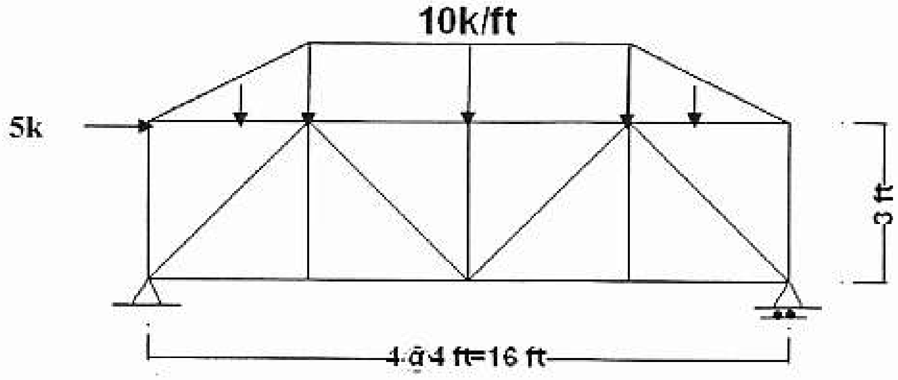
الجامعة التكنولوجية – قسم هندسة البناء والانشاءات
الامتحان النهائي – الدور الاول / العام الدراسي 2010 – 2011

المادة : تطبيقات الحاسوب II | الصف :الرابع
الفرع : هندسة الطرق والجسور | الزمن : ساعة ونصف
التدريسي : د. نسرين صالح | تاريخ الامتحان : 2011 / 5/31

ملاحظة الاجابة عن ثلاثة اسئلة فقط

س1: : اكتب ملف الادخال للمنشأ الشبكي المعدني المبين بالشكل ادناه مع توضيح ارقام نقاط الوصل(Joints) وارقام العناصر (Members) على الرسم. اذا علمت ان ابعاد المقاطع الافقية والعمودية (w10x30)، ابعاد المقاطع المائلة من نوع حديد زاوية مزدوجة يتم تحديدها من قبل البرنامج. اكتب الايعازات اللازمة لتصميم المنشأ وطباعة كافة نتائج التصميم في ملف الاخراج اذا علمت ان Fy تساوي 34 ksi، قيمة CB يتم حسابها من قبل البرنامج، نسبة الاجهاد المسموح به للمقاطع المائلة 0.9. صمم المقاطع العمودية والافقية حسب متطلبات الكود والمقاطع المائلة حسب متطلبات المقطع الاخف وزنا. اهمل الوزن الذاتي للمنشأ.

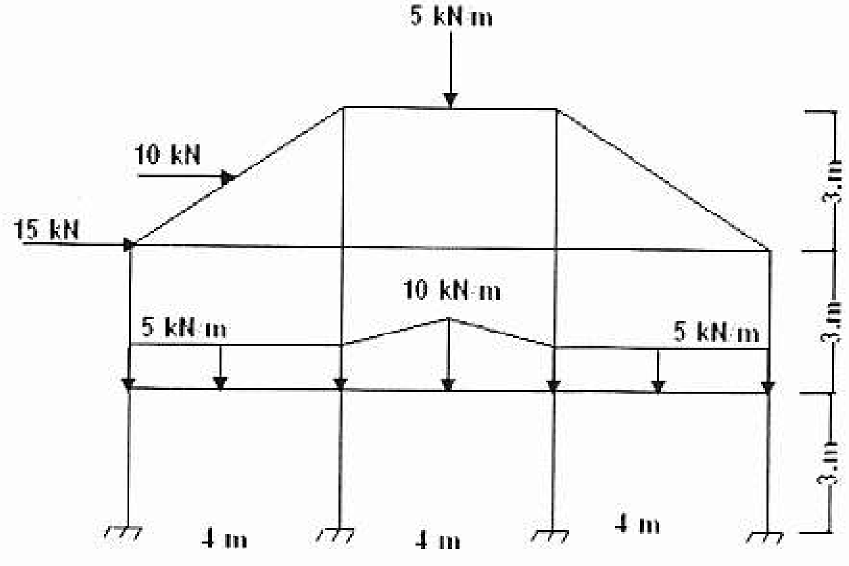


س2: ارسم المنشأ الخرساني المبين بالشكل ادناه باستخدام طريقة الاستحداث التلقائي مع توضيح ارقام نقاط الوصل(Joints) وارقام العناصر (Members) على الرسم. اكتب اوامر ملف الادخال اللازمة لتحليل المنشأ تحت تأثير حالات التحميل التالية.

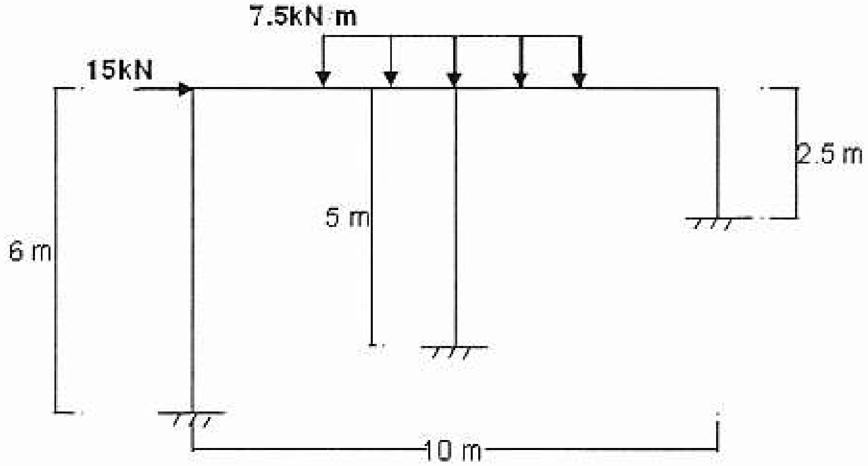
1- الوزن الذاتي للمنشأ(D)، 2- الاحمال الحية العمودية المسلطة (L)،3- احمال الحية الافقية المسلطة (W)

4- الحمل الكلي = 1.2 D + 1.6 L ، 5- الحمل الكلي= 1.2 D+1.0 L+0.8W

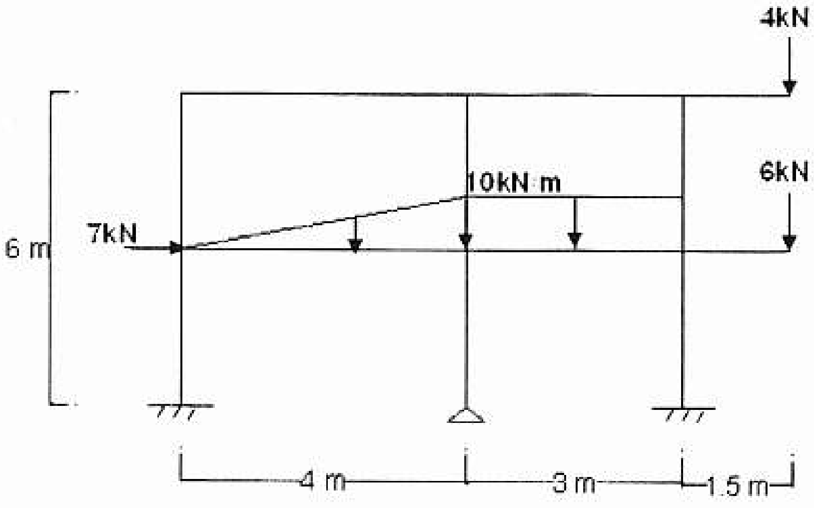
اذا علمت ان ابعاد مقاطع الاعمدة 400mm x 400mm وابعاد مقاطع العتبات(BF=1200mm, H=750mm, BW=350mm, HF=100mm). اكتب اوامر التحليل اللازمة لطباعة نتائج القوى للعناصر فقط مع رسم منحني الانحراف في ملف الاخراج ولحالتين التحميل(4& 5).



س3: اكتب ملف الادخال للمنشأ المعدني المبين بالشكل ادناه مع توضيح ارقام نقاط الوصل(Joints) وارقام العناصر (Members) على الرسم. اذا علمت ان ابعاد المقاطع الافقية والعمودية (MC8x12 مزدوجة][ ) . اكتب الايعازات اللازمة لتصميم الاسس وطباعة كافة نتائج التصميم في ملف الاخراج وذلك للاحمال الكلية (تشمل الاحمال المسلطة فقط)، اذا علمت ان : مقدار Fc يساوي 35 MPa ، معامل الامان يساوي 1.5 ، مقدار تحمل التربة يساوي 2000 psf ،مع الاخذ بنظر الاعتبار تدرج الاساس، نسبة ابعاد الاساس تساوي 1.5 .



س4: : اكتب ملف الادخال للمنشأ الخرساني المبين بالشكل ادناه مع توضيح ارقام نقاط الوصل(Joints)وارقام العناصر (Members)على الرسم. اذا علمت ان ابعاد الاعمدة (500 mm) وابعاد العتبات (700x400 mm) . (معامل المرونة للخرسانة يساوي 24000MPa وكثافة الخرسانة تساوي $23\ kN/m^3$).اكتب الاوامر اللازمة للتصميم الاعمدة والعتبات مع طباعة كافة نتائج التصميم في ملف الاخراج وذلك لحالة التحميل ($W_u = 1.2D + 1.6L$). اذا علمت ان قيمة ($f'_c = 32\,MPa$) للاعمدة فقط مع استخدام طوق دائري للاعمدة، قيمة ($F_y = 400\,MPa$) للعتبات فقط . عمق مقاطع العتبات الجديد يساوي 670 mm .



Concrete Design Parameters

<table>
<tr><th>Parameter Name</th><th>Default Value</th><th colspan="2">Description</th></tr>
<tr><td>FYMAIN</td><td>60000 psi</td><td colspan="2">Yield Stress for main reinforcing steel.</td></tr>
<tr><td>FYSEC</td><td>60000 psi</td><td colspan="2">Yield Stress for second steel.</td></tr>
<tr><td>FC</td><td>4000 psi</td><td colspan="2">Compressive Strength of Concrete.</td></tr>
<tr><td>CLT</td><td>1.5 inch</td><td colspan="2">Clear cover for Top reinforcement.</td></tr>
<tr><td>CLB</td><td>1.5 inch</td><td colspan="2">Clear cover for Bottom reinforcement.</td></tr>
<tr><td>CLS</td><td>1.5 inch</td><td colspan="2">Clear cover for Side reinforcement.</td></tr>
<tr><td>MAXMAIN</td><td>Φ-60 mm</td><td colspan="2">Maximum main reinforcement diameter.</td></tr>
<tr><td>MINMAIN</td><td>Φ-6 mm</td><td colspan="2">Minimum main reinforcement diameter.</td></tr>
<tr><td>MINSEC</td><td>Φ-6 mm</td><td colspan="2">Minimum secondary reinforcement diameter.</td></tr>
<tr><td>SFACE</td><td>0.0</td><td colspan="2">Face of support location at start of beam(positive number)</td></tr>
<tr><td>EFACE</td><td>0.0</td><td colspan="2">Face of support location at end of beam(positive number)</td></tr>
<tr><td>REINF</td><td>0.0
1.0</td><td colspan="2">Tied Column
Spiral Column</td></tr>
<tr><td>WIDTH</td><td>ZD</td><td colspan="2">Width of concrete member</td></tr>
<tr><td>DEPTH</td><td>YD</td><td colspan="2">Depth of concrete member</td></tr>
<tr><td>NSECTION</td><td>10</td><td colspan="2">Number of equally spaced sections to be considered in finding critical moments for beam design.</td></tr>
<tr><td rowspan="4">TRACK</td><td></td><td>Beam Design</td><td>Column Design</td></tr>
<tr><td>0.0</td><td>Critical moment not printed out</td><td>Standard print out</td></tr>
<tr><td>1.0</td><td>Print out</td><td>Standard print plus column interaction</td></tr>
<tr><td>2.0</td><td>Print out required steel for sections</td><td>Standard print plus Schematic</td></tr>
</table>

Footing Design Parameters

Parameter Name	Default Value	Description
FY	60000 psi	Yield Stress for main reinforcing steel.
FC	3000 psi	Compressive Strength of Concrete.
CLEAR	3 inch	Clear cover for slab reinforcement
REINF	Number 9 bar	Main reinforcement bar size for slab design.
FFAC	1.0	Load factor design
BC	3000 psf	Soil bearing Capacity
RATIO	1.0	Ratio between Slab sides
DEPTH	Calculate by the program	The min. depth of the footing base slab> Program changes this value if required for design.
S1,S2	Calculate by the program	Size of the footing base slab- S1 and S2 correspond to column sides YD and ZD respectively.
EMBEDMENT	0.0	The depth of the footing base from the support point of the column.
PEDESTAL	0.0 1.0	No pedestal design Pedestal design with program calculating pedestal dimensions.
TRACK	1.0 2.0	Only numerical output is provided Numerical output and sketch provided.

Steel Design Parameters

Parameter Name	Default Value	Description
KY	1.0	K value in local y-axis. Usually, this is minor axis.
KZ	1.0	K value in local z-axis. Usually, this is major axis.
LY	Member length	Length in local y-axis to calculate slenderness ratio
LZ	Member length	Length in local z-axis to calculate slenderness ratio
FYLD	36 KSI	Yield strength of steel.
NSF	1.0	Net section factor for tension members
UNL	Member length	Unsupported length for calculating allowable bending stress.
UNF	1.0	Same as above provided as a friction of acual member length.
CB	1.0 0.0	Cb value as used in section 1.5 of AISC Cb value to be calculated. Any other value will mean the value to be used in design.
SSY	0.0 1.0	Sidesway in local y-axis No sidesway
SSZ	0.0 1.0	Sidesway in local z-axis No sidesway
CMY,CMZ	0.85 Calculated	Sidesway (Cm value in local y and z axis) No sidesway (Cm value in local y and z axis)
MAIN	0.0 1.0	Check for slenderness Suppress slenderness check
STIFF	Member length	Spacing of stiffeners for plate girder design.
DMAX	45 inch	Maximum allowable depth
DMIN	0.0	Minimum allowable depth
RATIO	1.0	Permissible ratio of the actual to allowable stresses.
BEAM	0.0 1.0	Design only for end moments or those at locations specified by the Section command. Calculate moments at tenth points along the beam, and use the maximum, Mz location for design.
TRACK	0.0 1.0 2.0	Suppress critical member stresses. Print all critical member stresses. Print expanded output.

University of Technology
Building and Construction Eng. Dept.
Final Exam - First Attempt - 2010/20100

Subject : Computer Application — Class: 4th
Branch : Highways and Bridges — Time : 3 Hours
Examiner : A.L. Ahmed Subhi — Date : 31 /5 / 2010

Only Four Questions are required

Q-1/ what is the current LOS during the peak hour for six-lane freeway in a growing urban area? What LOS will occur in 3 years? When should a fourth lane be added in each direction to avoid an excess of demand over capacity (LOS F)?

Given the following

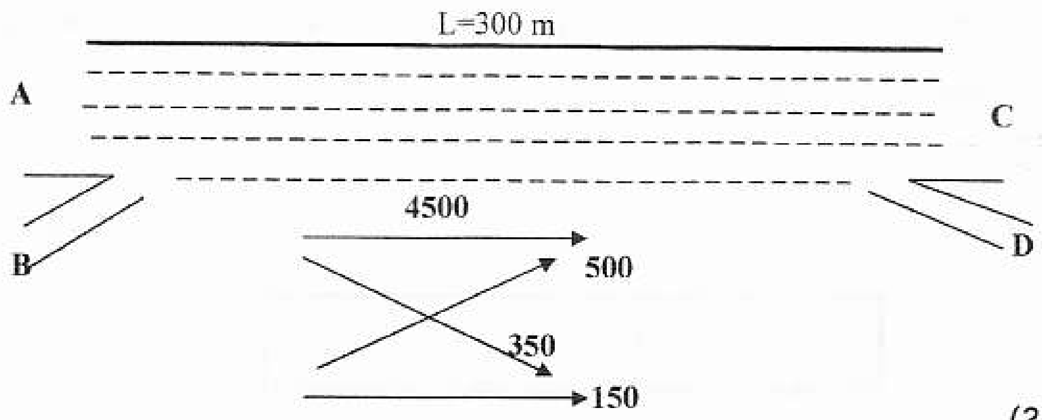
(25 marks)

- ☒ 5,000 veh/h (one direction, existing)
- ☒ 6 lanes
- ☒ Level terrain
- ☒ 10 percent trucks
- ☒ 5,600 veh/h (one direction, in 3 years)
- ☒ 0.95 PHF; and Beyond 3 years, traffic grows at 4.5 percent per year.
- ☒ FFS = 100 km/h (measured in field).
- ☒ Percent of Trucks = 10
- ☒ Assume 0 percent buses and RVs.
- ☒ Assume commuter traffic.

Q-2/ what are the level of service and capacity of the weaving segment?

Given the following:

√ Flow rate (A-C) = 4,500 pc/h, √ Flow rate (A-D) = 350 pc/h,
√ Flow rate (B-C) = 500 pc/h, √ Flow rate (B-D) = 150 pc/h, and
√ FFS = 110 km/h for freeway, √ Weaving segment length = 300 m. See Figure (1)



(25 marks)

Figure (1)

Q-3/

(A)

A 4-lane basic freeway section carries 6% trucks and buses and 2% recreational vehicles. One segment to be analyzed contains a 1.4-km segment with a +3.7% grade. What is the heavy vehicle adjustment factor for this segment?

(B)

Consider the freeway section in the above branch (A). If the free-flow speed 90 km/h, the hourly volume is 2040 vehicles per hour and the PHF is 0.91 with all familiar users, what is the level of service? (25 marks)

Q-4/

(A) Calculate the volume to capacity ratio for the peak 15 minutes at a location along an urban freeway if the 1/4-hr volumes during the afternoon peak are 1500, 1850, 1800 and 1400 vehicles and the capacity is probably about 7600 vph.

(B). certain roadway has a PHF of 0.87. If the highest 15-minute volume observed in a day is 492 vehicles (in 15 minutes), what is the peak hour volume?

(25 marks)

Q-5/

(A)What are the main traffic facilities that Highway Capacity Software Deals with?

(B) What are the required input data for Basic Freeway Segments analysis?

(C) What do we mean by weaving length and weaving width? Explain and support your answer with any necessary figures.

(25 marks)

GOOD LUCK

Steps

1. Convert volume (veh/h) to flow rate (pc/h) (use Equation 24-1).	$v = \frac{V}{(PHF)(f_{HV})(f_p)}$ $v(A\text{-}C) = \frac{975}{(0.85)(0.816)(1.000)} = 1{,}406$ pc/h $v(A\text{-}D) = 937$ pc/h $v(B\text{-}C) = 750$ pc/h
1a. Determine f_p (use Chapter 23).	$f_p = 1.000$
1b. Determine f_{HV} (use Chapter 23).	$f_{HV} = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)}$ $f_{HV} = \frac{1}{1 + 0.15(2.5 - 1) + 0} = 0.816$
2. Determine weaving segment configuration type (use Exhibit 24-5).	Type A (all weaving vehicles must make one lane change)
3. Compute critical variables.	$v_w = 937 + 750 = 1{,}687$ pc/h $v_{nw} = 1{,}406$ pc/h $v = 1{,}406 + 1{,}687 = 3{,}093$ pc/h $VR = \frac{1{,}687}{3{,}093} = 0.545 \qquad R = \frac{750}{1{,}687} = 0.445$

4. Compute weaving and nonweaving speeds assuming unconstrained operation (use Exhibit 24-6 and Equations 24-3 and 24-4).	$W_i = \frac{a(1+VR)^b\left(\frac{v}{N}\right)^c}{(3.28L)^d} \qquad S_i = 24 + \frac{S_{FF} - 16}{1 + W_i}$ $W_w = \frac{0.15(1+0.545)^{2.2}\left(\frac{3{,}093}{3}\right)^{0.97}}{(3.28 * 300)^{0.80}} = 1.319$ $W_{nw} = \frac{0.0035(1+0.545)^{4.0}\left(\frac{3{,}093}{3}\right)^{1.3}}{(3.28 * 300)^{0.75}} = 0.938$ $S_w = 24 + \frac{110 - 16}{1 + 1.319} = 64.5$ km/h $S_{nw} = 24 + \frac{110 - 16}{1 + 0.938} = 72.5$ km/h
5. Check type of operation (use Exhibit 24-7).	$N_w = 1.21(N)VR^{0.571}L^{0.234}/S_w^{0.438}$ $N_w = 1.21(3)(0.545^{0.571})(300^{0.234})/64.5^{0.438} = 1.57$ $N_w(max) = 1.4$, therefore constrained operation
6. Repeat Step 4 for constrained operation.	$W_w = \frac{0.35(1+0.545)^{2.2}\left(\frac{3{,}093}{3}\right)^{0.97}}{(3.28 * 300)^{0.80}} = 3.077$ $W_{nw} = \frac{0.0020(1+0.545)^{4.0}\left(\frac{3{,}093}{3}\right)^{0.97}}{(3.28 * 300)^{0.75}} = 0.536$ $S_w = 24 + \frac{110 - 16}{1 + 3.077} = 47.1$ km/h $S_{nw} = 24 + \frac{110 - 16}{1 + 0.536} = 85.2$ km/h
7. Compute weaving segment speed (use Equation 24-5).	$S = \frac{v}{\left(\frac{v_w}{S_w}\right) + \left(\frac{v_{nw}}{S_{nw}}\right)} = \frac{3{,}093}{\left(\frac{1{,}687}{47.1}\right) + \left(\frac{1{,}406}{85.2}\right)} = 59.1$ km/h
8. Compute weaving segment density (use Equation 24-6).	$D = \frac{\left(\frac{v}{N}\right)}{S} = \frac{\left(\frac{3{,}093}{3}\right)}{59.1} = 17.4$ pc/km/ln
9. Determine level of service (use Exhibit 24-2).	LOS D
10. Determine weaving segment capacity (use Exhibit 24-8 and Equations 24-7 and 24-8).	$c_b = 4{,}790$ pc/h (Exhibit 24-8(B)) $c = c_b * f_{HV} * f_p = 4{,}790 * 0.816 * 1.000 = 3{,}909$ veh/h $c_h = c * PHF = 3{,}909 * 0.85 = 3{,}323$ veh/h

EXHIBIT 24-6. CONSTANTS FOR COMPUTATION OF WEAVING INTENSITY FACTORS

General Form

$$W = \frac{a(1+VR)^b\left(\frac{v}{N}\right)^c}{(3.28L)^d}$$

	Constants for Weaving Speed, S_w				Constants for Nonweaving Speed, S_{nw}			
	a	b	c	d	a	b	c	d
Type A Configuration								
Unconstrained	0.15	2.2	0.97	0.80	0.0035	4.0	1.3	0.75
Constrained	0.35	2.2	0.97	0.80	0.0020	4.0	1.3	0.75
Type B Configuration								
Unconstrained	0.08	2.2	0.70	0.50	0.0020	6.0	1.0	0.50
Constrained	0.15	2.2	0.70	0.50	0.0010	6.0	1.0	0.50
Type C Configuration								
Unconstrained	0.08	2.3	0.80	0.60	0.0020	6.0	1.1	0.60
Constrained	0.14	2.3	0.80	0.60	0.0010	6.0	1.1	0.60

EXHIBIT 24-7. CRITERIA FOR UNCONSTRAINED VERSUS CONSTRAINED OPERATION OF WEAVING SEGMENTS

Configuration	Number of Lanes Required for Unconstrained Operation, N_w	N_w(max)
Type A	$1.21(N)VR^{0.571}L^{0.234}/S_w^{0.438}$	1.4
Type B	$N[0.085 - 0.703VR + (71.57/L) - 0.0112(S_{nw} - S_w)]$	3.5
Type C	$N[0.761 - 0.047VR - 0.00036L - 0.0031(S_{nw} - S_w)]$	3.0[a]

Note:
a. For two-sided weaving segments, all freeway lanes may be used by weaving vehicles

EXHIBIT 24-2. LOS CRITERIA FOR WEAVING SEGMENTS

LOS	Density (pc/km/ln)	
	Freeway Weaving Segment	Multilane and Collector-Distributor Weaving Segments
A	≤ 6.0	≤ 8.0
B	> 6.0–12.0	> 8.0–15.0
C	> 12.0–17.0	> 15.0–20.0
D	> 17.0–22.0	> 20.0–23.0
E	> 22.0–27.0	> 23.0–25.0
F	> 27.0	> 25.0

EXHIBIT 23-9. PASSENGER-CAR EQUIVALENTS FOR TRUCKS AND BUSES ON UPGRADES

Upgrade (%)	Length (km)	E_T								
		Percentage of Trucks and Buses								
		2	4	5	6	8	10	15	20	25
< 2	All	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
≥ 2–3	0.0–0.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	> 0.4–0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	> 0.8–1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	> 1.2–1.6	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5
	> 1.6–2.4	2.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.0
	> 2.4	3.0	3.0	2.5	2.5	2.0	2.0	2.0	2.0	2.0
> 3–4	0.0–0.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	> 0.4–0.8	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5
	> 0.8–1.2	2.5	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	> 1.2–1.6	3.0	3.0	2.5	2.5	2.5	2.5	2.0	2.0	2.0
	> 1.6–2.4	3.5	3.5	3.0	3.0	3.0	3.0	2.5	2.5	2.5
	> 2.4	4.0	3.5	3.0	3.0	3.0	3.0	2.5	2.5	2.5
> 4–5	0.0–0.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	> 0.4–0.8	3.0	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.0
	> 0.8–1.2	3.5	3.0	3.0	3.0	2.5	2.5	2.5	2.5	2.5
	> 1.2–1.6	4.0	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0
	> 1.6	5.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0	3.0
> 5–6	0.0–0.4	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	> 0.4–0.5	4.0	3.0	2.5	2.5	2.0	2.0	2.0	2.0	2.0
	> 0.5–0.8	4.5	4.0	3.5	3.0	2.5	2.5	2.5	2.5	2.5
	> 0.8–1.2	5.0	4.5	4.0	3.5	3.0	3.0	3.0	3.0	3.0
	> 1.2–1.6	5.5	5.0	4.5	4.0	3.0	3.0	3.0	3.0	3.0
	> 1.6	6.0	5.0	5.0	4.5	3.5	3.5	3.5	3.5	3.5
> 6	0.0–0.4	4.0	3.0	2.5	2.5	2.5	2.5	2.0	2.0	2.0
	> 0.4–0.5	4.5	4.0	3.5	3.5	3.5	3.0	2.5	2.5	2.5
	> 0.5–0.8	5.0	4.5	4.0	4.0	3.5	3.0	2.5	2.5	2.5
	> 0.8–1.2	5.5	5.0	4.5	4.5	4.0	3.5	3.0	3.0	3.0
	> 1.2–1.6	6.0	5.5	5.0	5.0	4.5	4.0	3.5	3.5	3.5
	> 1.6	7.0	6.0	5.5	5.5	5.0	4.5	4.0	4.0	4.0

EXHIBIT 23-10. PASSENGER-CAR EQUIVALENTS FOR RVs ON UPGRADES

Upgrade (%)	Length (km)	E_R								
		Percentage of RVs								
		2	4	5	6	8	10	15	20	25
≤ 2	All	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
> 2–3	0.0–0.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	> 0.8	3.0	1.5	1.5	1.5	1.5	1.5	1.2	1.2	1.2
> 3–4	0.0–0.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	> 0.4–0.8	2.5	2.5	2.0	2.0	2.0	2.0	1.5	1.5	1.5
	> 0.8	3.0	2.5	2.5	2.5	2.0	2.0	2.0	1.5	1.5
> 4–5	0.0–0.4	2.5	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5
	> 0.4–0.8	4.0	3.0	3.0	3.0	2.5	2.5	2.0	2.0	2.0
	> 0.8	4.5	3.5	3.0	3.0	3.0	2.5	2.5	2.0	2.0
> 5	0.0–0.4	4.0	3.0	2.5	2.5	2.5	2.0	2.0	2.0	1.5
	> 0.4–0.8	6.0	4.0	4.0	3.5	3.0	3.0	2.5	2.5	2.0
	> 0.8	6.0	4.5	4.0	4.5	3.5	3.0	3.0	2.5	2.0

EXHIBIT 23-2. LOS CRITERIA FOR BASIC FREEWAY SEGMENTS

Criteria	LOS				
	A	B	C	D	E
	FFS = 120 km/h				
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	120.0	120.0	114.6	99.6	85.7
Maximum v/c	0.35	0.55	0.77	0.92	1.00
Maximum service flow rate (pc/h/ln)	840	1320	1840	2200	2400
	FFS = 110 km/h				
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	110.0	110.0	108.5	97.2	83.9
Maximum v/c	0.33	0.51	0.74	0.91	1.00
Maximum service flow rate (pc/h/ln)	770	1210	1740	2135	2350
	FFS = 100 km/h				
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	100.0	100.0	100.0	93.8	82.1
Maximum v/c	0.30	0.48	0.70	0.90	1.00
Maximum service flow rate (pc/h/ln)	700	1100	1600	2065	2300
	FFS = 90 km/h				
Maximum density (pc/km/ln)	7	11	16	22	28
Minimum speed (km/h)	90.0	90.0	90.0	89.1	80.4
Maximum v/c	0.28	0.44	0.64	0.87	1.00
Maximum service flow rate (pc/h/ln)	630	990	1440	1955	2250

Note:
The exact mathematical relationship between density and v/c has not always been maintained at LOS boundaries because of the use of rounded values. Density is the primary determinant of LOS. The speed criterion is the speed at maximum density for a