez-Lordegan Freeway		1411	14	8264	3541	1402	2116	1586	1620	18529
Traffic of Izeh-Dehdez-Lordegan Freeway		1412	15	8594	3683	1444	2179	1634	1669	19203
Traffic of Izeh-Dehdez-Lordegan Freeway		1413	16	8938	3830	1487	2244	1683	1719	19901
Traffic of Izeh-Dehdez-Lordegan Freeway		1414	17	9296	3983	1532	2311	1733	1771	20626
Traffic of Izeh-Dehdez-Lordegan Freeway		1415	18	9668	4142	1578	2380	1785	1824	21377
Traffic of Izeh-Dehdez-Lordegan Freeway		1416	19	10055	4308	1625	2451	1839	1879	22157
Traffic of Izeh-Dehdez-Lordegan Freeway		1417	20	10457	4480	1674	2525	1894	1935	22965

Second scenario (applying rail)
Traffic of Izeh-Dehdez-Lordegan Freeway within operation years (with rail)

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Izeh-Dehdez-Lordegan Freeway
Summary of Report

Traffic		Year	Operation year	Light		Heavy				Sum total
				Sedan	Pickups	& Minibus autobus	axis-2 truck	axis-3 truck	axis-4 & truck more	
Transitional traffic	Traffic transferred from existing Izeh-Lordegan axis to freeway	1397	Izeh	2616	831	411	424	241	205	4728
	Traffic transferred from Andimeshk-Pole Zal axis to freeway		Pole Zal	984	711	277	131	206	269	2578
Traffic of Izeh-Dehdez-Lordegan Freeway		1397		3600	1542	688	555	447	474	7306
Traffic rate		1398		49.3%	21.1%	9.4%	13.7%		6.5%	
Traffic of Izeh-Dehdez-Lordegan Freeway applying 10% of induced traffic		1398	1	4158	1781	791	638	514	545	8427
Traffic of Izeh-Dehdez-Lordegan Freeway applying 10% of induced traffic		1399	2	4781	2048	902	727	586	621	9665
Traffic of Izeh-Dehdez-Lordegan Freeway		1400	3	5020	2150	947	763	615	652	10147
Traffic of Izeh-Dehdez-Lordegan Freeway		1401	4	5271	2258	985	794	640	678	10626
Traffic of Izeh-Dehdez-Lordegan Freeway		1402	5	5535	2371	1024	826	666	705	11127
Traffic of Izeh-Dehdez-Lordegan Freeway		1403	6	5811	2490	1065	859	693	733	11651
Traffic of Izeh-Dehdez-Lordegan Freeway		1404	7	6102	2615	1108	893	721	762	12201
Traffic of Izeh-Dehdez-Lordegan Freeway		1405	8	6407	2746	1152	929	750	792	12776
Traffic of Izeh-Dehdez-Lordegan Freeway		1406	9	6727	2883	1198	966	780	824	13378
Traffic of Izeh-Dehdez-Lordegan Freeway		1407	10	7063	3027	1246	1005	811	857	14009
Traffic of Izeh-Dehdez-Lordegan Freeway		1408	11	7346	3148	1283	1035	835	883	14530
Traffic of Izeh-Dehdez-Lordegan Freeway		1409	12	7640	3274	1321	1066	860	909	15070
Traffic of Izeh-Dehdez-Lordegan Freeway		1410	13	7946	3405	1361	1098	886	936	15632
Traffic of Izeh-Dehdez-Lordegan Freeway		1411	14	8264	3541	1402	1131	913	964	16215
Traffic of Izeh-Dehdez-Lordegan Freeway		1412	15	8594	3683	1444	1165	940	993	16819
Traffic of Izeh-Dehdez-Lordegan Freeway		1413	16	8938	3830	1487	1200	968	1023	17446
Traffic of Izeh-Dehdez-Lordegan Freeway		1414	17	9296	3983	1532	1236	997	1054	18098
Traffic of Izeh-Dehdez-Lordegan Freeway		1415	18	9668	4142	1578	1273	1027	1086	18774
Traffic of Izeh-Dehdez-Lordegan Freeway		1416	19	10055	4308	1625	1311	1058	1119	19476
Traffic of Izeh-Dehdez-Lordegan Freeway		1417	20	10457	4480	1674	1350	1090	1153	20204

6-6-7 Study of the traffic quality of freeway in case of establishment

According to subclause 6-4-4, the traffic of third parcel of freeway was estimated. Whereas the first year of axis operation was assumed 1399 (2020), the traffic quality within fifth operation year (1403), tenth operation year (1408) and fifteenth operation year (1413), and end of operation (1418) respectively were studied.

6-6-1 Study of traffic quality level of Izeh-Dehdez-Lordegan Freeway

Considering the geometric plan proposed by this consulting engineers, and rate of heavy and recreational vehicles, the traffic quality within different years was calculated. In this parcel, the longitudinal slope 6% with the maximum length of 1.2km was considered for the most critical part of this variant. Study of the quality of Izeh-Dehdez-Lordegan Freeway in 2 parcels and 2 scenarios is presented in following table: (it is notable that the foothills include only 7% of total path length).

Calculations of quality level of freeway within operation period

		Izeh-Lordegan Freeway									
		Scenario 1 (Predicted)- predicted attraction			Scenario 2 (probable)- realization of 80% of predicted attraction			scenario 3 (pessimistic)- realization of 65% of predicted attraction			
		year	Foothills	mountain	special uphill parcels (for maximum slope)	Foothills	mountain	special uphill parcels (for maximum slope)	Foothills	mountain	special uphill parcels (for maximum slope)
Freeway	1398	1	2	2	1	1~2	2	1	1	1	
	1402	1~2	3	3	1	2	2	1	2	2	
	1407	2	3	3	2	2~3	3	1	2	2	
	1412	2~3	4	4	2	3	3	1	2~3	3	
	1417	3	4	4	2	3~4	4	2	3	3	
Freeway with the assumption of transportation of 50% of load by the studied railway	1398	1	1	2	1	1	1	1	1	1	
	1402	1	2	2	1	1	1~2	1	1	1	
	1407	1~2	2	3	1	2	2	1	1~2	2	
	1412	2	3	3	1	2	2~3	1	2	2	
	1417	2	3	3~4	2	3	3	1	2	2~3	

6-7 Conclusion of traffic studies

According to the applied studies, it is estimated that the available axis doesn't respond the current traffic during the project years, and its quality will be very undesirable, reduction of service level will increase the fuel consumption and travel time, as well as reduction of axis safety, thus considering the high traffic of axis, it should be designed as freeway. Construction of freeway will increase the transitive quality and prevent the service level reduction. In order to promote the quality of traffic, in consideration of the foregoing, execution of project as freeway for increasing the capacity and achievement to the respective goals, seems to be evident.

8- Geological studies

To design the trenches, it is required to provide sampling of the materials of slopes domain by the qualified rock mechanic and soil mechanics, and upon applying the required tests, the precise values of physical and geomechanical parameters of materials forming the slopes domain such as adhesion, angle of internal friction, compressive strength, Yang module, Poisson's ratio and specific weight to be determined and submitted to the consultant, to provide the computations related to stability of slope. In addition, in order to provide the design computations, upon approval of the path plan, the precise cross-sections of trenches to be prepared and provided.

Due to weakness of most of materials and formations of the path, and expense of stabilization cost of high trenches and sometimes impossibility of stabilization of some high trenches, it is proposed to avoid establishment of high trenches in this path, and reduce the height of trenches by transversal displacement of path and construction of more embankments. In case of impossibility of path displacement, the high trenches to be converted to the tunnel, or in case of nonexistence of adequate overload for tunnel construction, after excavation of the trenches, it is better to construct the concrete gallery within these areas and make embankment over them. moreover, in a few trenches of this path, due to high slope of natural ground, reducing the trenches slope and increasing the number and width of berms results in increase of trenches heights. This will intensify the instability of trenches susceptible to slide. Therefore, sampling and geomechanical tests ought to be conducted by technical and rock mechanics and soil mechanics laboratory to specify the strengthening and

physical parameters of materials of each trench and present to the consultant. Upon conducting the required computations, the geometric structure of trenches is determined and maintenance system of each one of trenches (if required), is designed.

Because a few areas of the route are mountainous, construction of tunnel in a few areas of all three corridors is unavoidable. Considering the basic studies, construction of tunnel within areas of the axis seems to be necessary. However, the said tunnels were proposed based on the basic studies, and it is probable to change their number and location of construction, and exact kilometer will be anticipated after approval of plan and providing the cross sections.

Table (4)- Lithology of Izeh-Dehdez-Lordegan Freeway

Row	Kilometer from/ to	Length (km)	Lithology	Formation	Symbol on geological plan
1	149.5-159.5	10	Alluviums and young terraces	Quaternary deposits	Q
2	159.5-163	3.5	Gray marl and calcareous shale with argillic limestone, and sometimes purple shale in the bed	Pabdeh	Pd
3	163-164.5	1.5	Cream to gray limestone, dolomitic and dolomite limestone	Asmari	As
4	164.5-165	0.5	Gray marl and calcareous shale with argillite limestone and sometimes purple share in bed	Pabdeh	Pd
5	165-166	1	Gray marl, calcareous shale and argillite limestone	Gourpey	Gu
6	166-170.5	4.5	Alluviums and young terraces	Quaternary deposits	Q
7	170.5-176	5.5	Gray limestone and sometimes argillite (Ilam)-limestone and sometimes gray shale (Sarvak)	Quaternary deposits	Q
7	170.5-176	5.5	Gray limestone and sometimes argillite (Ilam)-limestone and sometimes	Ilam-Sarvak	Il-Sv

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			gray shale (Sarvak)		
8	176-176.5	0.5	Gray marl, calcareous shale and argillite limestone	Pabdeh+Gourpey	Pd + Gu
9	176.5-178	1.5	Cream to gray limestone, dolomitic limestone and dolomite	Asmari	As
10	178-180.5	2.5	Cream to gray limestone, dolomitic limestone and dolomite+ quaternary deposits	Asmari+ quaternary	As+Q
11	180.5-181	0.5	Red marl and sometimes gray to green, gypsum limestone	Gachsaran	Gs
12	181-182	1	Cream to gray limestone, dolomitic limestone and dolomite+ red marl and sometimes gray to green, gypsum limestone	Asmari+ Gachsaran	Gs+As
13	182-186.5	4.5	Cream to gray limestone, dolomitic limestone and dolomite	Asmari	As
14	186.5-187	0.5	Red marl and sometimes gray to green, gypsum limestone	Gachsaran	Gs
15	187-188	1	Cream to gray limestone, homiletic limestone and dolomite	Asmari	As
16	188-189	1	Cream to gray limestone, dolomitic limestone and dolomite+ red marl and sometimes gray to green, gypsum limestone	Asmari+ gachsaran	Gs+As
17	189-190	1	Red and sometimes gray to green marl, gypsum limestone	Gachsaran	Gs
18	190-193	3	Sandstone, red marls and siltstone, sometimes conglomerate+ alluviums and young terraces	Aghajari+ Quaternary	Aj+Q
19	193-194.5	1.5	Sandstone, red marls and siltstone, sometimes conglomerate	Aghajri	Aj
20	194.5-200	5.5	Sandstone, red marls and siltstone, sometimes conglomerate+ alluviums and young terraces	Aghajari+ Quaternary	Aj+Q
21	200-219	19	Sandstone, red marls and siltstone, sometimes conglomerate	Aghajri	Aj
22	219-224	5	Red and sometimes gray to	Gachsaran	Gs

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			green, gypsum limestone		
23	224-226	2	Cream to grey limestone, dolomitic limestone and dolomite	Asmari	As
24	226-227.5	1.5	Gray marl, calcareous shale with argillite limestone and sometimes purple shale in bed	Pabdeh	Pd
25	227.5-235	7.5	Cream to gray limestone, dolomitic limestone and dolomite	Asmari	As
26	235-244.5	9.5	Conglomerate, sandstone and silty and sandy marl	Bakhtiari	Bk
27	244.5-246	1.5	Alluviums and young terraces	Quaternary deposits	Q
28	246-249.5	3.5	Cream to gray limestone, dolomitic limestone and dolomite+ quaternary deposits	Asmari + quaternary	As+Q
29	249.5-250	0.5	Conglomerate, sandstone and silty and sandy marl+ quaternary deposits	Bakhtiari+ quaternary	Bk+Q
30	250-251	1	Red marl and sometimes gray to green, gypsum limestone + quaternary deposits	Gachsaran+ quaternary	Gs+Q
31	251-252.5	1.5	Alluviums and young terraces	Quaternary deposits	Q
32	252.5-254	1.5	Conglomerate, sandstone and silty and sandy marl+ quaternary deposits	Quaternary deposits	Q
33	254-256	2	Red marl and sometimes gray to green, gypsum limestone+ quaternary deposits	Gachsaran+ Quaternary	Gs+Q
34	256-259.5	3.5	Conglomerate, sandstone and silty and sandy marl	Bakhtiari	Bk
35	259.5-260.5	1	Alluviums and young terraces	Quaternary deposits	Q
36	260.5-262	1.5	Conglomerate, sandstone and silty and sandy marl+ quaternary deposits	Bakhtiari+ Quaternary	Bk+Q
37	262-265	3	Red marl and sometimes gray to green, gypsum limestone	Gachsaran	Gs
38	265-266.5	1.5	Conglomerate, sandstone and silty and sandy marl+ quaternary deposits	Bakhtiari+ Quaternary	Bk+Q
39	266.5-270	3.5	Alluviums and young terraces	Quaternary deposits	Q

40	270-271.957	2	Cream to gray limestone, dolomitic limestone and dolomite+ quaternary deposits	Asmari + quaternary	As+Q
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9- Hydrological studies

The axis crossing region is located at Khuzestan and Chaharmahal & Bakhtiari Provinces. Izeh-Dehdez-Lordegan Freeway crosses through Izeh-Dehdez-Lordegan Cities. The nearest meteorological station along the path that its height is close to the axis crossing region as well as its data and statistical measurements are available for use in required quantity, is Izeh and Lordegan Synoptic Meteorological Station. Thus, the raining statistics related to the project crossing zone were extracted from respective stations and relative results are observed as below.

It is notable that the other city of Izeh-Dehdez-Lordegan Freeway options means Dehdez excludes any meteorological station.

Considering the hydrological studies, the maximum moment discharge based on the maxim 24-hrs raining has been calculated for the 50-year return period. Accordingly, the proposed measures of big bridges and mouth type 6m to up were presented. According to estimation of maximum moment discharge of different basins and assumed bridges, as well as presented tables, the number and type of bridges assumed for transiting the maximum moment discharge in Izeh-Dehdez-Lordegan Freeway that is a part of Ahvaz-Izeh-Dehdez-Lordegan Freeway, it seems to be adequate in all basins and studying options, considering the proposed bridges.

It is remarkable that whereas the proposed items are renovated, the location and exact measures of bridges are specified in next phases of studies and

after confirmation of approved item.

Maximum moment discharge (QMax) of watersheds and measures of
proposed bridge of Izeh-Dehdez-Lordegan Freeway

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Row	Km	Basic area (km ²)A	Horizontal length of basin (Km) L	Difference between the farthest elevation of basin and catchment	Basin slope m/ms	Centralization time min tc	Peak time tp	Max moment discharge s/m ³ Qmax	Measures of proposed bridge	Remark
1	155+200	38	11200	1600	0.14	54.11	39.82	646.37	2×20	
2	166+000	7	4100	1000	0.24	20.31	16.70	284.01	1×10	
3	166+500	12	7500	1800	0.24	32.54	25.23	322.18	1×10	
4	170+400	38	10700	1700	0.16	50.15	37.17	692.52	2×15	
5	176+050	44	11200	2000	0.18	49.66	36.84	809.02	840	Viaduct 14
6	183+405	820	87000	3000	0.03	453.41	293.34	1893.59	450	Karoon River-Viaduct
7	183+950	44	12000	1700	0.14	57.25	41.92	711.08	200	Viaduct
8	190+011	234	24000	2200	0.09	115.44	80.01	1981.21	200	Kalneh River-viaduct
9	191+960	216	22000	2150	0.10	105.33	73.46	1991.79	4×20	
10	195+350	62	12700	1500	0.12	64.14	46.49	903.32	3×20	
11	219+000	58	10200	1200	0.12	54.26	39.92	984.13	3×20	
12	224+120	470	54000	2700	0.05	272.19	179.81	1770.58	600	Karoon River-Viaduct
13	227+500	3	2100	1020	0.49	9.31	8.64	235.31	1×10	
14	230+250	3	2200	900	0.41	10.31	9.39	216.30	1×10	
15	233+600	5	3300	1000	0.30	15.81	13.46	251.60	1×10	
16	236+700	6	4700	1150	0.24	22.54	18.27	222.45	1×10	
17	239+250	14	7400	880	0.12	42.21	31.82	298.03	1×10	
18	245+900	560	49000	1600	0.03	297.59	195.81	1937.30	5×30	Menj River (Lordegan Berm)
19	254+000	22	8800	700	0.08	56.31	41.29	360.95	1×20	
20	255+300	10	6700	560	0.08	44.78	33.56	201.84	1×10	
21	265+000	7	4800	380	0.08	35.37	27.17	174.52	1×10	
22	266+150	7	3800	400	0.11	26.48	21.03	225.45	1×10	

9- List of technical buildings of project

9-1 List of large river bridges and viaducts of axis

List of large river bridges and viaducts of Izeh-Dehdez-Lordegan Freeway is as per following table:

List of large river bridges and viaducts of Izeh-Dehdez-Lordegan Freeway

No.	Kilometer	The proposed size	Description
1	155+200	2×20	
2	166+000	1×10	
3	166+500	1×10	
4	170+400	2×15	
5	176+050	840=140+140+420+140	Chardeh Bridge
6	183+405	450	Karoon Bridge
7	183+950	200	Valley Bridge
8	190+011	200	Valley Bridge
9	191+960	4×20	
10	195+350	3×20	
11	219+000	3×20	
12	224+120	600	Karoon Bridge
13	227+500	1×10	
14	230+250	1×10	
15	233+600	1×10	
16	236+700	1×10	
17	239+250	1×10	
18	245+900	5×30	Monj Bridge
19	254+000	1×20	
20	255+300	1×10	
21	265+000	1×10	
22	266+150	1×10	

9-2 List of tunnels of Izeh-Dehdez-Lordegan Freeway

List of tunnels of Izeh-Dehdez-Lordegan Freeway is as per following table:

List of tunnels of Izeh-Dehdez-Lordegan Freeway

no	km start	km end	length
1	162102	165040	2938
2	170526	175534	5008
3	176500	176925	425
4	182964	183146	182
5	183720	183800	80
6	184083	184377	294
7	217736	218261	525
8	224438	225728	1290
9	227764	230155	2391
10	231261	231562	301
11	232007	232989	982
12	234327	234376	49
13	234990	235208	218
14	236500	236620	120
15	239889	240866	977
مجموع			15780

10- Economic and financial evaluation

in order to conduct feasibility studies on this freeway, we already need to determine technical and economic viability of the project to make practical and sound decisions and perform feasibility study. Traffic studies for technical justification and investigation of investments for economic viability must be conducted.

Feasibility studies are the basic and most important sections of any project of economic studies. This section is of a larger importance in studies concerning constructional projects due to spending large disbursements in billion Rials. In addition, long time spent to run such huge projects and the impact of parameters such as inflation rate and investment commission rate double the significance of these studies.

We can conduct economic studies from different points of view. In this section, we consider just two views:

- a) National interests; b) private sector investments

In the following sections we will consider these two views under titles “economic evaluation” (national interests) and financial evaluation (private sector investment).

It should be noted that in economic and financial evaluation we have considered the cost of construction of the aforementioned freeway according to 2014 price list, taking inflation rate into account.

10-1 Economic evaluation (public sector investment and national interests view)

In national interests view, the government and the public are considered the same. Therefore, sources of income are all indirect. Earnings in this view result from saving in fuel and time as well as lower depreciation and

car accidents. Regardless of distribution of fuel subsidies by the government or fuel provision at actual cost, economizing in the use of fuel is a part of interests.

Economic evaluation has been conducted with and without inflation rate. Based on calculations, net present value, benefit-to-cost ratio and economic rate of return for our study alternatives according to public sector investment and national interests view are given in tables 2

Table 2- net present value, benefit-to-cost ratio and economic rate of return for alternatives of Izeh-Dehdez-Lordegan freeway from public investment and national interests view (economic evaluation of plan)

Analysis type	Without construction of railway		With the assumption of railway construction	
	B/C	ERR	B/C	ERR
Computational	2.31	24.67	1.87	21.03
Probable	1.97	21.96	1.62	18.77
Pessimistic	1.71	19.72	1.43	16.91

In this plan, both cost and benefit have been devaluated with a 12% rate. As it can be seen, based on 12% rate, all alternatives are acceptable because their net present value is positive.

As it is observed, the net present value for all alternatives is positive indicating that establishment of all alternatives is economically feasible.

With respect to tables (2), we can conclude that alternative 2 (in both cases, with and without inflation rate) is the most optimum and appropriate alternative in terms of economic evaluation because the largest net present value gives the highest benefit-to-cost ratio and economic rate of return.

10-2 Financial valuation (viewpoint of private sector investment)

In private sector investment view, what matters to the private sector investor is return on investment during a specified period of time and in a direct manner. It means that indirect earnings arising from a decrease in fuel consumption, travel time, car accidents and depreciation are not considered benefits for the investor and the only source of income in this view is toll collection and use of collective incomes. In many cases where toll collection does not respond to the investor's expenses, the government encourages to participation through giving long-term loans and allocating investors' subsidy.

In this part, it is supposed that 50% of project construction cost is supplied by private sector, and the government allows the private sector to return its capital through receiving dues from vehicles and establishment of welfare service complexes, and so can earn profit.

The financial valuation of Izeh-Dehdez-Lordegan Freeway is provided in consideration of varied dues rate in the following tables. In these tables, the assumptions of financial studies, dues rate in the freeways in progress of operation, mean freeway dues rate, construction costs, the separated traffic of freeway, dues and incomes (investor share) of vehicles, estimation of dues rate during operation and depreciation of investor cost are provided based on the received dues (return of investor's capital). Financial calculations were applied in three computational, probable and pessimistic scenarios, and each one in two states of with and without railway, in the

current conditions of freeways dues and applying the growth rate 20% on dues. In addition, in computational-without railway state, computations were provided in three models:

- a. Current conditions of freeways rate and applying the growth rate 20 to dues;
- b. Current conditions of freeways rate and applying growth rate 15% on dues;
- c. Calculation of minimum dues for reaching to the capital return in 15th year (with dues growth 20%).

10-2-1 Summary of financial valuation

According to the calculation conducted and presented in previous part, and relative tables, summary of financial valuation of Izeh-Dehdez-Lordegan Freeway is as per following table.

Summary of financial valuation of Izeh-Dehdez-Lordegan Freeway
 (interest to cost ratio, economic return rate)

Analysis type	Without construction of railway		With the assumption of railway construction	
	B/C	ERR	B/C	ERR
Computational	2.2	31.78	1.7	26.46
Probable	1.80	27.44	1.4	21.29
Pessimistic	1.5	22.91	1.11	15.78

11- Analysis of sensitivity

11-1 Analysis of sensitivity to the fuel

Reduction of 50% of petrol and gasoil in calculations

Price of per liter of petrol within 2014: 12500 IRR

Price of per liter of gasoil within 2014: 13750 IRR

According to the conducted calculations, summary of analysis of sensitivity to the fuel is as per following table:

Summary of analysis of sensitivity to fuel
 (interest to cost ratio, economic return rate)

Analysis type	Without construction of railway		With the assumption of railway construction	
	With inflation		Without inflation	
	B/C	ERR	B/C	ERR
Computational	1.62	18.84	1.38	16.41
Probable	1.42	16.84	1.22	14.72
Pessimistic	1.26	15.2	1.11	13.36

11-2 Analysis of sensitivity to the travel time

Reduction of 50% of travel time cost in calculations

Business trip-hrs: 41194 IRR

Nonbusiness trip-hrs: 12358 IRR

According to the conducted calculations, summary of analysis of sensitivity to the travel time is as per following table:

Summary of analysis of sensitivity to travel time
 (interest to cost ratio, economic return rate)

Analysis type	Without construction of railway		With the assumption of railway construction	
	With inflation		Without inflation	
	B/C	ERR	B/C	ERR
Computational	2.15	23.41	1.73	19.78

11-3 Analysis of sensitivity to the accidents

Removal of the impact of freeway construction from Andimeshk-Pole Zal accidents and applying reduction of 50% of accidents in Izeh axis is considered instead of 60%.

According to the calculations, summary of analysis of sensitivity to the accidents is as per following table:

Summary of analysis of sensitivity to accidents
 (interest to cost ratio, economic return rate)

Analysis type	Without construction of railway		With the assumption of railway construction	
	With inflation		Without inflation	
	B/C	ERR	B/C	ERR
Computational	2.18	23.51	1.73	19.75

12- Final conclusion of project

According to the geological studies, economic and financial justification, geometric specifications and studies on the path, construction of Izeh-Dehdez-Lordegan Freeway is proposed.